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:

Asthana, D. K. (2006).*Text Book of Environmental Studies*. S. Chand Publishing.

Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

Basu, R. N., (Ed.) (2000). *Environment*. University of Calcutta, Kolkata

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Mahapatra, R., Jeevan, S.S., Das, S. (Eds) (2017). *Environment Reader for Universities*, Centre for Science and Environment, New Delhi.

Masters, G. M., &Ela, W. P. (1991).*Introduction to environmental engineering and science*. Englewood Cliffs, NJ: Prentice Hall.

Odum, E. P., Odum, H. T., & Andrews, J. (1971).*Fundamentals of ecology*. Philadelphia: Saunders.

Sharma, P. D., & Sharma, P. D. (2005).*Ecology and environment*.Rastogi Publications.

ENVIRONMENTAL SCIENCE

[ENVS] PROJECT

COLLEGE ROLL No. – ECOA20F275

CU ROLL No.- 203223_11_0039

CU REGISTRATION No.- 223-1211-0320-20

SEMESTER : 2

TOPIC OF THE PROJECT :

POLLUTION OF THE GANGES.

SAY *NO* TO POLLUTION TOWARDS RIVER GANGA.

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 is the third largest river on Earth .

RISE OF RIVER GANGA: The sacred river Ganga rises from the Gangotri Glacier situated in the southern Great Himalayas on the Indian side of the border with the Tibet Autonomous Region of China. The true source of the Ganges, however, is considered to be at Gaumukh, about 13 miles (21 km) southeast of Gangotri. The Alaknanda and Bhagirathi rivers unite at Devaprayag to form the main stream known as the Ganga.

THE GANGOTRI GLACIER

MOUTH OF RIVER GANGA: The course river **Ganga** ends at the **Ganges delta**, where the rivers **Ganga** and **Brahmaputra** meet. Finally she empties herself at the **Bay of Bengal**. The **Ganges Delta** is situated both in parts of **Bangladesh** and the state of **West Bengal**. The Ganges Delta is primarily formed of the **sediment laden waters** of both river Ganga and river Brahmaputra.

THE GANGES DELTA

THE COURSE OF RIVER GANGA: The **upper course** stretches from **Gangotri glacier** 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**. The **lower course** is in **West Bengal.**

THE COURSE OF RIVER GANGA

GANGES POLLUTION

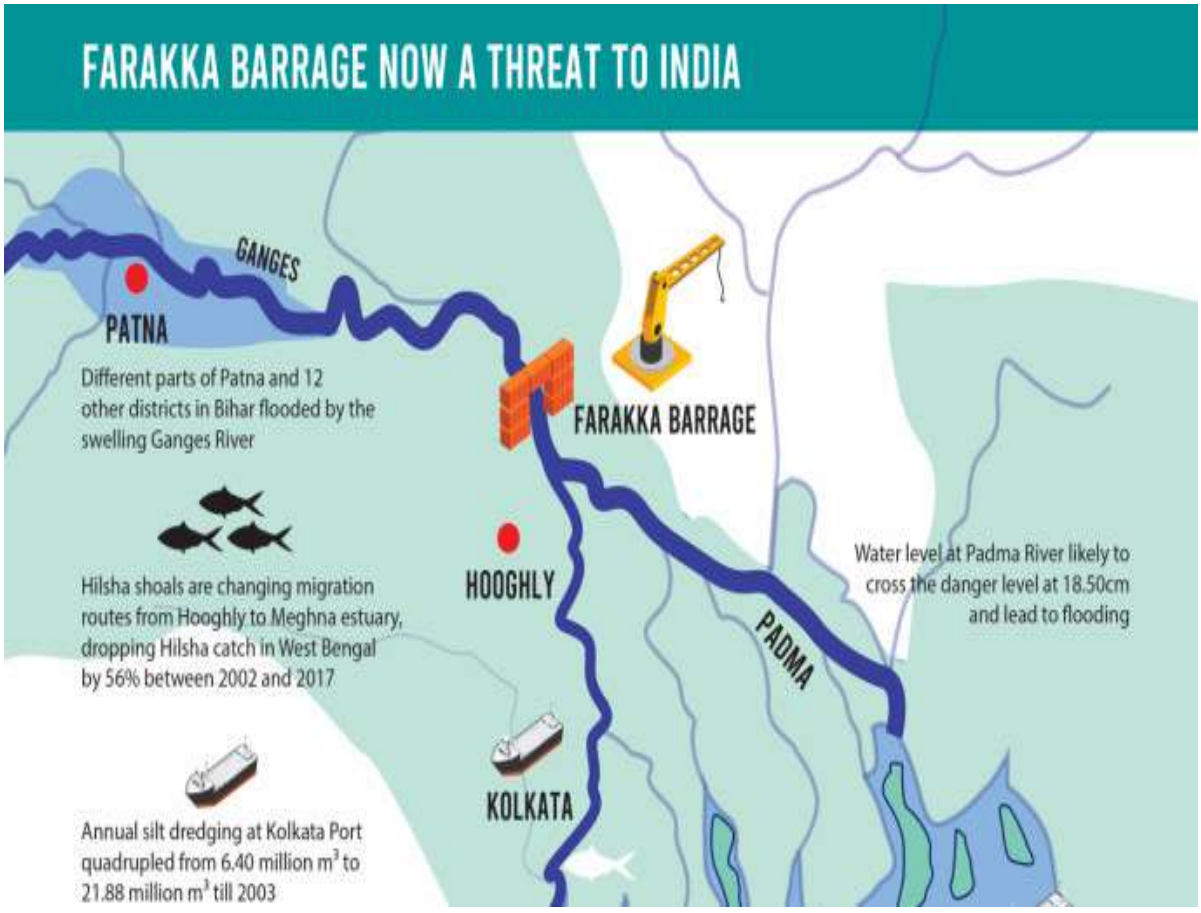
The Ganges is threatened by severe pollution. This poses a danger not only to humans but also to animals; the Ganges is home to approximately 140 species of fish and 90 species of amphibians. The levels of fecal coliform bacteria from human waste in the river near Varanasi are more than a hundred times the Indian government's official limit.[The Ganga Action Plan, an environmental initiative to clean up the river, has been considered a failure which is variously attributed to corruption, a lack of will in the government, poor technical expertise, environmental planning and a lack of support from the native religious authorities.

MAJOR CAUSES OF GANGES POLLUTION:

- **A tremendous amount of sewage that is majorly untreated is disposed off in the river on a day to day basis.**

- **Large number of textile industries, slaughterhouses, hospitals and distilleries and chemical plants dispose off their untreated waste in the river.**

- **Cutting off the natural flow of the river, dams are responsible for the pollution of river Ganga as well.**



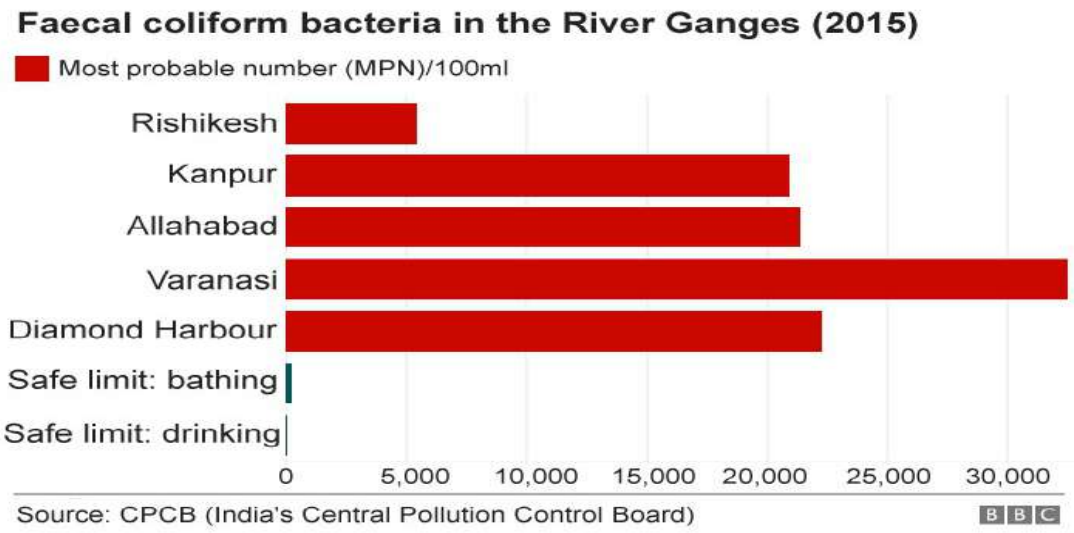
- **Tremendous amount of fertilizers that are used gets continuously flown into the Ganga along with rainwater causing hazard to the aquatic animals.**



- **Being a river that is worshipped by people belonging to a larger religious group, every year, countless people dispose the ashes of their dead ones into the river.**


REGIONS WHERE RIVER GANGA IS HIGHLY POLLUTED:

The study was conducted during the summer months of three consecutive years - 2016 to 2018. Researchers chose a middle reach of the river(518 km) between Kanpur and Varanasi, which is considered to be the most polluted region. They also looked at downstream regions of two drains, Wazidpur drain in Kanpur that flushes 54 million liters per day (MLD) of industrial waste and Assi drain at Varanasi that releases more than 66 MLD of sewage waste into the river. [as per reports in year 2018]



A study on pollution levels of Ganga conducted by a Doon based WILDLIFE INSTITUTE OF INDIA [WII] has revealed that river Ganga is most contaminated in West Bengal as against the popular perception of river being most polluted in Kanpur belt of UP.

Scientists of the institute assessed 43 stretches of the river [each of 5km] for 2 seasons for the presence of 13 banned Organo chlorine pesticides [OCPs] based on their persistent bio-accumulative and toxic nature and nine extremely toxic heavy metals including Lead and Chromium.

For this purpose the river Ganga was divided into 5 zones—UPPER ZONE [Uttarakhand] , UPPER MIDDLE ZONE [Uttar Pradesh , before econfluence with Yammuna] , UPPER MIDDLE ZONE [Varanasi, Ghaziapur, Mirzapur and Ballia], LOWER MIDDLE ZONE [Bihar and Jharkhand] and LOWER ZONE [West Bengal].

The lower zone comprising of West Bengal was found to have highest concentration of pesticides. The main cause of high pollution in the lower zone is due to the high annual precipitation rate which leads to more flooding and facilitates the movement of pesticides from the agro- feilds to the near by water body. This high pollution rate has caused suppression of sensitive aquatic animals. If this continues than it will cause a adverse effect in Sundarban area leading to its Biodiversity.

RIVER GANGA CLEAN UP PROJECTS :

❖ NAMAMI GANGA PROJECT:

The Central government's ambitious project to clean River Ganga, under its Namami Gange Project (NGP), has borne some fruit with river water from Rudraprayag in Uttarakhand to Uluberia in West Bengal improving between 2014 and 2019. The dissolved oxygen level has improved at 27 locations while biochemical oxygen demand (BOD) and faecal coliform (FC) has improved at 42 and 21 locations, respectively, the information provided by the ministry to Kochi-based Right to Information applicant, K Govindan Nampoothiry, stated.

The ministry has provided an annual average of Ganga water quality on these three parameters, thereby discounting the season variations. These parameters help in understanding the water quality of an aquatic system. Higher dissolved oxygen (national standard is 5 milligram per litre or more) shows whether water can sustain aquatic life. Lower BOD (national standard is 3 milligram per litre or less) shows there is less amount of bacteria and other microorganisms in water. Faecal coliform (national standard less is than 2,500 coliform in 100 ml of water) indicates the amount of sewage in water.

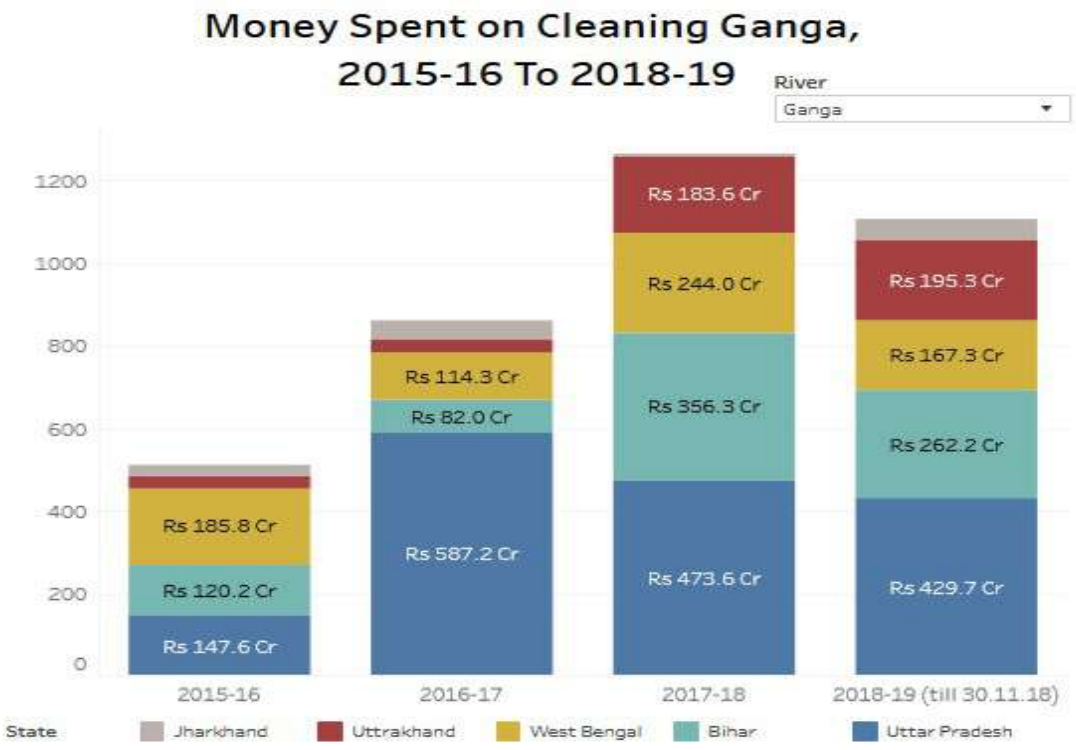
STATUS OF SEWAGE INFRASTRUCTURE PROJECTS IN EIGHT STATES

STATES	NO OF PROJECTS SANCTIONED	NO OF PROJECTS COMPLETED
UTTAR PRADESH	50	16
UTTARAKHAND	34	23
BIHAR	30	1
WEST BENGAL	22	3
DELHI	11	0
JHARKHAND	2	1
HARYANA	2	2
HIMACHAL PRADESH	1	0

SOURCE: UNION JAL SHAKTI MINISTRY

ThePrint

THE DATA SHOWS THE WORK PROGRESS OF NAMAMI GANGE PROJECT



DATA SHOWING MONEY SPENT ON CLEANING GANGA BY VARIOUS STATES

The data shows that in the past six years the water quality of the river on these three parameters has improved marginally at most locations. Experts say by this pace, the authorities would take decades to make water fit for human consumption.

The Central government had initially fixed 2019 as the deadline to clean the national river but extended it to 2022 as the Namami Gange Project (NGP) took off slowly. As on August 1, only 29 percent of the 154 sewage projects taken up have been completed. For these projects, the ministry has allotted Rs 23,120 crore, as per government documents.

PROJECTS UNDER THE SCHEME

	Number	Completed	Sanctioned amount (₹ cr)	Current expenditure (₹ cr)
Sewage infrastructure	137	31	20,033	3,934
Ghat/river surface cleaning/river front development	64	31	1,242	790
Non-infra institutional development	18	1	1,086	42
Research & study	5	1	126	6.97
Biodiversity	6	2	33.42	21
Afforestation/ecological task force/bioremidation/ construction of toilets	31	10	1,426.26	1,020
			23,946.68	5,813.97

All data till December 2018 Source: Namami Gange portal

NAMAMI GANGE BUDGET SCHEME

A ministry official privy to the information about the project said the sewage infrastructure projects are coming up in eight states — Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Haryana Delhi and Himachal Pradesh — through which the 2,525-km river flows.

UNDER NAMAMI GANGE PROJECT 2 NEW SEWAGE TREATEMENT PLANTS OFCAPACITY OF 31 MLD AND 10 MLD IS INTRODUCED IN BHATPARA.

WORK UNDER NAMAMI GANGE PROJECT IN UTTAR PRADESH.

The RTI reply showed the maximum improvement in Ganga water quality has happened in the hills of Uttarakhand, primarily due to effort been made to contain the flow of human and animal sewage. Another reason for this could be that unlike the plains, the flow of industrial waste in the hill is much less.

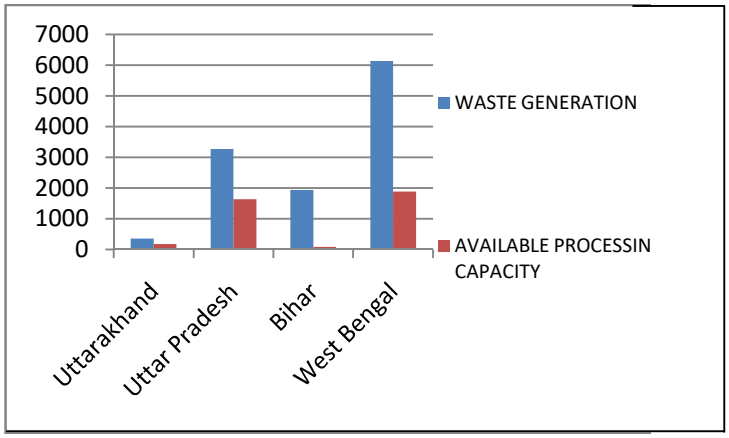
WHY NAMAMI GANGE PROJECT REMAIN UNSUCCESFUL TILL NOW ?

- **One reason for this failure could be the lack of effective implementation of the Namami Gange plan, with funds lying unspent. Namami Gange was announced as a ₹20,000 crore project, but actual spending has been far less. For instance, the water ministry set aside ₹9,000 crore for the Ganga in the last four years, but less than half of that has actually been spent. This financial mismanagement was highlighted in a 2017 Comptroller and Auditor General of India performance audit, which also pointed out general mismanagement and major shortage in staff as major issues with Namami Gange.**

- **As a result, the daily large-scale discharge of liquid and solid waste into the Ganga remains unchecked. Every day, nearly three billion litres of sewage is dumped into the Ganga, but existing sewage treatment capacity along the river can only treat 2.25 billion litres per day. More worryingly, less than one-third (32%) of the total solid waste generated daily (11,729 tonnes) can be treated with the capacity of current treatment plants. In 2018, CPCB revealed that there were 961 industrial units on the Ganga's banks and 211 of these were flouting regulations regarding waste water.**

ACROSS STATES , THERE IS LIMITED CAPACITY TO PROCESS WASTE BEFORE IT ENTERS RIVER GANGA:

STATE :	UTTARAKHAND	UTTAR PRADESH	BIHAR	WEST BENGAL
WASTE GENERATION:	350	3275	1940	6132
AVAILABLE PROCESSING CAPACITY:	175	1637	82	1882



OTHER RIVER GANGA CLEAN UP PROJECTS ARE:

- GANGA MAHASABHA
- GANGES ACTION PLAN
- NATIONAL RIVER GANGA BASIN AUTHORITY [NRGBA]
- 2010 GOVERNMENT CLEAN- UP CAMPAIGN
- GANGA MANTHAN

DIFFERENCE BETWEEN NAMAMI GANGE PROJECT AND OTHER PREVIOUS PROJECTS

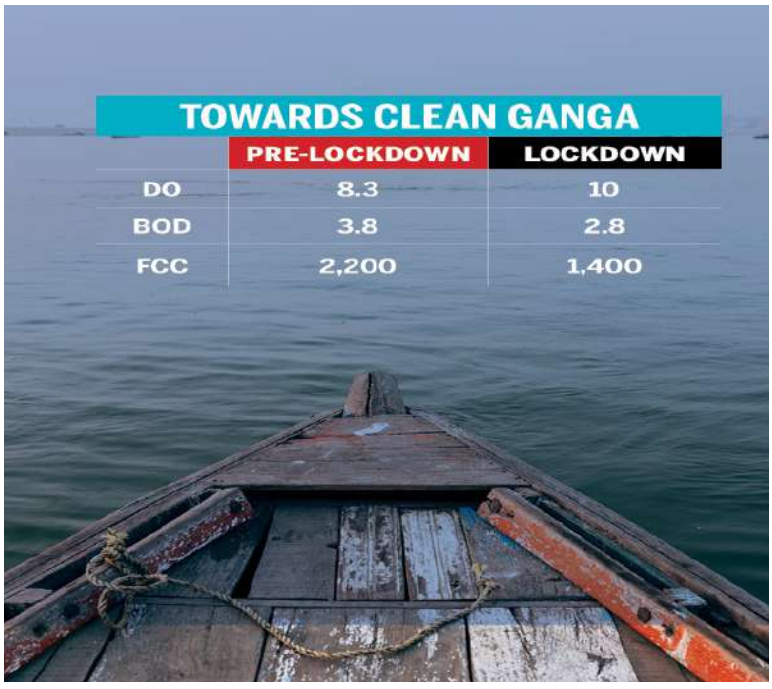
CONCLUSION:

Pandemic lets India's rivers breathe:

The lockdown though, and the absolute suspension of all industrial activity, has achieved what no programme has managed to do so far. The river Ganga started showing improvements in water quality just ten days after the lockdown was imposed, with CPCB water monitoring data from late April indicating that 27 of 36 water monitoring points along the river, had water clean enough to bathe in, and for vegetation and marine life to propagate.

Over 80 per cent of the pollution in the river is actually caused by domestic sewage from villages and towns. However, the rest is contributed by industries. With industrial pollution dropping to zero, sewage is no longer mixing with industrial effluents enabling the river to better assimilate its pollutants. Another cause for the improvement was due to reduced lifting of water by industries, increasing the river's flow rate, and allowing pollutants to get diluted quicker.

The Yamuna has also healed itself now with animals and birds now flocking to its waters. As the nation's most polluted river, the Yamuna collects untreated industrial effluents released by seven different states. 80 per cent of this is estimated to come from Delhi, Mathura and Agra. However, the Delhi Pollution Control Committee has noted that, over the last 60 days, the river has gotten around 33 per cent cleaner.



DO- DISSOLVED OXYGEN ,BOD-BIOCHEMICAL OXYGEN DEMAND, FCC- FECAL COLIFORM COUNT

BIBLIOGRAPHY

ALL THE DATA AND INFORMATION OF THIS PROJECT IS SOURCED FROM VARIOUS WEBSITES, WHICH ARE AS FOLLOWS:

- www.wikipedia.org
- www.britannica.in
- www.downtoearth.org.in
- www.thehindu.com
- www.mission-ganga.thewaternetwork.com
- www.theprint.in
- www.Nmcg.nic.in
- www.economictimes.com
- www.hindustantimes.in
- www.indiatoday.in
- www.uniindia.in

THE GANGA TO ME IS THE SYMBOL OF INDIA'S MOST MEMORABLE PAST WHICH HAS BEEN FLOWING TO THE PRESENT AND CONTINUES TO FLOW TOWARDS THE OCEAN OF THE FUTURE.
DHARMA LIKE GANGES IS EVER PURE AND MAKE YOUR EFFORT TO KEEP HER THE WAY IT IS.

College roll number – ECOA20F276

CU Registration number -223-1211-0324-20

CU Roll number -203223-11-0040

Subject- AECC ENVS tutorial

Project topic- Wildlife conservation

Semester – 2

Batch- 2020-2023

Wildlife conservation

Acknowledgement

I would like to thank my subject teachers of AECC ENVS who have helped me understand the topics and provided me with sufficient study materials.

I would also like to thank all the other concerned teachers who have helped me complete my project on wildlife conservation with their constant efforts and help.

Wildlife conservation: meaning

Wildlife conservation is the practice of protecting plant and animal species and their habitats. As part of the world's ecosystems, wildlife provides balance and stability to nature's processes. The goal of wildlife conservation is to ensure the survival of these species, and to educate people on living sustainably with other species

Benefits of wildlife

- 1. Promotes pollination and continuity of native plant species
- 2. Medicinal value
- 3. Aesthetic benefits
- 4. It is fun and entertaining!
- 5. Preserves heritage and culture
- 6. Promotes tourism attraction
- 7. Protection of biodiversity and endangered species
- 8. Protecting ecological stability and balance
- 9. Can enhance food security
- 10. Education and learning
- 11. Important for the identification of new plant and animal species for research
- 12. Economic benefits associated with tourism
- 13. Creation of jobs
- 14. Protects the livelihoods and knowledge of indigenous people
- 15. It serves as a preserve for future generations

Threats to wildlife

1. Illegal wildlife trade

Seized ivory in Malaysia (Shutterstock)

The illegal wildlife trade is the fourth largest criminal industry in the world, after drugs, arms and human trafficking.Indeed, the population of the African elephant has plunged 30% over the last seven years, largely down to poaching.The most heartbreaking aspect of the trade is that it is often fuelled by bogus beliefs and unsubstantiated claims. The pangolin, for example, is one of the most trafficked animals on the planet, its scales used in traditional Chinese medicine to help with ailments ranging from lactation difficulties to arthritis. And what is this magical substance made of? Keratin, the same material that makes up our own hair and fingernails.

2. Habitat destruction

Rainforest cleared for farming (Shutterstock)

The recent fires that swept across the Amazon rightly drew attention to just how fragile the most important ecosystems on the planet are – and threw an unrelenting spotlight on the impact of uncontrolled logging and habitat destruction, as humans move into areas previously left untouched.

It has reached the stage where habitat loss is the greatest threat to the majority of wildlife. Half of the world's original forests are gone, and what remains is being cut down 10 times faster than it can be replaced.

In Africa, where the human population is expected to quadruple by the end of the century, animals that need large areas to roam are being squeezed into smaller and smaller areas.

3. Invasive species

Cane toads make a deadly meal for native species like kookaburras (Shutterstock)

As if competing with humans for resources wasn't tough enough for the world's wildlife, many species have to deal with the threat of invasive species, too.

Whether accidentally or intentionally introduced, these non-native species grow and reproduce rapidly, then spread across ecosystems aggressively. They are one of the leading threats to native wildlife, putting 42% of threatened or endangered species at risk.

One of the most sobering examples of the devastation caused by invasive species is the cane toad in Australia. Introduced from Hawaii to control a native grey-backed cane beetle, the toads decided they liked to eat other native fauna better and proceeded to multiply at an alarming rate.

4. Pollution

Whale Shark filter feeds in polluted ocean (Shutterstock)

800 *million* tonnes of plastic is dumped into the ocean each year, washing up on previously pristine parts of the planet. Henderson Island, part of the Pitcairns, has the highest concentration of plastic pollution in the world.

Plastic is having a devastating impact on the world's marine wildlife, too, with over 600 species under threat. They eat it. They get trapped in it. It overwhelms and destroys their environments. And because plastic degrades to microscopic levels, fish absorb through their stomachs and into their flesh, meaning that humans also end up eating their own plastic waste.

Other pollutants like pesticides and herbicides released into the environment have an impact, too. Agricultural run-off is having a devastating effect on the Great Barrier Reef in Australia. And the the few remaining gharial in India and Nepal are struggling in the face of pollution in their river homes.

5. Climate change

Polar bears stranded on melting ice (Shutterstock)

From more regular and fiercer storms to longer and more intense droughts, the impact of climate change caused by human activities is clear to see.

It is having an extraordinary effect and the world's ecosystems, with rising ocean temperatures and diminishing Arctic sea ice affecting marine biodiversity, shifting vegetation zones and forcing species to adapt to new conditions. From polar bears in the Arctic to marine turtles off the coast of Africa, our planet's diversity of life is at risk.

Some species are able to adjust. Others move into new, more favourable areas. Some species are being affected in ways that will have an impact for generations to come.

Importance of wildlife conservation

Biodiversity

Biodiversity is one important issue. Reduction in numbers of one animal interrupts the eco system and the natural food chain, and leads to the threat of other species.

Release suffering

Animal conservation can be important to relieve suffering for animals because they are kept captive. Examples of this is the use of elephants in South East Asia for tourism. Likewise, the use of orangutans in Indonesia for boxing shows. In addition to the suffering cause to the animals, these activities create sharp population decline for the species.

Human needs

Reduction in numbers of one animal can also have a chain effect on other species that are important to human beings. All animals play an important role in the eco system. The loss or reduction of certain species can have a flow on effect; including an effect on human food and water source that are critical to our survival.

Water and air

Keeping the eco system in balance helps providing with clean air and clean water that we all benefit from, people and animals.

Effects of wildlife depletion

1)Loss of Wildlife Species Eventually leads to Extinction of a Particular Set of Animal Species - Normally in The Wild if the Animals do not get adequate Food or Water during a Famine or drought they will perish without Human or a Country's Forest Department's assistance.

2) Similarly in Forest Fires, Many Plants, Trees, Birds, Reptiles, Insect species & Animals get Engulfed by fire - So they will also lose their lives if the Forest fires are not doused on time.

3) Deforestation and Habitat Loss due to Developmental Works & Timber related Tree felling carried out by Human beings also causes untold damage to an Ecosystem and Many Animals are deprived of their Forests and a Safe abode.

4) Hunting and Poaching of Animals also causes a Depletion of a Species of animals in number count.

5) Uncontrolled Fishing and Over Exploitation of Marine resources by Humans are also responsible for Extinction of Aquatic & Amphibious varieties of Animals & reptiles.

6) Releasing Toxic Pesticides & Industrial Effluents leads to Toxicity of Water bodies like Rivers, Lakes & Water bodies and a Lower Biochemical Oxygen Demand will result in Elimination of Aquatic life.

All of these causes lead to Depletion of Wild animals and their Former Habitats (Forests, Grasslands, Plains, Valleys) are completely Wiped out and taken over by Human beings for Real Estate Projects, Railways, Roads, Industries, Aerodromes, Yards etc.

So Greenhouse Effect will come into play, Ozone Layer depletion and Global Warming with Climate change will become the Order of the Day with Scanty Rainfall, Drought, Smog and Acid Rains Everybody is Bound to Suffer in Future due to these wrongful methods being followed.

Basically if there are No Big Carnivores, then The Forest will be Full of Herbivores and Over Grazing will occur, and The Primary Producers like Grass, Plants & shrubs will dwindle. The Humans will be Lesser afraid without The Carnivorous animals, and they will take over The Wild areas - Similarly If there are No Primary Producers or Herbivores, then The Pure Carnivores will not find food to survive.

So if The Wild has to Survive, then it must have Wild Animals in its Abode as a Balanced Ecosystem and a Vice versa Policy is also applicable - If The Animals have to Survive, they will Definitely Need a Natural Habitat to Sustain their living.

National parks and wildlife sanctuaries in India

- Corbett National Park
- Dachigam National Park
- Dudhwa National Park
- Gobind Sagar Wildlife Sanctuary
- Nanda Devi Biosphere Reserve
- Valley of Flowers National Park
- Rajaji National Park
- Hemis National Park
- Kishtwar National Park
- Great Himalayan National Park
- Pin Valley National Park
- Ranthambore National Park
- Keoladeo Ghana National Park
- Gir National Park
- Blackbuck National Park
- Bandhavgarh National Park
- Kanha National Park
- Pench National Park
- Panna National Park
- Madhav National Park
- Indravati National Park
- Hazaribagh National Park
- Betla National Park
- Chilika Wildlife Sanctuary
- Jaldapara National Park
- Sunderban National Park
- Simlipal National Park
- Gorumara National Park
- Kaziranga National Park
- Manas Tiger Reserve
- Nokrek National Park
- Khanghendzonga National Park
- Bandipur National Park
- Nagarhole National Park

Conclusion

Protection of Wildlife alone is not possible only by laws and Government. Despite all of these laws and efforts, destruction of wildlife, illegal trade and poaching continues. Active cooperation from the common public is also very necessary. It is now high time for us to understand the gravity of the situation and act on its behalf. And this can only be achieved by our awareness and by further stringent laws by the Government. We must not lose the national treasures in our rat race of urbanization and modernization.

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AIR POLLUTION

A growing global hazard

College Roll. No: **ECOA20F279**
Semester: **2**
Subject: **AECC2 – Environmental Studies**
University Reg. No: **223-1211-0335-20**
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Living in a city, we know what we're looking at when we see a sheet of smog over a cityscape, exhaust billows across a busy highway, or thick smoke rising from factory chimneys. Air pollution is a familiar hazard. **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 materials**. There are many different types of air pollutants, such as gases (such as ammonia, carbon monoxide, sulphur dioxide, nitrous oxides, methane, carbon dioxide and chlorofluorocarbons), particulates (both organic and inorganic), and biological molecules. Air pollution may cause diseases, allergies and even death to humans; it may also cause harm to other living organisms such as animals and food crops and may damage the natural environment (for example, climate change, and ozone depletion or habitat degradation) or built environment (for example, acid rain). Both human activity and natural processes can generate air pollution. When the National Ambient Air Quality Standards were established in 1970, air pollution was regarded primarily as a threat to respiratory health. Over the next decades as air pollution research advanced, public health concerns broadened to include cardiovascular disease; diabetes mellitus; obesity; and reproductive, neurological, and immune system disorders. As the air pollution levels increase, scientists and environmentalists have come forward with various measures to implement for curbing the environmental hazard.

Productivity losses and degraded quality of life caused by air pollution are estimated to cost the world economy $5 trillion per year. Various pollution

control technologies and strategies are available to reduce air pollution. To reduce the impacts of air pollution, both international and national legislation and regulation have been implemented to regulate air pollution. Local laws where well enforced in cities have led to strong public health improvements.

With some successful implementations like the Montreal Protocol and the Helsinki Protocol, many measures remain partly implemented, while others received minimum engagement from citizens. This project takes a deeper look at the causes, effects and measures taken against the global environmental, social and economic hazard - Air Pollution.

Sources of air pollution

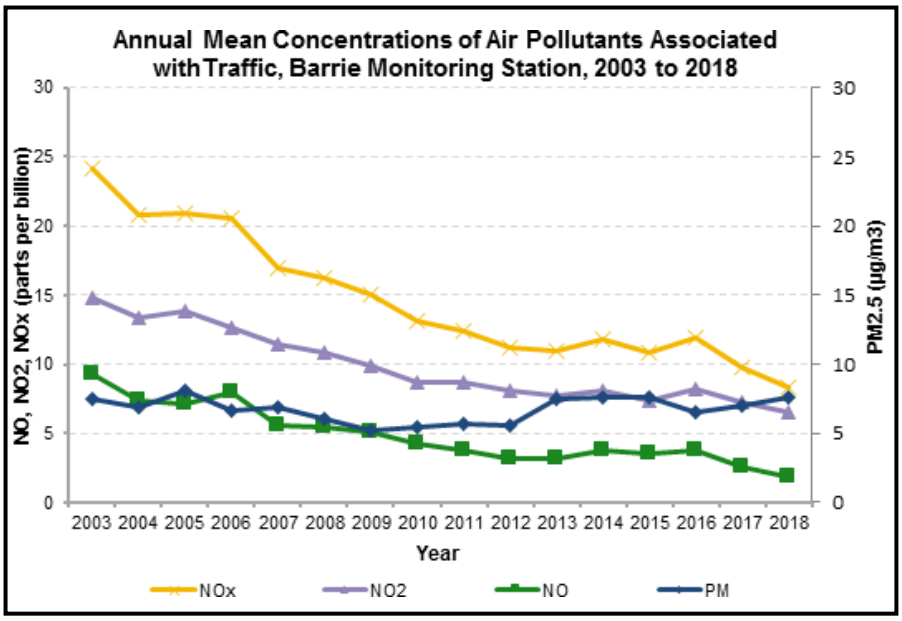
The harmful emissions such as gases (such as ammonia, carbon monoxide, sulphur dioxide, nitrous oxides, methane, carbon dioxide and chlorofluorocarbons), particulates (both organic and inorganic), and biological molecules, that pollute the air are known as **pollutants**. Various sources release these pollutants into the air. Some are given below:

Anthropogenic sources:

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.

- **Traffic-Related Air Pollution** (TRAP), from motor vehicle emissions, maybe the most recognizable form of air pollution. It contains most human-made air pollution elements: ground-level ozone, various forms of carbon, nitrogen oxides, sulphur oxides, volatile organic compounds, polycyclic aromatic hydrocarbons, and fine particulate matter.

Emissions from motor vehicles



- 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 the presence of sunlight.

Smog in Delhi, India

- **Noxious gases**, which include carbon dioxide, carbon monoxide, nitrogen oxides (NOx), and sulphur oxides (SO_x), are components of motor vehicle emissions and by-products of industrial processes.

Emissions of NO_x gases from a fish factory in Senegal

- **Particulate matter** (PM) is composed of chemicals such as sulphates, nitrates, carbon, or mineral dust. Vehicle and industrial emissions from fossil fuel combustion, cigarette smoke, waste incinerators, as well as furnaces and other types of fuel-burning heating devices all contain particulate matter.

Emissions from a waste incinerator

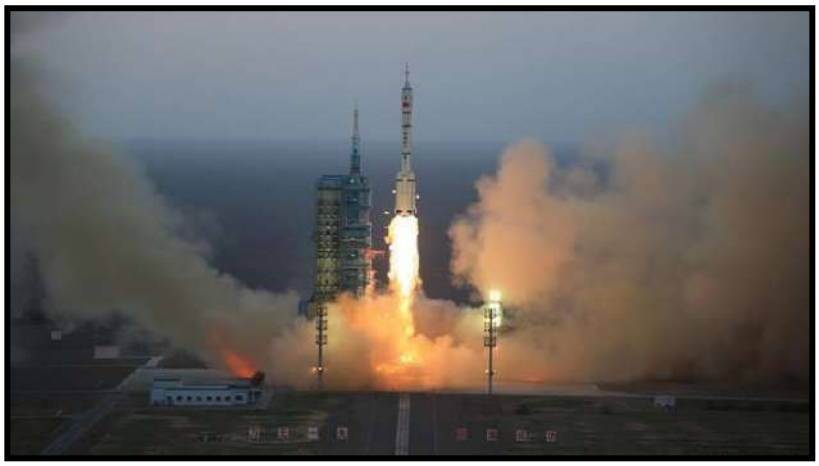
- **Volatile organic compounds** (VOC) vaporize at or near room temperature—hence, the designation volatile. VOCs are given off by paints, aerosol sprays, hair sprays, cleaning supplies, pesticides, some furnishings, and even craft materials like glue. Gasoline and natural gas are major sources of VOCs, which are released during combustion by humans.

Aerosol cans that cause emission of VOC

- **Controlled burn practices** in agriculture and forest management and fertilized farmland may be a major source of nitrogen oxides and other harmful pollutants.

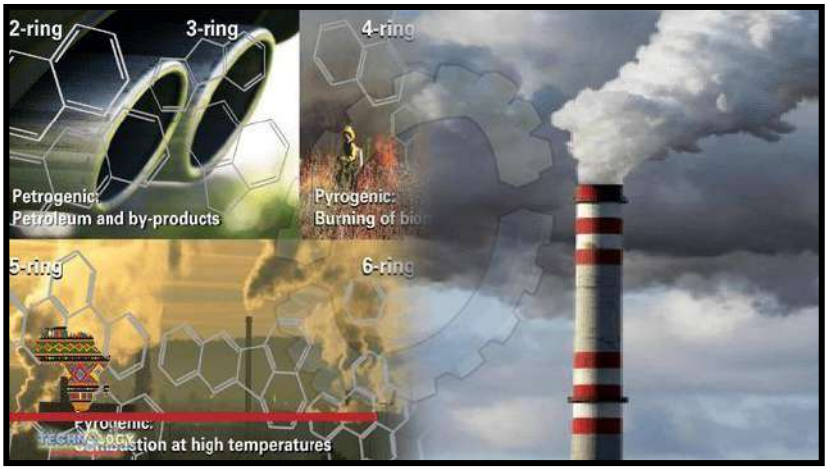
Controlled burning of crops

- **Military resources**, such as nuclear weapons, toxic gases, germ warfare and rocketry also release noxious oxides and carbon compounds into the air.



Polluting gases expelled during rocket launch

- **Polycyclic aromatic hydrocarbons** (PAH) are organic compounds containing carbon and hydrogen. In addition to combustion, many industrial processes, such as iron, steel, and rubber product manufacturing, as well as power generation, also produce PAHs as a by-product.



Toxic PAH released into the air from sources

- 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. Landfills are also known to generate methane, which is not only a major greenhouse gas

Landfills – liberation of methane

Natural sources:

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.

Dust storms

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**.

Wildfire - contributes to the carbon levels

- **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, sulphur 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 sulfuric, 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.

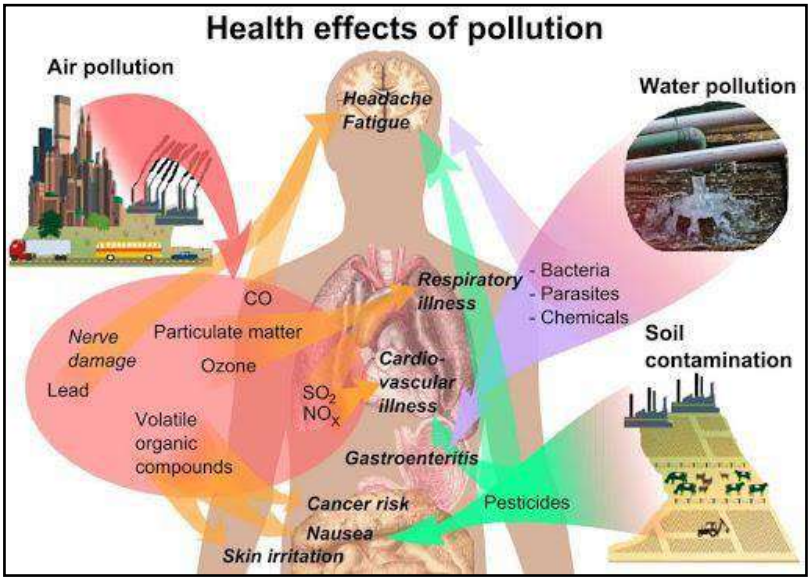
Volcano gas contributes to 0.2% of air pollution

- Radon gas, a health hazard, from radioactive decay within the Earth's crust. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as the basement.

Effects of Air Pollution

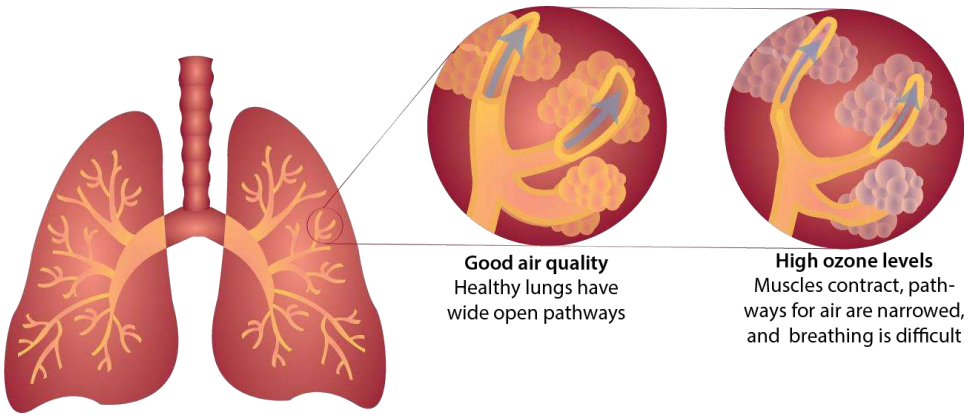
1. Effect on humans:

The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing, asthma and worsening of existing respiratory and cardiac conditions. These effects can result in increased medication use, increased doctor or emergency department visits, more hospital admissions and premature death. The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the individual's health status and genetics



- **Respiratory diseases**:
    - Air pollution can affect lung development and is implicated in the development of emphysema, asthma, and other respiratory diseases, such as chronic obstructive pulmonary disease (COPD). Additionally, air pollution has been associated with increased

hospitalization and mortality from asthma and COPD. Chronic obstructive pulmonary disease (COPD) includes diseases such as chronic bronchitis and emphysema. Particulate matter and nitrogen oxide are linked to chronic bronchitis.



- It is believed that much like cystic fibrosis, by living in a more urban environment serious health hazards become more apparent. Studies have shown that in urban areas patients suffer mucus hypersecretion, lower levels of lung function, and more self-diagnosis of chronic bronchitis and emphysema.

- Children who play several outdoor sports and live in high ozone communities are more likely to develop asthma and are more likely to develop bronchitis symptoms.

- **Cardiovascular disease:** A 2007 review of evidence found that, ambient air pollution exposure is a risk factor correlating with increased total mortality from cardiovascular events
  - Air pollution is also emerging as a risk factor for stroke, particularly in developing countries where pollutant levels are highest. A 2007 study found that in women, air pollution is not

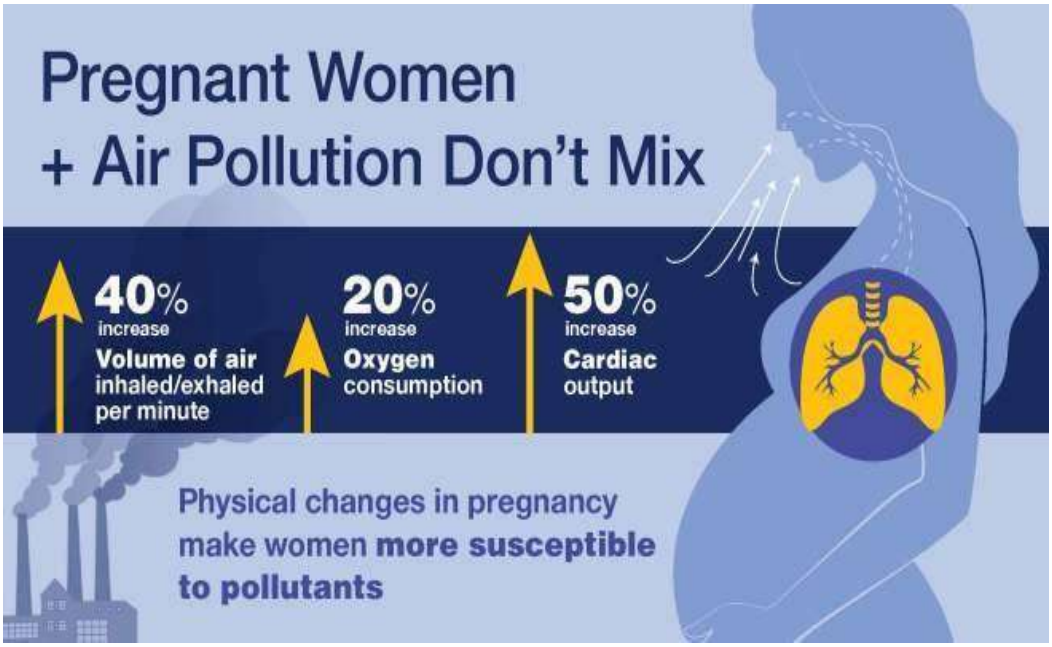
associated with haemorrhagic but with ischemic stroke. Air pollution was also found to be associated with increased incidence and mortality from coronary stroke in a cohort study in 2011.

- Fine particulate matter can impair blood vessel function and speed up calcification in arteries.
- NIEHS researchers established links between short-term daily exposure by post-menopausal women to nitrogen oxides and increased risk of haemorrhagic stroke.
- For a cross-section of older Americans, exposure to TRAP can result in lowered levels of high-density lipoprotein, sometimes called good cholesterol, increasing their risk for cardiovascular disease.

  According to a National Toxicology Program (NTP) report, TRAP exposure also increases a pregnant woman's risk for dangerous changes in blood pressure, known as hypertensive disorders, which

are a leading cause of pre-term birth, low birth weight, and maternal and foetal illness and death.

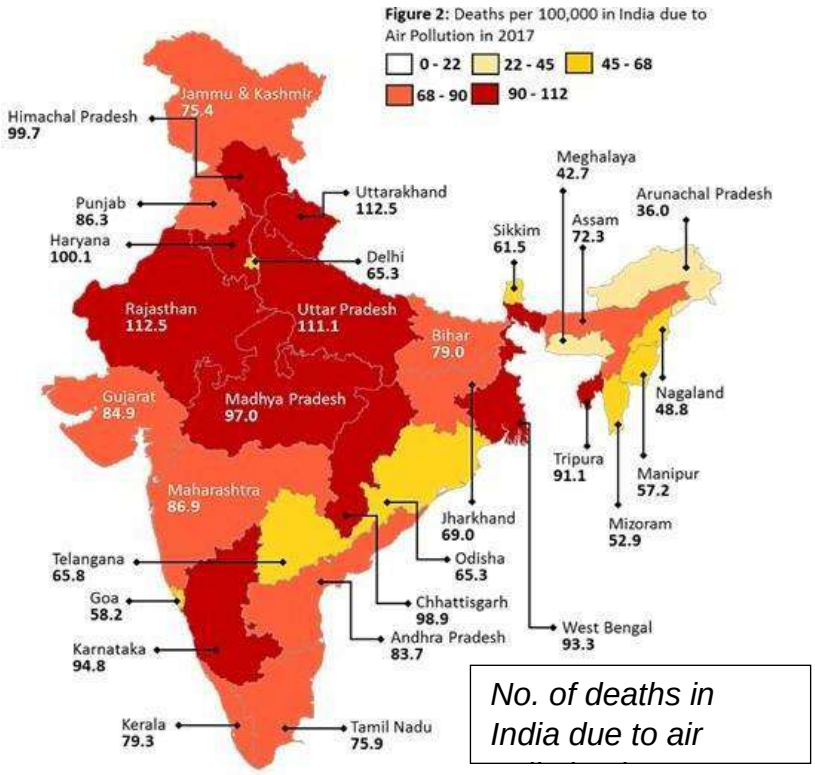
- **Others**:
  - Ambient levels of air pollution have been associated with preterm birth and low birth weight. A 2014 WHO worldwide survey on maternal and perinatal health found a statistically significant association between low birth weights (LBW) and increased levels of exposure to PM2.5. Women in regions with greater than average PM2.5 levels had statistically significant higher odds of pregnancy resulting in a low-birth weight infant even when adjusted for country-related variables. The effect is thought to be from stimulating inflammation and increasing oxidative stress.



  - A 2014 study found that PAHs might play a role in the development of childhood Attention Deficit Hyperactivity Disorder (ADHD). Researchers have also begun to find evidence for air pollution as a risk factor for autism spectrum disorder (ASD). In

Los Angeles, children who were living in areas with high levels of traffic-related air pollution were more likely to be diagnosed with autism between 3-5 years of age.

- **Mortality**: The World Health Organization estimated in 2014 that every year air pollution causes the premature death of some 7 million people worldwide. Studies published in March 2019 indicated that the number may be around 8.8 million. **India has the highest death rate due to air pollution**. India also has more deaths from asthma than any other nation according to the World Health Organization. In December 2013 air pollution was estimated to kill 500,000 people in China each year.
    - Urban outdoor air pollution is estimated to cause 1.3 million deaths worldwide per year. Children are particularly at risk due to the immaturity of their respiratory organ systems.



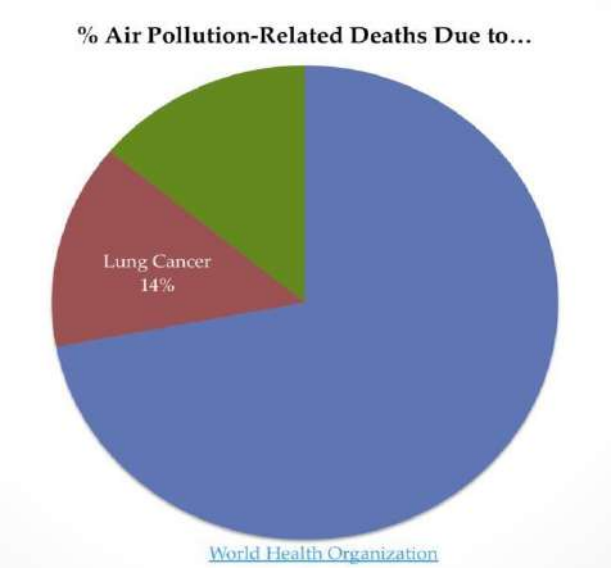
No. of deaths in India due to air

- Diesel exhaust (DE) is a major contributor to combustion-derived particulate matter air pollution. In several human experimental studies, using a well-validated exposure chamber setup, DE has been linked to acute vascular dysfunction and increased thrombus formation.

- **Cancer**

Air pollution exposure is associated with oxidative stress and inflammation in human cells, which may lay a foundation for chronic diseases and cancer. **In 2013, the International Agency for Research on Cancer of the World Health Organization (WHO) classified air pollution as a human carcinogen**.

- A large study of more than 57,000 women found living near major roadways may increase a woman's risk for breast cancer.
- The National Institute of Environmental Health Sciences (NIEHS) Sister Study found other airborne toxic substances, especially methylene chloride, which is used in aerosol products and paint removers, are also associated with increased risk of breast cancer.



- Occupational exposure to benzene, an industrial chemical and component of gasoline, can cause leukaemia and is associated with non-Hodgkin's Lymphoma.
- A long-term study, 2000-2016, found an association between lung cancer incidence and increased

reliance on coal for energy generation.

Agricultural effects:

In India in 2014, it was reported that air pollution by black carbon and ground level ozone had reduced crop yields in the most affected areas by almost half in 2011 when compared to 1980 levels.

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 Institute 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. One out of ten deaths in 2013 was caused by diseases associated with air pollution and the problem is getting worse. The problem is even more acute in the developing world. "Children under age 5 in lower-income countries are more than 60 times as likely to die from exposure to air pollution as children in high-income countries." 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.

Air quality index

The air quality index (AQI) is an index for reporting air quality on a daily basis. It is a measure of how air pollution affects one's health within a short time period. The purpose of the AQI is to help people know how the local air quality impacts their health. The Environmental Protection Agency (EPA) calculates the AQI for **five major air pollutants**, for which national air quality standards have been established to safeguard public health:

1. Ground-level ozone
2. Particle pollution/particulate matter (PM2.5/pm 10)
3. Carbon Monoxide
4. Sulphur dioxide
5. Nitrogen dioxide

Air quality Index – India

The Central Pollution Control Board along with State Pollution Control Boards has been operating National Air Monitoring Program (NAMP) covering 240 cities of the country having more than 342 monitoring stations. An Expert Group comprising medical professionals, air quality experts, academia, advocacy groups, and SPCBs was constituted and a technical study was awarded to IIT Kanpur. IIT Kanpur and the Expert Group recommended an AQI scheme in 2014.[20] While the earlier measuring index was limited to three indicators, the new index measures eight parameters.[21] The continuous monitoring systems that provide data on near real-time basis are installed in New Delhi, Mumbai, Pune, Kolkata and Ahmedabad.

There are six AQI categories, namely **Good**, **Satisfactory**, **Moderately polluted**, **Poor**, **Very Poor**, and **Severe**. The proposed AQI will consider **eight** pollutants (PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, O_3, NH_3, and Pb) for which short-term (up to 24-

hourly averaging period) National Ambient Air Quality Standards are prescribed. Based on the measured ambient concentrations, corresponding standards and likely health impact, a sub-index is calculated for each of these pollutants. The worst sub-index reflects overall AQI. Likely health impacts for different AQI categories and pollutants have also been suggested, with primary inputs from the medical experts in the group. The AQI values and corresponding ambient concentrations (health breakpoints) as well as associated likely health impacts for the identified eight pollutants are as follows:

AQI Category (Range)	PM10 (24hr)	PM2.5 (24hr)	NO2 (24hr)	O3 (8hr)	CO (8hr)	SO2 (24hr)	NH3 (24hr)	Pb (24hr)
Good (0–50)	0–50	0–30	0–40	0–50	0–1.0	0–40	0–200	0–0.5
Satisfactory (51–100)	51–100	31–60	41–80	51–100	1.1–2.0	41–80	201–400	0.5–1.0
Moderately polluted (101–200)	101–250	61–90	81–180	101–168	2.1–10	81–380	401–800	1.1–2.0
Poor (201–300)	251–350	91–120	181–280	169–208	10–17	381–800	801–1200	2.1–3.0
Very poor (301–400)	351–430	121–250	281–400	209–748	17–34	801–1600	1200–1800	3.1–3.5
Severe (401–500)	430+	250+	400+	748+	34+	1600+	1800+	3.5+

AQI Category (Range)	Effects
Good (0–50)	Minimal impact
Satisfactory (51–100)	May cause minor breathing discomfort to sensitive people.
Moderately polluted (101–200)	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.
Poor (201–300)	May cause breathing discomfort to people on prolonged exposure, and discomfort to people with heart disease.
Very poor (301–400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases.
Severe (401–500)	May cause respiratory impact even on healthy people, and serious health impacts on people with lung/heart disease. The health impacts may be experienced even during light physical activity.

Measure against Air Pollution

World Health Organisation

- WHO Member States recently adopted a resolution and a road map for an enhanced global response to the adverse health effects of air pollution.

- WHO develops and produces "**Air quality guidelines**" recommending exposure limits to key air pollutants.

- WHO creates detailed health-related assessments of different types of air pollutants, including particulates and black carbon particles, ozone, etc.

- WHO produces evidence regarding the linkage of air pollution to specific diseases, such as cardiovascular and respiratory diseases and cancers, as well as burden of disease estimates from existing air pollution exposures, at country, regional, and global levels.

- WHO's "**Health in the green economy**" series is assessing the health co-benefits of climate mitigation and energy efficient measures that reduce air pollution from housing, transport, and other key economic sectors.

- WHO's work on "Measuring health gains from sustainable development" has proposed air pollution indicators as a marker of progress for

development goals related to sustainable development in cities and the energy sector.

- WHO assists Member States in sharing information on successful approaches, on methods of exposure assessment and monitoring of health impacts of pollution.

- The WHO co-sponsored "**Pan European Programme on Transport Health and Environment (The PEP)**", has built a model of regional, Member State and multi-sectoral cooperation for mitigation of air pollution and other health impacts in the transport sector, as well as tools for assessing the health benefits of such mitigation measures.

On-site measures:

- Using **high-efficiency particulate air** (HEPA) filtration

- 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.

- **Electrostatic precipitators**- An electrostatic precipitator (ESP), or electrostatic air cleaner is a particulate collection device that removes particles from a flowing gas (such as air), using the force of an induced electrostatic charge. Electrostatic precipitators are highly efficient filtration devices that minimally impede the flow of gases through the

Particulate scrubber

device, and can easily remove fine particulates such as dust and smoke from the air stream

- **Particulate scrubbers**- Wet scrubber is a form of pollution control technology. The term describes a variety of devices that use pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.

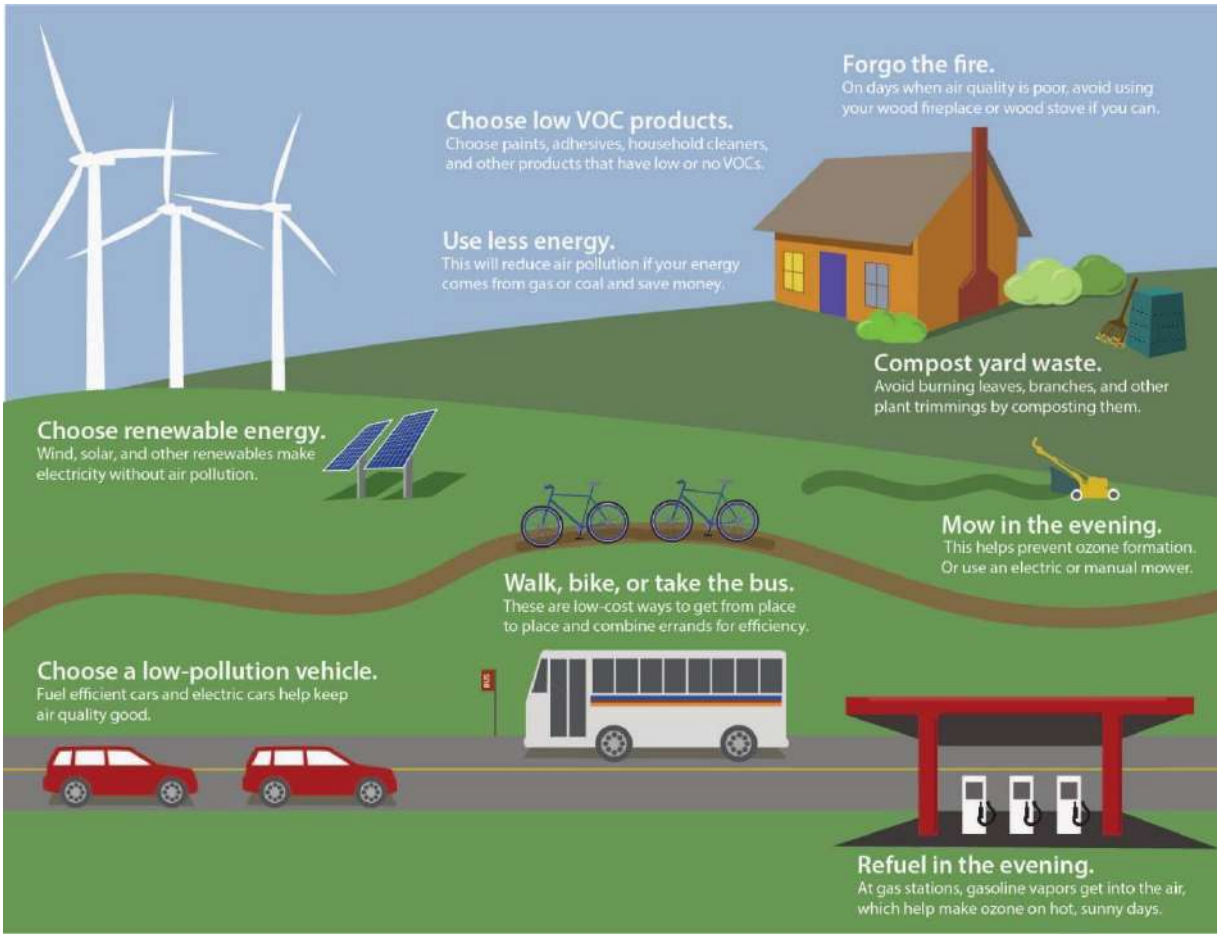
A baghouse for air filtration in San Diego

- **Baghouses**- Designed to handle heavy dust loads, a dust collector consists of a blower, dust filter, a filter-cleaning system, and a dust receptacle or dust removal system (distinguished from air cleaners which utilize disposable filters to remove the dust).

- Use of Low NOx burners like **Selective catalytic reduction** (SCR), **Selective non-catalytic reduction** (SNCR), NOx scrubbers, Exhaust gas recirculation, Catalytic converter (also for VOC control).

Community-level measures

- Creating active travel options, such as bicycling and walking paths.
- Improving urban design with gardens, parks, and street-side trees.
- Taking a bus or carpooling.



- Buying a car that has greater fuel efficiency.
- Turning off lights and appliances when they are not in use.
- Using energy-efficient light bulbs and appliances.
- Buying fewer things that are manufactured using fossil fuels.

Conclusion

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. And 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!

CU REGISTRATION NO- 223-1211-0392-20

COLLEGE ROLL NO: ECOA20F285.

CU ROLL NO: 203223-11-0060

TOPIC NAME :: ENDANGERED AND ENDEMIC SPECIES OF INDIA

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my departmental H.O.D (Dr. Smita nath) as well as our principal mam (Dr. Madhumanjari Mandal) and all other teachers who took our ENVS classes and gave me the golden opportunity to do this wonderful project on the topic (**ENDANGERED AND ENDEMIC SPECIES OF INDIA**), which also helped me in doing a lot of research and I came to know about so many new things I am really thankful to them.

And, I would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

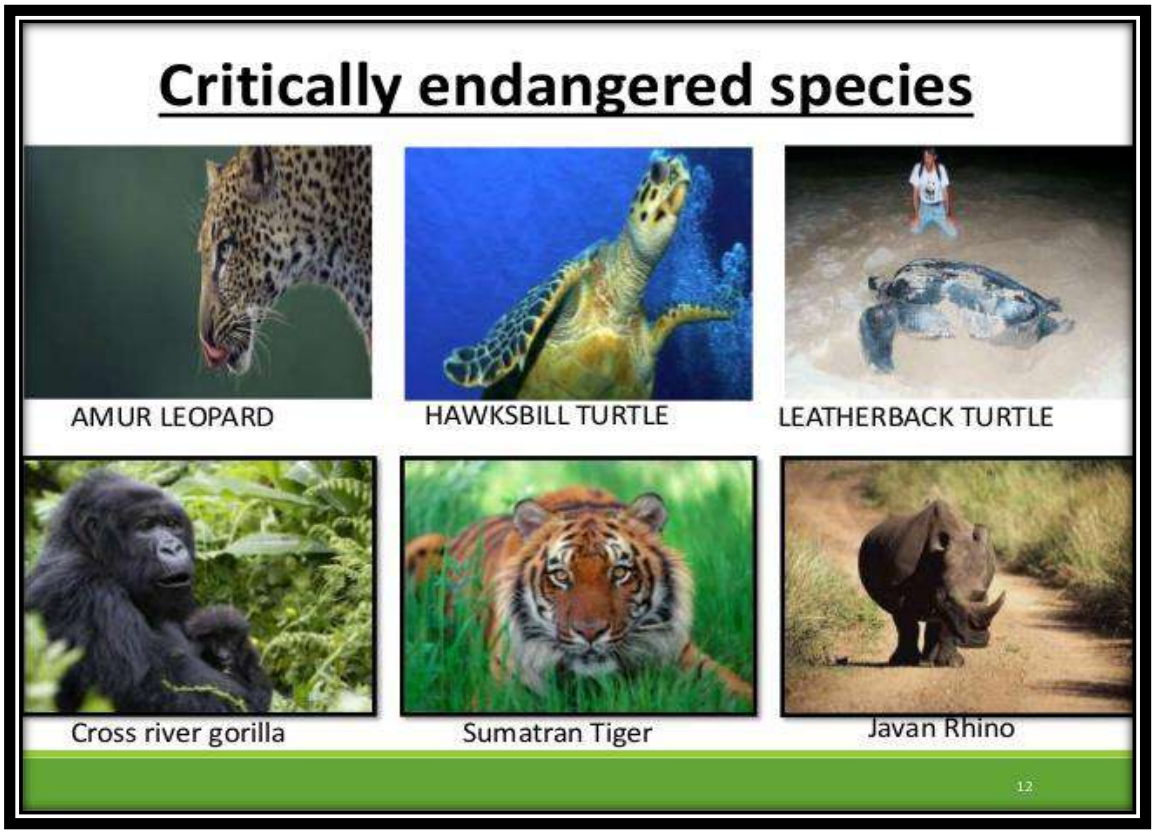
CONTENT

INTRODUCTION

Life on Earth is in the throes of a new wave of mass extinction, unlike anything since the demise of the dinosaurs. In the last 500 years, 844 species – like the passenger pigeon, auk, thylacine, and quagga – are known to have died out, and up to 16,000 others are now known to be threatened. Two thirds of turtles could be gone by the 2025, great apes have recently declined by over 50% in parts of Africa, half of marsupials and one in three amphibians are in jeopardy, and a staggering 40% of Asia's plants and animals could soon be lost.

But this may only be a fraction of the true number facing extinction. Though only 1.5 million species have been described, there could be between 5 to 30 million in total. Of these, some experts predict that one could be falling extinct every 20 minutes – or 27,000 a year.

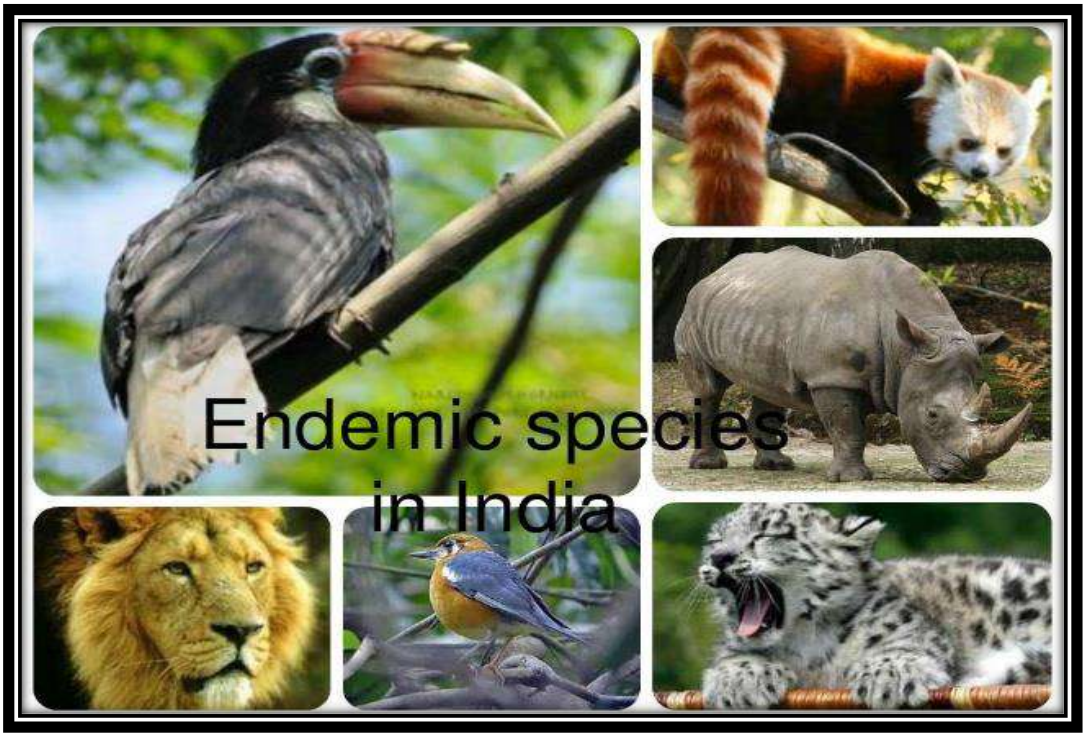
Conservationists argue that humans have an ethical obligation to protect other species, that diversity and natural beauty are highly prized by mankind, and that biodiversity is a vital resource: we rely on ecosystems to provide food, oxygen and natural resources, recycle wastes and fertilise soils for agriculture. The total value of services provided to man by nature has been estimated at $33 trillion annually.



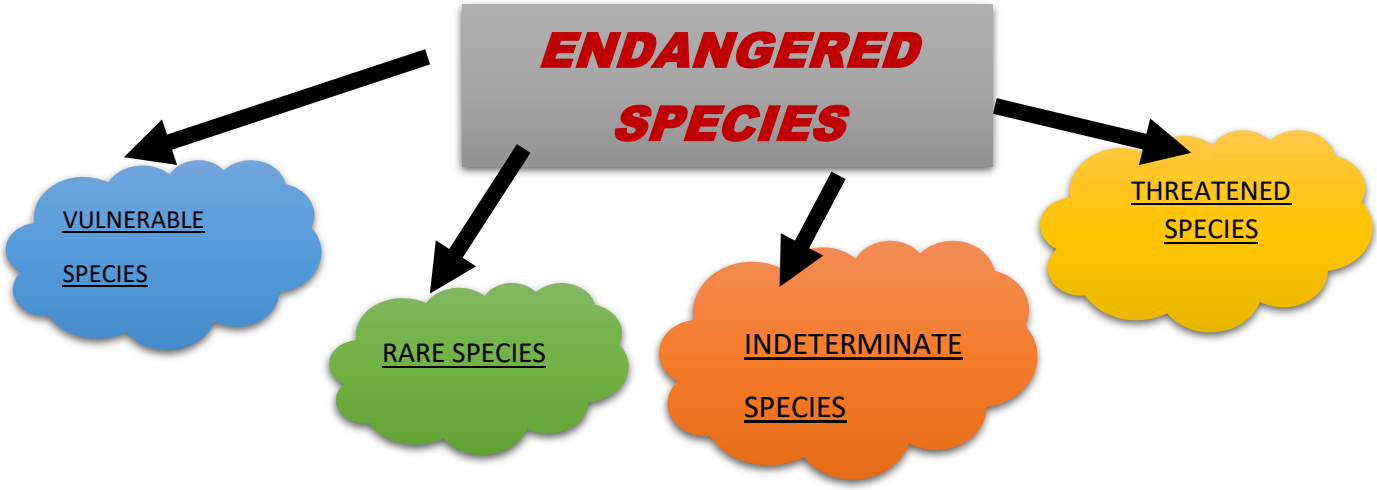
ENDANGERED SPECIES

- A species is said to be endangered, when its number has been reduced to a critical level. Unless it is protected and conserved, it is in immediate danger of extinction.
- In India 450 plant species have been identified as endangered species.
- About 100 mammals and 150 birds are endangered species.

ENDEMIC SPECIES



- The species which are found only in a particular region are known as endemic species.
- India is rich in plant and animal endemic species
- Western Ghats rich in 60% amphibians, 50%, reptiles endemic species
- Out of 47,000 species,7,000 –endemic
- 62% endemic found in Himalayas and western Ghats



1.Vulnerable species: A species is said to be vulnerable when its population is facing continuous decline due to habitat destruction or over exploitation

Example : - Barasingha, Blackbuck, Nilgiri Langur, One Horned Rhinoceros

2.Rare species: A species is said to be rare, when it is localized within restricted area.

Example : - giant panda , cheetah , wild bactrian camel

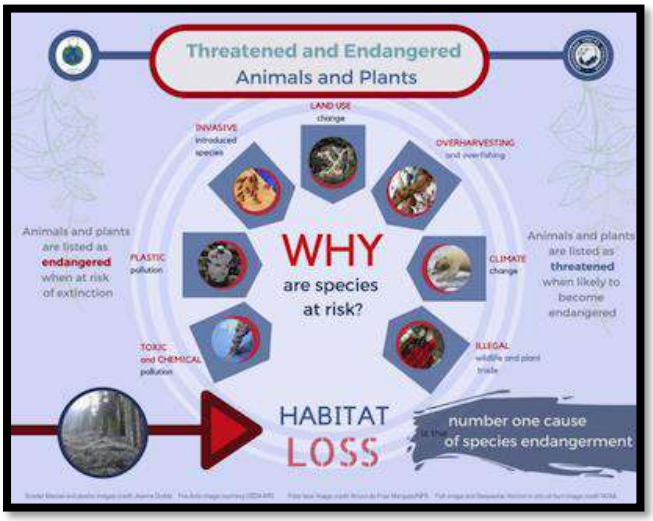
3.Indeterminate species : A species is said to be indeterminate species when we didn't have any actual database for these species

Example :- Giant squirrel

4.Threatened species : Threatened Species are any species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future.

Example :- Angelfish, albacore tuna , albatross

FACTORS AFFECTING ENDANGERED SPECIES



1. POLLUTION : Pollution like air pollution, water pollution and waste pollution, especially in the form of plastic plays a very dominant role in the endangerment of animal species. Pollution not only causes health hazards for humans, but it affects the animals also

2. DESTRUCTION OF HABITAT : Loss of habitat is one of the primary reasons for the endangerment of species. Today, human intervention plays a major role in the destruction of the natural landscape. Human activities like removal of trees that provide both food and shelter for innumerable number of species, mining and agriculture.

3. OVER HUNTING : Over hunting and poaching has a very destructive and catastrophic effect on the number of animals and fishes all over the world.

OTHER REASONS ARE :

- INVASIVE SPECIES
- NEW SPECIES INTRODUCTION AND COMPETITION
- HUMAN – WILDFILE CONFLICT
- DISEASE
- LOW BIRTH RATE
- OVER-EXPLOITATION
- CLIMATE CHANGE
- WILDLIFE TRADE

IMPORTANT ENDANGERED SPECIES

1.REPTILES –

As of September 2016, the International Union for Conservation of Nature (IUCN) lists 382 endangered reptile species. 7.4% of all evaluated reptile species are listed as endangered. The IUCN also lists nine reptile subspecies as endangered.

Of the subpopulations of reptiles evaluated by the IUCN, one species subpopulation has been assessed as endangered.

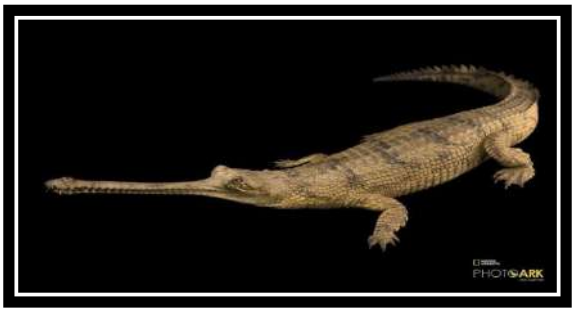
For a species to be considered endangered by the IUCN it must meet certain quantitative criteria which are designed to classify taxa facing "a very high risk of extinction". An even higher risk is faced by *critically endangered* species, which meet the quantitative criteria for endangered species. Critically endangered reptiles are listed separately. There are 578 reptile species which are endangered or critically endangered.

Additionally 910 reptile species (18% of those evaluated) are listed as *data deficient*, meaning there is insufficient information for a full assessment of conservation status. As these species typically have small distributions and/or populations, they are intrinsically likely to be threatened, according to the IUCN. While the category of *data deficient* indicates that no assessment of extinction risk has been made for the taxa, the IUCN notes that it may be appropriate to give them "the same degree of attention as threatened taxa, at least until their status can be assessed."

NAME OF SOME ENDANGERED REPTILES:-

- **Gharial - *Gavialis gangeticus***
- **Hawksbill Sea Turtle - *Eretmochelys imbricata***
- **Leatherback Sea Turtle - *Dermochelys coriacea***
- **Rao's torrt frog -*Micrixalus kottigeharensis***

Eretmochelys imbricata



Gavialis gangeticus

2.BIRDS:–

Out of the approximately 11,154 known bird species, 159 (1.4%) have become extinct, 226 (2%) are critically endangered, 461 (4.1%) are endangered, 800 (7.2%) are vulnerable and 1018 (9.1%) are near threatened. There is a general consensus among scientists who study these trends that if human impact on the environment continues as it has one-third of all bird species and an even greater proportion of bird populations will be gone by the end of this century.

Since 1500, 150 species of birds have become extinct. Historically, the majority of bird extinctions have occurred on islands, particularly those in the Pacific. These include countries such as New Zealand, Australia, Fiji, and Papua New Guinea.

Some species are not extinct and seem numerous, but exist in highly reduced numbers from previous years. For example, the Wood Thrush population in North America has declined 50% in the last 50 years. According to the American Bird Conservatory, in the Western Hemisphere 12% of bird species are declining at a rate such that they will be extinct within the next century

NAME OF SOME ENDANGERED BIRDS:-

- **Great Indian Bustard : *Ardeotis nigriceps***
- **White Bellied Heron : *Ardea insignis***
- **Spoon Billed Sandpiper : *Calidris pygmaea***
- **Bugun liocichla : *Liocichla bugunorum***
- **Himalayan quail : *Ophrysia superciliosa***
- **Jerdon's courser : *Rhinoptilus bitorquatus***
- **Red-headed vulture :*Sarcogyps calvus***

Ardeotis nigriceps

Ardea insignis

Calidris pygmaea

3.MAMMALS :

In India, mammals comprise 410 species, 186 genera, 45 families and 13 orders of which nearly 89 species are listed as threatened in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Animals (IUCN 2006). This includes two species that are locally extinct from India viz. *Acinonyx jubatus* and *Rhinoceros sondaicus*.

The mammals are the class of vertebrate animals characterized by the presence of mammary glands, which in females produce milk for the nourishment of young; the presence of hair or fur; specialized teeth; the presence of a neocortex region in the brain; and endothermic or "warm-blooded" bodies. The brain regulates endothermic and circulatory system, including a four-chambered heart. Mammals encompass some 5,500 species (including Humans), distributed in about 1,200 genera, 152 families and up to 46 orders, though this varies with the classification scheme.

NAME OF SOME ENDANGERED MAMMALS

- Asiatic golden cat (*Catopuma temmincki*)
- Asiatic lion (*Panthera leo persica*)
- Indian wild ass or Khur (*Equus hemionus khur*)
- Hispid hare (*Caprolagus hispidus*)
- Hoolock gibbon (*Hoolock hoolock*)
- Indian elephant (*Elephas maximus indicus*)
- Golden jackal (*Canis aureus*)
- Kashmir stag / Hangul (*Cervus affinis hanglu*)
- Indian leopard (*Panthera pardus fusca*)
- Nilgiri tahr (*Hemitragus hylocrius*)
- Nilgiri marten (*Martes gwatkinsi*)

(*Catopuma temmincki*)

(*Panthera leo persica*)

4.PRIMATES :-

The World's 25 Most Endangered Primates is a list of highly endangered primate species selected and published by the International Union for Conservation of Nature Species Survival Commission Primate Specialist Group (IUCN/SSC PSG), the International Primatological Society (IPS), and Conservation International (CI). The 2012–2014 list added the Bristol Conservation and Science Foundation (BCSF) to the list of publishers. The IUCN/SSC PSG worked with CI to start the list in 2000, but in 2002, during the 19th Congress of the International Primatological Society, primatologists reviewed and debated the list, resulting in the 2002–2004 revision and the endorsement of the IPS. The publication has since been a joint project between the three conservation organizations and has been revised every two years following the biannual Congress of the IPS. Starting with the 2004–2006 report, the title changed to "Primates in Peril: The World's 25 Most Endangered Primates". That same year, the list began to provide information about each species, including their conservation status and the threats they face in the wild. The species text is written in collaboration with experts from the field, with 60 people contributing to the 2006–2008 report and 85 people contributing to the 2008–2010 report. The 2004–2006 and 2006–2008 reports were published in the IUCN/SSC PSG journal *Primate Conservation*, while the 2008–2010 and 2010-2012 report were published as independent publications by all three contributing organizations.

NAME OF SOME ENDANGERED PRIMATES:-

- silky sifaka (*Propithecus candidus*),
- Delacour's langur (*Trachypithecus delacouri*)
- grey-shanked douc (*Pygathrix cinerea)*
- Blue-eyed black lemur (*Eulemur flavifrons)*
- Northern sportive lemur (*Lepilemur septentrionalis)*

Propithecus candidus

Pygathrix cinerea

5.PLANTS :-

As of September 2016, the International Union for Conservation of Nature (IUCN) lists 2493 critically endangered plant species, including 145 which are tagged as *possibly extinct* or *possibly extinct in the wild*. 11% of all evaluated plant species are listed as critically endangered. The IUCN also lists 89 subspecies and 70 varieties as critically endangered.

Additionally 1674 plant species (7.6% of those evaluated) are listed as *data deficient*, meaning there is insufficient information for a full assessment of conservation status. As these species typically have small distributions and/or populations, they are intrinsically likely to be threatened, according to the IUCN. While the category of *data deficient* indicates that no assessment of extinction risk has been made for the taxa, the IUCN notes that it may be appropriate to give them "the same degree of attention as threatened taxa, at least until their status can be assessed."

NAME OF SOME ENDANGERED PLANTS:-

Plant	Also Known As	Region (Status)
Polygala irregularis	Milkwort	Gujarat (rare)
Amentotaxus assamica	Assam catkin yew	Arunachal Pradesh (threatened)
Lotus corniculatus	Bird's foot	Gujarat (rare)

Mosses

1.Bryoxiphium madeirense

2. *Distichophyllum carinatum*

Liverworts

1.Aitchisoniella himalayensis

2.*Andrewsianthus ferrugineus*

Polypodiales

1.Acrorumohra hasseltii

2.Actiniopteris kornasii

Polygala irregularis

Amentotaxus assamica

BRIEF HISTORY OF THE RED DATA BOOK

The name of this book has its origins in Russia, it was originally known as the Red Data Book of the Russian Federation or the RDBRF. The book was based on research conducted between 1961 and 1964 by biologists in Russia. Hence, it is also called the Russian Red Data Book.

Currently, the International Union for Conservation of Nature maintains the Red Data Book. IUCN is the world's most detailed inventory centre of the global conservation status of biological species. The International Union for Conservation of Nature **(**IUCN**) was founded in 1948 with an aim to maintain a complete record of every species that ever lived.**

The Red Data Book contains the complete list of threatened species. The main aim behind this documentation is to provide complete information for research and analysis of different species.

The Red Data Book contains colour-coded information sheets, which are arranged according to the extinction risk of many species and subspecies.

- **Black represents species that are confirmed to be extinct.**
- **Red represents species that are endangered**
- **Amber for those species whose status is considered to be vulnerable**
- **White is assigned for species that are rare**
- **Green for species that were formerly endangered, but their numbers have started to recover**
- **Grey coloured for the species that are classified as vulnerable, endangered, or rare but sufficient information is not available to be properly classified.**

In a nutshell, the Red Data Book indexes species as:

- **Threatened**
- **Not threatened**
- **Unknown**

ADVANTAGES OF THE RED DATA BOOK

- **It helps in identifying all animals, birds and other species about their conservation status.**
- **It is used to evaluate the population of a particular species.**

DISADVANTAGES OF THE RED DATA BOOK

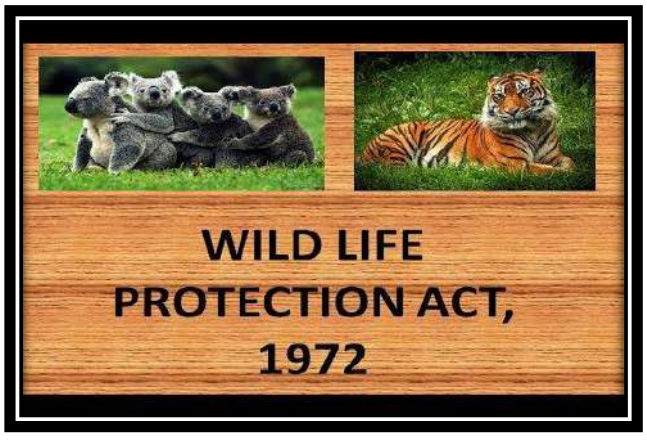
- **The information available in the Red Data Book is incomplete. Many species, both extct and extant are not updated in this book.**
- **This book maintains the complete record of all animals, plants, other species but it has no information about the microbes.**

FEW WAYS TO SAVE ENDANGERED ANIMALS

- **If pollution can be controlled all across the globe then it can have a major positive impact on animals, fish and birds all over the world.**
- **To save the endangered animals from extinction, a number of breeding programmes have been introduced. The government, NGOs and the other corporate bodies should come forward for this noble cause as this programme involves dedicated and special people and of course a lot of money.**
- **Reintroducing the endangered animals to the wild once their numbers increase has become successful in some cases though all species have not done well.**
- **If hunting and poaching can be controlled then there can be a significant change in the numbers of the endangered animals.**

STEPS TAKEN BY THE GOVERNMENT FOR WILDLIFE PROTECTION

• All the states, excluding Jammu and Kashmir (it has its own Act), adopted Wildlife (Protection) Act in 1972 which prohibits any type of trade for endangered and rare species.
• The Central Government provides every type of financial assistance to the State Governments for the conservation and protection of the endangered species.
• National ban was imposed on tiger hunting in 1970 and Wildlife Protection Act became effective in 1972. According to the latest tiger census (2015), there is an overall increase of 30% in tiger population. In 2010, there were 1700 tigers left in India according to tiger census which has gone up to 2226 tigers in 2015.
• Innumerable numbers of National Parks, Wildlife Sanctuaries, Parks etc have been established by the government.
• In 1992, Central Zoo Authority (CZA) was initiated for the supervision of the management of zoological parks in the country.
• In 1996, the Wildlife Advisory Committee and Wildlife Institute were established for seeking advice on different features of Wildlife conservation and matters related to it.
There are several other initiatives which have been taken up by the government to save the endangered species of India.
India is part of five main International Conventions which are associated to wildlife conservation. They are (i) Convention on International Trade in Endangered Species (CITES), (ii) Coalition Against Wildlife Trafficking (CAWT), (iii) International Whaling Commission (IWC), (iv) United Nations Educational, Scientific and Cultural Organization – World Heritage Committee (UNESCO – WHC) and (v) the Convention on Migratory Species (CHS).
Numerous positive steps are being taken for saving the endangered species of India. But that is not enough. There is a dire need for more NGOs and the private corporate sectors to come forward for this noble cause.



CONCLUSION

It is important remember to take care of the animals we have today, and their environment. We humans are the main cause of extinction. Because of us, they lose their home just because we need to make paper, or they die because we need food. Poachers also kill endangered animals or sell them to people who have money and are willing to spend it on a rare or endangered animal.

There are a lot of ways to help endangered animals today such as volunteering or donating to help build animal homes. We can learn more about extinct and endangered animals,by check out some of these organizations: Defenders of Wildlife, Wildlife Conservation Society, Wildlife Alliance, African Wildlife Foundation, and the Animal Welfare Institute. They help endangered animals by finding them a new home, taking care of them temporarily if they are hurt. Some are dedicated to animals from a specific country.

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I need to mention the names of the resources that helped me a lot to complete my project work

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THANK YOU

DEPARMENT: ECONOMICS
AECC: ENVS
CU REGISTRATION NO.: 223-1211-0409-20
CU ROLL NUMBER: 203223-11-0064
COLLEGE ID : ECOA20F289

INDEX

FIRE AS AN ECOLOGICAL FACTOR

Fire ecology is a scientific discipline concerned with natural processes involving fire in an ecosystem and the ecological effects, the interactions between fire and the abiotic and biotic components of an ecosystem, and the role as an ecosystem process. Many ecosystems, particularly prairie, savanna, chaparral and coniferous forests, have evolved with fire as an essential contributor to habitat vitality and renewal.[1] Many plant species in fire-affected environments require fire to germinate, establish, or to reproduce. Wildfire suppression not only eliminates these species, but also the animals that depend upon them.

Campaigns in the United States have historically molded public opinion to believe that wildfires are always harmful to nature. This view is based on the outdated beliefs that ecosystems progress toward an equilibrium and that any disturbance, such as fire, disrupts the harmony of nature. More recent ecological research has shown, however, that fire is an integral component in the function and biodiversity of many natural habitats, and that the organisms within these communities have adapted to withstand, and even to exploit, natural wildfire. More generally, fire is now regarded as a 'natural disturbance', similar to flooding, wind-storms, and landslides, that has driven the evolution of species and controls the characteristics of ecosystems.

Fire suppression, in combination with other human-caused environmental changes, may have resulted in unforeseen consequences for natural ecosystems. Some large wildfires in the United States have been blamed on years of fire suppression and the continuing expansion of people into fire-adapted ecosystems, but climate change is more likely responsible. Land managers are faced with tough questions regarding how to restore a natural fire regime, but allowing wildfires to burn is the least expensive and likely most effective method.

Fire components

A fire regime describes the characteristics of fire and how it interacts with a particular ecosystem.[6] Its "severity" is a term that ecologists use to refer to the impact that a fire has on an ecosystem. Ecologists can define this in many ways, but one way is through an estimate of plant mortality. Fire can burn at three levels. Ground fires will burn through soil that is rich in organic matter. Surface fires will burn through dead plant material that is lying on the ground. Crown fires will burn in the tops of shrubs and trees. Ecosystems generally experience a mix of all three.

Fires will often break out during a dry season, but in some areas wildfires may also commonly occur during a time of year when lightning is prevalent. The frequency over a span of years at which fire will occur at a particular location is a measure of how common wildfires are in a given ecosystem. It is either defined as the average interval between fires at a given site, or the average interval between fires in an equivalent specified area.

Defined as the energy released per unit length of fireline (kW m^{-1}), wildfire intensity can be estimated either as

- the product of
    - the linear spread rate (m s^{-1}),
    - the low heat of combustion (kJ kg^{-1}),
    - and the combusted fuel mass per unit area,
- or it can be estimated from the flame length.

Abiotic responses

Fires can affect soils through heating and combustion processes. Depending on the temperatures of the soils caused by the combustion processes, different effects will happen- from evaporation of water at the lower temperature ranges, to the combustion of soil organic matter and formation of pyrogenic organic matter, otherwise known as charcoal.

Fires can cause changes in soil nutrients through a variety of mechanisms, which include oxidation, volatilization, erosion, and leaching by water, but the event must usually be of high temperatures in order of significant loss of nutrients to occur. However, quantity of nutrients available in soils are usually increased due to the ash that is generated, and this is made quickly available, as opposed to the slow release of nutrients by decomposition. Rock spalling (or thermal exfoliation) accelerates weathering of rock and potentially the release of some nutrients.

Increase in the pH of the soil following a fire is commonly observed, most likely due to the formation of calcium carbonate, and the subsequent decomposition of this calcium carbonate to calcium oxide when temperatures get even higher. It could also be due to the increased cation content in the soil due to the ash, which temporarily increases soil pH. Microbial activity in the soil might also increase due to the heating of soil and increased nutrient content in the soil, though studies have also found complete loss of microbes on the top layer of soil after a fire. Overall, soils become more basic (higher pH) following fires because of acid combustion. By driving novel chemical reactions at high temperatures, fire can even alter the texture and structure of soils by affecting the clay content and the soil's porosity.

Removal of vegetation following a fire can cause several effects on the soil, such as increasing the temperatures of the soil during the day due to increased solar radiation on the soil surface, and greater cooling due to loss of radiative heat at night. Fewer leaves to intercept rain will also cause more rain to reach the soil surface, and with fewer plants to absorb the water, the amount of water content in the soils might increase. However, it might be seen that ash can be water repellent when dry, and therefore water content and availability might not actually increase.

Biotic responses and adaptations

PLANTS :

Plants have evolved many adaptations to cope with fire. Of these adaptations, one of the best-known is likely *pyriscence*, where maturation and release of seeds is triggered, in whole or in part, by fire or smoke; this behaviour is often erroneously called *serotiny*, although this term truly denotes the much broader category of seed release activated by any stimulus. All pyriscent plants are serotinous, but not all serotinous plants are pyriscent (some are necriscent, hygriscent, xeriscent, soliscent, or some combination thereof). On the other hand, germination of seed activated by trigger is not to be confused with pyriscence; it is known as *physiological dormancy*.

In chaparral communities in Southern California, for example, some plants have leaves coated in flammable oils that encourage an intense fire. This heat causes their fire-activated seeds to germinate (an example of dormancy) and the young plants can then capitalize on the lack of competition in a burnt landscape. Other plants have smoke-activated seeds, or fire-activated buds. The cones of the Lodgepole pine (*Pinus contorta*) are, conversely, pyriscent: they are sealed with a resin that a fire melts away, releasing the seeds. Many plant species, including the shade-intolerant giant

sequoia (*Sequoiadendron giganteum*), require fire to make gaps in the vegetation canopy that will let in light, allowing their seedlings to compete with the more shade-tolerant seedlings of other species, and so establish themselves. Because their stationary nature precludes any fire avoidance, plant species may only be fire-intolerant, fire-tolerant or fire-resistant.

Fire intolerance-

Fire-intolerant plant species tend to be highly flammable and are destroyed completely by fire. Some of these plants and their seeds may simply fade from the community after a fire and not return; others have adapted to ensure that their offspring survives into the next generation. "Obligate seeders" are plants with large, fire-activated seed banks that germinate, grow, and mature rapidly following a fire, in order to reproduce and renew the seed bank before the next fire. Seeds may contain the receptor protein KAI2, that is activated by the growth hormones karrikin released by the fire.

Fire tolerance -

Fire-tolerant species are able to withstand a degree of burning and continue growing despite damage from fire. These plants are sometimes referred to as "resprouters." Ecologists have shown that some species of resprouters store extra energy in their roots to aid recovery and re-growth following a fire. For example, after an Australian bushfire, the Mountain Grey Gum tree (*Eucalyptus cypellocarpa*) starts producing a mass of shoots of leaves from the base of the tree all the way up the trunk towards the top, making it look like a black stick completely covered with young, green leaves

Fire resistance

Fire-resistant plants suffer little damage during a characteristic fire regime. These include large trees whose flammable parts are high above surface fires. Mature ponderosa pine (*Pinus ponderosa*) is an example of a tree species that suffers virtually no crown damage

under a naturally mild fire regime, because it sheds its lower, vulnerable branches as it matures.

Animals, birds and microbes

A mixed flock of hawks hunting in and around a bushfire

Like plants, animals display a range of abilities to cope with fire, but they differ from most plants in that they must avoid the actual fire to survive. Although birds may be vulnerable when nesting, they are generally able to escape a fire; indeed they often profit from being able to take prey fleeing from a fire and to recolonize burned areas quickly afterwards. In fact, many wildlife species globally are dependent on recurring fires in fire-dependent ecosystems to create and maintain habitat. Some anthropological and ethno-ornithological evidence suggests that certain species of fire-foraging raptors may engage in intentional fire propagation to flush out prey. Mammals are often capable of fleeing a fire, or seeking cover if they can burrow. Amphibians and reptiles may avoid flames by burrowing into the ground or using the burrows of other animals. Amphibians in particular are able to take refuge in water or very wet mud.

Some arthropods also take shelter during a fire, although the heat and smoke may actually attract some of them, to their peril. Microbial organisms in the soil vary in their heat tolerance but are more likely to be able to survive a fire the deeper they are in the soil. A low fire intensity, a quick passing of the flames and a dry soil will also help. An increase in available nutrients after the fire has passed may result in larger microbial communities than before the fire. The generally greater heat tolerance of bacteria relative to fungi makes it possible for soil microbial population diversity to change following a fire, depending on the severity of the fire, the depth of the microbes in the soil, and the presence of plant cover. Certain species of fungi, such as *Cylindrocarpon destructans* appear to be unaffected by combustion contaminants, which can inhibit re-population of burnt soil by other

microorganisms, and therefore have a higher chance of surviving fire disturbance and then recolonizing and out-competing other fungal species afterwards.

Fire and ecological succession

Fire behaviour is different in every ecosystem and the organisms in those ecosystems have adapted accordingly. One sweeping generality is that in all ecosystems, fire creates a mosaic of different habitat patches, with areas ranging from those having just been burned to those that have been untouched by fire for many years. This is a form of ecological succession in which a freshly burned site will progress through continuous and directional phases of colonization following the destruction caused by the fire. Ecologists usually characterize succession through the changes in vegetation that successively arise. After a fire, the first species to re-colonize will be those with seeds are already present in the soil, or those with seeds are able to travel into the burned area quickly. These are generally fast-growing herbaceous plants that require light and are intolerant of shading. As time passes, more slowly growing, shade-tolerant woody species will suppress some of the herbaceous plants. Conifers are often early successional species, while broad leaf trees frequently replace them in the absence of fire. Hence, many conifer forests are themselves dependent upon recurring fire.

Different species of plants, animals, and microbes specialize in exploiting different stages in this process of succession, and by creating these different types of patches, fire allows a greater number of species to exist within a landscape. Soil characteristics will be a factor in determining the specific nature of a fire-adapted ecosystem, as will climate and topography.

Examples of fire in different ecosystems

FORESTS :

Mild to moderate fires burn in the forest understory, removing small trees and herbaceous groundcover. High-severity fires will burn into the crowns of the trees and kill most of the dominant vegetation. Crown fires may require support from ground fuels to maintain the fire in the forest canopy (passive crown fires), or the fire may burn in the canopy independently of any ground fuel support (an active crown fire). High-severity fire creates complex early seral forest habitat, or snag forest with high levels of biodiversity. When a forest burns frequently and thus has less plant litter build-up, below-ground soil temperatures rise only slightly and will not be lethal to roots that lie deep in the soil. Although other characteristics of a forest will influence the impact of fire upon it, factors such as climate and topography play an important role in determining fire severity and fire extent. Fires spread most widely during drought years, are most severe on upper slopes and are influenced by the type of vegetation that is growing.

Forests in British Columbia

In Canada, forests cover about 10% of the land area and yet harbor 70% of the country's bird and terrestrial mammal species. Natural fire regimes are important in maintaining a diverse assemblage of vertebrate species in up to twelve different forest types in British Columbia. Different species have adapted to exploit the different stages of succession, regrowth and habitat change that occurs following an episode of burning, such as downed trees and debris. The characteristics of the initial fire, such as its size and intensity, cause the habitat to evolve differentially afterwards and influence how vertebrate species are able to use the burned areas.

Shrublands

Fig : Lightning-sparked wildfires are frequent occurrences on shrublands and grasslands in Nevada.

LIGHTNING-SPARKED WILDFIRES ARE FREQUENT OCCURRENCES ON SHRUBLANDS AND GRASSLANDS IN NEVADA. :

Shrub fires typically concentrate in the canopy and spread continuously if the shrubs are close enough together. Shrublands are typically dry and are prone to accumulations of highly volatile fuels, especially on hillsides. Fires will follow the path of least moisture and the greatest amount of dead fuel material. Surface and below-ground soil temperatures during a burn are generally higher than those of forest fires because the centers of combustion lie closer

to the ground, although this can vary greatly. Common plants in shrubland or chaparral include manzanita, chamise and Coyote Brush.

California shrublands -

California shrubland, commonly known as chaparral, is a widespread plant community of low growing species, typically on arid sloping areas of the California Coast Ranges or western foothills of the Sierra Nevada. There are a number of common shrubs and tree shrub forms in this association, including salal, toyon, coffeeberry and Western poison oak. Regeneration following a fire is usually a major factor in the association of these species.

South African Fynbos shrublands -

Fynbos shrublands occur in a small belt across South Africa. The plant species in this ecosystem are highly diverse, yet the majority of these species are obligate seeders, that is, a fire will cause germination of the seeds and the plants will begin a new life-cycle because of it. These plants may have coevolved into obligate seeders as a response to fire and nutrient-poor soils. Because fire is common in this ecosystem and the soil has limited nutrients, it is most efficient for plants to produce many seeds and then die in the next fire. Investing a lot of energy in roots to survive the next fire when those roots will be able to extract little extra benefit from the nutrient-poor soil would be less efficient. It is possible that the rapid generation time that these obligate seeders display has led to more rapid evolution and speciation in this ecosystem, resulting in its highly diverse plant community.

GRASSLANDS :

Grasslands burn more readily than forest and shrub ecosystems, with the fire moving through the stems and leaves of herbaceous plants and only lightly heating the underlying soil, even in cases of high intensity. In most grassland ecosystems, fire is the primary mode of decomposition, making it crucial in the recycling of nutrients. In some grassland systems, fire only became the primary

mode of decomposition after the disappearance of large migratory herds of browsing or grazing megafauna driven by predator pressure. In the absence of functional communities of large migratory herds of herbivorous megafauna and attendant predators, overuse of fire to maintain grassland ecosystems may lead to excessive oxidation, loss of carbon, and desertification in susceptible climates. Some grassland ecosystems respond poorly to fire.

North American grasslands -

In North America fire-adapted invasive grasses such as Bromus tectorum contribute to increased fire frequency which exerts selective pressure against native species. This is a concern for grasslands in the Western United States.

In less arid grassland presettlement fires worked in concert with grazing to create a healthy grassland ecosystem as indicated by the accumulation of soil organic matter significantly altered by fire. The tallgrass prairie ecosystem in the Flint Hills of eastern Kansas and Oklahoma is responding positively to the current use of fire in combination with grazing.

South African savanna -

In the savanna of South Africa, recently burned areas have new growth that provides palatable and nutritious forage compared to older, tougher grasses. This new forage attracts large herbivores from areas of unburned and grazed grassland that has been kept short by constant grazing. On these unburned "lawns", only those plant species adapted to heavy grazing are able to persist; but the distraction provided by the newly burned areas allows grazing-intolerant grasses to grow back into the lawns that have been temporarily abandoned, so allowing these species to persist within that ecosystem.

Longleaf pine savannas-

Much of the southeastern United States was once open longleaf pine forest with a rich understory of grasses, sedges, carnivorous plants and orchids. The above maps shows that these ecosystems (coded as pale blue) had the highest fire frequency of any habitat, once per decade or less. Without fire, deciduous forest trees invade, and their shade eliminates both the pines and the understory. Some of the typical plants associated with fire include Yellow Pitcher Plant and Rose pogonia. The abundance and diversity of such plants is closely related to fire frequency. Rare animals such as gopher tortoises and indigo snakes also depend upon these open grasslands and flatwoods. Hence, the restoration of fire is a priority to maintain species composition and biological diversity.

Fire in wetlands -

Although it may seem strange, many kinds of wetlands are also influenced by fire. This usually occurs during periods of drought. In landscapes with peat soils, such as bogs, the peat substrate itself may burn, leaving holes that refill with water as new ponds. Fires that are less intense will remove accumulated litter and allow other wetland plants to regenerate from buried seeds, or from rhizomes. Wetlands that are influenced by fire include coastal marshes, wet prairies, peat bogs, floodplains, prairie marshes and flatwoods. Since wetlands can store large amounts of carbon in peat, the fire frequency of vast northern peatlands is linked to processes controlling the carbon dioxide levels of the atmosphere, and to the phenomenon of global warming. Dissolved organic carbon (DOC) is abundant in wetlands and plays a critical role in their ecology. In the Florida Everglades, a significant portion of the DOC is "dissolved charcoal" indicating that fire can play a critical role in wetland ecosystems.

Fire suppression

Fire serves many important functions within fire-adapted ecosystems. Fire plays an important role in nutrient cycling, diversity maintenance and habitat structure. The suppression of fire can lead to unforeseen changes in ecosystems that often adversely affect the plants, animals and humans that depend upon that habitat. Wildfires that deviate from a historical fire regime because of fire suppression are called "uncharacteristic fires".

CHAPARRAL COMMUNITIES :

In 2003, southern California witnessed powerful chaparral wildfires. Hundreds of homes and hundreds of thousands of acres of land went up in flames. Extreme fire weather (low humidity, low fuel moisture and high winds) and the accumulation of dead plant material from 8 years of drought, contributed to a catastrophic outcome. Although some have maintained that fire suppression contributed to an unnatural buildup of fuel loads, a detailed analysis of historical fire data has showed that this may not have been the case. Fire suppression activities had failed to exclude fire from the southern California chaparral. Research showing differences in fire size and frequency between southern California and Baja has been used to imply that the larger fires north of the border are the result of fire suppression, but this opinion has been challenged by numerous investigators and is no longer supported by the majority of fire ecologists.

One consequence of the fires in 2003 has been the increased density of invasive and non-native plant species that have quickly colonized burned areas, especially those that had already been burned in the previous 15 years. Because shrubs in these communities are adapted to a particular historical fire regime, altered fire regimes may change the selective pressures on plants and favor invasive and non-native species that are better able to exploit the novel post-fire conditions.

FISH IMPACTS :

The Boise National Forest is a US national forest located north and east of the city of Boise, Idaho. Following several uncharacteristically large wildfires, an immediately negative impact on fish populations was observed, posing particular danger to small and isolated fish populations. In the long term, however, fire appears to rejuvenate fish habitats by causing hydraulic changes that increase flooding and lead to silt removal and the deposition of a favorable habitat substrate. This leads to larger post-fire populations of the fish that are able to recolonize these improved areas. But although fire generally appears favorable for fish populations in these ecosystems, the more intense effects of uncharacteristic wildfires, in combination with the fragmentation of populations by human barriers to dispersal such as weirs and dams, *will* pose a threat to fish populations.

Fire as a management tool

Restoration ecology is the name given to an attempt to reverse or mitigate some of the changes that humans have caused to an ecosystem. Controlled burning is one tool that is currently receiving considerable attention as a means of restoration and management. Applying fire to an ecosystem may create habitats for species that have been negatively impacted by fire suppression, or fire may be used as a way of controlling invasive species without resorting to herbicides or pesticides. However, there is debate as to what state managers should aim to restore their ecosystems to, especially as to whether "natural" means pre-human or pre-European. Native American use of fire, not natural fires, historically maintained the diversity of the savannas of North America. When, how, and where managers should use fire as a management tool is a subject of debate.

Fig: Prescribed Burn in Oak Savannah in Iowa

THE GREAT PLAINS SHORTGRASS PRAIRIE :

A combination of heavy livestock grazing and fire-suppression has drastically altered the structure, composition, and diversity of the shortgrass prairie ecosystem on the Great Plains, allowing woody species to dominate many areas and promoting fire-intolerant invasive species. In semi-arid ecosystems where the decomposition of woody material is slow, fire is crucial for returning nutrients to the soil and allowing the grasslands to maintain their high productivity.

Although fire can occur during the growing or the dormant seasons, managed fire during the dormant season is most effective at increasing the grass and forb cover, biodiversity and plant nutrient uptake in shortgrass prairies. Managers must also take into account, however, how invasive and non-native species respond to fire if they want to restore the integrity of a native ecosystem. For example, fire can only control the invasive spotted knapweed (*Centaurea maculosa*) on the Michigan tallgrass prairie in the summer, because this is the time in the knapweed's life cycle that is most important to its reproductive growth.

Mixed conifer forests in the US Sierra Nevada -

Mixed conifer forests in the United States Sierra Nevada used to have fire return intervals that ranged from 5 years up to 300 years, depending on the local climate. Lower elevations had more frequent fire return intervals, whilst higher and wetter elevations saw much longer intervals between fires. Native Americans tended to set fires during fall and winter, and land at a higher elevation was generally occupied by Native Americans only during the summer.

Finnish boreal forests -

The decline of habitat area and quality has caused many species populations to be red-listed by the International Union for Conservation of Nature. According to a study on forest management of Finnish boreal forests, improving the habitat quality of areas outside reserves can help in conservation efforts of endangered deadwood-dependent beetles. These beetles and various types of fungi both need dead trees in order to survive. Old growth forests can provide this particular habitat. However, most Fennoscandian boreal forested areas are used for timber and therefore are unprotected. The use of controlled burning and tree retention of a forested area with deadwood was studied and its effect on the endangered beetles. The study found that after the first year of management the number of species increased in abundance and richness compared to pre-fire treatment. The abundance of beetles continued to increase the following year in sites where tree retention was high and deadwood was abundant. The correlation between forest fire management and increased beetle populations shows a key to conserving these red-listed species.

Australian eucalypt forests -

Much of the old growth eucalypt forest in Australia is designated for conservation. Management of these forests is important because species like *Eucalyptus grandis* rely on fire to survive. There are a few eucalypt species that do not have a lignotuber, a root swelling structure that contains buds where new shoots can then sprout.

During a fire a lignotuber is helpful in the reestablishment of the plant. Because some eucalypts do not have this particular mechanism, forest fire management can be helpful by creating rich soil, killing competitors, and allowing seeds to be released.

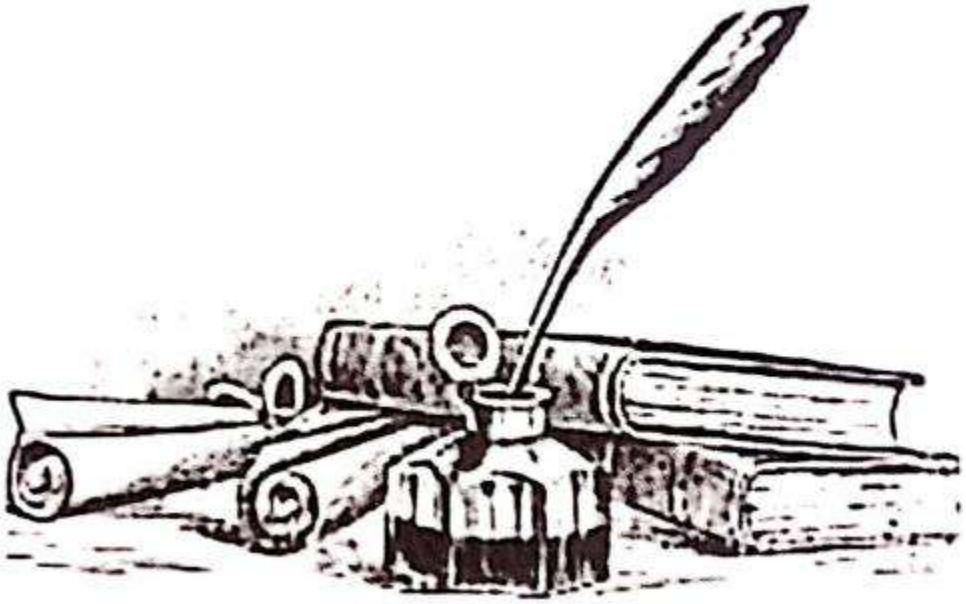
Management policies

UNITED STATES :

Fire policy in the United States involves the federal government, individual state governments, tribal governments, interest groups, and the general public. The new federal outlook on fire policy parallels advances in ecology and is moving towards the view that many ecosystems depend on disturbance for their diversity and for the proper maintenance of their natural processes. Although human safety is still the number one priority in fire management, new US government objectives include a long-term view of ecosystems. The newest policy allows managers to gauge the relative values of private property and resources in particular situations and to set their priorities accordingly.

One of the primary goals in fire management is to improve public education in order to suppress the "Smokey Bear" fire-suppression mentality and introduce the public to the benefits of regular natural fires.

ACKNOWLEDGEMENT



I would like to express my thanks of gratitude to my subject teachers of AECC-ENVS and our principal who gave me the opportunity to do this wonderful project which also helped me in doing a lot of research and I came to know about so many new things I am really thankful to them.

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GANGES POLLUTION

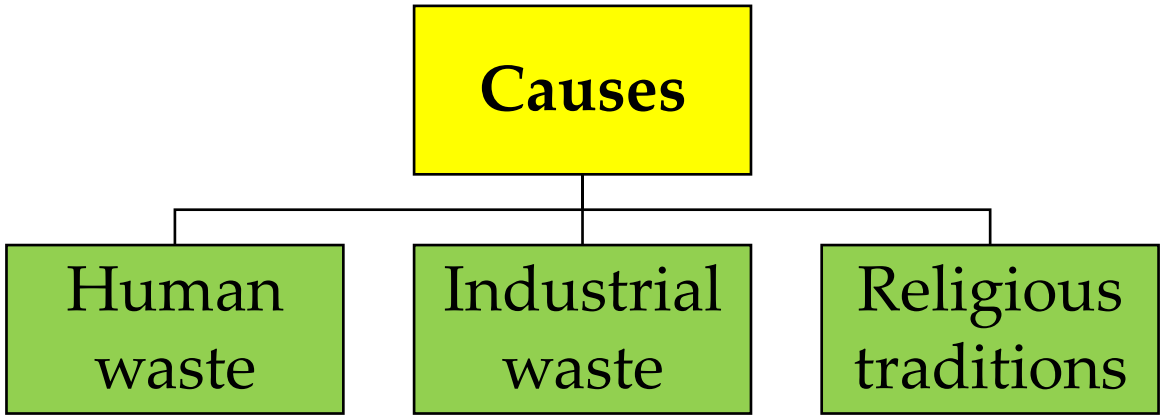
ENVS PROJECT

COLLEGE ROLL NO: ECOA20F292
CU ROLL NO: 203223-11-0068
CU REGISTRATION NO: 223-1211-0425-20

GANGES POLLUTION

Ganga, known as Ganges in British Rule is one of the most revered waterways in the World but also one of the most polluted. It provides water and is a true lifeline for nearly 450 million people, more than any other river in the world. Ganga is the largest river (2074 km) in India which stretches from Gangotri Glacier of Western Himalayas in Uttarakhand and flows south and east through the Gangetic Plain of India & Bangladesh, and eventually empties into the Bay of Bengal. This river is now threatened by severe pollution. In turn, this severe pollution poses a threat to the life of humans, animals and many marine species.

Severely polluted with human waste and industrial contaminants, the river provides water to about 40% of India's population across 11 states. Today, the Ganges is considered to be the fifth most polluted river in the world. A number of initiatives have been undertaken to clean the river, but failed to deliver desired results.



HUMAN WASTE: 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, 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. 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 nonbiodegradable. 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 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.

CONSEQUENCES

1. *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. 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 is found in the Ganges. 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.

2. *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.

3. *Human life*-An analysis of the Ganges water in 2006 and 2007 showed significant associations between waterborne/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.

INDIVIDUAL EFFORTS

1.Restoring ecological flows at every point along the Ganga's course.

2. Preventing and curtailing all waste water, starting with sewage and industrial waste, from mixing with the river. This especially needs to be prevented along the heavily polluted Kanpur and Varanasi stretches of Ganga.

3. Promoting massive water conservation and water resource management, inclusive of rain water harvesting schemes, at both centralized and decentralized levels within the Ganga River Basin.

4.Implementing a detailed legislation that prevents any source of pollution or threats to the health of the national river.

5. Continual stakeholder involvement, including persistent and consistent efforts to implement policies and plans that connect state and local bodies, addressing their challenges and encouraging training and capacity-building programs.

6. Mass awareness campaigns and media-based water eco-consciousness campaigns that get people to not only stop pollution, but to also become an active part of the solution.

CLEAN UP EFFORTS

There are a number of Government initiatives have been taken to clean up Ganga:-

1. Ganga Mahasabha
2. Ganges action plan
3. National river ganga basin authority (NRGBA)
4. 2010 Government clean-up campaign
5. Namami Gange Project
6. Ganga Manthan

NAMAMI GANGE PROJECT

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. 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 crores 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. 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).

Conclusion

Speaking about the health of river Ganges, at this point, the river is effectively dead. No one ever thought this would happen. All the rubbish and sewage from the cities goes straight into the river Ganges. More than 400 tanneries also drain their poisonous water into the Ganges. The water contains heavy metals, acids, dyes and other chemicals used by the tanneries. Tanneries claim the pollution is caused by the other towns and cities on the Ganges and not by them. Water and sanitation remain a colossal issue in India up to 600 million people here don't have access to a toilet. This is exactly why regulations protecting the environment are so important. If it is convenient and profitable to pollute, it is sure the people will pollute. Not even a religious and cultural icon like the Ganges River can be safe. The Ganges and other Indian rivers are horrifically polluted and successive Indian Governments have failed to clean them up.

Now we have a Covid situation which may have created Havoc for the humans but has been a boon for the environment. Ganga can now be seen clear and recovering its health. Scientists have claimed that the water quality has seen a remarkable improvement and is now fit for drinking in various places which is not even fit for bathing before. Nature made it possible within very short span which could not be made possible by years of human effort the human. This is no less than a miracle**.** Dolphins and birds have started returning to mother Ganga. Hope this situation remains the same even after the lockdown ends and the river nurtures all form of life**.**

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B.Sc. (HONOURS)

2020-2023

ENVIRONMENTAL STUDIES

PROJECT

ON

AIR POLLUTION

SUBMITTED

BY

SEMESTER: II

DEPARTMENT: ECONOMICS

COLLEGE ROLL NO: ECOA20F280

REGISTRATION NO: 223-1211-0460-20

CU ROLL NO: 203223-11-0078

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CONTENTS

1.INTRODUCTION

Air pollution can be defined as the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk. In an even broader sense, air pollution means the presence of chemicals or compounds in the air which are usually not present and which lower the quality of the air or cause detrimental changes to the quality of life (such as the damaging of the ozone layer or causing global warming).

Air pollution is probably one of the most serious environmental problems confronting our civilization today. Most often, it is **caused by human activities** such as mining, construction, transportation, industrial work, agriculture, smelting, etc. However, natural processes such as volcanic eruptions and wildfires may also pollute the air, but their occurrence is rare and they usually have a local effect, unlike human activities that are ubiquitous causes of air pollution and contribute to the global pollution of the air every single day.

A large number of contaminants may pollute the air in a large variety of forms. Almost any toxic chemical could make its way into the atmosphere to pollute the air that we breathe. Aerosol particles (clouds of liquid and solid particles in a gas) that are found in the air may also contain pollutants.

The chemical compounds that lower the air quality are usually referred to as air pollutants. These compounds may be found in the air in two major forms:

- in a gaseous form (as gases),
- in a solid form (as particulate matter suspended in the air).

Examples of Air Pollutants

In most cases, air pollutants cannot be seen or smelled. However, that does not mean that they do not exist in high enough amounts to be a health hazard! Additionally, a number of gases are linked to the so-called "greenhouse effect", which means that those gases retain more heat and thus contribute to the overall global warming. The most common example of a greenhouse gas is carbon dioxide, which is emitted from many industrial processes. Another example is methane, which is also an explosive gas.

2. METHODS TO CONTROL AIR POLLUTION

1.Renewable fuel and clean energy production

The most basic **solution for air pollution** is to move away from fossil fuels, replacing them with alternative energies like solar, wind and geothermal.

2.Energy conservation and efficiency

Producing clean energy is crucial. But equally important is to reduce our consumption of energy by adopting responsible habits and using more efficient devices.

3.Eco-friendly transportation

Shifting to electric vehicles and hydrogen vehicles, and promoting shared mobility (i.e carpooling, and public transports) could reduce air pollution.

4.Green building

From planning to demolition, green building aims to create environmentally responsible and resource-efficient structures to reduce their carbon footprint.

In addition, monitoring air pollution levels has become very important to detect pollution peaks, better control air pollution and eventually **improve air quality**.

3. EFFECTS OF AIR POLLUTANTS.

Carbon Monoxide	Affects the cardio vascular system, exacerbating cardiovascular disease symptoms, particularly angina; may also particularly affect fetuses, sick, anemic and young children, affects nervous system impairing physical coordination, vision and judgments, creating nausea and headaches, reducing productivity and increasing personal discomfort.
Nitrogen Oxides	Increased susceptibility to infections, pulmonary diseases, impairment of lung function and eye, nose and throat irritations.
Sulphur Dioxide	Affect lung function adversely.
Particulate Matter and Respirable Particulate Matter (SPM and RPM)	Fine particulate matter may be toxic in itself or may carry toxic (including carcinogenic) trace substance, and can alter the immune system. Fine particulates penetrate deep into the respiratory system irritating lung tissue and causing long-term disorders.
Benzene	Both toxic and carcinogenic. Excessive incidence of leukemia (blood cancer) in high exposure areas.

4. IMPACTS OF AIR POLLUTION ON ENVIRONMENT

• **Global warming:** According to estimates, at the current rate of increase, the average global temperature up by 3°C to 8°C in the next 100 years. This will affect the climate of different regions, distribution of plants and animals, disturbance in agriculture and food production, melting of snow caps and resultant increase in sea levels. This will submerge parts of coastal cities of Calcutta, New York, London and other major cities.

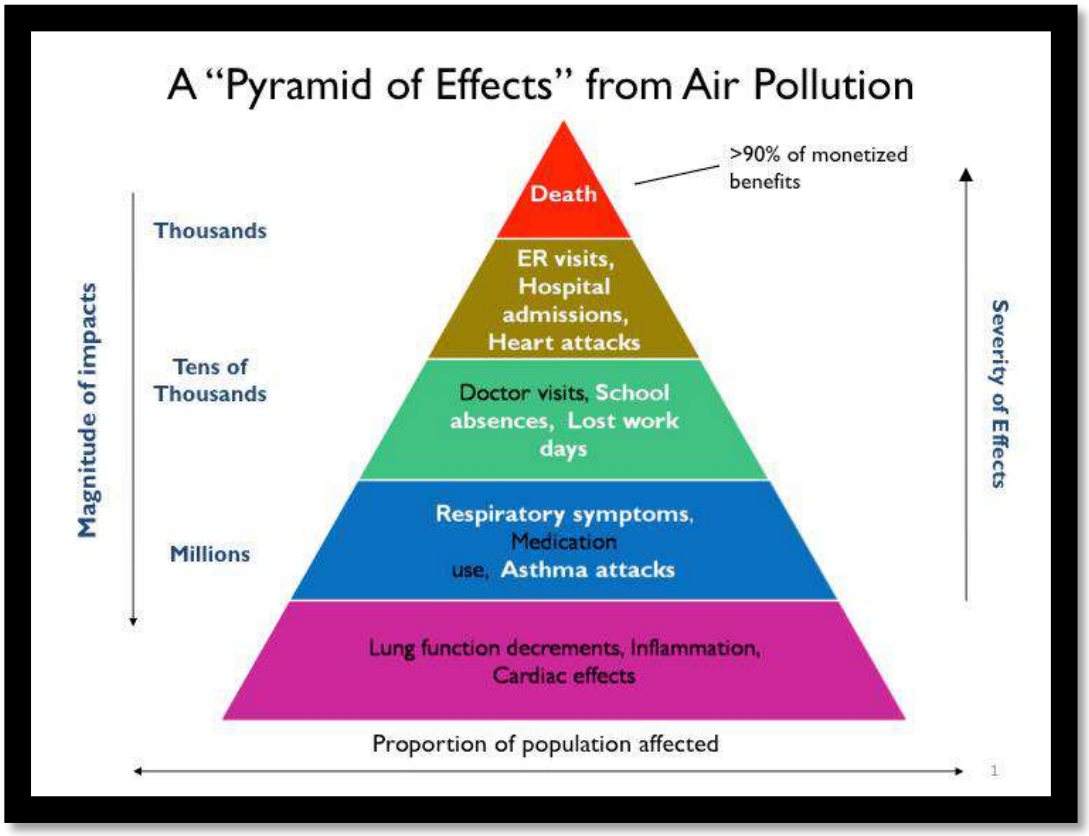
• **Formation of photochemical smog:** When pollutants like hydrocarbons and nitrogen oxides combine in the presence of sunlight, smog is formed. This is a mixture of gases and since it is formed by photochemical reactions, it is called the photochemical smog. The word 'smog' is derived from the two words-smoke and fog. It forms a yellowish-brown haze especially during winter and hampers visibility. It also causes many respiratory disorders and allergies as it contains polluting gases.

• **Formation of acid rain:** Sulphur dioxide and nitrogen oxides react with water in the atmosphere producing sulphuric acid and nitric acid. These acids come down along with the rain. This phenomenon is called acid rain. The pH of acid rain varies from 3-6. The composition of acid rain is sulphuric acid, nitric acid and weak carbonic acid. Its adverse effects on the environment include: causes respiratory and skin disorders, affects productivity of plants by damaging the leaves, enters the soil and affects the soil, pH and causes leaching, enters the ground and river waters which causes harm to the aquatic life, causes damage to marble and thus damages buildings and monuments (like Taj Mahal).

• **Aerosol formation:** Aerosol is formed by the dispersion of solid or liquid matter in the atmosphere. If the aerosols form a thick layer in the troposphere, they affect the weather conditions by blocking the solar radiation. Aerosols are also deposited on the leaves and affect the photosynthesis. Aerosols disperse the organic metallic pollutants far and wide.

• **Depletion of Ozone:** The stratosphere of the atmosphere has ozone (O_3). Ozone is known to absorb the Ultraviolet (UV) rays present in the sun's radiation and protects us from the harmful effects of the UV rays. However, hydrocarbons such as the chlorofluorocarbons (CFCs) destroy the ozone molecules which deplete the ozone layer. Ozone holes have been detected in the atmosphere which permits the

UV rays to reach the earth's surface. The harmful effects of the UV rays are visible in the countries such as Australia and New Zealand where the rate of skin cancer is higher than the other regions of the world (www.tutorvista.com).



5.STEPS TAKEN BYGOV. TO REDUCE AIR POLLUTION.

A. National Clean Air Programme

A long-term, time-bound, national-level strategy to tackle the increasing air pollution problem across the country in a comprehensive manner. The total tentative cost of NCAP is estimated at Rs 637 crore.

Objective: Comprehensive management plan for prevention, control and abatement of air pollution, besides augmenting the air quality monitoring network across the country.

Focuses on: Collaborative and participatory approach covering all sources of pollution and coordination between relevant central ministries, state governments, local bodies and other stakeholders

- Intensive awareness, training and capacity-building drive, with specific impetus on augmentation of manpower and infrastructure facilities of the Central Pollution Control Board (CPCB) and the state pollution control board (SPCBs)
- A credible, transparent and accountable data collection and monitoring system that is available for timely swift action is to be ensured
- Increasing the number of monitoring stations, data dissemination, public participation on planning and implementation
- Setting up of air information centre for data analysis, resource apportionment studies, national inventory and rural monitoring stations, besides guidelines for indoor air pollution. Recently, The National Green Tribunal (NGT) has directed the Ministry of Environment, Forest and Climate Change (MoEFCC) to modify the National Clean Air Programme (NCAP)
- Deadline to reduce air pollution by 20-30% by 2024 needs to be reduced.
- Increase the target of reduction.
- Review the action in terms of shift to e-vehicles and CNG vehicles, intensifying public transport systems, mechanical cleaning of roads, improvement in fuel quality, etc.
- Ensure the assessment and installation of the requisite number of Ambient Air Quality Monitoring Systems within six months.

B. The Central Pollution Control Board (CPCB)

- It is a **statutory organisation** under the Ministry of Environment, Forest and Climate Change (Mo.E.F.C).
- It was **established** in 1974 **under the Water (Prevention and Control of pollution) Act, 1974**.
- It is also **entrusted** with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.
- It **provides technical services** to the Ministry of Environment and Forests under the provisions of the Environment (Protection) Act, 1986.
- It **Co-ordinates** the activities of the State Pollution Control Boards by providing technical assistance and guidance and also **resolves disputes** among them.
- It is the **apex organisation** in country in the field of pollution control.

C. LiDAR (Light Detection and Ranging):

Being used to vertically monitor the air quality of Delhi-NCR

- To track the evolution of a pollutant over time
- To detect leakage of organic pollutants in storage facilities and industrial plants, such as oil refineries
- To observe the structure and height of mixing layers
- To measure the transport and diffusion of plumes or clouds of particulates
- To remotely determine smoke-plume opacity

D. Climate & Clean Air Coalition

- Unites governments, civil society and private sector, committed to improving air quality and protecting the climate in next few decades by reducing short-lived climate pollutants (SLCP) across sectors
- By the governments of Bangladesh, Canada, Ghana, Mexico, Sweden and the United States, along with the United Nations Environment Programme (UNEP)
- Objective: To address short-lived climate pollutants.
- Initial focus on: Methane, black carbon, and HFCs

E. National Air Quality Index (AQI)

- The AQI is an index for **reporting daily air quality.** It tells how clean or polluted the air is.
- The higher the AQI value, the greater the level of air pollution and the greater the health Concern.
- Research studies have attributed the **key sources of PM2.5** in summer to be: dust and construction activities (35%), transport sector (20%) and industry (20%).

CONCLUSION

Upon studying the causes and effects of air pollution closely we can conclude that pollution causes a serious threat to us as well as our surroundings. It also leads to loss of biodiversity.

We need to control and prevent air pollution as soon as possible by using various preventive measures as suggested in the project.

Air pollution has also caused a serious effect to our country. India is one of the most polluted countries in the world. The air quality index of our major cities like Delhi and Kolkata are deteriorating day by day.the problem should be looked into as soon as possible.

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ENVS PROJECT ON:

MEDICAL WASTE, ITS ENVIRONMENTAL IMPACT AND MANAGEMENT.

COLLEGE ROLL NUMBER: ECOA20F281

CU ROLL NUMBER: 203223-11-0080

CU REGISTRATION NUMBER: 223-1211-0464-20

COURSE: Bsc. Hons (ECONOMICS)

SEMESTER: II

SUBJECT CODE: ENVS, AECC2

MEDICAL WASTE, ITS ENVIRONMENTAL IMPACT AND MANAGEMENT

INTRODUCTION

WHAT IS MEDICAL WASTE ?

Medical waste is any waste that is generated as a by-product of health care work at doctor's surgeries, dentists, hospitals and laboratories. It includes any material that could come into contact with the body during diagnosis, research, drug administration or any type of treatment.

It's likely to be infectious, or potentially infectious, and is often contaminated with bodily fluids in some way- but the term can also be used to refer to general waste from any medical practice, as well as specific waste streams typically found in the medical industry.

DIFFERENT TYPES OF MEDICAL WASTES

1. **Infectious waste:** *anything that's infectious or contaminated.*

2. **Sharps:** *waste like needles, scalpels, broken glass and razors.*

3. **Pathological waste:** *human or animal tissues, body parts, blood and fluids.*

4. **Pharmaceutical waste:** *Unused and expired drug or medicines, like creams, pills, antibiotics.*

5. **Genotoxic waste:** *cytotoxic drugs and other hazaedous toxic waste, that's carcinogenic, mutagenic or teratogenic.*

6. **Radioactive waste:** *Any waste containing potentially radioactive materials.*

7. **Chemical waste:** *Liquid waste, typically from machines, batteries and disinfectants.*

8. **General/other waste:** *all other non-hazardous wastes.*

DIFFERENT ILL-EFFECTS OF MEDICAL WASTES.

1. HEALTH RISKS

Health care wastes contain potentially harmful microorganisms that can infect hospital patients, health workers and the general public. Other potential hazards may include drug-resistant microorganisms which spread from health facilities into the environment.

Adverse health outcomes associated with health care wastes and by-products also include:

- *Sharps-inflicted injuries*
- *Toxic exposure to pharmaceutical products, in particular, antibiotics and cytotoxic drugs released into the surrounding environment, and to substances such as mercury or dioxins, during the handling or incineration of health care wastes;*
- *Chemical burns arising in the context of disinfection, sterilization or waste treatment activities*
- *Air pollution arising as a result of the release of particulate matter during medical waste incineration;*
- *Thermal injuries occurring conjunction with open burning and the operation of medical waste incinerators; and*
- *Radiation burns*

2. RISKS RELATED TO SHARPS.

Worldwide, an estimated 16 billion injections are administered every year. Not all needles and syringes are disposed of safety, creating a risk of injury and infection and opportunities for refuse.

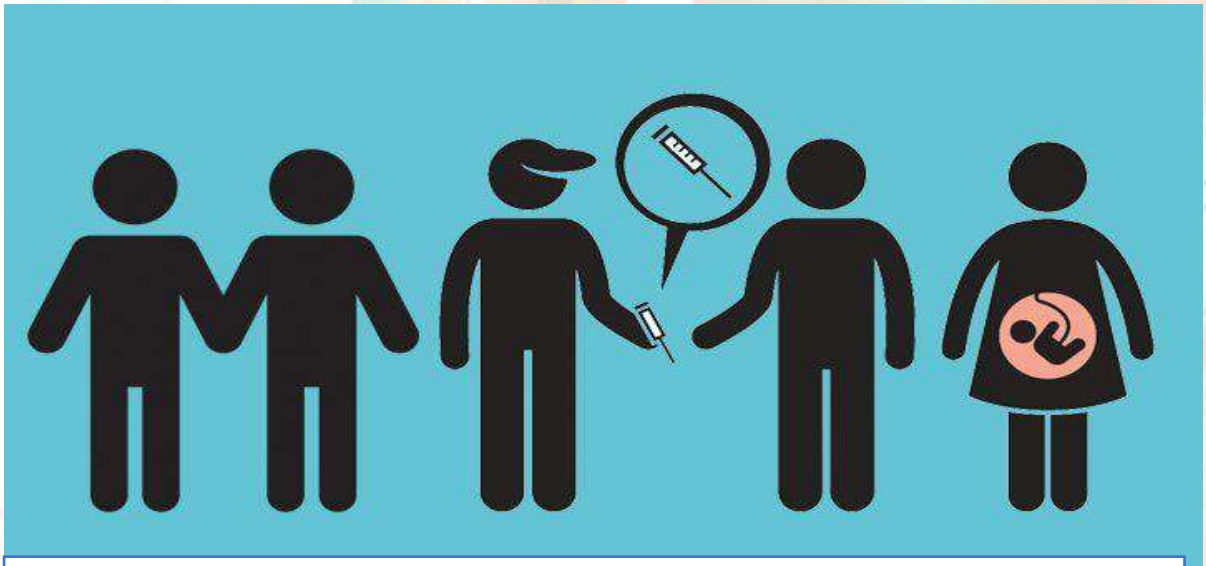
Injections with contaminated needles and syringes in low- and middle- income countries have reduced substantially in recent years, partly due to efforts to reduce reuse of injection devices. Despite this progress, in 2010, unsafe injections were still responsible for as many as 33800 new HIV infections,1.7 million hepatitis B infections and 315000 hepatitis C infections.

A person who experiences one needle stick injury from a needle used on an infected source patient has risks of 30%,1.8%, and 0.3% respectively of becoming infected with HBV, HCV and HIV.

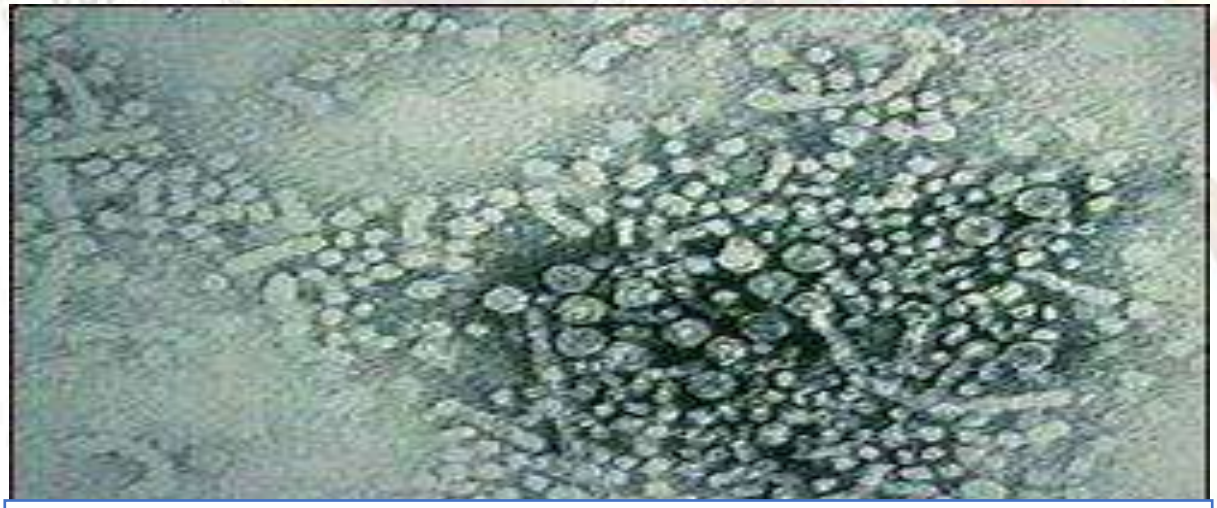
Additional hazards occur from scavenging at the waste disposal sites and during the handling and manual sorting of hazardous waste from health care facilities. The waste handlers are at immediate risk of needle-stick injuries and exposure to toxic or infectious materials.

In 2015, a joint WHO/UNICEF assessment found that just over half (58%) of sampled facilities from 24 countries had adequate systems in place for the safe disposal of medical waste.

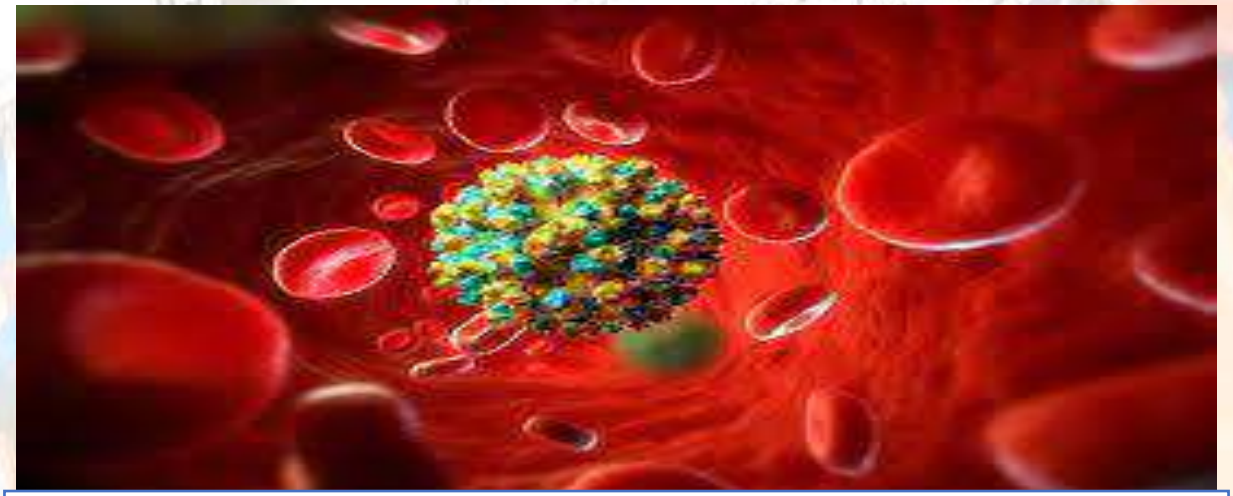
SOME ILLUSTRATIONS



SPREAD OF HIV DUE TO SYRINGE INFECTION



SPREAD OF HEPATITIS B DUE TO SHARP-INFECTION



SPREAD OF HEPATITIS C DUE TO SHARP-INFECTION

ENVIRONMENTAL IMPACT

Treatment and disposal of healthcare waste may pose health risks indirectly through the release of pathogens and toxic pollutants into the environment.

- *The disposal of untreated health care wastes in landfills can lead to the contamination of drinking, surface, and ground waters if those landfills are not properly constructed.*
- *The treatment of healthcare wastes with chemical disinfectants can result in the release of chemical substances are both handled, stored and disposed in an environmentally sound manner.*
- *Incineration of waste has been widely practised but inadequate incineration the incineration of unsuitable materials results in the release of pollutants into the air and in the generation of ash residue. Incinerated materials containing or treated with chlorine can generate dioxins and furans, which are human carcinogens and have been associated with a range of adverse health effects. Incineration of heavy metals or materials with high metal content (in particular lead, mercury and cadmium) can lead to the spread of toxic metals in the environment.*
- *Only modern incinerators operating at 850-1100°C and fitted with special gas-cleaning equipment are able to comply with international emission standards for dioxins and furan.*

- *Alternatives to incineration such as autoclaving, microwaving, stream treatment integrated with internal mixing, which minimize the formation and release of chemicals or hazardous emissions should be given consideration in settings where there are sufficient resources to operate and maintain such systems and dispose of the treated waste.*

DISPOSAL AND MANAGEMENT

Now as we know that medical wastes are tremendously harmful for our environment, we now focus our attention on its management and disposal.

1. **INCINERATION:** *This is the process of burning of waste in temperatures raging from 1,800°F to 2,000°F (982°C to 1093°C). On-site incineration provides the advantage of a quick, easy disposal method, but there are emissions concerns. While some states and localities actively encourage incineration as the preferred method of treatment, others have enacted moratoriums on the incinerators to suspend permitting until further information the safety of the option is available.*

2. **AUTOCLAVING:** *Autoclaving which is also known simply as stream sterilization, is the most commonly utilized alternative to incineration. It is both less costly and carries no documented health impacts. In this method, wastes are sterilized or disinfected prior to disposal in a landfill. Bags of waste are placed in a determined period of time at a specified*

pressure and temperature. This assures the destruction of micro-organisms. Approximately 90% of regulated medical wastes and suitable for autoclaving, particularly microbiological wastes. Autoclaves are not suitable, however for pathological, cytotoxic, or other toxic chemical wastes.

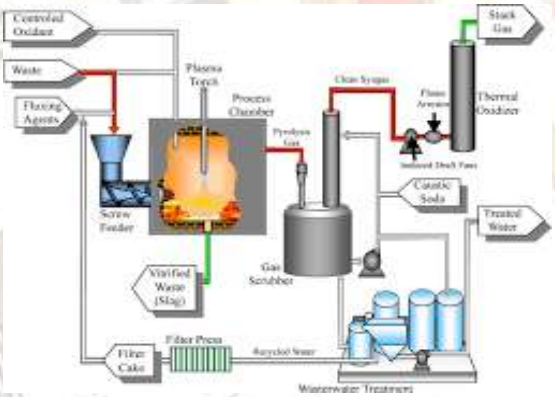
3.GAS STERILIZATION: *In this process, medical waste is fed into an evacuated air-tight chamber and treated with a sterilization agent (such as ethylene oxide or formaldehyde). The gas that comes into contact with the waste will kill harmful, infectious agents. It's important to note that EPA does not recommend ethylene oxide for treating infectious wastes because of its toxicity.*

3.CHEMICAL DISINFECTION: *This process involves the use of chemical agents for disinfection, such as chlorine. Chemical disinfection processes are most appropriate for liquid wastes, although they can still be used to treat solid wastes. There are a number of factors that should be considered regarding the effective usage, including: the types and biology of contamination and quantity, contact time, and mixing requirements. Another option is the grinding of medical waste before exposing it to liquid chemical disinfectants. Grinding ensures sufficient exposure of chemical disinfectant. Grinding ensures sufficient exposure of chemical agent to all parts of the waste and assists in easy disposal of any residues. The resulting liquids are placed into the sewer system, while solid residues are disposed in landfills.*

4.MICROWAVE: *The application of microwave technology treatment also can disinfect waste. Waste is first shredded, and then mixed with water and internally heated to neutralize all present biologicals. Computerized controls are employed to ensure the minimum parameters for disinfection and proper equipment function. As with autoclaving approximately 90% of medical wastes can be treated with this process. The shredding process results in a volume reduction, and energy use is reportedly lower than that of an incinerator.*

4. IRRADIATION: *This method involves sterilizing waste by exposing it to a cobalt source. Cobalt gives out gamma radiations that destroy all microbes in waste. The high cost of cobalt and high operating costs, however, have discouraged commercial ventures from using the treatment and management of medical waste. There also have been some questions raised about some questions raised about the actual process of radiating the material and achieving adequate disinfection. As with autoclaving and microwave methods, it is not recommended for pathological wastes.*

7. THERMAL INACTIVATION: *This process involves heating waste to temperatures at which infectious agents are killed. It is used for treating large volumes of liquid clinical wastes. A chamber is preheated to an intense, specified time, then released.*



COLOUR CODING FOR BIOMEDICAL WASTE MANAGEMENT

Different coloured bins are used for disposal od different kind of medical wastes. They are- Yellow, Red, Blue, Black

COLOUR CODING	TYPE OF CONTAINER	WASTES	TREATMENT OPTION
YELLOW	PLASTIC BAG	HUMAN ANATOMICAL WASTE, ANIMAL WASTE, BODY PART CARCASSES, BLEEDING PARTS, FLUIDS, BLOOD AND EXPERIMENTAL ANIMALS USED FOR RESEARCH, MICROBIOLOGY OR BIO-TECHNOLOGICAL WASTE, USED VACCINES, INFECTIOUS AGENTS, SOLID WASTES (ITEMS CONTAMINATED WITH BLOODS AND FLUIDS COTTONS, DRESSINGS AND PLASTERS.	INCINERATION, DEEP BURIAL, LOCAL AUTOCLAVING, MICROWAVING.
RED	INFECTED CONTAINER/ PLASTIC BAG	MICROBIOLOGY OR BIO-TECHNOLOGICAL WASTES, HUMAN AND ANIMAL CELLS, INFECTIOUS AGENTS, SOLID WASTES (SOILED PLASTERS, DRESSINGS AND COTTONS CONTAMINATED WITH BLOOD), SOLID WASTES (SHARPS SUCH AS TUBING, CATCHERS, ETC)	LOCAL AUTOCLAVING, MICROWAVING, INCINERATION, DISINFECTION BY CHEMICAL TREATMENT.
BLUE/ WHITE TRANSLU-CENT	PLASTIC BAG, PUNCTURE PROOF CONTAINER	WASTE SHARPS (NEEDLES, SURINGES, SCALPELS), SOLID WASTES (WASTE GENERATED FROM DISPOSABLE ITEMS SUCH AS TUBING, CATCHERS, ETC.)	DISINFECTION, CHEMICAL TREATMENT, AUTOCLAVING, MICROWAVING, SHREDDING.
BLACK	PLASTIC BAG	DISCARDED MEDICINE AND CYTOTOXIC DRUGS, INCINERATION ASH, CHEMICAL USED IN PRODUCTION OF BIOLOGICALS, CHEMICALS USED IN DISINFECTION, INSECTICIDES, ETC.	INCINERATION, DESTRUCTION, DRUG DISPOSAL, DISPOSAL IN MUNICIPAL LAND-FILLS, CHEMICAL TREATMENT AND DISCHARGE INTO DRAINS.

CASE STUDY

ENVIRONMENTAL IMPACT OF MEDICAL WASTES DUE TO COVID 19

ABSTRACT

Covid-19 Pandemic leads to medical services for the society all over the world. The Covid-19 pandemic influence the waste management and specially medical waste management. In this study, the effect of the Covid-19 outbreak on medical waste was evaluated via assessing the solid waste generation, composition, and management status in five hospitals in Iran. The results indicated that the epidemic Covid-19 leads to increased waste generation on average 102.2 % in both private and public hospitals. In addition, the ratio of infectious waste in the studied hospitals increased by an average of 9 % in medical waste composition and 121 % compared with before COVID-19 pandemic. Changes in plans and management measurement such as increasing the frequency of waste collection per week leads to lower the risk of infection transmission from medical waste in the studied hospitals. The results obtained from the present research clearly show the changes in medical waste generation and waste composition within pandemic Covid-19. In addition, established new ward, Covid-19 ward with high-infected waste led to new challenges which should be managed properly by change in routine activities.

INTRODUCTION

Ever increasing population growth in cities in pace with economic growth has led to an increased production of various types of municipal solid waste, in particular, medical waste. Proper management of municipal waste in order to reduce its

adverse effects on the environment and the health of citizens is a necessity. Different types of municipal solid waste have numerous effects on health, environmental, economic and social aspects; Nowadays, the littered waste management is considered in priority.

Amongst the types of municipal solid waste, medical waste is important due to its potential infection increased generation rate. Medical waste, depending on their sources includes hospital waste, dental waste, medical laboratory waste and etc.. Hospital waste is one of the most important medical wastes, which include different types of infectious, sharp, toxic, chemical and pharmaceutical, and semi-household wastes. Proper management of medical waste in order to control its corresponding risks on health and to prevent the transmission of infectious such as hepatitis, AIDS, and typhoid is a necessity. The medical waste management elements include waste segregation, storage, transportation, disinfection and final disposal. Pandemic Covid-19 leads to increases in patient and healthcare activities; one of the consequences of Covid-19 is its effect on the quantity and composition of medical waste. The Covid-19 pandemic with change the influence the lifestyle influence the quantity and composition of municipal solid waste; waste management in this condition is done according to new guidelines. Covid-19 pandemic has increased the waste generation and the proportion of infectious waste in the landfill; one of the concerns raised in this area is the littering of masks and gloves by citizens which are potentially infectious. Furthermore, caring for sick or suspected people at home has led to the production of infectious waste in addition to hospitals waste. The aim of this study was to evaluate the effects of

Covid-19 on the quantity, composition and management of medical waste in Iran in order to identify the challenges posed by the epidemic on medical waste management. To this end, five hospitals in different cities were surveyed and their waste management elements activities were compared with before Covid-19 pandemic.

METHOD

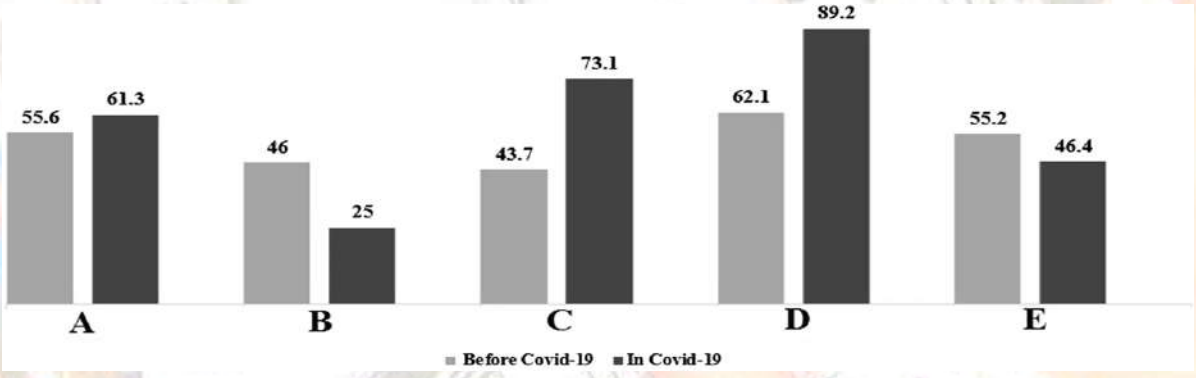
In this study, five hospitals including two private hospitals and three public hospitals in different cities of Iran were surveyed in terms of waste generation, waste composition and waste management. The general characteristics of waste management activities for the studied hospitals is summarized in Table 1. The data were collected by interviews with staff responsible for waste management in different hospitals. This information was provided and collected based on the physical analysis of hospital wastes. The classification of produced waste in studied hospitals was done according to the model presented in Table 2, which is common in medical waste management in Iran. The medical waste composition in the studied hospitals were classified into five categories. In addition, to understand the impact of the epidemic on waste generation, waste composition and the status of hospital waste management, data were reviewed and analyzed in the two period of before and during Covid-19 pandemic via statistical T-Test with 95 % confidence interval.

TABLE -1

Hospital	Type	Has Covid ward?	Has other ward?	Number of bed in Covid ward	Number of bed in other ward	With temporary storage?
A	Private	Yes	Yes	27	156	Yes
B	Public	Yes	Yes	106	91	Yes
C	Private	Yes	Yes	20	44	Yes
D	Public	Yes	No	200	0	Yes
E	Public	Yes	Yes	25	86	Yes

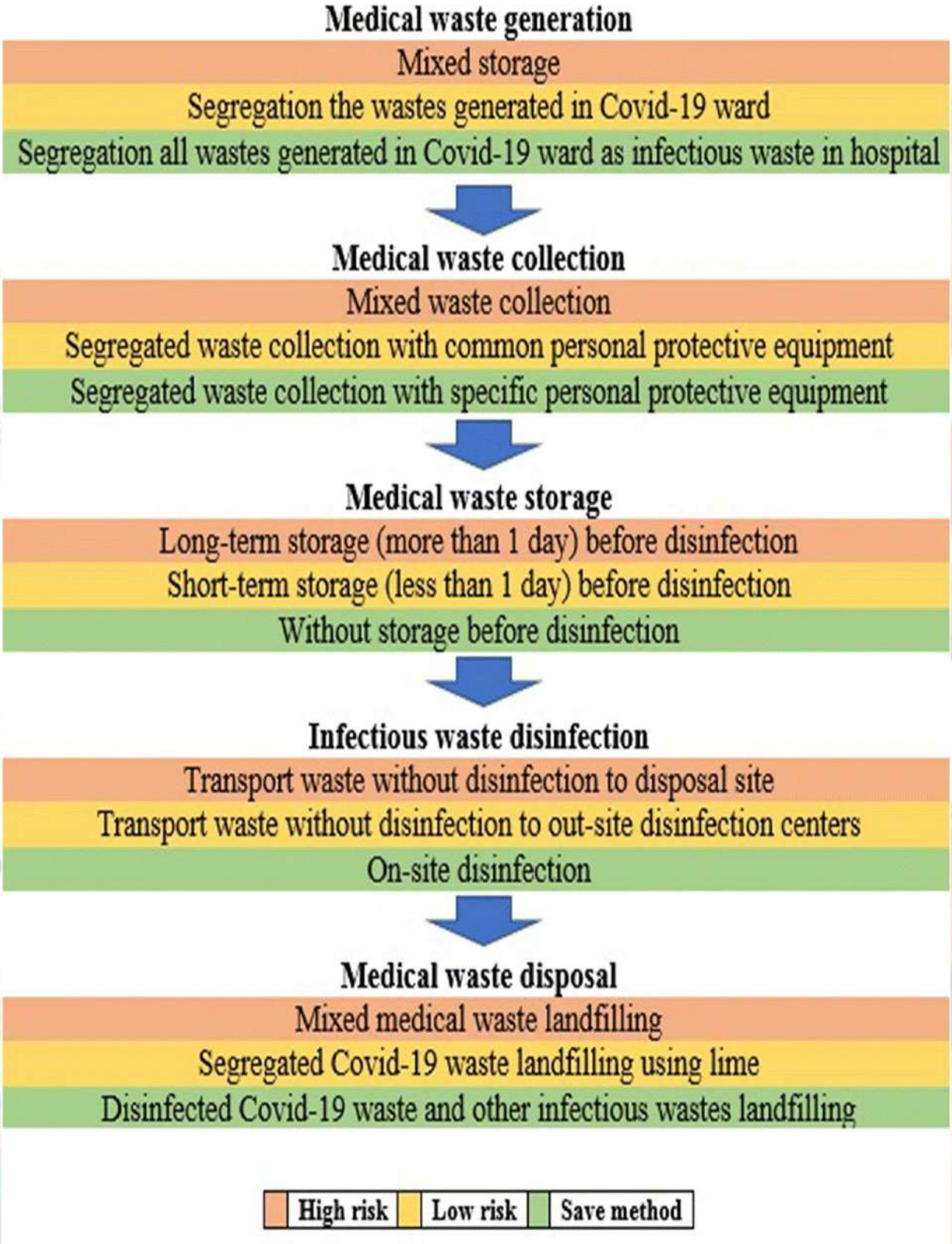
TABLE- 2

Type of medical waste	Example
Semi-household waste	Dry paper towel, dry gauze, nylon, plastic, syringe and needle packaging, film packet plastic, mixed gypsum and gauze, paper banderole, food waste, food waste packaging, tea slag, filter tip, mixed soil and gypsum, medicine ampoule packaging
Infectious waste	Blood-contaminated paper towel, blood-contaminated gauze, nylon gloves, latex gloves, syringes, personal protective equipment like mask and gown in Covid-19 pandemic.
Chemical and pharmaceutical waste	Used medicine ampoule, crylic, calcium hydroxide
Sharp waste	Needles, surgical blades
Pathological waste	Tissues



Comparison of infectious waste ratio (%) with before Covid-19 pandemic in the studied hospitals

Different plan for medical waste management in epidemic condition



CONCLUSION OF THE CASE STUDY

Medical waste generation, composition and management in five hospitals in Covid-19 pandemic in Iran was investigated. One of the effects of Covid-19 pandemic on medical waste was to increase the generation of this type of waste, which in the studied hospitals were found to be 0.95 to 3.51 kg/bed/day. In addition, an increase in the ratio of infectious waste in the medical waste mass was observed by 9 % due to the increase in patients in the infectious ward and staff use of personal protective equipment in the studied hospitals. The existence of appropriate high-capacity disinfection equipment in hospitals have led to proper management of increased quantity and potential of infectious in medical waste. Segregation of Covid-19 waste from other medical waste as well as daily disinfection of Covid-19 waste and infectious waste generated in other wards has reduced the possibility of disease transmission from the waste mass, however, the lack of separate containers for disposing of gloves and face masks in hospitals can lead to increase the risk of infection and disease from the medical waste.

ACKNOWLEDGEMENT

I would like to express my special thanks to Dr. Srijita Ghosh ma'am, Dr. Malini Kundu ma'am, Dr. Sushmita Gonslaves ma'am, Dr. Tina Mukherjee ma'am, Dr. Camellia Nandi ma'am, Dr. Sushmita Kar ma'am, Prof. Koly De ma'am, Dr.Aniruddha Chatterjee sir, for their able guidance and support in completing my project.

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Date:

6/7/2021

Teacher's signature:

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SEMESTER : TWO

DEPARTMENT : ECONOMICS

AECC ENVS PROJECT

*PROJECT TOPIC :*POLLUTION A CASE STUDY

ACKNOWLEDGEMENT

I would like to thank my subject teachers of AECC ENVS and our department HOD for providing me with adequate study materials for this topic and encouraging me to do this project systematically. I would also like to thank my parents and batchmates, because without their timely help and guidance, it would have been impossible for me to opt and work on this project.

CONTENTS

WHAT IS POLLUTION

Pollution, also called **environmental pollution**, the addition of any substance (solid, liquid, or gas) or any form of energy (such as heat, sound, or radioactivity) to the environment **at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form.**

HISTORY

Although environmental pollution can be caused by **natural events** such as forest fires and active volcanoes, use of the word pollution generally implies that the contaminants have an **anthropogenic source—that is, a source created by human activities.** Pollution has accompanied humankind ever since groups of people first congregated and remained for a long time in any one place. Pollution was not a serious problem as long as there was enough space available for each individual or group.However, with the establishment of permanent settlements by **great numbers of people, pollution became a problem, and it has remained one ever since.**

MAJOR TYPES OF 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**.

AIR POLLUTION

Air pollution, **release into the atmosphere of various gases, finely divided solids, or finely dispersed liquid aerosols** at rates that exceed the natural capacity of the environment to dissipate and dilute or absorb them. These substances may reach concentrations in the air that cause **undesirable health, economic, or aesthetic effects.**

Major Air Pollutants

Clean, dry air consists primarily of **nitrogen and oxygen—78 percent and 21 percent** respectively, by volume. The remaining **1 percent** is a mixture of other gases, **mostly argon (0.9 percent), along with trace (very small) amounts of carbon dioxide, methane, hydrogen, helium, and more.** Water vapour is also a normal, though quite variable, component of the atmosphere, normally ranging from 0.01 to 4 percent by volume; under very humid conditions the moisture content of air may be as high as 5 percent.

The three main types of air pollution are:

1)Criteria pollutants

There are six major air pollutants that have been designated by the U.S. Environmental Protection Agency (EPA) as "criteria" pollutants— **carbon monoxide (CO), nitrogen oxides (NO and NO_2), sulfur dioxide (SO_2), ozone (O_3), particulate matter, lead (Pb).**

2) Air toxics

Hundreds of specific substances are considered hazardous when present in trace amounts in the air. These pollutants are called air toxics. These are namely- **arsenic, asbestos, benzene, beryllium compounds, cadmium compounds, chlorine, coke oven emissions, cyanide compounds, formaldehyde, lead compounds, mercury compounds, nickel compounds, radionucleides (radon, radium, uranium),selenium compounds, vinyl chloride**

3) Greenhouse gases

Global warming is recognized by almost all atmospheric scientists as a significant environmental problem caused by an increase in levels of certain trace gases in the atmosphere since the beginning of the Industrial Revolution in the mid-18th century. These gases, collectively called greenhouse gases, include **carbon dioxide, organic chemicals called chlorofluorocarbons (CFCs), methane, nitrous oxide, ozone, and many others**. Carbon dioxide, although not the most potent of the greenhouse gases, is the most important because of the huge volumes emitted into the air by combustion of fossil fuels (e.g., gasoline, oil, coal).

WATER POLLUTION

Water pollution, **the release of substances into subsurface** groundwater or into lakes, streams, rivers, estuaries, and oceans to the point where the substances interfere with beneficial use of the water or with the natural functioning of ecosystems. In addition to the release of substances, such as chemicals or microorganisms, water pollution may also include **the release of energy, in the form of radioactivity or heat**, into bodies of water.

Types Of Water Pollution

- **Surface water pollution.**
- **Groundwater pollution.**
- **Chemical pollution.**
- **Nutrients pollution.**
- **Oxygen depletion pollution.**
- **Microbiological pollution.**
- **Suspended matter.**

Major Water Pollutants

Water bodies can be polluted by a wide variety of substances, including pathogenic microorganisms, organic waste, plant nutrients, toxic chemicals, sediments, heat, petroleum (oil), and radioactive substances. Several types of water pollutants are considered below. (For a discussion of the handling of sewage and other forms of waste produced by human activities, see waste disposal.)**Types- Domestic sewage, Toxic waste, Sediment, Thermal pollution, Petroleum (oil) pollution**

LAND POLLUTION

Land pollution**, the deposition of solid or liquid waste materials on land or underground** in a manner that can **contaminate the soil and groundwater, threaten public health, and cause unsightly conditions and nuisances.**

Major Types of Land Pollution are

- **Agricultural Land Pollution**
- **Non-biodegradable Solid Waste**
- **Industrial Waste**
- **Deforestation**
- **Mining.**

LIGHT POLLUTION

Light pollution is the **excess amount of light in the night sky**. Light pollution, also called **photopollution**, is almost always found in urban areas. Light pollution can **disrupt ecosystems by confusing the distinction between night and day.** Nocturnal animals, those that are active at night, may venture out during the day, while diurnal animals, which are active during daylight hours, may remain active well into the night. Feeding and sleep patterns may be confused. **Light pollution also indicates an excess use of energy.**

NOISE POLLUTION

Noise pollution is the **constant presence of loud, disruptive noises in an area.** Usually, noise pollution is caused by construction or nearby transportation facilities, such as airports.Noise pollution is **unpleasant, and can be dangerous**. Some songbirds, such as robins, are unable to communicate or find food in the presence of heavy noise pollution. The sound waves produced by some noise pollutants can **disrupt the sonar** used by marine animals to communicate or locate food.

MOST POLLUTING INDUSTRIES

The **Pure Earth**, an **international non-for-profit organization** dedicated to **eliminating life-threatening pollution in the developing world,** issues an annual list of some of the **world's most polluting industries.**

- Lead-Acid Battery Recycling
- Industrial Mining and Ore Processing
- Lead Smelting
- Tannery Operations
- Artisanal Small-Scale Gold Mining
- Industrial/Municipal Dumpsites
- Industrial Estates
- Chemical Manufacturing
- Product Manufacturing
- Dye Industry

WORLD'S WORST POLLUTED PLACES

Pure Earth issues an **annual list of some of the world's worst polluted places.**

- Agbogbloshie, Ghana
- Chernobyl, Ukraine
- Citarum River, Indonesia
- Dzershinsk, Russia
- Hazaribagh, Bangladesh
- Kabwe, Zambia
- Kalimantan, Indonesia
- Matanza Riachuelo, Argentina
- Niger River Delta, Nigeria
- Norilsk, Russia

REDUCING POLLUTION AND CONCLUSION

Pollution control is a term used in environmental management. It **means the control of emissions and effluents into air, water or soil.** Without pollution control, the waste products from **overconsumption, heating, agriculture, mining, manufacturing, transportation** and other human activities, **whether they accumulate or disperse, will degrade the environment.** In the hierarchy of controls, **pollution prevention and waste minimization are more desirable than pollution control**.Around the world, people and governments are making efforts to combat pollution. **Recycling,** for instance, is becoming more common. In recycling, **trash is processed so its useful materials can be used again.** Recycling **reduces the amount of garbage that ends up in landfills, incinerators, and waterways.**

Governments can combat pollution by **passing laws that limit the amount and types of chemicals factories and agribusinesses are allowed to use. International agreements** can also reduce pollution. The **Kyoto Protocol**, a United Nations agreement to limit the emission of greenhouse gases, has been signed by **191 countries.** The United States, the world's second-largest producer of greenhouse gases, did not sign the agreement. Other countries, such as China,

the world's largest producer of greenhouse gases, have not met their goals. **As countries around the world become wealthier, some forms of pollution increase**. Countries with growing economies usually need more power plants, which produce more pollutants.

Reducing pollution requires e**nvironmental, political, and economic leadership**. Developed nations must work to reduce and recycle their materials, while developing nations must work to strengthen their economies without destroying the environment. **Developed and developing countries must work together toward the common goal of protecting the environment for future use.**

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NAME : SHREYASEE SARKAR
SEMESTER : 2
SUBJECT : AECC-2
COLLEGE ROLL NO : ECOA20F283
CU ROLL NO :203223-11-0084
CU REGISTRATION NO :223-1211-0471-20

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ENVIRONMENTAL POLLUTION

INTRODUCTION

The word ‘environment’ has been derived from the french word ‘environ’ meaning surrounding . Environment denotes the sum total of physical and biological factors that directly influences survival,growth,development and reproduction . Favourable environmental conditions lead to the existence and development of living organisms. When there is an undesirable change in the surrounding that has harmful effects on plants and animals, it leads to environmental pollution.

Environmental pollution is a major issue these days. The major types of environmental pollution are air pollution ,water pollution, noise pollution ,soil pollution . Hence to throw light on these major issues I decided to make a project on environmental pollution so that a greater scope of the syllabus can be covered .

AIR POLLUTION

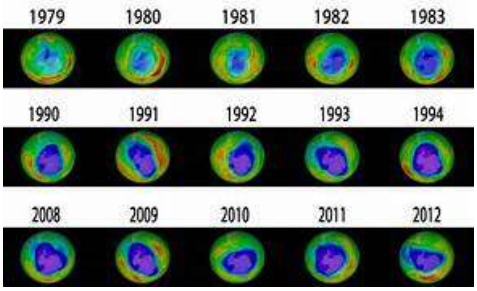
Definition : Air pollution refers to the contamination of air by undesirable solid or gaseous substances that are harmful for human health and environment .

Causes : Some of the major causes of air pollution are listed below -

- Emission of CO_2 and other greenhouse gases by industries ,vehicles etc.
- Combustion of fossil fuels.
- Release of CFCs by refrigerators and air conditioners.
- Release of gases by volcanic eruption.

Effects : Some of the major effects of air pollution are listed below -

- Increase in respiratory diseases such as lung cancer ,asthma ,chronic bronchitis, emphysema etc.
- Increase in the ozone hole due to emission of various greenhouse gases .



WATER POLLUTION

Definition : Water pollution refers to the direct or indirect degradation in the quality or composition of water as a result of man's activities such that the water becomes unfit for any purpose .

Causes : Some of the major causes of water pollution are listed below -

- Dumping of solid and liquid wastes on water bodies by humans .
- Release of sewage wastes by industries into the water bodies nearby .
- Contamination of water due to air pollution .The gases that lead to air pollution eventually mix up with the water vapour in high altitudes and come down to earth in the form of rain causing water pollution.

Effects : Some of the major effects of water pollution ar listed below -

- Water pollution drastically affects human health; in fact, it can kill. In 2015 alone, a study revealed that waterborne illnesses caused 1.8 million deaths worldwide.
- It can cause contamination of drinking water – thereby contributing to waterborne illnesses.
- Water pollution also affects the ecosystem – it can cause a phenomenon called eutrophication. This can cause fish and other aquatic organisms to die.

NOISE POLLUTION

Definition : Noise pollution refers to the unwanted or excessive sound that can have disastrous effects on human health ,wildlife and environmental quality.

Causes : Some of the major causes of noise pollution are listed below -

- Sound caused by various machineries in big industries .
- Sound caused by numerous vehicles that run on the road at a time .
- Sound produced by various machineries at construction sites .

Effects : Some of the major effects of noise pollution are listed below -

- Continuous exposure to loud levels of noise can straightforwardly result in the damage of eardrums and hence loss of hearing .
- The high levels of sound can disturb the sleeping pattern of an individual and thus can lead to uncomfortable and irritable situations .
- Disturbance of sleep ,aggressive behaviour ,hypertension or stress can be associated with excessive sound levels .

SOIL POLLUTION

Definition : Soil pollution refers to the contamination of soil with anomalous concentrations of toxic substances

Causes : Some of the major causes of soil pollution are listed below -

- Agricultural activities involving the diffusion of herbicides ,pesticides and/or insecticides and fertilizers
- Chemical waste dumping - whether accidental or deliberately , such as illegal dumping.
- Leaks from sewer lines into subsurface (e.g. adding chlorine which could generate trihalomethanes such as chloroform).

Effects : Some of the major effects of soil pollution are listed below -

- Exposure to high levels of lead can result in permanent damage to the nervous system. Children are particularly vulnerable to lead.
- 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).

CONCLUSION

Apart from these four types of pollution ,there are many other types as well like marine pollution, nuclear pollution ,thermal pollution which are basically subtypes of these four. Nevertheless whichever form of pollution it might be ,ultimately it leads to degradation of environmental health .However this deterioration can be controlled by taking proper measures at individual ,societal and governmental level.

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ENVIRONMENTAL SCIENCE (ENVS) PROJECT

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CU ROLL NUMBER- 203223-11-0095
CU REGISTRATION NUMBER- 223-1211-0499-20
SEMESTER - 2
DEPARTMENT - ECONOMICS
TOPIC - ***A CASE STUDY ON AMAZON FOREST FIRES OF 2019 & 2020***

AMAZON FOREST- AN INTRODUCTION

- The Amazon Biome spans approximately 6.7 million square kilometers(twice the size of India)
- The basin is shared by 8 countries (Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana and Suriname), as well as the overseas territory of French Guiana.
- It is made up of a mosaic of ecosystems and vegetation types including rainforests, seasonal forests, deciduous forests, flooded forests, and savannas.

AMAZON FOREST- AN INTRODUCTION (CONTINUED)

- The Amazon rainforest has been around for at least 55 million years.
- A lot of the species in the Amazon Rainforest you can't find anywhere else in the world! There are over 2.5 million species of insects, more than 40,000 different varieties of plants, 1,500 bird species, and over 2,000 fish species.
- There are about 50 tribes that are native to the Amazon Rainforest that has never had any contact with the outside world at all! Wow, they would probably get a big shock if they ever had to come into contact with the modern world as we know it today.
- In 1500 there were between 6 and 9 million Amazon natives. Today there are only an estimated 250,000 left. The Amazon natives speak about 170 different languages.

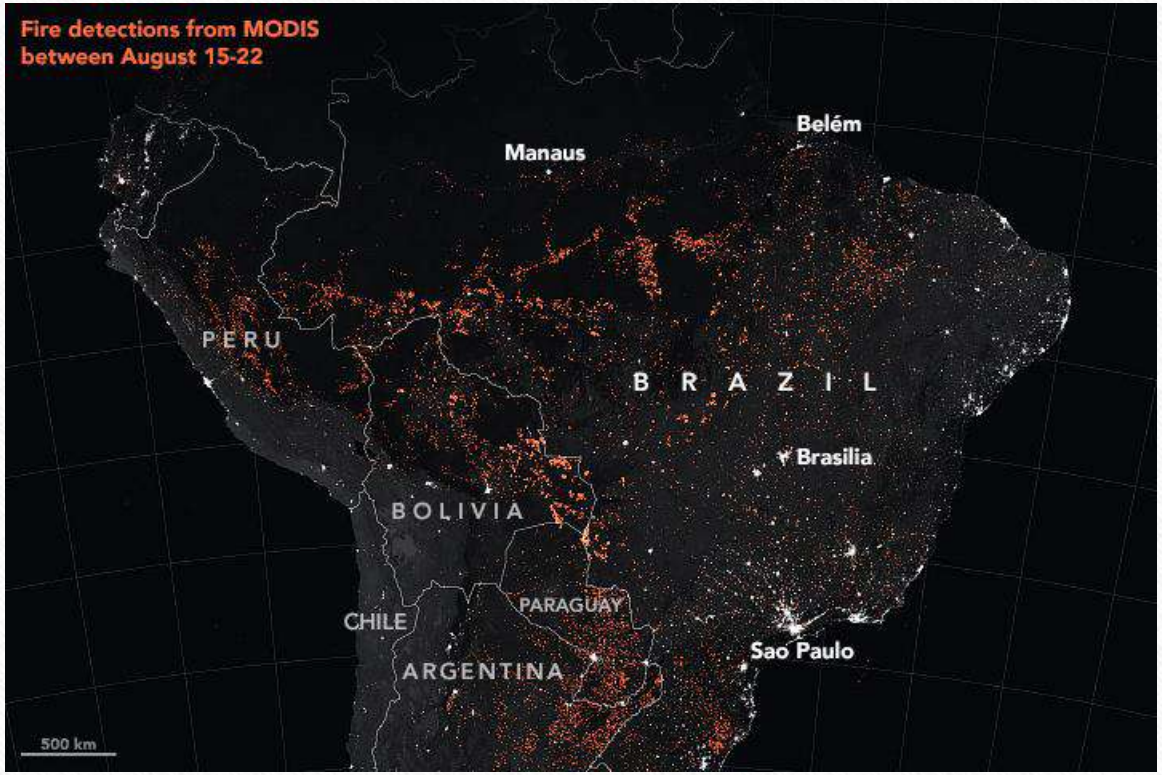
WHAT IS A FOREST FIRE?

- Forest fire is the uncontrolled fire that destroys large parts of the forest.
- Forests are highly vulnerable to this phenomenon.
- It is a disaster that involves widespread destruction of forest resources and wildlife.
- It is prevalent mostly in the environment where there are very high temperature, low humidity, and high-speed winds.

THE AMAZON FORESTFIRE

- The 'world's lungs" raged with fire across the southern Amazon in August and September, making it one of the biggest environmental events of 2019.
- The fires in the Amazon region in 2019 were unprecedented in their destruction. Thousands of fires had **burned more than 7,600 square kilometers by October that year**. In 2020, things were no better and, in all likelihood, worse.
- In fact, 2020's fires have been the worst since at least 2012, when the satellite was first operated.
- The **number of fires burning the Brazilian Amazon increased 28 per cent in July 2020** over the previous year.
- The **fires in the first week of September are double those in 2019**, according to INPE, Brazil's national research space agency.

But the question is “What causes the forests to burn?”



Amazon is home to more species of plants and animals than any other terrestrial ecosystem on the planet: one in 10 known species on Earth. ***When Amazon burns, species Suffer.***

THE CAUSES OF THE FOREST FIRES

- ***Most fires within the Amazon tropical rainforest are anthropogenic (human-made)*** as opposed to biogenic (natural).
- These can be for many reasons, such as illegal logging, deforestation efforts, agricultural burning (mainly due to slash and burn methods used by locals to clear the forests for agricultural purposes),etc.
- Whilst most fires in the Amazon are started by humans, this is not always the case***. The three main causes of forest fires are:***

1. Dry environment
2. Lightning strikes
3. Volcanic eruptions

WHAT CAUSED THE AMAZON RAINFOREST FIRE?

- **Human intervention:** According to INPE (Brazil's space research center), 99% of the Amazon wildfire is caused due to human intervention either accidentally or on purpose. It also estimated that 2020 has seen an 80% increase in the forest fire in the Amazon compared to 2019.

- **Cattle ranchers & Loggers:** The current Amazon wildfire is said to have been caused by the cattle ranchers and the loggers who are currently undertaking measures to clear the forest areas and utilize it for the economic benefits.

WHAT CAUSED THE AMAZON RAINFOREST FIRE? (CONTINUED)

Farmers:

- Amazon is mostly characterized by humid weather condition.
- However, between July and August, it too is a subject of the dry season.
- 2020's Amazon wildfire coincides with the dry season – a condition favorable for clearing the forest areas.
- This makes it evident that the farmers wait for the dry season to clear out the forest areas for agricultural purposes.
- The Brazilian farmers had even organized a "fire day" along the highway BR-163.

Budget cuts: Many blame the budget cut for IBAMA – Brazil's environmental agency by 24% in April 2020 by the Brazilian government. These budget cuts have reduced IBAMA's capacity to monitor and enforce fines on those who illegally light fires in the Amazon rainforest

BUT WHY ARE THE AMAZON FOREST FIRES “A BIG DEAL”?

GLOBAL IMPLICATIONS – ON CLIMATE

- Amazon Forest helps balance the global carbon budget by absorbing carbon dioxide from the atmosphere, and plays a key role in the global water cycle, stabilizing global climate and rainfall.
- A nine nation network of Indigenous territories and natural areas have protected a massive amount of biodiversity and primary forest.
- As the rainforest bleeds biomass through deforestation, it loses its ability to capture carbon from the atmosphere and releases carbon through combustion.
- If the annual fires burning the Amazon are not curtailed, one of the world's largest carbon sinks will progressively devolve into a carbon faucet, releasing more carbon dioxide than it sequesters-***resulting in poor air quality & change in weather patterns***

LOCAL IMPLICATIONS – ON CLIMATE

- While the global impacts are dire, the local impacts of these fires are also significant. ***Persistent poor air quality***, which extends far into Brazil and other regions of South America, including in metropolitan centers like São Paulo, can lead to ***health problems***.
- As roads are built and forests are cleared for timber production and agriculture, a checkerboard of tropical forest edges is created. These destructive activities can lead to ***rapid extinctions*** and a ***severe loss of species*** richness anywhere that human encroachment occurs.

GLOBAL IMPLICATIONS – ON HEALTH

- Zoonotic diseases, like SARS-CoV-2, the virus that causes COVID-19, are on the rise. Understanding the root causes of these spillover events gives us insight into how to prevent future zoonotic outbreaks. The degradation and fragmentation of tropical rainforests such as the Amazon may be a key factor in this process.
- The checkerboard of forest edges increases the potential points of contact between humans and wildlife, which in turn increases the likelihood of viral transmission and the ***emergence of novel human diseases.***
- Maintaining the Amazon's current high level of biodiversity is vital, both for the health of the global ecosystem and because, otherwise, the Amazon could become a ***future hotspot of emerging diseases***.

"When forests are cut down, we often see disease outbreaks"

WHAT ARE THE MEASURES TAKEN BY THE WORLD?

G7 Countries:

•The G7 countries have pledged to donate $20 million to aid the Amazon countries to fight the wildfire.
•These countries have also agreed to launch a long-term global initiative to protect the Amazon rainforest.
•This plan would involve the reduction of the deforestation rate and promotion of afforestation of the Amazon rainforest.

Germany and Norway:

- Germany and Norway had ceased the funds to programs that aim to prevent deforestation of the Amazon rainforest.
- Both the countries had accused the Brazilian government of not taking the necessary steps to contain the forest fire.

WHAT CAN YOU DO TO SAVE THE RAINFORESTS?

- **Educate yourself & others:**

What happens to nature across the world impacts us on our own doorstep, and the choices we make here have an impact on the world. Hence educating oneself with knowledge & sharing it helps create pressure on authorities to take proper actions & enforce laws strictly.

- **Reduce your carbon footprint:**

Drive less, take public transportation, turn down your home thermostat (even a couple degrees makes a big difference!), turn off lights and electronics when not in use, and avoid unnecessary air travel

- **Support indigenous communities:**

Buying artisanal and fair trade products made by indigenous peoples is a unique and effective way to protect rainforests and sustainable livelihoods

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my Professors, Principal & Vice Principal who gave me the golden opportunity to do this wonderful project of Environmental Science.

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THANK YOU!

ENVS PROJECT ON AIR POLLUTION

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AIR POLLUTION

INTRODUCTION

Today, air pollution has emerged as a global public health problem and is identified as a major environmental health hazard by agencies such as the World Health Organization (WHO) and governments around the world. An increase in concentration of pollutants - both gaseous and solid - is among the largest health risk in the world and according to the latest data released by WHO, indoor and outdoor air pollution were responsible for 3.7 million deaths of people aged under in 2012. In recent years, air pollution has acquired critical dimensions and the air quality in most Indian cities that monitor outdoor air pollution fail to meet WHO guidelines for safe levels. Furthermore, the issue of indoor air pollution has put women and children at high risk.

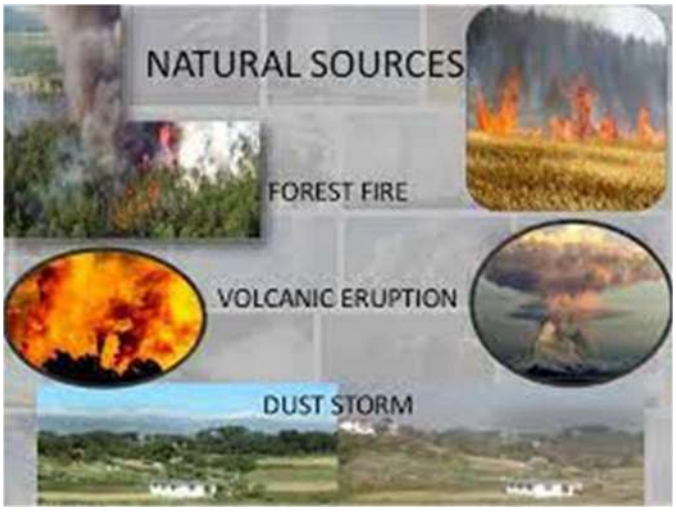
Sources of Air pollution

When we try to study the sources of Air pollution, we usually enlist a series of activities and interactions that create these pollutants. There are two types of sources that we will take a look, namely Natural sources and Man-made sources.

NATURAL SOURCES

Natural sources of pollution include dust carried by the wind from locations with very little or no green cover, gases released from the body processes of living beings (Carbon dioxide from humans during respiration, Methane from cattle during digestion, Oxygen from plants during Photosynthesis).

Smoke from the combustion of various inflammable objects, volcanic eruptions etc. along with the emission of polluted gases also makes it to the list of natural sources of pollution.



MAN MADE SOURCES

While looking at the man-made contributions towards air pollution, it can be further divided into:

1. **Outdoor pollution sources**
2. **Indoor pollution sources**

OUTDOOR POLLUTION SOURCES

The major outdoor pollution sources include power generation, vehicles, agriculture/waste incineration, industry and building heating systems.

Smoke features as a prominent component. The smoke emitted from various forms of combustion, like in biomass , factories, vehicles, furnaces, etc. Waste dumped in landfills generates methane, which is harmful in several ways. The reactions of certain gases and chemicals also form harmful fumes that can be dangerous to the well-being of living creatures.

INDOOR POLLUTION SOURCES

In low- and middle-income countries, mostly burning fuels such as dung, coal and wood in inefficient stoves or open hearths produces a variety of health-damaging pollutants. These include carbon monoxide, methane, particulate matter (PM), polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOC).

Even burning kerosene in simple wick lamps also produces significant emissions of fine particles and other pollutants. Exposure to smoke from cooking fires causes 3.8 million premature deaths every year.

IMPACTS OF AIR POLLUTION

HEALTH

Around the world, nine out of 10 people breathe unhealthy air. Air pollution is now the biggest environmental risk for early death, responsible for more than 6 million premature deaths each year from heart attacks, strokes, diabetes and respiratory diseases. That's more than the deaths from AIDS, tuberculosis and malaria combined .Children, the elderly, people with existing diseases, and minority and low-income communities are particularly vulnerable to adverse health outcomes and economic impacts, such as missed work days, from exposure to air pollution. Research suggests that long term exposure to some pollutants increases the risk of emphysema more than smoking a pack of cigarettes a day..

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.

CLIMATE CHANGE

Climate Change is another consequence of global warming. When the temperature of the planet increases, there is a disturbance in the usual climatic cycles, accelerating the changes of these cycles in an evident way.

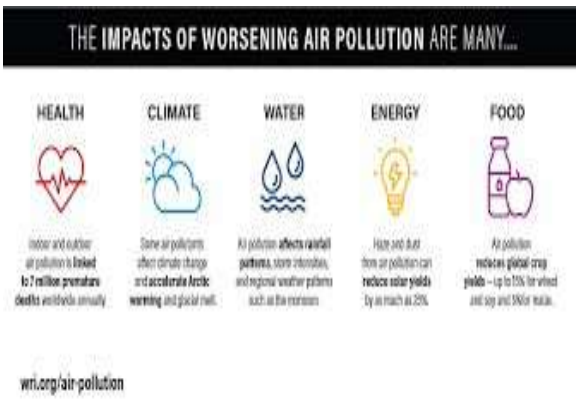
Due to climate change, the mass of the poles is melting, and this is leading to flooding and the rising of sea levels.

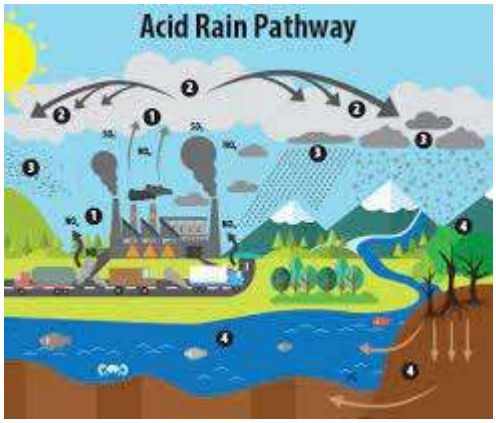
ACID RAIN

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.





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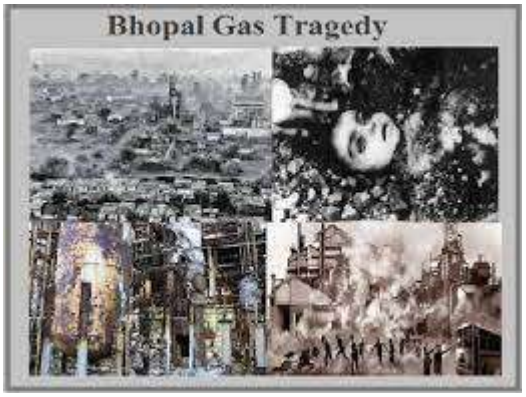
HISTORICAL DISASTERS

The world's worst short-term civilian pollution crisis was the Bhopal Gas Tragedy in 1984 in India Leaked industrial vapours from the Union Carbide factory, belonging to Union Carbide, Inc., U.S.A. (later bought by Dow Chemical Company), killed at least 3787 people and injured from 150,000 to 600,000.

The United Kingdom suffered its worst air pollution event when on 4th December Great Smog of 1952 formed over London. In six days more than 4,000 died and more recent estimates put the figure at nearer 12,000.

An accidental leak of anthrax spores from a biological warfare laboratory in the former USSR in 1979 near Sverdlovsk is believed to have caused at least 64 deaths.

The worst single incident of air pollution to occur in the US occurred in Donora ,Pennsylvania in late October 1948, when 20 people died and over 7,000 were injured.



HOTSPOTS

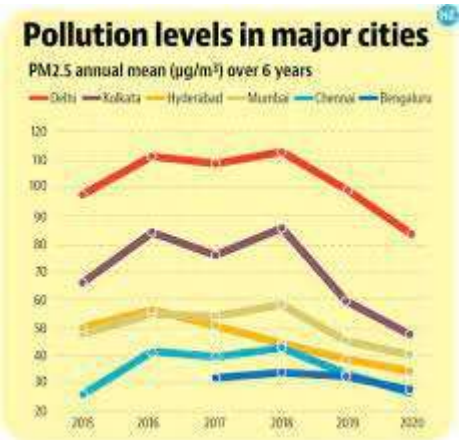
Air pollution hotspots are areas where air pollution emissions expose individuals to increased negative health effect. They are particularly common in highly populated, urban areas, where there may be a combination of stationary sources (e.g. industrial facilities) and mobile sources (e.g. cars and trucks) of pollution. Emissions from these sources can cause respiratory disease, childhood asthma, cancer, and other health problems. Fine particulate matter such as diesel soot, which contributes to more than 3.2 million premature deaths around the world each year, is a significant problem. It is very small and can lodge itself within the lungs and enter the bloodstream. Diesel soot is concentrated in densely populated areas, and one in six people in the U.S. live near a diesel pollution hot spot.

While air pollution hotspots affect a variety of populations, some groups are more likely to be located in hotspots. Previous studies have shown disparities in exposure to pollution by race and/or income. Hazardous land uses (toxic storage and disposal facilities, manufacturing facilities, major roadways) tend to be located where property values and income levels are low. Low socioeconomic status can be a proxy for other kinds of social vulnerability including race, a lack of ability to influence regulation and a lack of ability to move to neighborhoods with less environmental pollution. These communities bear a disproportionate burden of environmental pollution and are more likely to face health risks such as cancer or asthma.

1Toxic air pollution hotspots

CITIES

Air pollution is usually concentrated in densely populated metropolitan areas, especially in developing countries where environmental regulations are relatively lax or nonexistent. However, even populated areas in developed countries attain unhealthy levels of pollution, with Los Angeles and Rome being two examples. Between 2002 and 2011 the incidence of lung cancer in Beijing near doubled. While smoking remains the leading cause of lung cancer in China, the number of smokers is falling while lung cancer rates are rising.



WAYS TO REDUCE AIR POLLUTION

1.Using Public Transport

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.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.

3.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.

4.Use filter and chimney

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.

5.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.

6. 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

While the effects of air pollution on materials, vegetation, and animals can be measured, health effects on humans can only be estimated from epidemiological evidence. Most of the evidence comes from occupational exposure to much higher concentrations of pollutants than the general public is exposed to. Moreover, the health effects of smoking and other lifestyle characteristics and exposures confound the observations of air pollutant effects. Ethical considerations preclude deliberate exposure of human subjects to concentrations of pollutants that might produce adverse effects, so evidence from sources other than epidemiology is virtually impossible to obtain. All of the evidence we have suggests that air pollutants threaten human health and well-being to an extent that control of these pollutants is necessary.

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SEMESTER- 2
HONOURS SUBJECT – ECONOMICS
SUBJECT FOR TUTORIAL- AECC ENVS
TUTORIAL TOPIC– PROJECT TIGER
BATCH- 2020-23

INTRODUCTION

The tiger is a symbol of power and virility for the natural world, much worshiped by forest communities all over as the guardian of the tree and the forest and as a symbol of fertility, regeneration and reproduction. In traditional legends about gods, goddesses and spirits the tiger and man forged a link to defeat evil and bring light on this planet. This deep rooted link with the tiger engulfed belief, myth and legend all over the range that it roamed till a few hundred years ago. With the rapid development of modern technologies like the gun and the advent of the 'jeep' the tiger over the last few hundred years got slaughtered over its entire range and by those who held offices of power, and ruled. This slaughter created a deep schism in the psyche of forest communities. The tiger was their god and guardian and it was being killed. In India the slaughter of the tiger was checked only in 1970 with a complete ban on hunting. Soon after an estimate of tiger numbers was conducted and a miniscule population of around 1,800, revealed the plight of this extraordinary predator. It is impossible to determine the extent of its population at the turn of the century but it must have been in tens of thousands. lndira Gandhi, then Prime Minister of India, felt strongly about protecting India's wilder- ness areas. The tiger was getting a fresh lease of life, but would it be too late?. It was Guy Mountfort, an international conservationist who, at a joint meeting of IUCN and the World Wildlife Fund, proposed an international effort to create effective and fully equipped reserves for the long-term survival of the tiger. He also suggested that all efforts and resources be concentrated on the race of tigers that was still found in relatively large numbers, namely the India subspecies or royal Bengal tiger. The resources required were some $400,000 and the project was accepted and called 'Operation Tiger'. A special committee was created by lndira Gandhi to coordinate action in India under the chairmanship of Dr. Karan Singh. The first five-year budget envisaged an expenditure of nearly 4 crores by the Indian Government. Similar encouragement

was received from the King of Nepal and the President of Bangladesh, and the neighboring Himalayan state of Bhutan quickly added their support, ensuring the contiguous protection of habitat for the survival of this species. The subcontinent was at last taking positive action to protect the royal Bengal tiger. The WWF's international appeal raised more than 800,000 pounds in 18 months. The original 'Tiger Task Force' of 1972 had selected nine areas to become special reserves, and in 1973 'Project Tiger' was inaugurated in Corbett National Park in Uttar Pradesh, under the directorship of Kailash Sankhala.All over the world, public awareness and sensitivity rallied to the cause of the tiger's conservation. Real animal furs lost their social importance as more and more people adopted the conservationist view. Fashions changed, and in many countries the wearing of skins from rare wild animals became more likely to attract anger and hostility than the envy and admiration, of earlier years. With the money that came in to the WWF an infrastructure and a pool of equipment was created in the reserves. The Fund

supplied forty vehicles, two launches for the Sun- darbans mangrove swamps straddling the borders of lndia and Bangladesh, complete radio and wireless networks for several reserves, tractors, telemetry and capture equipment, and other research apparatus such as cameras, binoculars and night lenses. For the tiger, it was the first ray of hope.The Indian Government by allocating funds regularly to Project - Tiger ensured that top priority was given to these areas of rich biodiversity. In many ways saving the tiger meant saving the total biodiversity of these areas. The project apart from conserving the tiger, also protects a wide spectrum of species from the lowest invertebrates to the mighty elephant. So has been the case with the survival and preservation of floral communities. This is the largest conservation effort spearheaded by the Indian in the world. Conceived, formulated and executed by indigenous effort and manpower. Over the last 20 years 43 crores have been provided as central assistance to the states who in turn placed matching grants for recurring expenses in addition to providing money from non-plan for routine works.Today 20 years later there are 19 Project Tiger Reserves encompassing a total area of 29,716 sq. kms with a population of 1,327 tigers (estimates from 1989 census of tigers).In 1972 there were 268 tigers within nine reserves. The population has increased, and till the mid-eighties (1984) the population of tigers reached 1121 in seventeen reserves. By the end of the eighties many serious problems started

afflicting our Project Tiger Reserves. The population of India has gone up by 300 million people since Project Tiger started.The population of livestock has increased by over 100 million in the same period. The resultant increase in biotic pressure, since firewood, timber and pasture are essential for the very survival of man, has been exceedingly heavy. Over and above this an ever increasing demand due to market forces and consumerism, were changing a way of life and exacting a pressure on natural resource, the effect of the latter much more severe than the former. Despite these limitations these areas are relatively much better than other forested tracts in India.The Forest survey of India in its vegetation monitoring of 16 tiger reserves reveals between 1983-1989 some of the progression and regression in the status of vegetative cover in the tiger reserves. The pressures of poaching have also increased especially due to the use of tiger bones for eastern medicinal derivatives. The South-East Asian countries have shown sharp declines in their tiger numbers and the demand for bones forces poaching gangs in India to not only meet the supply but at extraordinary profits. This is a direct external threat to species survival. Today political activists seem to have made some Project-Tiger reserves a target for their refuge and actions.With all the above pressures wildlife management has suffered

- **. Political and bureaucratic constraints, have probably further agravated the**

problem. Within all these limitations and drawbacks a team of forest personnel throughout the 19 tiger reserves in India have tried to do their level best to manage and protect these areas.All in all Project Tiger faces a new set of serious problems. Project Tiger saved the tiger from extinction in the nick of time but over 20 years it is clear that expanding human populations, a new way of life based on alien models, and the resultant effect on natural resources has created fresh problems that indicate danger for the tiger. Militancy and poaching only add fuel to the fire.This is a serious and critical moment in the history of tiger conservation. In this review an attempt is being made to look into all the tiger reserves dispassionately, identify the major problems and make a determined and fresh effort to ensure the future of the tiger.

WHAT IS PROJECT TIGER ?

Project tiger is a tiger conservation programme launched in April 1973 by the Government of India during Prime Minister Indira Gandhi's tenure. Kailash Sankhala was the first director of Project Tiger As the Bengal Tiger is the national animal of India, this project aims to stem the dwindling population of the big cats and work to increase their numbers. 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.. State surveys have reported a significant increase in the tiger population which was estimated at 2,967 during the 2018 count (as part of a four yearly tiger census). Project Tiger's main aims are to:

- Reduce factors that lead to the depletion of tiger habitats and to mitigate them by suitable management. The damages done to the habitat shall be rectified to facilitate the recovery of the ecosystem to the maximum possible extent
- Ensure a viable tiger population for economic, scientific, cultural, aesthetic and ecological values.

The monitoring system M-STrIPES was developed to assist patrol and protect tiger habitats. It maps patrol routes and allows forest guards to enter sightings, events and changes when patrolling. It generates protocols based on these data, so that management decisions can be adapted

Project Tiger was administered by the National Tiger Conservation Authority. The overall administration of the project is monitored by a steering committee, which is headed by a director. A field director is appointed for each reserve, who is assisted by a group of field and technical personnel.

- Shivalik-Terai Conservation Unit
- Th-East Conservation Unit
- Sunderbans Conservation Unit
- Western Ghats Conservation Unit
- Eastern Ghats Conservation Unit
- Central India Conservation Unit
- Sariska Conservation Unit
- Kaziranga Conservation Unit

The various tiger reserves were created in the country based on the 'core-buffer' strategy:

- Core area: the core areas are free of all human activities. It has the legal status of a national park or wildlife sanctuary. It is kept free of biotic disturbances and forestry operations like collection of minor forest produce, grazing, and other human disturbances are not allowed within.
- Buffer areas: the buffer areas are subjected to 'conservation-oriented land use'. They comprise forest and non-forest land. It is a multi-purpose use area with twin objectives of providing habitat supplement to spillover population of wild animals from core conservation unit and to provide site specific co-developmental inputs to surrounding villages for relieving their impact on core area.

The important thrust areas for the Plan period are:

- Stepped up protection/networking surveillance.
- Voluntary relocation of people from core/critical tiger habitat to provide inviolate space for tiger.
- Use of information technology in wildlife crime prevention.
- Addressing human wildlife conflicts.
- Capacity building of frontier personnel.
- Developing a national repository of camera trap tiger photographs with IDs.
- Strengthening the regional offices of the NTCA.
- Declaring and consolidating new tiger reserves.
- Foresting awareness for eliciting new tiger reserves.
- Foresting Research.

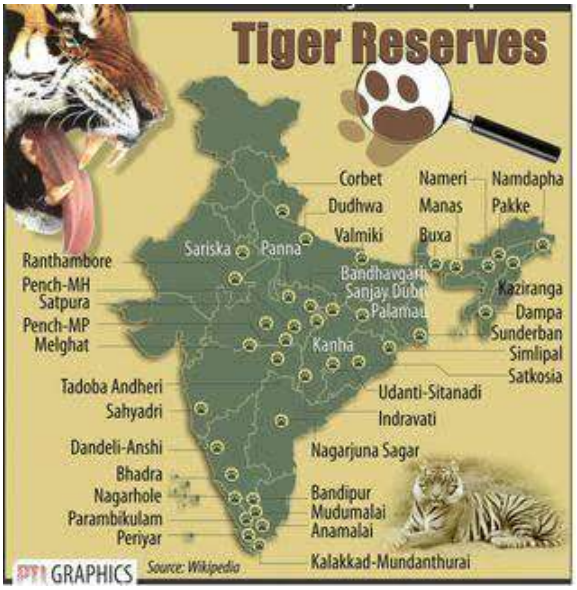
For each tiger reserve, management plans were drawn up based on the following principles:

- Elimination of all forms of human exploitation and biotic disturbance from the core area and rationalization of activities in the buffer zone
- Restricting the habitat management only to repair the damages done to the ecosystem by human and other interferences so as to facilitate recovery of the ecosystem to its natural state
- Monitoring the faunal and floral changes over time and carrying out research about wildlife

Tiger pug marks at Sunderbans tiger reserve, West Bengal

By the late 1980s, the initial nine reserves covering an area of 9,115 square kilometers (3,519 square miles) had been increased to 15 reserves covering an area of 24,700 km² (9,500 sq mi). More than 1100 tigers were estimated to inhabit the reserves by 1984. By 1997, 23 tiger reserves encompassed an area of 33,000 km² (13,000 sq mi), but the fate of tiger habitat outside the reserves was precarious, due to pressure on habitat, incessant poaching and large-scale development projects such as dams, industry and mines. Wireless communication systems and outstation patrol camps have been developed within the tiger reserves, due to which poaching has declined considerably. Fire protection is effectively done by suitable preventive and control measures. Voluntary Village relocation has been done in many reserves, especially from the core area. Livestock grazing has been controlled to a great extent in the tiger reserves. Various compensatory developmental works have improved the water regime and the ground and field level vegetation, thereby increasing the animal density. Research data pertaining to vegetation changes are also available from many reserves. Future plans include use of advanced information and communication technology in wildlife protection and crime management in tiger reserves, GIS based digitized database

development and devising a new tiger habitat and population evaluation system.Project Tiger's efforts were hampered by poaching, as well as debacles and irregularities in Sariska and Namdapha, both of which were reported extensively in the Indian media. The 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 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 own



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

Si No.	Tiger Reserves (Year of Creation)	State	Population of tiger
1	Bandipur (1973–74)	Karnataka	120
2	Corbett (1973–74)	Uttarakhand	215
3	Kanha (1973–74)	Madhya Pradesh	80
4	Manas (1973–74)	Assam	11

5	Melghat (1973–74)	Maharashtra	25
6	Palamau (1973–74)	Jharkhand	3
7	Ranthambore (1973–74)	Rajasthan	37
8	Similipal (1973–74)	Odisha	3
9	Sunderbans (1973–74)	West Bengal	68
10	Periyar (1978–79)	Kerala	20
11	Sariska (1978–79)	Rajasthan	9
12	Buxa (1982–83)	West Bengal	2
13	Indravati (1982–83)	Chhattisgarh	12
14	Namdapha (1982–83)	Arunachal Pradesh	11
15	Dudhwa (1987–88)	Uttar Pradesh	58
16	Kalakad-Mundanthurai (1988–89)	Tamil Nadu	10
17	Valmiki (1989–90)	Bihar	40
18	Pench (1992–93)	Madhya Pradesh	43
19	Tadoba-Andhari (1993–94)	Maharashtra	115
20	Bandhavgarh (1993–94)	Madhya Pradesh	63
21	Panna (1994–95)	Madhya Pradesh	17
22	Dampa (1994–95)	Mizoram	3
	Bhadra (1998–99)	Karnataka	22
43	Nawegaon-Nagzira (2013–14)	Maharashtra	7

44	Nagarjunsagar Srisailam (1982–83)	Andhra Pradesh	74
45	Amrabad (2014)	Telangana	-
46	Pilibhit (2020)	Uttar Pradesh	65
47	Bor (2014)	Maharashtra	5
48	Rajaji (2015)	Uttarakhand	-
49	Orang (2016)	Assam	-
50	Kamlang (2016)	Arunachal Pradesh	-
51	Srivilliputhur - Megamalai (2021)	Tamil Nadu	14

TABLE SHOWING THE RISE OF TIGERS IN INDIA AS COMPARED TO ASIAN COUNTRIES

- 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.
- 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.

THE SUCCESS OF PROJECT TIGER:

The journey of increasing tiger population has not been easy. Around the 1970s the tiger count was only one thousand and two hundred, but according to the recent census, it has increased to five thousand. In fact, there has been a thirty per cent rise in the population in the last eight years.This says a lot about the efforts put in by the government and the national parks. While the whole world is seeking methods of increasing the number of tigers, India has already started achieving milestones through Project Tiger.From turning hunting grounds to tiger reserves, India has shown its magic of conserving wildlife in general. They have also updated the acts regarding forest and wildlife. Any kind of illegal trading of animals has been banned. Human interference in any of the reserves and forests is not allowed. A proper habitat has been created for the Tigers to hunt, live and survive. The world has recognised this project as the ‘Most successful project’.The project is still going on and will continue until the Tigers don’t come out of the endangered species category. The next recording of the population is going to be in 2019 and the number recorded will be a mark of success.

CHALLENGES FACED BY THE GOVERNMENT FOR PROJECT TIGER:

Any successful project has to bear a lot of pressure and has to face many challenges. Making Project Tiger into a successful piece of work, there are efforts and dedication of various government officials.

During ancient times, it was difficult to take off the lands that were used for hunting. Many didn't like it and raised objections. But the project happened nonetheless.

Another major challenge was poaching. Many individuals use to sell tiger bones and skin to international markets. This was a major business for them and earned good money. After all the initiatives taken by the project, they couldn't stop illegal trading of animal skin. Individuals used to break the law and sell them to international buyers. This triggered the depletion of tigers. The government officials made strict law and grounded the problem. During the building of sanctuaries and reserves, the human population living over there faced the problem and therefore raised their voice against it. They passed out a Forest Rights Act in which they ki stated their difficulty. They wanted to have space for them as well and did not want to move from their original area. In some national parks, humans still reside on the outskirts of the park. They have come in peace with the Project Tiger and understood its importance. Though some individuals are not very sure about the decision, the project is happening in full speed.

EMPLOYMENT GENERATED BY THE PROJECT TIGER:

With the increasing success of the project, the demand for human help came into the picture. Starting from building national parks to handling it, every aspect of it generated employment. When the grounds were converted into national parks, general labourers got work. And as the project is still exceeding, there is always a need for labour. Other than that, builders and architects are needed to plan the area. The Project Tiger made a point to appoint the best worker, new or old. After the work was done and the wildlife was settled, the national parks require management. There is a conservation team for every state. In that team, managers, supervisors and employees were recruited. To make people aware about the existence of the Project Tiger and to make them realise the importance of the problem, a marketing team was hired. Posters, banners, television commercials and social media helped in spreading the word. The breeding of the animals is done by the experts. This part of the job is ever increasing due to the spread of the project. They make sure that all the facilities, species and everything is proper for the breeding of the tigers.The most significant job that gets majority profit is the tourism industry. With national parks exceeding and rare animals being conserved, tourists visit the place often. The national parks have started to keep an entry fee and also has safaris for extra income. The local guides are getting more opportunities to do their jobs.This way the Project Tiger was not only useful for tigers, but for humans as well

HOW PROJECT TIGER HELPED IN PROTECTING OTHER WILD SPECIES?

After seeing the success of Project Tiger, the government updated the Wildlife Protection Act of 1972. This made sure that along with tigers, other wildlife also gets protected. One by one, every national park took an initiative to save endangered species. For, e.g.: Gir conserves lions, and Kaziranga conserves one-horned rhinos. The project made people realize the importance of other wildlife. As hunting was banned to save tigers, other animals were also saved from the brutal clutches of the game. Eventually, the population of many animals started increasing. Tiger reserves also have various other animals. So along with the tigers, even they are conserved.All decisions taken in accordance with Project Tiger helped in the growth of other species. Many national parks started having their own individual projects. Despite all the challenges, the project made sure to save animals from the hands of humans. Government became more aware of the species that are depleting. The awareness made them realize to do something about the other endangered species as well. Now along with the national of the country, all the other species are also being saved.

ACKNOWLEDGMENT

I would like to thank my subject teachers of AECC ENVS for providing me with adequate study materials for this topic and encouraging me to do this project systematically. I would also like to thank my mother and brother, because without their timely help and guidance, it was impossible for me to opt and work on this project.

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, it has almost stopped.

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.

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

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DEPARTMENT: ECONOMICS

TOPIC: MAN-MADE DISASTERS: BHOPAL TRAGEDY

MAN-MADE DISASTERS: BHOPAL TRAGEDY

DEFINITION OF MAN-MADE DISASTERS:

Man-made disasters are disasters that have an element of human intent, negligence, or error involving a failure of a man-made system, as opposed to natural disasters resulting from natural hazards. The difference between natural and man-made disasters is the element of human intent or negligence that leads to human suffering and environmental damage; many mirror natural disasters, yet man has a direct hand in their occurrence.

These are the net result of inadequately managed man-made hazards and they typically cost the most in terms of human suffering, loss of life and long-term damage to a country's economy and productive capacity.

Some common man-made disasters are nuclear accidents, chemical and oil spill, dam failure, civil disorder, terrorism, war, biological/chemical threat, etc.

SOCIETAL HAZARDS:

There are certain societal hazards that can occur by inadvertently overlooking a hazard, a failure to notice or by purposeful intent by human inaction or neglect, consequences as a result of little or no preventive actions to prevent a hazard from occurring. Although not everything is within the scope of human control, there is anti-social behaviour and crimes committed by individuals or groups that can be prevented by reasonable apprehension of injury or death.

Terrorism: The common definition of terrorism is the use or threatened use of violence for the purpose of creating fear in order to achieve a political, religious, or ideological goal. Targets of terrorist acts can be anyone, including private citizens, government officials, military personnel, law enforcement officers, firefighters, or people serving in the interests of governments.

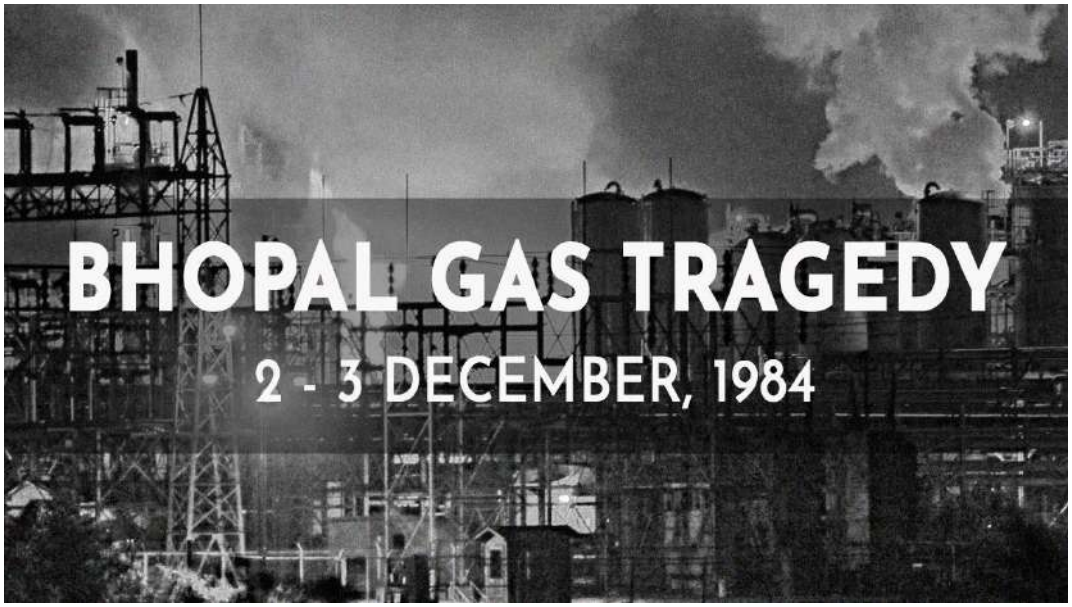
War: War is a conflict between relatively large groups of people, which involves physical force inflicted by the use of weapons. Warfare has destroyed entire cultures, countries, economies and inflicted great suffering on humanity. Acts of war are normally excluded from insurance contracts and sometimes from disaster planning.

Industrial Hazards: Industrial Hazards resulting in releases of hazardous materials usually occur in a commercial context, such as mining activities. They often have an environmental impact, but also can be hazardous for people living in proximity. The Bhopal disaster saw the release of methyl isocyanate into the neighbouring environment seriously affecting large numbers of people. It is probably the world's worst industrial accident to date.

Radioactive Materials: Radioactive materials produce ionizing radiation which may be very harmful to living organisms. Damage from even a short exposure to radioactivity may have long term adverse health consequences. Exposure may occur from nuclear fallout when nuclear weapons are detonated or nuclear containment systems are compromised.A number of military accidents involving nuclear weapons have also resulted in radioactive contamination, for example the 1966 Palomares B-52 crash and the 1968 Thule Air Base B-52 crash.

BHOPAL GAS TRAGEDY

On the night of December 2, 1984, chemical, methyl isocyanate (MIC) spilt out from Union Carbide India Ltd's (UCIL's) pesticide factory turned the city of Bhopal into a colossal gas chamber. It was India's first major industrial disaster. At least 30 tonnes of methyl isocyanate gas killed more than 15,000 people and affected over 600,000 workers. Bhopal gas tragedy is known as world's worst industrial disaster. The Bhopal Gas Tragedy is rightly considered by many as a continuing disaster as it still has its impacts even after thirty seven years.



Warning bell before the tragedy:

In 1969, the UCIL factory was made to produce Sevin (a pesticide) using methyl isocyanate as an intermediate. In 1976, trade unions in Bhopal complained of pollution within the plant. A few years later, a worker accidentally inhaled a large amount of toxic phosgene gas, leading to his death a couple of hours later. Observing the events, a journalist began investigating the plant and also published his findings in Bhopal's local paper, saying - 'Wake up people of Bhopal, you are on the edge of a volcano'. Two years before tragedy struck Bhopal, around 45 workers who were exposed to phosgene were admitted to a hospital. Between 1983 and 1984, there were leaks of phosgene, carbon tetrachloride, methyl isocyanate and mono methylamine.

HOW THE LEAK HAPPENED:

Union Carbide India's Bhopal facility housed three 68,000-litre liquid MIC storage tanks: E610, E611, and E619. Months before the tragedy, MIC production was in progress and was being filled in the tanks. No tank was allowed to be filled more than 50% of its capacity and the tank was pressurized with inert nitrogen gas. The pressurization allowed liquid MIC to be pumped out of each tank. However, one of the tanks (E610) lost the ability to contain nitrogen gas pressure, hence liquid MIC could not be pumped out of it. As per the rules, each of the tanks could not be filled with more than 30 tonnes of liquid MIC.
But this tank had 42 tonnes. This failure forced UCIL to halt methyl isocyanate production in Bhopal and the plant was partly shut for maintenance. An attempt was made to make the defective tank functional again on December 1, however the attempt failed.

By early December 1984, most of the plant's MIC related safety systems were malfunctioning and many valves and lines were in poor condition. In addition, several vent gas scrubbers had been out of service as well as the steam boiler, intended to clean the pipes. During the late evening hours of 2 December 1984, water was believed to have entered a side pipe and into Tank E610 whilst trying to unclog it, which contained the 42 tons of MIC that had been there since late October. The introduction of water into the tank subsequently resulted in a runaway exothermic reaction, which was accelerated by contaminants, high ambient temperatures and various other factors, such as the presence of iron from corroding non-stainless steel pipelines. The pressure in tank E610, although initially nominal at 2 psi at 10:30 p.m., it had reached 10 psi by 11 p.m. Two different senior refinery employees assumed the reading was instrumentation malfunction. By 11:30 p.m., workers in the MIC area were feeling the effects of minor exposure to MIC gas, and began to look for a leak. One was found by 11:45 p.m., and reported to the MIC supervisor on duty at the time. The decision was made to address the problem after a 12:15 a.m. tea break, and in the meantime, employees were instructed to continue looking for leaks. The incident was discussed by MIC area employees during the break.

In the five minutes after the tea break ended at 12:40 a.m., the reaction in tank E610 reached a critical state at an alarming speed. Temperatures in the tank were off the scale, maxed out beyond 25 °C (77 °F), and the

pressure in the tank was indicated at 40 psi (275.8 kPa). One employee witnessed a concrete slab above tank E610 crack as the emergency relief valve burst open, and pressure in the tank continued to increase to 55 psi (379.2 kPa); this despite the fact that atmospheric venting of toxic MIC gas had already begun. Direct atmospheric venting should have been prevented or at least partially mitigated by at least three safety devices which were malfunctioning, not in use, insufficiently sized or otherwise rendered inoperable:

- A refrigeration system meant to cool tanks containing liquid MIC, shut down in January 1982, and whose freon had been removed in June 1984. Since the MIC storage system assumed refrigeration, its high temperature alarm, set to sound at 11 °C (52 °F) had long since been disconnected, and tank storage temperatures ranged between 15 °C (59 °F) and 40 °C (104 °F)
- A flare tower, to burn the MIC gas as it escaped, which had had a connecting pipe removed for maintenance, and was improperly sized to neutralise a leak of the size produced by tank E610
- A vent gas scrubber, which had been deactivated at the time and was in 'standby' mode, and similarly had insufficient caustic soda and power to safely stop a leak of the magnitude produced

About 30 tonnes of MIC escaped from the tank into the atmosphere in 45 to 60 minutes. This would increase to 40 tonnes within two hours. The gases were blown in a southeasterly direction over Bhopal.

A UCIL employee triggered the plant's alarm system at 12:50 a.m. as the concentration of gas in and around the plant became difficult to tolerate. Activation of the system triggered two siren alarms: one that sounded inside the UCIL plant itself, and a second directed to the exterior, which would alert the public and the city of Bhopal. The two siren systems had been decoupled from one another in 1982, so that it was possible to leave the factory warning siren on while turning off the public one, and this is exactly what was done: the public siren briefly sounded at 12:50 a.m. and was quickly turned off, as per company procedure meant to avoid alarming the public around the factory over tiny leaks. Workers, meanwhile, evacuated the UCIL plant, travelling upwind.

However, by then the chemical reaction in the tank had reached a critical state. About 30 tonnes of MIC escaped from the tank into the

atmosphere within an hour. Most Bhopal residents were made aware of the gas leak by exposure to the gas itself.

Tank 610 in 2010. During the decontamination of the plant, the tanl was removed from its foundations and set aside.

ACUTE EFFECTS:

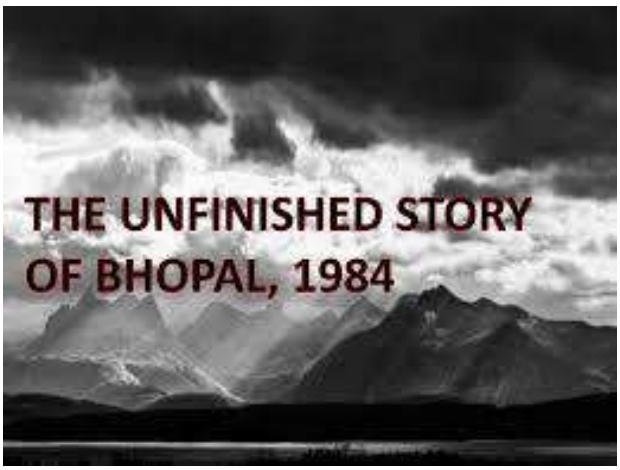
The initial effects of exposure were coughing, severe eye irritation and a feeling of suffocation, burning in the respiratory tract, blepharospasm, breathlessness, stomach pains and vomiting. People awakened by these symptoms fled from the plant. Those who ran inhaled more than those in vehicles. Owing to their height, children and other residents of shorter stature inhaled higher concentrations, as methyl isocyanate gas is approximately twice as dense as air and, therefore, in an open environment has a tendency to fall toward the ground.

Thousands of people had died by the following morning. Primary causes of deaths were choking, reflexogenic circulatory collapse and pulmonary oedema. Findings during autopsies revealed changes not only in the lungs but also cerebral oedema, tubular necrosis of the kidneys, fatty degeneration of the liver and necrotising enteritis. The stillbirth rate increased by up to 300% and the neonatal mortality rate by around 200%.

IMMEDIATE AFTER EFFECTS:

In the immediate aftermath, the plant was closed to outsiders (including UCC) by the Indian government, which subsequently failed to make data public, contributing to the confusion. The initial investigation was conducted entirely by the Council of Scientific and Industrial Research (CSIR) and the Central Bureau of Investigation. The UCC chairman and CEO Warren Anderson, together with a technical team, immediately travelled to India. Upon arrival Anderson was placed under house arrest and urged by the Indian government to leave the country within 24 hours. Union Carbide organized a team of international medical experts, as well as supplies and equipment, to work with the local Bhopal medical community, and the UCC technical team began assessing the cause of the gas leak.

The health care system immediately became overloaded. In the severely affected areas, nearly 70% were under-qualified doctors. Medical staff were unprepared for the thousands of casualties. Doctors and hospitals were not aware of proper treatment methods for MIC gas inhalation.



There were mass funerals and cremations. Photographer Pablo Bartholemew, on commission with press agency Rapho, took an iconic color photograph of a burial on 4 December, *Bhopal gas disaster girl.* Another photographer present, Raghu Rai, took a black and white photo. The photographers did not ask for the identity of the father or child as she was buried, and no relative has since confirmed it. As such, the identity of the girl remains unknown. Both photos became symbolic of the suffering of victims of the Bhopal disaster, and Bartholomew went on to win the 1984 World Press Photo of the Year.

Within a few days, trees in the vicinity became barren and bloated animal carcasses had to be disposed of. 170,000 people were treated at hospitals and temporary dispensaries, and 2,000 buffalo, goats, and other animals were collected and buried. Supplies, including food, became scarce owing to suppliers' safety fears. Fishing was prohibited causing further supply shortages.

Lacking any safe alternative, on 16 December, tanks 611 and 619 were emptied of the remaining MIC by reactivating the plant and continuing the manufacture of pesticide. Despite safety precautions such as having water-carrying helicopters continually overflying the plant, this led to a second mass evacuation from Bhopal. The Government of India passed the "Bhopal Gas Leak Disaster Act" that gave the government rights to represent all victims, whether or not in India. Complaints of lack of information or misinformation were widespread. An Indian government spokesman said, "Carbide is more interested in getting information from us than in helping our relief work".

CAUSES:

There are two main lines of argument involving the disaster. The "corporate negligence" point of view argues that the disaster was caused by a potent combination of under-maintained and decaying facilities, a weak attitude towards safety, and an under-trained workforce, culminating in worker actions that inadvertently enabled water to penetrate the MIC tanks in the absence of properly working safeguards.

CORPORATE NEGLIGENCE:
This point of view argues that management (and to some extent, local government) underinvested in safety, which allowed for a dangerous working environment to develop. Factors cited include the filling of the MIC tanks beyond recommended levels, poor maintenance after the plant ceased MIC production at the end of 1984, allowing several safety systems to be inoperable due to poor maintenance, and switching off safety systems to save money— including the MIC tank refrigeration system which could have mitigated the disaster severity, and non-existent catastrophe management plans. Other factors identified by government inquiries included undersized safety devices and the dependence on manual operations. Specific plant management deficiencies that were identified include the lack of skilled operators, reduction of safety management, insufficient maintenance, and inadequate emergency action plans.

ADEQUACY OF EQUIPMENT AND REGULATIONS:
The factory was not well equipped to handle the gas created by the sudden addition of water to the MIC tank. The MIC tank alarms had not been working for four years and there was only one manual back-up system, compared to a four-stage system used in the United States. The flare tower and several vent gas scrubbers had been out of service for five months before the disaster. Only one gas scrubber was operating: it could not treat such a large amount of MIC with sodium hydroxide (caustic soda), which would have brought the concentration down to a safe level. The flare tower could only handle a quarter of the gas that leaked in 1984, and moreover it was out of order at the time of the incident.

ONGOING CONTAMINATION:

Chemicals abandoned at the plant continue to leak and pollute the groundwater. Whether the chemicals pose a health hazard is disputed. Contamination at the site and surrounding area was not caused by the gas leakage. The area around the plant was used as a dumping ground for hazardous chemicals and by 1982 water wells in the vicinity of the UCIL factory had to be abandoned. UCC states that "after the incident, UCIL began clean-up work at the site under the direction of Indian central and state government authorities". The work was continued from 1994 by Eveready Industries India, Limited (EIIL) who was UCIL's successor. In 1998, the Madhya Pradesh State Government, which owned and had been leasing the property to EIIL, cancelled the lease, took over the facility and assumed all accountability for the site, including the completion of any remediation.

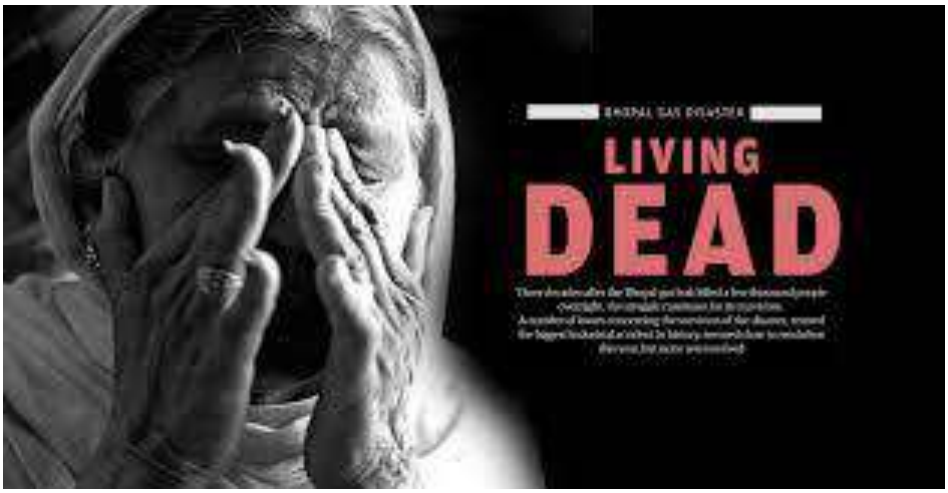
LONG TERM HEALTH EFFECTS:

A total of 36 wards were marked by the authorities as being "gas affected," affecting a population of 520,000. Of these, 200,000 were below 15 years of age, and 3,000 were pregnant women. The official immediate death toll was 2,259, and in 1991, 3,928 deaths had been officially certified. New data collected over the past nine years by the Sambhavna Trust suggests that even after three decades, the mortality rate for gas-exposed victims is still 28% higher than average. They are twice as likely to die of cancers, diseases of the lungs and tuberculosis, three times as likely to die from kidney diseases and 63% more likely to have illnesses. The data also suggests that the explosion has had a particularly adverse effect on women exposed to the gas, even as babies just days old, causing high rates of infertility, stillbirths, abortions, early menopause and wreaking havoc on menstrual cycles. As a result, many women in Bhopal continue to be abandoned by their husbands, believed not to be capable of fulfilling the familial duties expected of them.

Yet it is the lasting impact on the second and third generation, and on those yet unborn that haunts those in Bhopal the most. The Chingari children's centre, established for those born with disabilities as a consequence of the disaster, has registered over 1,000 children, with most affected by cerebral palsy, muscular dystrophy, autism, intellectual disabilities and severe learning difficulties.

A number of clinical studies are performed. The quality varies, but the different reports support each other. Studied and reported long-term health effects are:

- Eyes: Chronic conjunctivitis, scars on cornea, corneal opacities, early cataracts
- Respiratory tracts: Obstructive and/or restrictive disease, pulmonary fibrosis, aggravation of tuberculosis and chronic bronchitis
- Neurological system: Impairment of memory, finer motor skills, numbness, etc.
- Psychological problems: Post traumatic stress disorder (PTSD)
- Children's health: Peri- and neonatal death rates increased. Failure to grow, intellectual impairment, etc.



IMPACT ON ENVIRONMENT:

Apart from the human toll, we can't also ignore the environmental impact of the disaster. Over 2000 animals were killed by the gas that night. Because of reckless dumping of extremely poisonous waste within the pesticide factory till 1984 and outside it in 1996, groundwater has been contaminated in places over four kilometres around it. According to the latest study by the Indian Institute of Toxicology Research, a Central government agency, the groundwater in 42 communities, with a population of nearly 100,000, is contaminated and continues to spread. Rachna Dhingra of Bhopal Group for Information and Action said more than 10 thousand families were exposed to contaminated water over 20 years. In 1982 tubewells in the vicinity of the UCIL factory had to be abandoned and tests in 1989 performed by UCC's laboratory revealed that soil and water samples collected near the factory and inside the plant were toxic to fish. Reported polluting compounds include 1-naphthol, naphthalene, Sevin, tarry residue, mercury, toxic organochlorines, volatile organochlorine compounds, chromium, copper, nickel, lead, hexachloroethane, hexachlorobutadiene, and the pesticide HCH.

Fish mortality in Bhopal

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SEMESTER – II

CBCS CURRICULUM

ENVS ASSIGNMENT

SCOTTISH CHURCH COLLEGE

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ENVIRONMENTAL PERFORMANCE INDEX

UNITING THE WORLD FOR ITS SURVIVAL

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INTRODUCTION

Even before 2021, before the Wuhan pandemic, the concerns for the environment were raised at the higher level of the world forum. In this world of constant power struggle and dominance , leaders often forgot about the harms to the surrounding .The proof of planet earth dying was clear as crystal and something had to be done. Even though people say, acknowledging the problem is 50% closer to solution but in this case, was much lower than 1% . Something had to be done in order to assess the real problems happening around the world and give them an equal chance to represent the peril and show the improvements . This was when the UN council played a significant role in moderating views and solutions from different part of their world. One of those solution was the introduction of the Environmental Performance Index .

ORIGIN

In 1993, the Statistical Division of the UN Secretariat suggested the introduction of the system of environmental and economic accounting with the motto of taking the environmental factor into account in national statistics of different countries, allowing to compare flows related to environmentally exploitive and environmental activities. In 2001, the scientists of Columbia and Yale universities in the framework of the sustainable development assessment proposed the index of environmental sustainability, suggesting the aggregation based on the average arithmetic of 76 indicators.

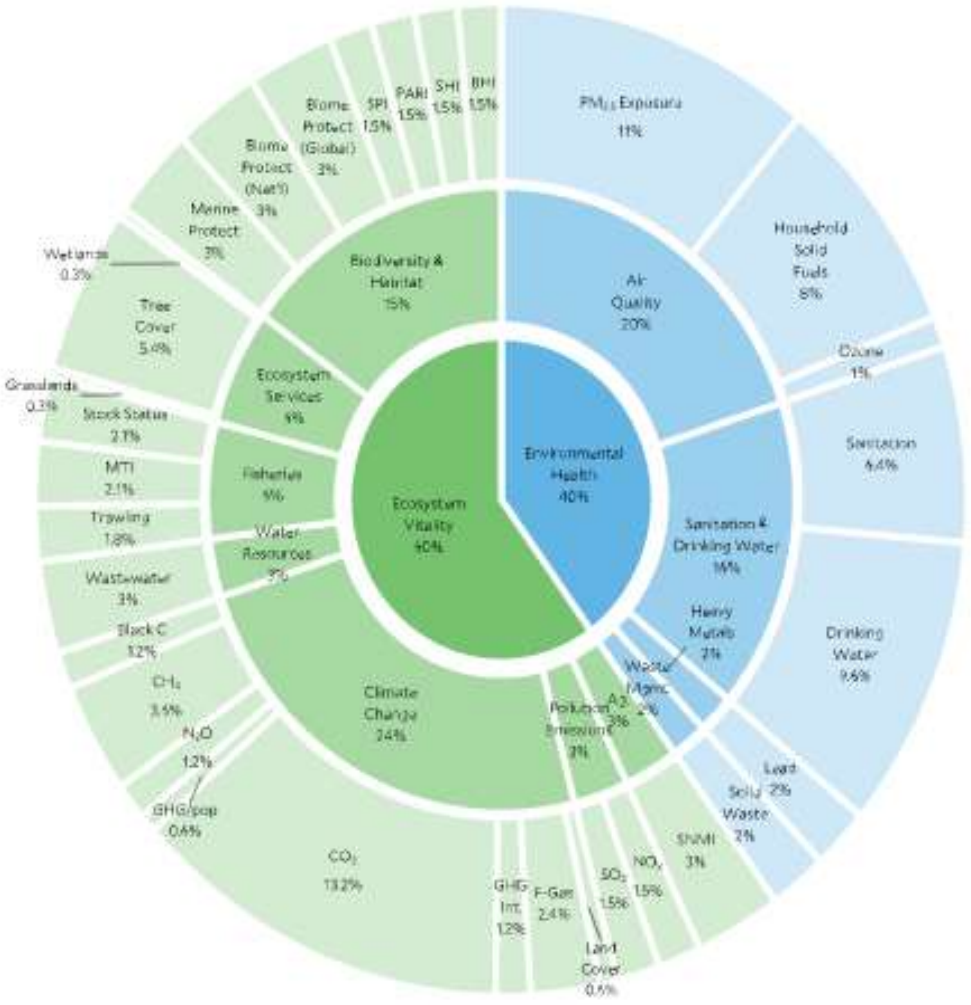
This index allows the inter-country comparing of the environmental sustainability level, assessing the environmental policy results, identifying the countries that are facing the environmental crisis.

In addition, the index makes it possible to make more informed decisions based on analytical and quantitative data. The disadvantage of the proposed approach is the large number of evaluation parameters, which makes its practical application difficult. In addition, a number of researchers realized that it is necessary to measure the environmental performance rather than environmental sustainability.

METHOD

The function of EPI might seem easy, but the amount of data gathered in this process is huge . The EPI refers to almost all official data available from the sources .

Each country is assessed on the basis of 32 criteria collected in 11 groups, which in turn are divided into two parts: ecosystem Vitality and environmental health.
In the first part there are 7 groups of criteria, in the second there are 3. In this case, the role of each group is estimated as a percentage. So in the part of "ecosystem vitality", the key role—25%—is played by climate change criteria as a result of anthropogenic emissions of gases. In the second part of "environment health", 25% is due to the consequences of the morbidity of the population due to environmental degradation.



120 countries were considered; those vast majority of countries, with the exception of some least developed countries and small countries in the Caribbean and Oceania. Graphs of the dependence of the EPI index on the share of the population employed in the service sector and on the per capita GDP were constructed. Through the obtained field of points, the averaged curve was drawn, and in parallel to this curve there are additional curves to the left and to the right of it, between which the greatest density of the data scatter is observed—the "main data band". Analyzing the obtained graphs, it is easy to see that this dependence has an exponential character: the larger the proportion of the population engaged in services, the higher the EPI, i.e., with the growth of post-industriality, the measures to prevent environmental degradation are increased. The same trend can be observed on the graph of dependence of the EPI index on GDP per capita: the more economically developed the country is, the greater the measures taken to prevent deterioration of the environment.

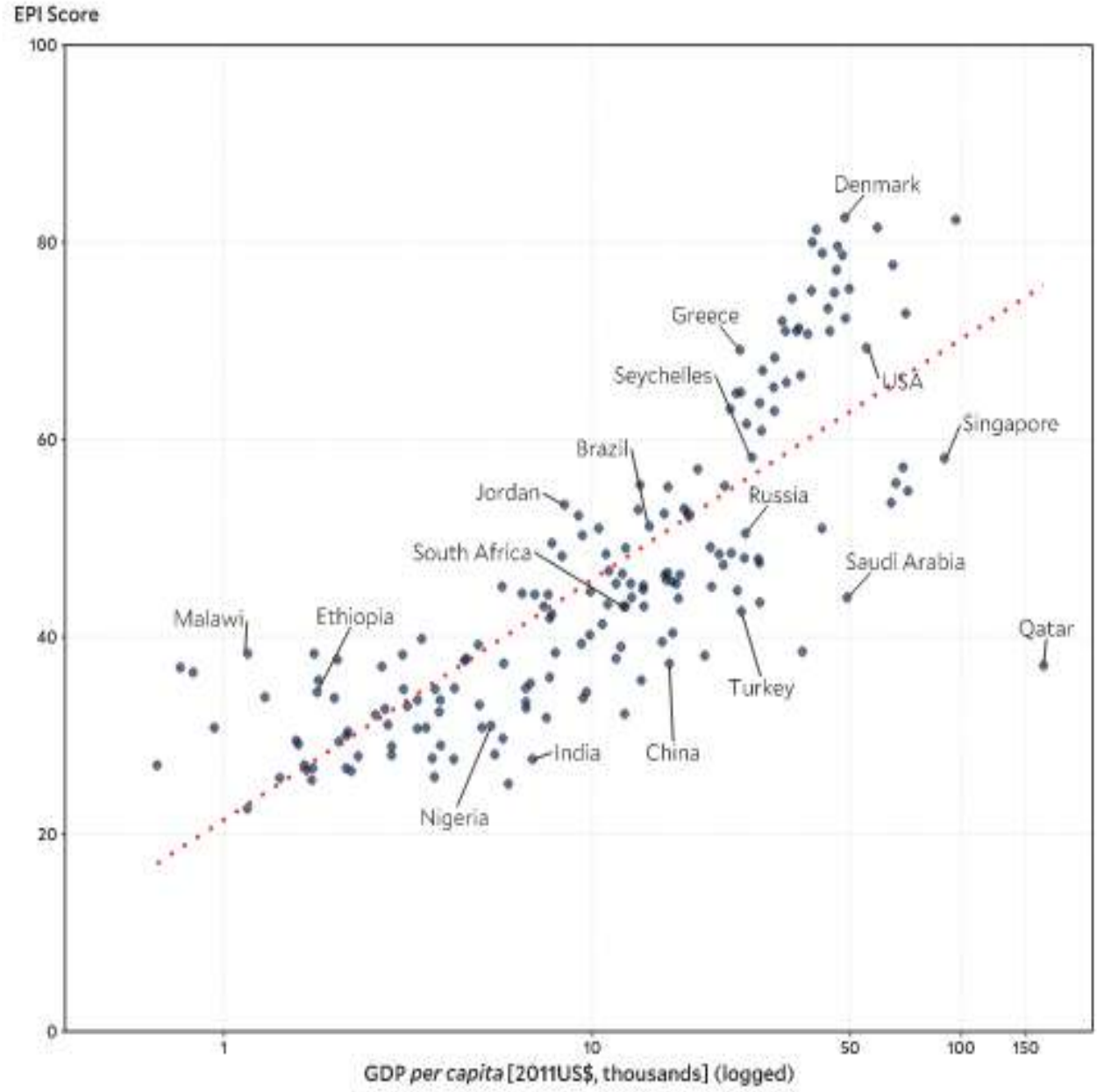
Four groups of countries can be identified on the graphs of dependence of the index EPI on employment in the service sector and on GDP per capita. The first group is the leaders of post-industrial development and policy in the field of environmental protection; In these countries the EPI index is more than 80, employment in the service sector is more than 70%, and GDP per capita is over 35 thousand US dollars. This group includes only four countries: Iceland, Switzerland, Sweden and Norway. At the same time, it can be seen that on the graph of the dependence of the EPI index on GDP per capita these countries "fell out" of the main band (except Norway).

The second group is also the countries that now are joining or have already entered the post-industrial phase, where the EPI index is more than 70, the share of employment in the service sector is more than 65% and GDP per capita is more than 20 thousand US dollars, except for the countries of the first group. This group includes France, Austria, Malta, Great Britain, Finland, Germany, Italy, Japan, New Zealand, Spain, Singapore. A special place is occupied by Panama and Belize. In terms of employment in the service sector (67%), they fall into this group, as these countries are very actively involved in ecotourism. However, in terms of GDP per capita, they immediately "fly out" from this group. The reverse situation has developed with Slovakia, Portugal and the Czech Republic: they came into this group due to rather high GDP per capita, however, when using the share of the population engaged in services, these countries leave this group and hardly meet the criteria of post-industrialism.

The third, rather numerous, but compact group includes countries of an industrial type or a catching-up countries, but also includes a number of post-industrial countries. These countries have more than 55 EPI, more than 50% of the population are employed in the services sector, and GDP per capita is more than 5 thousand US dollars, except for the countries of the first and second groups. This group includes all types of countries: developed, developing and transition countries: Russia, U

kraine, Belarus,
Bulgaria, Slovenia, Estonia, Latvia, Lithuania, Brazil, Syria, Denmark, Peru, Cro atia, Hungary, Portugal, Costa Rica ,Cuba, Slovakia, Czech Republic, Malaysia, Greece and other countries. The same group
includes Luxembourg, Canada, the Netherlands,
Australia, the USA, Israel, Belgium, which, undoubtedly, have entered the post-industrial phase of development, but they fell out of the "main band", because EPI is not very high (58-68), which indicates insufficient measures taken by states to improve the state of the environment.

This factor does not allow these countries to enter the second and even more so in the first group. Finally, the fourth group includes countries where the EPI index is more than 30, the share of the population employed in the service sector is more than 10% and the GDP per capita is more than $ 500, except for the countries of the first, second and third groups. This includes mainly developing countries that are in the industrial and even pre-industrial phase of development, where care for the environment is minimal, and in some countries is none at all. These are countries such as Romania, Sri Lanka, Thailand, Armenia, Kyrgyzstan, Turkey, Iran, Moldova, Ghana, China, DPRK, Pakistan, India, Sudan, Guinea, Angola, Niger, Kenya and many others. In this group, the range of countries is higher, many
countries fall out of the "main band". There are countries where much attention is paid to environmental problems (the EPI index can reach 60-80), but a very small percentage of the population in the service sector is occupied—no more than 50%. These are countries such as Mauritania (EPI-81), Albania, Morocco, Tunisia, Vietnam, Laos. Conversely, there are countries where the EPI index is very small (below 50), but a relatively large number of people (40-65%) are employed in the service sector. These countries include South Africa, Libya, Bolivia, Turkmenistan, Mongolia, UAE (in this country 78% of the population are in the service sector, and the index EPI is only 41). Comparing the graphs of the dependence of the EPI index on GDP per capita and on the share of the population engaged in services, it can be noted that they show the same trend: the higher the level of the economy in the country and the higher the level of post-industrialization, the more country pays attention to problems Improve the environment.


EPI Score
100
80
60
40
20
0
1
10
50
100
150
GDP per capita [2011US$, thousands] (logged)
Denmark
Greece
Seychelles
USA
Singapore
Brazil
Jordan
Russia
South Africa
Saudi Arabia
Malawi
Ethiopia
Qatar
Turkey
India
China
Nigeria

INDIA'S PERFORMANCE

India secured 168 rank in the 12th edition of the biennial Environment Performance Index 2020 out of 180 countries which was released by the Yale University on June 4, 2020. India's rank was 177 (with a score of 30.57 out of 100) in 2018.

The country scored 27.6 out of 100 in the 2020 index.

India ranks 172 in Health , with an EPI score of 16.3 and a 10 year change of 3.9 percent.

India has shown negative growth in the

1)Ozone layer with -0.4 % 10 year change .

2)Ecosystem vitality with -2.5% 10 year change

3)Biodiversity with -0.5% 10 year change

4)Species Habitat Index with -12.2% 10 year change

5)Ecosystem Services with -8.1 % 10 year change

But has reduced polluting significantly on

Climate Change by -2.9 % in 10 yrs

Pollution emission by -8.4 in 10 yrs

Peer Comparisons

EPI Scores for this country and peers based on similar characteristics

EPI PERFORMANCE	
Djibouti	28.1
Lesotho	28
Gambia	27.9
Mauritania	27.7
India	**27.6**
Ghana	27.6
Burundi	27
Haiti	27
Chad	26.7
Solomon Islands	26.7

GDP PER CAPITA	
Moldova	44.4
Bolivia	44.3
Uzbekistan	44.3
El Salvador	43.1
Timor-Leste	35.3
Laos	34.8
Viet Nam	33.4
Cabo Verde	32.8
Guatemala	31.8
India	**27.6**

ISSUE PERFORMANCE	
Eswatini	33.8
Cameroon	33.6
Comoros	32.1
Guatemala	31.8
Angola	29.7
Bangladesh	29
Lesotho	28
Gambia	27.9
India	**27.6**
Haiti	27

REGULATORY QUALITY	
Seychelles	58.2
Ukraine	49.5
Bosnia and Herzegovina	45.4
Sri Lanka	39
China	37.3
Kenya	34.7
Fiji	34.4
Guatemala	31.8
India	**27.6**
Cote d'Ivoire	25.8

VOICE & ACCOUNTABILITY	
Romania	64.7
Hungary	63.7
Bulgaria	57
Brazil	51.2
Suriname	45.2
Belize	41.9
Botswana	40.4
Namibia	40.2
Timor-Leste	35.3
India	**27.6**

POLITICAL STABILITY	
Israel	65.8
Colombia	52.9
Bahrain	51
Tunisia	46.7
Burkina Faso	38.3
Togo	29.5
Bangladesh	29
India	**27.6**
Guinea	26.4
Cote d'Ivoire	25.8

SOUTHERN ASIA	
Bhutan	39.3
Sri Lanka	39
Maldives	35.6
Pakistan	33.1
Nepal	32.7
Bangladesh	29
India	**27.6**
Afghanistan	25.5

G-20	
Mexico	52.6
Argentina	52.2
Brazil	51.2
Russia	50.5
Saudi Arabia	44
South Africa	43.1
Turkey	42.6
Indonesia	37.8
China	37.3
India	**27.6**

EASE OF DOING BUSINESS INDEX	
Greece	69.1
Albania	49
Panama	47.3
Tunisia	46.7
Uzbekistan	44.3
South Africa	43.1
Indonesia	37.8
Qatar	37.1
Mongolia	32.2
India	**27.6**

Conclusion

The main aim of Environmental Performance Index is to provide sustainable solution and view to the world by assessing the counties through certain criterion . Using a scientific index to measure sustainability is very helpful as

- Takes complex scientific information and synthesizes it in a way that makes it easily understandable at a glance.
- Helps to translate a wide variety of environmental indicators into a simple system that can be easily communicated.
- Can provide easy-to-understand information to citizens in order to help them comply with regulations (like no-burn days for air quality index) or make personal lifestyle choices that will benefit the environment.

But there are certain disadvantages such as

- Can be overly generalized and unscientific, relying on subjective judgments to weigh only a few of the numerous variables.
- A single index cannot tell the whole story; an index may indicate that a river is unfit for drinking water standards, but the river may be fine for swimming and a healthy habitat for fish and macroinvertebrates.
- An index is often limited in terms of time and space-- an unusual reading at one location or during a particular time period can skew the index.

Till now it has proved to be very helpful and much easier to its predecessors the Environment Sustainable Index .

EPI scores are taken seriously around the world . It helps countries to know their setbacks and areas that they could work on.

Sustainability is the only thing that can save the future from the present and sustainability serves as a hope for next generation to think of its next.

” **We have not inherited the land from our fathers, we have borrowed it from our children”**

by **Dennis J. Hall**

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Sustainable Development: Myth or Reality?
Prof. Vladimir Gorbanyov
Online Published: November 2, 2018
file:///C:/Users/Hcl%20me%201015/Downloads/Sustainable_Development_Myth_or_Reality.pdf

NAME: LAHER GUPTA

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NAME OF THE TOPIC: POLLUTION

DEPARTMENT:ECONOMICS

INDEX

INTRODUCTION

Pollution, also called environmental pollution, is the addition of any substance (solids, liquids, or gases) or any other form of energy (such as heat, sound, or radioactivity) to the environment at a rapid rate that can be dispersed, purified, decomposed, recycled, or stored safely. Major types of pollution, often separated by nature, air pollution, water pollution and land pollution. Today's society is also concerned about certain types of pollution, such as noise pollution, minimal pollution, and plastic pollution. Pollution of all kinds can have serious effects on the environment and wildlife and often affect human health and well-being.

Although pollution can be caused by natural phenomena such as forest fires and active volcanoes, the use of the word pollution often means that pollution has an anthropogenic source - that is, a source created by human activities. Pollution has been with humanity since groups of people first met and lived longer in any one place. Indeed, ancient human settlements are often identified by their waste - for example, dunes and piles of rubbish. Pollution was not a big problem as long as there was enough space for each person or group. However, with the establishment of permanent settlements by large numbers of people, pollution became a problem, and has remained so ever since.

Ancient cities often proved to be an extremely dangerous place, frequently ravaged by human waste and debris. Since about 1000 CE, the use of fossil fuels has caused a great deal of air pollution, and the conversion of coal into a smelting coke in the early 17th century only aggravated the problem. In Europe, from the Middle Ages to the early modern era, unsanitary urban conditions favored outbreaks of disease, from plague to cholera and typhoid fever. In the 19th century, water and air pollution and the accumulation of solid debris were a major problem in densely populated urban areas. However, with the rapid industrialization and population growth at unprecedented levels, pollution became a universal problem.

The presence of environmental pollution raises the issue of pollution control. Significant efforts are being made to reduce emissions through air pollution control, wastewater management, solid waste management, hazardous waste management and recycling. Unfortunately, pollution control efforts often outweigh the problem, especially in the most developed countries.

WATER POLLUTION

More than three quarters of the Earth's surface is covered with water; less than a third of the land is taken. As the population continues to grow, and people are putting more and more pressure on the world water sources. In a sense, our oceans, rivers, and other inland waters are “lighted up” by human activities — not that they take up too little space, but therefore their quality decreases.

Water pollution can be explained in many ways. Usually, one or more items are available they are built into the water and cause problems for animals or humans. Oceans, lakes, rivers, and other inland waters naturally can cleanse a certain amount of pollution by scattering harmless. If you poured a cup of black ink into the river, the ink would disappear immediately into it plenty of fresh river water. The ink would still be there in the river, but in torture so low that you would not be able to see it. At such low levels, chemicals ink probably wouldn't have a real problem. However, if you pour liters of ink in the river every few seconds through a pipe, the river turned black quickly.

Types of Water Pollution:

1. Chemical pollution

The most common type of water pollution, chemicals can penetrate deep into both groundwater, springs and those who settle on the face of the earth. As an important part of agriculture industry, it is not surprising that much of the chemical pollution comes from pesticides as well molds used for farming, but metals and solvents from industrial areas also lead contributors.

2. Groundwater pollution

As mentioned above, agriculture is a major source of water pollution, especially in groundwater. Fertilizers and pesticides applied to plants can get into the soil and contaminate underwater. Unlike many others on this list, microbiological pollutants are naturally rivers and water beds, so compromising the quality of springs, water sources and other sources of groundwater extracted for human use.

3. Microbiological contamination

Microbes, such as bacteria, protozoa, and viruses, can enter water and create

diseases such as bilharzia and cholera. People are most affected by this type of pollution in areas where adequate water treatment systems are not yet in place.

4. Nutrition pollution

While they are essential for the prosperity of underwater plants and animals, many nutrients can be critical imbalance of water-based ecosystems. Fertilizer contains high density of nutrients that if they pollute rivers, lakes and coastal areas, could cause an algal explosion can block sunlight and prevent the growth of other organisms.

Causes of Water Pollution:

There are many causes of water pollution, some of which are:

1. Sewage or contaminated water:

Waste from households, factories, or agricultural land pulls into rivers or lakes.This waste can be in the form of liquid waste, garbage, or sewage. Harmful chemicals getting out of this sewage can damage aquatic life.

2. Disposal:

Most bodies of water are converted into dumping sites in nearby areas. And this causes a big problem because garbage contains everything from plastic, aluminum to glass, Styrofoam, etc. And since all waste takes a different amount of time to degrade in water, it tends to be harmful marine life is even reduced.

3. Oil pollution:

One of the worst forms of water pollution is oil pollution. This is because oil spills from tanks and ships often form a thick layer above sea or ocean water. And as oil it does not melt, the clay remains forever.

4. Acid rain:

Although acid rain can be seen as a natural problem, it is wise to recognize that acid rain is real caused by acidic particles in the polluted air. These celestial particles receive mixed with water vapor and leads to acid rain.

5. Industrial waste:

Industrial waste is full of lead, asbestos, petrochemicals, and mercury. All of these chemicals are very dangerous to humans and to marine life. However, many industries tend to do so remove debris from large bodies of water such as rivers and lakes around residential areas, therefore, contaminating the fresh

AIR POLLUTION

Air pollution in its basic definition is the introduction of harmful substances into the earth's atmosphere. These substances are long lasting and cause many side effects. As you know, humans and other living things depend on air to breathe. When air quality is reduced to pollution, immediate and long-term effects occur. Pollution is known to cause allergies, diseases, damage to plants, and in extreme cases, even death. In addition, air pollution creates an imbalance in the natural gases that make up our planet's atmosphere. This imbalance contributes little to the depletion of the Ozone layer, an important stratosphere region that absorbs most of the harmful ultraviolet (UV) sunlight. As Ozone deplets, global warming increases. If enough air pollution is choking our environment, it creates the risk of further depletion of the Ozone layer.

It is important that we, as citizens of the world, have a clear understanding of the causes, consequences, and possible solutions to air pollution so that we can make informed decisions about the future of the Earth.

Causes of Air Pollution

There are many causes of air pollution. Because of the sanity of the mind, we have done our best to classify them into categories at the general level. Before we get into the various causes, let's take a quick step back and look at the different types of air pollution.

First, there is the invisible and visible air pollution. The smoke you see rising over the city is a good example of visible pollution.

Invisible pollution is less visible, but can be deadly in the same way, if not more so. Examples of invisible pollutants include nitrogen oxides, sulfur dioxide, and carbon monoxide, to name a few.

Carbon monoxide inhaled and introduced into the human bloodstream means a problem if the contamination is high enough.

Digging is very deep, air pollution can be divided into primary and secondary pollution.

Major pollutants, such as sulfur dioxide, are released directly into the atmosphere. Second pollution, like smog for example, is the result of primary pollutants that combine with particles already in the air.

Effects of Air Pollution:

1. Accelerated Global Warming.

Global warming refers to the rising temperatures the Earth continues to face. These high temperatures lead to melting glaciers and glaciers, raising sea levels and creating concerns about the human race.

2. Respiratory and Heart Anxiety.

Air pollution is known to cause irritation to the eyes, lungs, nose and throat. It causes respiratory problems and exacerbates existing conditions such as asthma and emphysema.

3. Wildlife Danger.

Many diseases and conditions in humans are also caused by animals. Air pollution causes many of the problems that people face.

Highly polluted areas are forcing residents to seek new homes, which could have a negative impact on the environment.

Toxic chemicals, which we will discuss in the next article, also put them on the surface of the water, which can lead to the dangers of marine life.

Ways to reduce Air Pollution

The common solutions to prevent and reduce air pollution are :-

1. Reduce the Use of Fuel-Free Vehicles.

As a leading contributor to air pollution, it makes sense that a car-based solution appears first on this list.

One way to do this is to switch to a hybrid car, or better yet, a completely electric vehicle.

Other ways include traveling by public transportation, driving with friends and colleagues, or even riding a bicycle to your destination.

2. Observe energy consumption.

When you leave home, be sure to turn off the lights, the TV, or any other electrical appliance.The fuel industry is a major cause of air pollution, and if you need less energy, then we have to rely on those plants to produce electricity.

This also means turning to electronic devices where possible. Fluorescent lightbulbs during their lifetime can reduce energy consumption while adding great savings to your pocket.

NOISE POLLUTION

Not all sounds are considered noise pollution. The World Health Organization (WHO) classifies noise above 65 decibels (dB) as noise pollution. To be clear, noise becomes dangerous if it exceeds 75 decibels (dB) and hurts more than 120 dB As a result, the recommended noise levels are maintained below 65 dB during the day and show that adequate sleep is not possible with noise at night above 30 dB dB

CAUSES OF NOISE POLLUTION

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

Sound of traffic

Traffic noise causes a lot of pollution in cities. For example, a car horn produces 90 dB and a bus produces 100 DB.

Construction sites

The construction of parks and the construction of vehicles and the rehabilitation of highway and stone roads are noisy.

Food and nightlife

Bars, restaurants and libraries spill out unless the weather is good can produce more than 100 dB. This includes noise from bars and clubs.

Animals

Noise made by animals may be unknown, but a dog that cries or barks, for example, can produce about 60-80 dB.

EFFECTS OF NOISE POLLUTION

As well as damaging our hearing impairment - tinnitus or deafness - loud noise can often damage people's health in many ways, especially for the very young and the very old. Here are some key ones:

Physical

Respiratory disturbances, heart rate, high blood pressure, headaches and, in the event of severe noise, persistent noise, gastritis, colitis and heart attack.

Psychological

Noise can cause stress attacks, fatigue, depression, anxiety and hysteria in humans and animals.

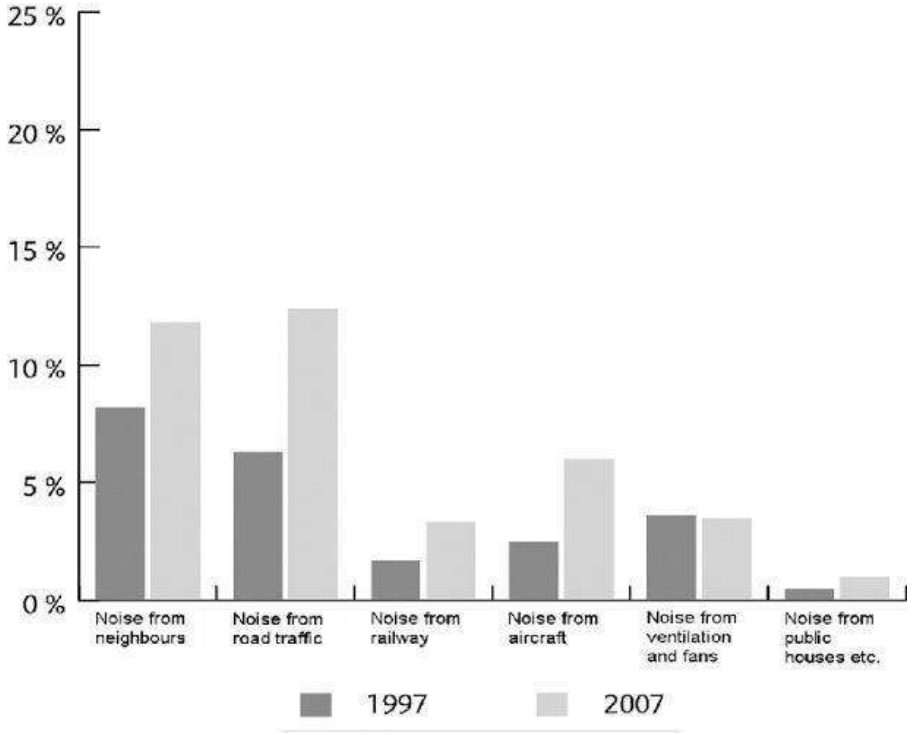
Sleep and behavioral problems

Noise above 45 dB lets you sleep or sleep well. Remember that according to the World Health Organization it should not be more than 30 dB. Excessive noise can have a hidden effect on our behavior, causing it to become aggressive and irritating.

WAYS TO REDUCE NOISE POLLUTION

International bodies such as the WHO agree that recognizing noise pollution is essential to beating this invisible enemy. For example: avoid noisy hobbies, choose alternative routes such as bicycles or electric cars in addition to taking a car, do your homework at recommended times, furnish homes with sound equipment, etc. Teaching the new generation is also an important aspect of environmental education.

Governments can also take steps to ensure sound management and reduce noise pollution. For example: protecting certain areas - rural areas, natural areas, city parks, etc. - for noise, regulations are introduced including measures to prevent and remedy - compulsory separation between residential areas and sound sources such as airports, fines for exceeding noise restrictions, etc. -, installing sound installation in new buildings, creating pedestrian areas where traffic is only allowed to enter loading loads from time to time, install traditional asphalt with more efficient options that can reduce traffic noise by up to 3 dB, among others.



SOIL POLLUTION

Soil pollution means soil pollution with an unwelcome concentration of toxic substances. It is a major environmental problem because it poses many health risks. For example, exposure to soils containing high concentrations of benzene increases the risk of leukemia.

It is important to understand that all soils contain harmful / toxic substances in humans and other organisms. However, the concentration of these substances in the uninfected soil is low enough that they are not harmful to the environment. When the concentration of one or more of these toxic substances is high enough to cause biological damage, the soil is considered polluted.

CAUSES OF SOIL POLLUTION

Human activities are a major cause of pollution:

WASTE DISPOSAL

We produce a lot of household waste every year, many of which can and should be recycled or reduced naturally. Most of our waste has been incinerated - causing potential air pollution problems - or buried in overcrowded areas

HEAD DESCRIPTION

As a result of deforestation and forest fires, the soil loses its vegetable cover. Erosion process is accelerated, resulting in soil erosion and water pollution. Deforestation leads to the loss of land value as, once converted to dry or barren land, it will never be fertile again.

EXCLUSION

Urban migration is another source of land degradation. Soil formation can cause rapid carbon loss and subsequent depletion, which contributes to climate change. In

addition, it distinguishes natural habitats, ecosystems and plains, affecting biodiversity.

Effects of Soil Pollution:

The soil affects almost every aspect of our daily lives. Because of this, we sometimes fail to understand the impact soil pollution has on our daily lives. Dirty soil means poor plants or even a toxic water table underground. Some of the major effects of soil pollution are listed below.

1. Effect on People's Health

If we look at the soil in which we can feed ourselves, its pollution has a profound effect on our health. Prolonged exposure to such soils can affect genetic makeup, create congenital diseases and health problems that are not easily cured. In fact, it can infect livestock to some extent and cause food poisoning for a long time.

2. Effect on Plant Growth

The natural balance of any system is affected by widespread soil contamination.

Soil fertility is gradually reduced, making the soil less suitable for cultivation or any other vegetation for survival. Soil pollution makes large layers of the earth a threat to health. Unlike deserts, which are ideal for native vegetation, such land could not support most forms of life.

3. Reducing Soil Fertility

Toxic chemicals present in the soil can reduce soil fertility and therefore reduce soil yield. Dirty soil is then used to produce fruits and vegetables, which are devoid of nutrients and can contain something toxic to create serious health problems for people who eat them. Such efforts to clean up the environment require a great deal of time and resources. Industries have been provided with regulations for the disposal of hazardous waste, which aims to reduce pollution.

Natural farming methods are supported, which do not use chemical pesticides and fertilizers. The use of plants that can remove dirt from the soil is encouraged.

Ways to reduce Soil Pollution

Soil pollution is a complex problem that needs to be addressed. It is important that we all know how important the world is to us. The sooner we see, the better we will be able to solve the problem of soil pollution. It is a complex problem, and therefore, it requires everyone, from the individual to the government, to work in perfect harmony. Below are a few things that can help reduce soil pollution.

1. Reduction of Use of Chemical Fertilizers

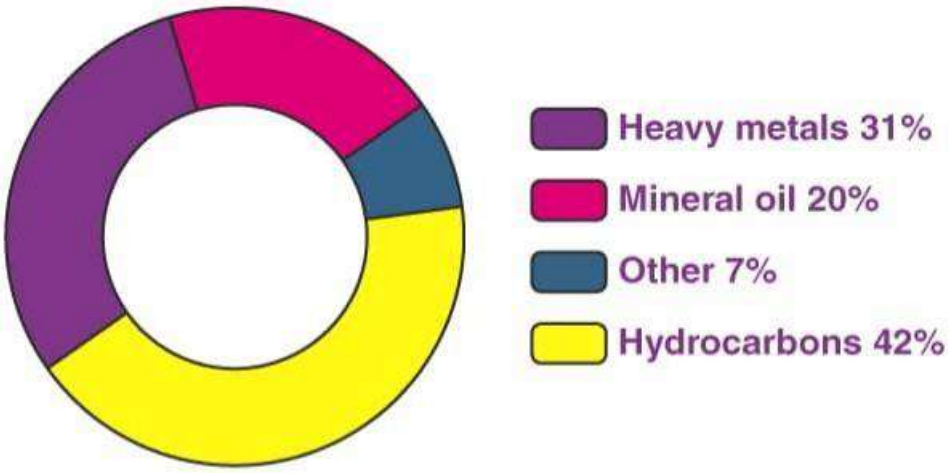
Chemical fertilizers do more harm than good. While the right amounts can increase soil fertility, overdosing actually puts toxins in the soil. Skipping of chemical fertilizers can pollute the soil in a number of ways. It can affect soil pH levels. It can also destroy microbes in the soil. Not only that, but the flow from such soil also creates water pollution. So using chemical fertilizers is like a two-edged sword.

2. Deforestation and Forests should be encouraged- One of the major causes of soil pollution is erosion caused by deforestation. It is only natural that with the ever-increasing population, mankind needs more space to expand its civilization. It is usually found in the loss of soil health. To prevent this from happening, deforested areas should be uprooted

3. Reuse products and reuse them

These measures not only reduce waste production but also ensure that soil pollution is reduced. Currently, plastic forms an integral part of the waste generated. More often than not, this waste is buried in landfills.

In landfills, these plastics and other materials decompose slowly and release toxic substances into the soil. These toxic substances are very harmful to soil health and are a major source of soil pollution. Through recycling and recycling, we will ensure that less waste is disposed of in these landfills, and this will reduce soil pollution.



CONCLUSION

In short, all forms of pollution leave a huge impact on our environment, human health, animals, and so on. We must join hands and take various efforts to combat this problem. Most innocent lives are put at risk because of daily pollution. If we do nothing from now on or take action to keep our planet clean, the day of destruction will be upon us.

Pollution poses a great deal of stress not only to humans but also to animals, leading many species to danger and extinction. Much is being done to control, monitor, and repair the damage caused by pollution. Problems vary and some are recognized but it is important to maintain a very close control of pollution so that we can keep the environment safe for future generations. . These changes were not always the result of thoughtless or selfish behavior; targets were often appropriate but the results were not the same as predicted. The importance of genetic diversity is shown here in relation to Dutch Elm disease. The need to maintain genetic diversity in plants, which is used for food and medicine, is being demonstrated in efforts such as the Ke Millennium Seed Bank Appeal.

Pollution harms living things, including us. The link between air pollution and health is difficult to quantify. It should be excluded from epidemiological studies and is complex because the trends vary. Many pollutants are produced by industrial processes and are expensive to reduce their emissions. It is also difficult to predict the long-term effects on climate change of air pollutants such as CFC and carbon dioxide. This scientific instability, along with financial problems, makes it difficult for international cooperation to reduce pollution. Not all substances contaminate industrial production; others, such as pesticides and certain plastics, are developed to improve the quality of life.

ACKNOWLEDGEMENT

I would like to express my warm gratitude to my friends and family who supported me while doing this project. Further, I would like to thank my respected Environmental science teacher for giving me this golden opportunity to complete such an eye-opening project about our important environmental conditions.

This project was very helpful in understanding the depth of environmental importance in human life. I am grateful for such a crucial topic which needs to be discussed among people as per the current gravity of the situation which is overwhelming our surrounding. I would like to thank the technical team supporting the successful completion of this project.

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India as a Mega Diversity nation

- **CU Roll No.- 203223-11-0022**
- **CU Registration No.- 223-1211-0286-20**
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- **Semester – 2**
- **Year- 2021-2022**
- **Topic Name- India as a Mega Diversity nation**

INDEX

INTRODUCTON

India is one of the world's most biologically and culturally diverse countries. It is also one of the poorest in terms of per capita income. India is one of the world's 'mega diversity' countries. It is ranked ninth in the world in terms of higher plant species richness. At the ecosystem level, India is also well-endowed, with ten distinct biogeographic zones.

It also contains two of the world's 25 biodiversity hotspots, because of their extraordinarily high levels of species-richness and endemicity, and threatened status.

India is considered to be the center of origin for the following crop species pigeon pea, egg plant cucumber, possibly cotton and sesame. But for millennia, numerous other crop species have been introduced to India and adapted to localized conditions.

As a consequence of both the diversity of these conditions and of the various ethnic populations living in India, the country has become an important centre of diversity of a great many domesticated species, including various cereals, millets, legumes, vegetables, temperate and tropical fruits, fibre crops, medicinal and aromatic plants.

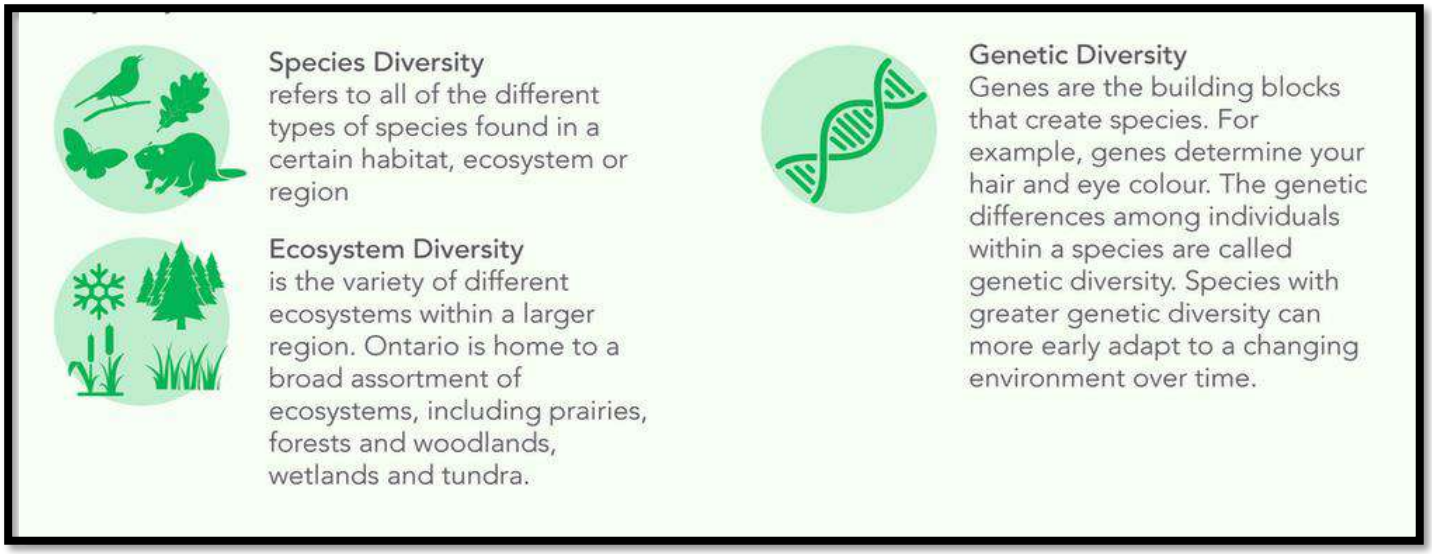
BIODIVERSITY & BIODIVETRSITY HOTSPOT

❖ What is Biodiversity: -

Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain.

The term biodiversity was coined in 1985. It is important in natural as well as artificial ecosystems. It deals with nature's variety, the biosphere. It refers to variabilities among plants, animals and microorganism species.

There are three different types of biodiversity:



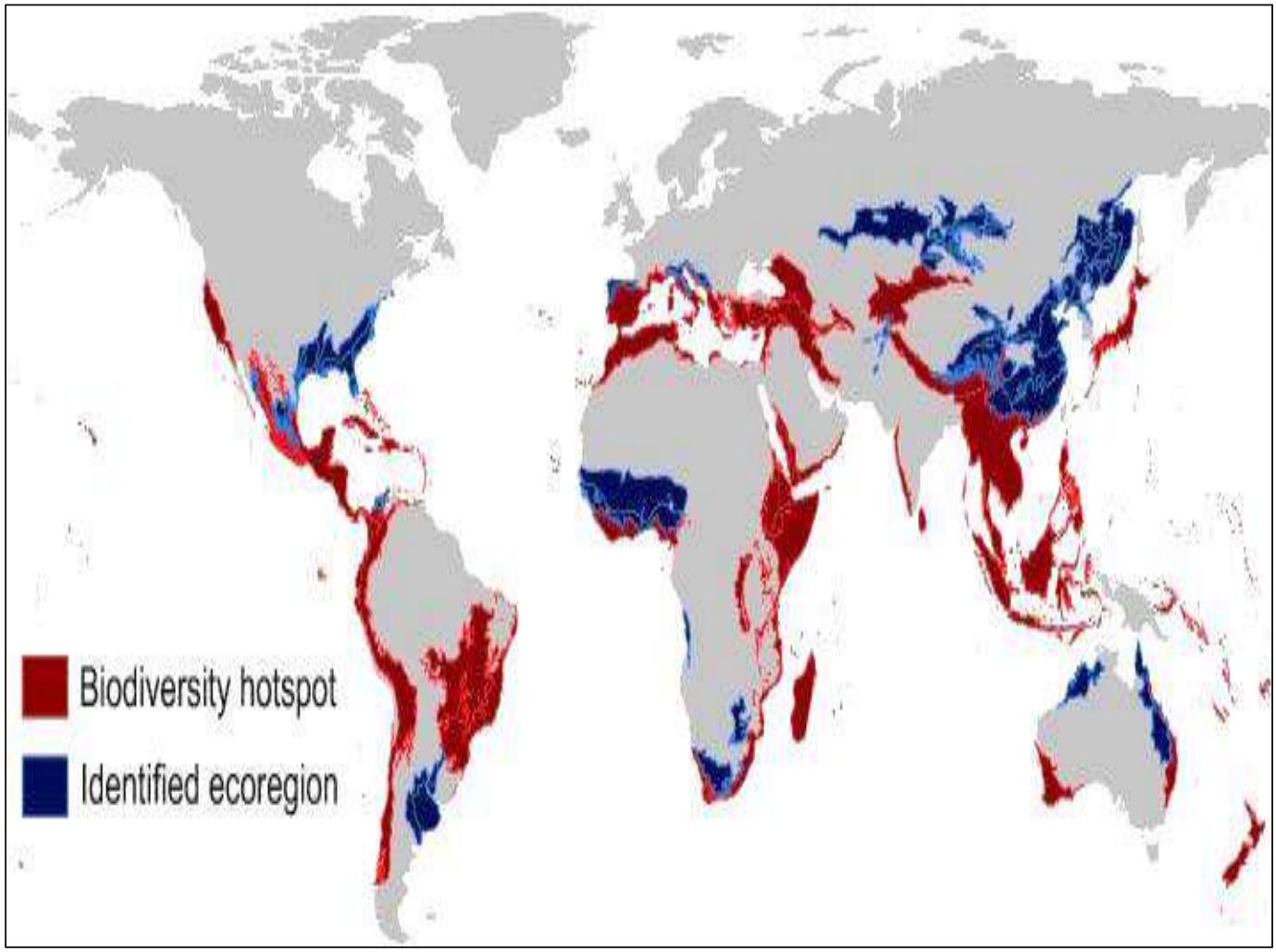
❖ What is Biodiversity Hotspot?

A **biodiversity hotspot** is a biogeographic region with significant levels of biodiversity that is threatened by human habitation.

Norman Myers wrote about the concept in two articles in “The Environmentalist” (1988), and 1990 revised after thorough analysis by Myers and others “Hotspots: Earth’s Biologically Richest and Most Endangered Terrestrial Ecoregions” and a paper published in the journal *Nature*.

To qualify as a biodiversity hotspot, a region must meet two strict criteria:

- It must have **at least 1,500 vascular plants as endemics** — which is to say, it must have a high percentage of plant life found nowhere else on the planet. A hotspot, in other words, is **irreplaceable**.
- It must have **30% or less of its original natural vegetation**. In other words, it must be threatened.



BIOGEOGRAPHIC CLASSIFICATION OF INDIA

As per the international 'biome' type of classification based upon climate, fauna and flora and the soil conditions, India can be divided into ten different biogeographic zones, namely:-

India's Biogeographic Zones:

i. The cold,mountainous,snow-covered trans –Himalyan region of Ladakh
ii. The Himalayan ranges and valleys of Kashmir,Himachal Pradesh,Uttarakhand,assam,and other Northern States
iii. The Terai,the lowland where the Himalayan rivers flow into the plants
iv. The Gangetic and Brahmaputra Plains
v. The Thar desewert of Rajasthan

vi. The semi-ard grassland region of the Deccan, Plateau,Gujrat,Maharashtra,Andhra Pradesh,Karnataka &Tamilnadu

vii. The northeastern states of India

viii. The Weatern Ghat in Maharastra,Karnataka,amd Kerala

ix. The Andaman & Nicobar islands

x. The long western and eastern coastal belts with sandy beaches,forests,and,mangroves.

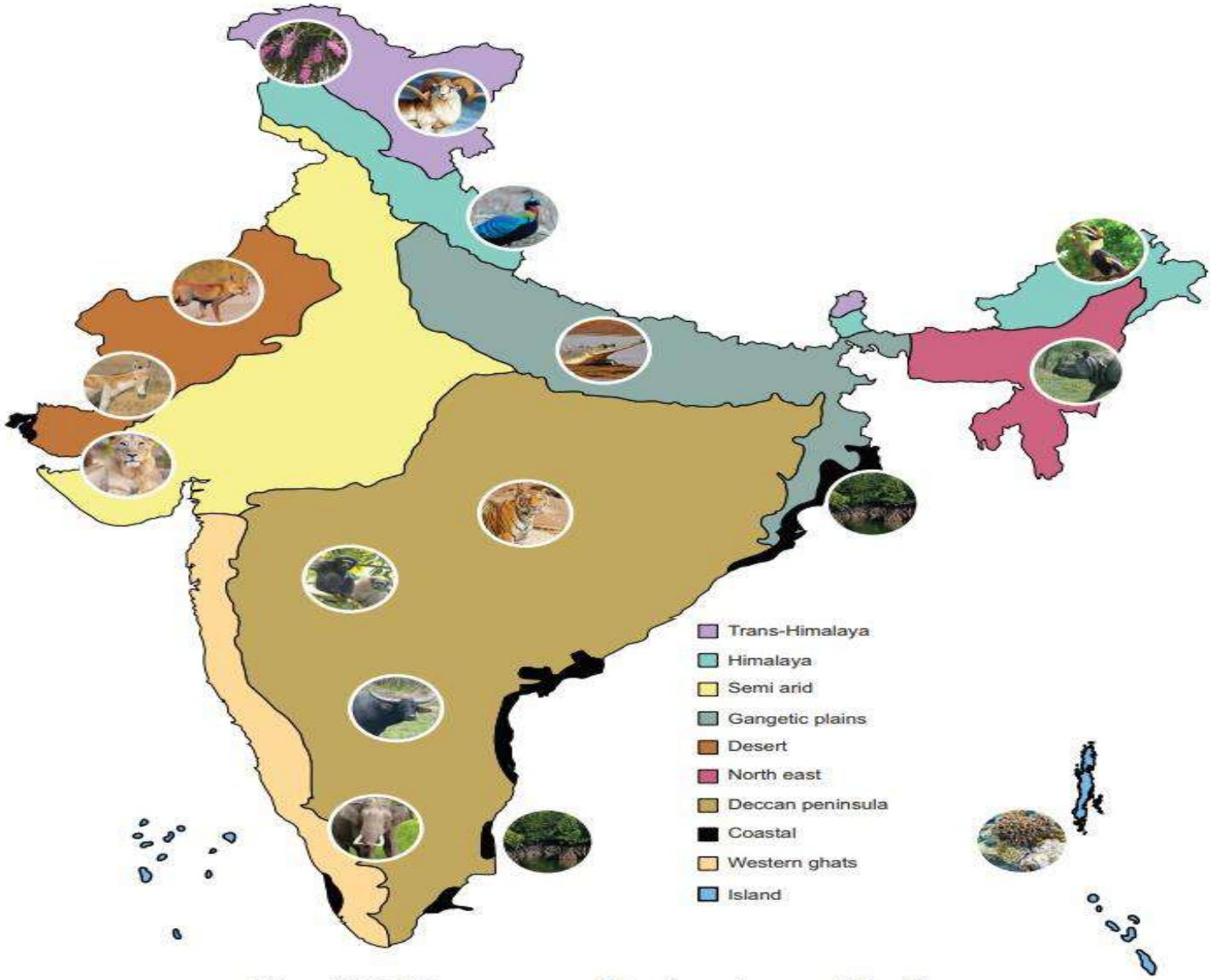


Fig. 12.3 Biogeographical regions of India

INDIA AS A MEGA DIVERSITY NATION

INDIA AS A MEGA DIVERSITY NATION (Biodiversity at National level)

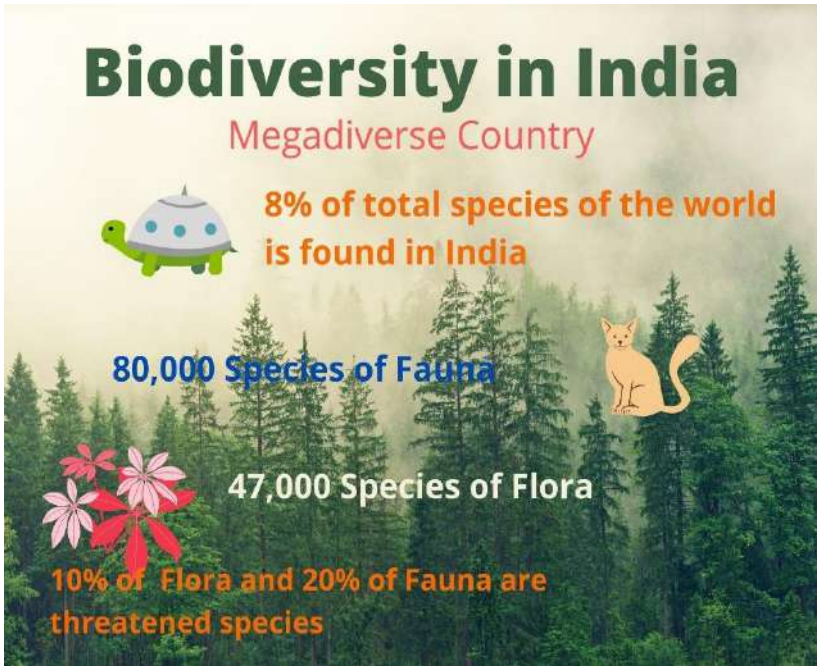
India is one of the 12 mega-diversity countries in the world. It host about 7% of global flora(47,000 plant species) and 6.5% of fauna (81,000 species of animal). Some of the biodiversity criteria are as follows:

1) **Endemism:** India shows a good number of **endemic species**. About 62% of amphibians and 50% of lizards are endemic to India. Western ghats are the site of maximum endemism.

2) **Centre of origin:** A large number of species are known to have originated in India. Nearly 5000 species of flowering plants had their origin in India.

	India's World Ranking	Number of species in India
Mammals	8th	350
Birds	8th	1200
Reptiles	5th	453
Amphibia	15th	182
Angiosperms	15th-20th	14,500

- About 2.1 million species have been identified till date,while many more species are believed to exist.
- The world major biodiversity is in its tropical forests having50-150 trees/hectare.It consists at least half of the worlds living species.
- According to UNEP estimate approximately 9.0-52 milion of speciesexistonm earth.
- India's position is 10th in the world &4th in Assia in terms of Plant diversity.



Continued....

- India is sharing 12.53 % of world's biodiversity
- India has 3.9 % of grasslands, 2.0 % of hot deserts, 4.1 m.ha of wetland ecosystems.
- India is the 7th largest country in the world and one among the 17 mega diversity centers.
- Among 34 globally identified biodiversity hotspots, India harbours 4 hotspots and they are-
  - Eastern Himalaya
  - Indo-Burma
  - Western Ghats and Sri-Lanka
  - Andaman and Nicobar island

BIODIVERSITY HOTSPOTS OF INDIA

Nature has liberally painted a variety of landscapes in our country. Many of these have been demarcated as Biodiversity Hotspots – areas that have extremely rich and diverse flora and fauna and are under threat of getting endangered. Officially, 4 out of the 36 Biodiversity Hotspots in the world are present in India: **the Himalayas**, **the Western Ghats**, **the Indo-Burma region** **and** **the Sundaland**. To these may be added the Sundarbans and the Terrai-Duar Savannah grasslands for their unique foliage and animal species.

EASTERN HIMALAYAS

The Eastern Himalayas are a region of global importance for biodiversity

-Three global 200 ecoregions

- Eastern Himalaya Alpine Meadows
- Eastern Himalayas Broad leaf and Conifer
- Terai Duar Savannas and Grasslands

PLANTS

Of the estimated 10,000 species of plants in the Himalaya Hotspot, about 3,160 are endemic, as are 71 genera. The largest family of flowering plants in the hotspot is the Orchidaceae, with 750 species.

MAMMALS

About 300 mammal species have been recorded in the Himalaya, including a dozen that are endemic to the hotspot—the Endangered golden langur (*Trachypithecus geei*) and Critically Endangered pygmy hog (*Sus salvanius*) among them.Some of the highest densities of the Endangered tiger (*Panthera tigris*) in the world, while the Brahmaputra and Ganges rivers that flow along the

foothills also support globally important populations of the Endangered South Asian river dolphin (*Platanista gangetica*). Some of the world's last remaining.

REPTILES

Although there has been little systematic study of reptiles and amphibians in the Himalaya Hotspot, at least 175 reptiles have been documented, of which nearly 50 are endemic. There is just one endemic genus, represented by a single species, the lizard Mictopholis austeniana

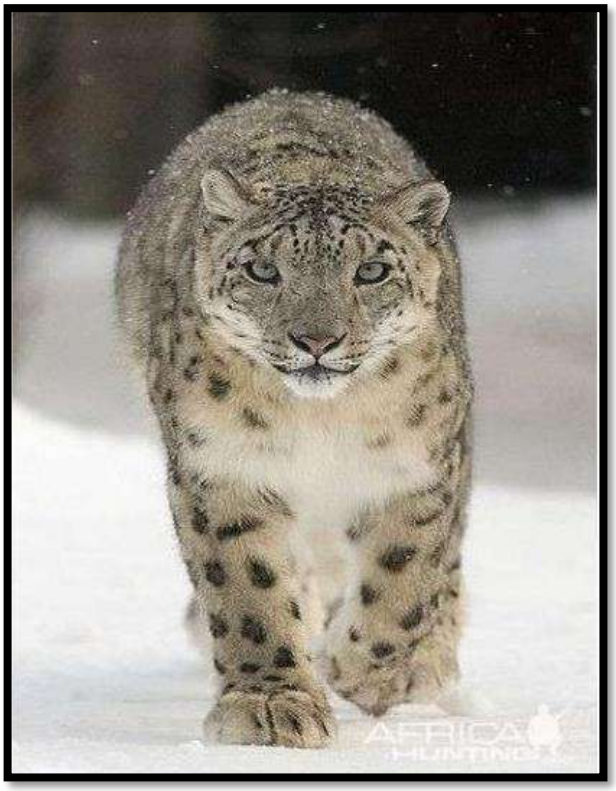
AMPHIBIAN

Among amphibians, there are 105 species known to occur in the hotspot, more than 40 of which are endemic. Most of these are frogs and toads, although there are also two species of caecilians, one of which, *Ichthyophis sikkimensis*, is endemic.

REPTILES

PLANTS

MAMMALS



WESTERN GHATS

It is one of the major hotspots of biological diversity in the world.It is sometimes called the GAREAT ESCARPMENT OF INDIA.It has total of 39 properties including NATIONAL PARK, WILD LIFE SANCTUARIES etc.

- This zone is one of the hotspots of Indianand great natural resource extends from Kanyakumari in south to the hills of Tapti river in north.
- The zone shows exceptionally rich biodiversity.
- It has 4,000 species of higher plants.
- There are about 1,800 endemic species.
- Out of 29 spp of Dipterocarpaceae present in India 13 are
- found in this region.
- There are 62 mammal genera.
- Significant species and species groups restricted to ghats Are as follows:-
- Primates(Nilgiri langur,Lion Tailed Macaque)
- Rodents(Platacothomysan endemic monotype genus,the Spiny durmouse)
- Carnivores(Malabar Civert,rusty spotted cat)
- It also have large population of tiger,leopard,sloth bear,Indian elephant and Gaur).

- The Western Ghats are one of the world's biodiversity hotspots with over 5,000 flowering plants, 139 mammals, 508 birds and 179 amphibian species.
- At least 325 globally threatened species occur here.
- The range covers 60,000km^2 and forms the catchment area for a complex of river systems that drain almost 40% of India.
- At 2695m, Mt Anamudi in Kerala, India is the highest peak in the Western Ghats.
- The Western Ghats are being considered as a UNESCO World Heritage Site.

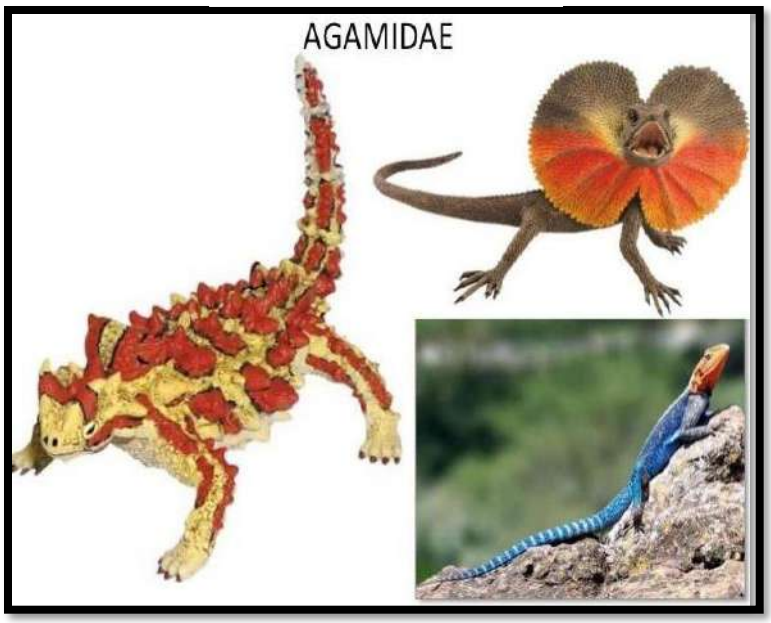
FRESH WATER FISHES

AMPHIBIANS

PURPLE FROG

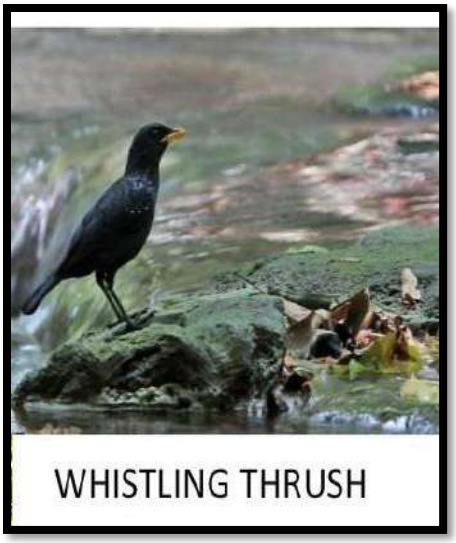
NASIKABATRACHUS SAHADRENSIS

REPTILES



MAMMALS

BIRDS



SUNDALAND

- Sundalnd,also refferd to as the Sundoic area ,is a bio-geographical area of south-eastern Asia.

❖ Sundaland hosts 25% of Earth's found and 17% of Earth's bird .Founded animals in Sundaland are Komodo Dragons,Asian Arowanas, pig-tailed langurs.

Komodo Dragons

Pig-tailed langurs

Asian Arowanas

Indo-Burma Region

- The Indo- Burma hotspot encompasses 23,73,000km of tropical Asia.
- Situated in the east of the Ganges-Brahmaputra lowlands and the associated foothills in Nepal,Bhutan,and India were considered in the Indo- Burma hotspot(now excluded from Indo-Chinese sub region of Himalayan hotspot).

- Bird life in Indo-Burma is also incredibly diverse, holding almost 1,300 different bird species, including the threatened white-eared night-heron, the grey-crowned crocias, and the orange-necked partridge.


white-eared night-heron


grey-crowned crocias


orange-necked partridge

CONCLUSION

Biodiversity is our life. If the biodiversity got lost at a tremendous rate in near feature, the survival of human being will be threatened. So, it is our moral duty to conserve Biodiversity as well our Enviornment. Long-term maintenance of species and their management requires co-operative efforts across entire landscape. Biodiversity should be dealt with at scale of habitats or ecosystems rather than at species level.

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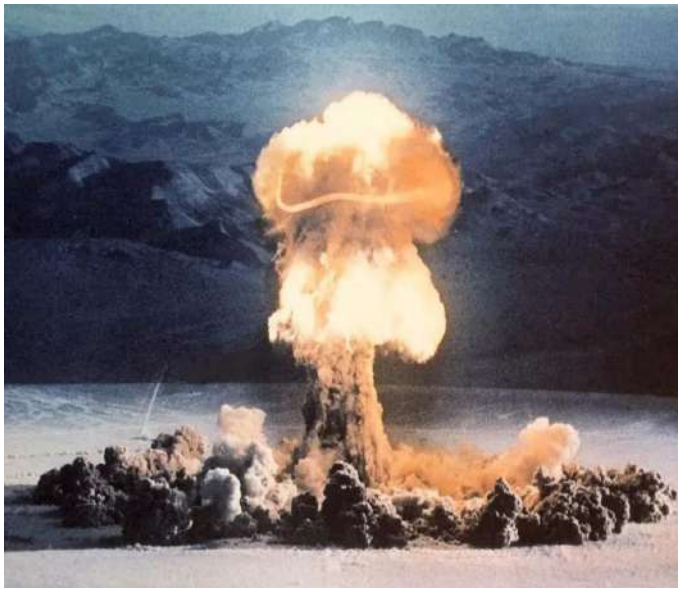


ENVIRONMENTAL

DISASTERS

INTRODUCTION :-

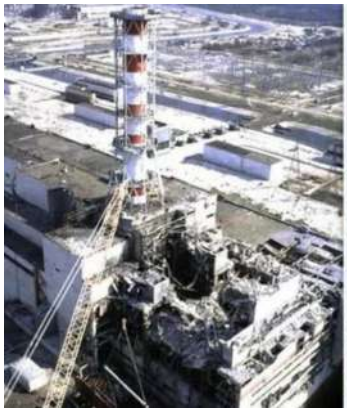
The Earth was never something we owned, we were always it's guests and it's always our master. They say humans are the most clever species on earth, but it's astonishing how we have jeopardized our own lives. It's unsettling how we have turned this green earth into a fiendish and horrific nightmare we dread. As said by Mahatma Gandhi, "Environment gives enough to fulfil each man's needs, however few out of every odd man's ravenousness." So many environmental disasters have ravaged the world lately. The environment, constituting air, water, trees, bacteria, insects, animals and so many other things, is degrading and it is happening solely because of environment's most important constituent, HUMANS.

A LIST OF ENVIRONMENTAL DISASTERS:--

1. Chernobyl disaster (1986):

The Chernobyl disaster was a nuclear accident that occurred on Saturday 26 April 1986 at the number 4 reactor in the Chernobyl Nuclear Power Plant, near the city of Pripyat in the north of the Ukrainian SSR in the Soviet Union. It is considered the worst nuclear disaster in history both in terms of cost and casualties. The accident started during a safety test on an RBMK-type nuclear reactor. A large amount of energy was suddenly released, and two explosions ruptured the reactor core and destroyed the reactor building. There was a highly destructive steam explosion from the vapourizing super-heated cooling water. This was immediately followed by an open air reactor core fire that released considerable airborne radioactive contamination for about nine days that precipitated onto parts of the USSR and Western Europe. The reactor explosion killed two of the reactor operating staff. 134 station staff and

firemen were hospitalised with acute radiation syndrome due to absorbing high doses of ionizing radiation. Of the 134 people,28 died in the days to months afterward and approximately 14 suspected radiation-induced cancer deaths followed within the next 10 years.



---Process of investigation at Chernobyl

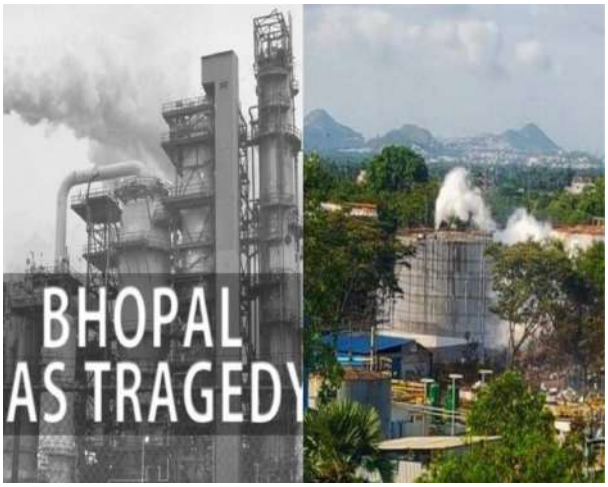
Photos from 1986--


2. Bhopal Gas Tragedy (1984):

The Bhopal Gas Tragedy was a gas leak incident on the night of 2-3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. It is considered among the world's worst industrial disasters. Over 500,000 people were exposed to methyl isocyanate(MIC) gas. The highly toxic substance made its way into and around the small towns located near the plant. The Indian government and local activists argue that slack management and deferred maintenance created a situation where routine pipe maintenance caused a backflow of water into a MIC tank triggering the disaster. Union Carbide Corporation (UCC) argues that water entered the tank through the act of sabotage. Almost 8000 people died due to the toxic gas within two weeks and another 8000 or more have since died from gas related diseases. Within a few days, trees in the vicinity became barren and bloated animal carcasses

had to be disposed off. Supplies including food became scarce owing to suppliers safety fears. Fishing was prohibited causing further shortages.

---Factory labourers demanding justice



Bhopal then------- Bhopal now

3. Mississippi River oil spill(1962-1963):

In 1962 and 1963, industrial accidents spilled 3.5 million gallons of oil into the Mississippi and Minnesota Rivers. The oil covered the Mississippi River from St. Paul to Lake Pepin, creating an ecological disaster and a demand to control water pollution. On December 7,1962, workers at the Richards Oil plant in Savage forgot to open steam lines that heated oil pipes at the plant. On December 8, these pipes burst in low temperatures. They spilled one million gallons of petroleum into the Minnesota River. By January 23, 1963 a storage tank collapsed at Honeymead Products Company. The accident violently spilled 3.5 million gallons of soybean oil into downtown Mantako. The

company recovered some of the oil but citizens drained 2.5 million gallons of it into nearby rivers. In March, the ice on the Minnesota and Mississippi rivers thawed, depositing oil between St. Paul and Lake Pepin. The Twin cities dumped industrial waste into this area of the river and the oil was unnoticed. This changed on March 28, 1963. Residents noticed oil covered ducks struggling in the Mississippi river. Ice on lake Pepin had dammed floating oil, creating a dangerous slick that coincided with the annual migration of water flow.

---Aerial photograph showing oil spill in Mississippi river.

Duck struggling in oil spilled water

4. Dust Bowl:

The Dust Bowl was a period of severe dust storms that greatly damaged the ecology and agriculture of the American and Canadian prairies during the 1930s. Severe drought and a failure to apply dryland farming methods to prevent the Aeolian

processes (wind erosion) caused the phenomenon. The drought came in three waves,1934, 1936 and 1939-1940, but some regions of the High Plains experienced drought conditions for as many as eight years. The Great Plains entered an unusually dry area in the summer of 1930. When severe drought struck the Great plains region in the 1930s, it resulted in erosion and loss of top soil because of farming practices at that time. The drought dried the topsoil and over time it became friable, reduced to a powdery consistency in some places. People had to move to other places seeking work, and there was widespread hunger and poverty. More than 500,000 Americans were left homeless. By 1940, countries that had experienced the most significant levels of erosion had a greater decline in agricultural land values. In highly eroded areas, less than 25% of the original agricultural losses were recovered.

-- Huge black dust clouds

Stretches of land covered in dust

CONCLUSION:-

Increased human activity has lead to an increased number of environmental disasters. Natural resources are being exploited beyond limits and the earth is dying every single minute. Changes like overpopulation, pollution, burning fossil fuels, and deforestation have triggered climate change, soil erosion, poor air quality and undrinkable water. Ice bergs are melting on a large scale and animal species are becoming extinct. Global warming is one of the main consequences of increased human activity. Increasing environmental impacts caused by increasing atmospheric carbon dioxide concentrations are rising global air temperatures, altered hydrological cycles resulting in more frequent and severe droughts, storms, and floods as well as sea level rise and ecosystem disruption.

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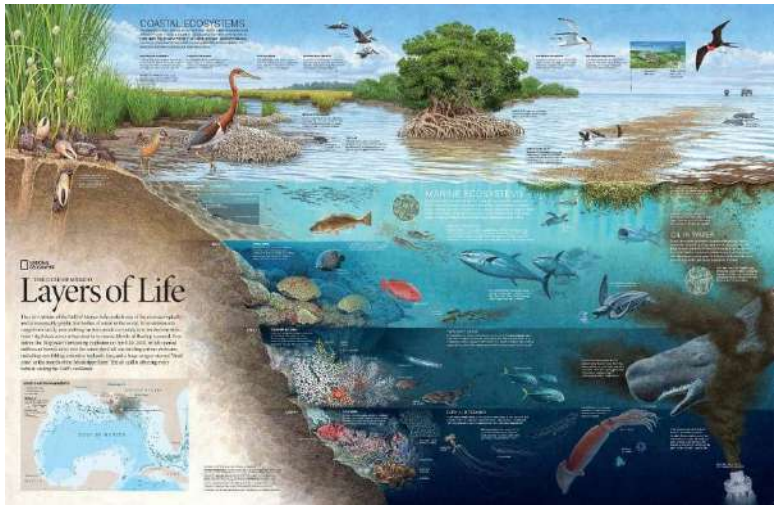
ENVS PROJECT WORK-AECC 2
SEMESTER II
(UNDER CBCS CIRCULUM)

- **COLLEGE ROLL NO. –** **ECOA20F273**
- **C.U. ROLL NO.-** **203223-11-0035**
- **C.U. REGISTRATION NO.-** **223-1211-0310-20**

ECOSYSTEM

ECOSYSTEM

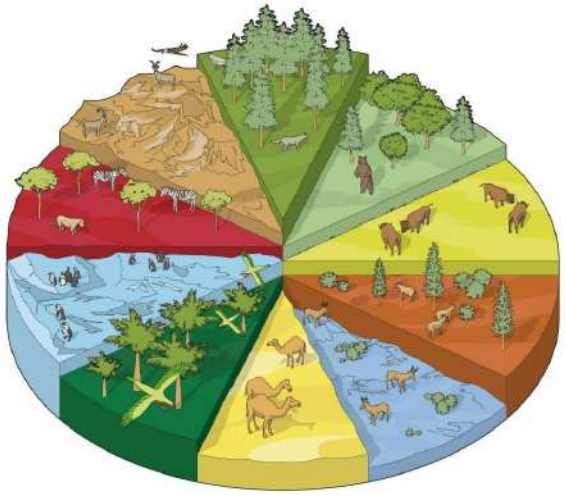
An ecosystem is a geographic area where plants, animals, and other organisms as well as weather and landscape, work together to form a bubble of life. Ecosystems contain biotic or living, parts, as well as abiotic factors, or nonliving parts. Biotic factors include plants, animals, and other organisms. Abiotic factors include rocks, temperature, and humidity.



Every factor in an ecosystem depends on every other factor, either directly or indirectly. A change in the temperature of an ecosystem will often affect what plants will grow there, for instance. Animals that depend on plants for food and shelter will have to adapt to the changes, move to another ecosystem, or perish.

ECOSYSTEM AND ENVIRONMENT

The whole surface of Earth is a series of connected ecosystems. Ecosystems are often connected in a larger biome. Biomes are large sections of land, sea, or atmosphere.



In an ecosystem, each organism has its role and purpose. Disturbing the balance of an ecosystem can be disastrous for all the living things relying on it. An example of an ecosystem are Coral Reefs but there are much smaller ecosystems. Each ecosystem differ in size and components, but the important thing to remember is that no matter the size, it's a symbiotic community. Our Earth is also considered as an ecosystem on a much larger scale. When we introduce external factors such as too much carbon dioxide or methane, it destroys the balance of the ecosystem which in turn affects those who live in it. The result is global warming, water shortage, extinction of species, etc. These impacts every living thing on the planet, which includes us. The impact of ecosystem destruction will be felt by everything eventually.

TYPES OF ECOSYSTEMS

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

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

a.) *Forest Ecosystems*-A forest ecosystem consists of several plants, animals and microorganisms that live in coordination with the abiotic factors of the environment. Forests help in maintaining the temperature of the earth and are the major carbon sink.

b.) *Grassland Ecosystem*-In a grassland ecosystem, the vegetation is dominated by grasses and herbs. Temperate grasslands, savanna grasslands are some of the examples of grassland ecosystems.

c.) *Desert Ecosystem*-Deserts are found throughout the world. These are regions with very little rainfall. The days are hot and the nights are cold.

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

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

b.) *Marine Ecosystem*-The marine ecosystem includes seas and oceans. These have a more substantial salt content and greater biodiversity in comparison to the freshwater ecosystem.

TERRESTRIAL ECOSYSTEM

Terrestrial ecosystems support most of our development, from raw materials to food production. Forests make up 30% of the Earth's surface, provide oxygen and shelter for many land species, and constitute and important stock of carbon.

- Terrestrial ecosystems include all the diverse flora and fauna that inhabit our landscapes. Terrestrial ecosystems provide many services, including:
- providing habitat for fauna and flora
- providing food, fibre, fuel, shelter resources
- storing, transforming and releasing carbon, water and other nutrients
- reducing the impact of floods, cyclones and droughts
- protecting soil resources from salinity and erosion
- producing atmospheric oxygen
- regulating climate.

- Grazing, forestry, horticulture and cropping systems rely on pastures, trees, pollination and other elements of terrestrial ecosystems. Terrestrial ecosystems provided food and other resources for traditional Indigenous lifestyles, and have cultural significance to Indigenous Australians today. Terrestrial ecosystems also support social and recreational activities.

TERRESTRIAL ECOSYSTEM

FOREST

A **forest ecosystem** is a functional unit or a system which comprises of soil, trees, insects, animals, birds, and man as its interacting units. A forest is a large and complex ecosystem and hence has greater species diversity.Also, it is much more stable and resistant to the detrimental changes.The components interact with each other makes it self-sustainable.

The three major forest ecosystems are:

- ***The Tropical Rainforest ecosystem-***luxuriant forest found in wet tropical uplands and lowlands around the Equator, dominated by broad-leaved trees that form a dense upper canopy
- ***The Temperate Deciduous forest ecosystem-***broad-leaf forests are a variety of temperate forest that lose their leaves each year,found in areas with warm moist summers and cool winters.
- ***The Boreal or Taiga forest ecosystem-***vegetation composed primarily of cone-bearing needle-leaved or scale-leaved evergreen trees, found in northern circumpolar forested regions characterized by long winters
- ***The Tundra forest ecosystem-***treeless regions found in the Arctic and on the tops of mountains, where the climate is cold and windy, and rainfall is scant.

Structural Features of the Forest Ecosystem

Species composition: It refers to the identification and enumeration of the plant and animal species of a forest ecosystem.

Stratification: It refers to the vertical distribution of different species which occupy different levels in the forest ecosystem. Every organism occupies a place in an ecosystem on the basis of source of nutrition.For example, in a forest ecosystem, trees occupy the top level, shrubs occupy the second and the herbs and grasses occupy the bottom level.

Components of a Forest Ecosystem

1. Productivity

The basic requirement for any ecosystem to function and sustain is the constant input of solar energy. Plants are also the producers in a forest ecosystem.There are two types of productivity in a forest ecosystem, primary and secondary. Primary productivity means the rate of capture of solar energy or biomass production per unit area over a period of time by the plants during photosynthesis. Secondary productivity means the rate of absorption of food energy by the consumers.

2. Decomposition

Decomposition is an extremely oxygen-requiring process. In the process of decomposition, decomposers convert the complex organic compounds of detritus into inorganic substances such as carbon dioxide, water and nutrients. Detritus is the remains of the dead plant such as leaves, bark, flowers and also the dead remains of the animals including their faecal matter. The steps involved in the process of decomposition are **fragmentation**(detritivores breaking down the detritus into smaller particles), **leaching**(water-soluble inorganic nutrients descend down into the soil and settle as unavailable salts), **catabolism**(bacterial and fungal enzymes reduce detritus into simpler inorganic substances), **humification**(accumulation of humus and decomposition at a slow rate) and **mineralization** (the humus gets further degraded by microbes and inorganic nutrients are released).

3. Energy flow

Energy flows in a single direction. Firstly, plants capture solar energy and then, transfer the food to decomposers. Organisms of different trophic levels are connected to each other for food or energy relationship and thus form a food chain.Energy Pyramid is always upright because energy flows from one trophic level to the next trophic level and in this process, some energy is always lost as heat at each step.

4. Nutrient Cycling

Nutrient cycling refers to the storage and movement of nutrient elements through the various components of the ecosystem. There are two types of Nutrient cycling, gaseous and sedimentary.For Gaseous cycle (i.e. nitrogen, carbon), atmosphere or hydrosphere is the reservoir whereas for the sedimentary cycle (i.e. phosphorus) Earth's crust is the reservoir.

TERRESTRIAL ECOSYSTEM

GRASSLAND

The Grassland Ecosystem is also called transitional landscape because grassland ecosystems are dominated by the grass with few or no trees in the area where there is not enough for a forest and too much of a forest. These are known by different names in different region of the world like steppes in Europe and Asia, pampas in South America, Veldt in South Africa and Downs in Australia.

Components of Grassland Ecosystem

1. Abiotic Components: These are non-living thing components consist of carbon, hydrogen, sulphur, nitrogen and phosphorous etc.

2. Biotic Components: These are living components and its sub-components are discussed below-

(I) Producers: The primary producers of food are the grasses such as **Aristida, Cynodon, Digitaria, Desmodium, Setaria** etc. If herbs and shrubs are present, they also contribute to the primary production of food.

(II) Consumers: The consumers in a grassland ecosystem are of three levels.

(a) Primary consumers: These feed directly from the grasses (grazing) and include herbivores such as **Cows, Buffaloes, Goats, Rabbits, Mouse** etc. and also **insects, termites, centipede, millipedes** etc.

(b) Secondary consumers: These consumers are the carnivorous animals such as snakes, lizard, jackal, foxes, frogs etc. which feed on the primary consumers.

(c) Tertiary consumers: Hawk, Eagles and vultures constitute the tertiary consumer in the grassland ecosystem which preys upon the secondary and primary consumer.

(III) Decomposers: The organic matter of the grassland is decomposed by the microbes like actinomycetes, fungi (Mucor, Aspergillus, Rhizopus, Penincillium, and Cladosporium), aerobic and anaerobic soil bacteria etc. They release the minerals back into the soil thus making the soil fertile.

Functions of the Grassland Ecosystem

The primary function of an ecosystem is productivity. The producers fix the solar energy and produce the complex organic matter with the help of minerals. It provides forage for livestock, protection and conservation of soil and water resources, furnishing a habitat for wildlife, both flora and fauna and (contribution to the attractiveness of the landscape. The functional aspects of the Grassland can be studied by two means:

1. Food Chain in an ecosystem: There is an important feature of the ecosystem that one level of an organism serves as food for another level of the organism. A series is formed which is known as Food Chain. In an ecosystem, the food chain does not follow the linear pattern, but an organism may feed upon more than one organism in the same food chain or upon organisms of different food chains. Thus interconnected food chain system is formed known as a food web.

2. Nutrient cycle in an ecosystem: For any ecosystem to be successful, it is important that the constituent materials move in a cyclic manner. The producers (green plant) takes up the mineral elements from the soil and air, convert them into organic form and after passing through the different trophic levels, are again returned to the soil and air.

Economic importance of Grassland Ecosystem

Grass lands biomes are important to maintain the crop of many domesticated and wild herbivores such as horse, mule, ass, cow, pig, sheep, goat,buffalo, camel, deer, zebra etc. which provides food, milk, wool and transportation to man.Hence, we can say that the Grassland Ecosystem is a mixture of grass, clover and other leguminous species, dicotyledonous, herbs and shrubs which contribute to a high degree of the preservation.

TERRESTRIAL ECOSYSTEM

DESERT

Intense solar radiation, lashing winds, and scarce rainfall create some of the harshest living condition in the biosphere called hot desert. In hot **desert ecosystem** generally with cloudless skies, the sun quickly heats the desert by day, producing the highest air temperatures in the biosphere.In contrast, the nights are very cold, as the temperature goes down tremendously due to loss of heat into the atmosphere through radiation. But despite such harsh living conditions, desert ecosystem exhibits a spectacular biological diversity. A large number of **plant and animal species** thrive in the deserts due to their morphological, anatomical, physiological and behavioural adaptations.

There are three life-forms of plants that are adapted to desert ecosystem:

a.) **Ephemeral annuals** are also called as 'drought evaders' or 'drought escapers'. They germinate, grow, flower, and release seeds within the brief period (6-8 weeks) when water is available and temperatures are warm.

b.) **The succulent plants** suffer from dryness in only external environment. Their succulent, fleshy stems, leaves and roots serve as water storage organs.

c.) **The shrub in desert** ecosystem or non-succulent perennials suffers from dryness both in their internal as well as external environments. Their morphological and physiological features include rapid elongation and extensive root system, high osmotic pressure and endurance of desiccation, ability to reduce transpiration and reduction in size of leaf blade. Root system is very extensive i.e. more than 30 m long (*Alfalfa spp*.) to siphon deep groundwater supplies.

There is waxy coating and sunken type of stomata on leaves, which reduces loss of water during transpiration. Desert grasses have rolled and folded leaves so that the sunken stomata become hidden to minimize the rates of transpiration.

The ***drought evader animals*** adopt undergo aestivation i.e., the breathing, heartbeat and other body activities slowdown, this in turn decreases the need of water. Many lay eggs that survive until the next rains when they hatch in the transient puddles. ***Amphibians*** like spade foot toad dig burrow with the help of its spade-like feet and goes to sleep till the rains arrive and undergo aestivation for 8-10 months. The ***birds*** make nest and reproduce during the rainy season when there is abundant food.

The ***drought resistant animals*** are active and carry their normal function throughout the year. They circumvent aridity and heat through morphological and physiological adaptations or by modifying their feeding and activity patterns. They remain in cool, humid underground burrows during the day time and search for food only at night when temperatures are lower.

Some ***xerocole rodents*** of desert ecosystem, that are active in the day periodically seek burrows and passively lose heat through conduction by pressing their bodies against the burrow walls.The ***reptiles and some insects*** are pre-adapted to the hot desert ecosystem. They excrete a dry metabolic waste product in the form of uric acid and guanine so that water loss is minimal. They have thick waterproof skin that also minimizes water loss.***Desert spiders, mites and insects*** secrete a waxy layer over their cuticles. Wax is impermeable to water thus prevents loss of water from their bodies.

Most of the ***mammals like kangaroo rat, the pocket mouse and the jerboa*** have adapted nocturnal habitat. They seal their burrows by day to keep their chamber moist, and can live throughout year without drinking water. They feed on dry seeds and dry plants even when succulent green plants are available. They remain in burrows during the day, and conserve water by excreting very concentrated urine and by hygroscopic water in their food. ***Other mammals like mule, deer and elk*** avoid the extreme temperatures of the day by limiting activity hours to dawn and dusk. The ***camel in the desert ecosystem*** can go for long periods without water because their body tissues can tolerate elevation in body temperature and a degree of dehydration. However, it uses water for temperature regulation.***Desert Gerbils*** have hairy soles on their feet which allow them excellent traction on sand.

AQUATIC ECOSYSTEM

An **aquatic ecosystem** is an ecosystem in a body of water. Communities of organisms that are dependent on each other and on their environment live in aquatic ecosystems. The two main types of aquatic ecosystems are **marine ecosystems** and **freshwater ecosystems**. There are three basic types of freshwater ecosystems: **Lentic***(slow moving water, including pools, ponds, and lakes)*; **lotic** *(faster moving water, for example streams and rivers)*; and **wetlands** *(areas where the soil is saturated or inundated for at least part of the time)*.

Functions of Aquatic Ecosystems-

Aquatic ecosystems perform many important environmental functions. For example,

i. they recycle nutrients
ii. purify water
iii. attenuate floods
iv. recharge ground water
v. provide habitats for wildlife
vi. used for human recreation
vii. are very important to the tourism industry, especially in coastal regions.

AQUATIC ECOSYSTEM

FRESHWATER

Fresh water starts out as water vapor that has evaporated from the surface of oceans, lakes, and other bodies of water. When this vapor rises, it leaves salts and other contaminants behind and becomes “fresh.” The water vapor collects in drifting clouds that eventually release the water back to Earth in the form of rain or snow. After fresh water reaches the ground through precipitation, it flows downhill across a landscape called the watershed to lakes, ponds, rivers, streams, and wetlands.

After fresh water reaches the ground through precipitation, it flows downhill across a landscape called the watershed to lakes, ponds, rivers, streams, and wetlands. But fresh water can be found in less-obvious places too. More than half of all freshwater on our planet seeps through soil and between rocks to form aquifers that are filled with groundwater. The top surface of an aquifer is called the water table, and this is the depth where wells are drilled to bring fresh water into cities and homes.

A wide range of plants, animals, and microbes are found in freshwater ecosystems. The smallest are the microscopic plants and animals known as **phytoplankton** and **zooplankton**, which form the bottom layer of freshwater food chains. There are also many freshwater invertebrates including worms and insects. Among the freshwater vertebrates, amphibians, such as frogs, live on land and water, while fish are purely water-dwelling. Many species of birds, such as kingfishers and ducks, live on or near freshwater.

The freshwater ecosystem is mainly divided into three types based on its region – Lotic, lentic, and wetland freshwater ecosystem.

a.) **Lotic Freshwater Ecosystem -**The water bodies moving in one direction is known as a lotic freshwater ecosystem. Rivers and streams are common examples of lotic ecosystems.

Rivers and streams are lotic ecosystems.They begin at a source—which could be a spring, lake, or snowmelt—and travel to their mouths, which may be the sea or another river. The water at the source is generally cooler, clearer, and has a higher oxygen content than at the mouth. Freshwater fish such as trout are often found near the source.Fish requiring less oxygen, like carp, are found near the mouth of a river.Fallen leaves, insects, and other detritus are important food sources.

b.) **Lentic Freshwater Ecosystem-**An aquatic ecosystem within stagnant or still water is known as Lentic Freshwater Ecosystem.Lakes, ponds, and reservoirs are lentic, or layered, systems with generally still water varying in size between a few square feet to thousands of square miles. The surface layer is populated by plankton, protists (single-celled organisms like ameba), and insects.

c.) **Wetland Freshwater Ecosystem-**Wetlands are still water bodies that support vascular plants. Marshes, swamps, and bogs are commonly known as wetland ecosystems. Wetlands are quite productive due to the proximity of water and soil.

The plant species found in the wetlands are known as hydrophytes as they have adapted the moist and humid environment of the region. The common hydrophyte plants found in the wetland ecosystem include cattails, tamarack, pond lilies, sedges, black spruce, etc.

As far as animal species are a concern, wetlands provide shelter to various amphibians, reptiles, birds, shrimp, shellfish, etc.

AQUATIC ECOSYSTEM

MARINE

Marine ecosystems are aquatic environments with high levels of dissolved salt, such as those found in or near the ocean. Marine ecosystems are defined by their unique biotic (living) and abiotic (nonliving) factors. Biotic factors include plants, animals, and microbes; important abiotic factors include the amount of sunlight in the ecosystem, the amount of oxygen and nutrients dissolved in the water, proximity to land, depth, and temperature.

Sunlight is one the most important abiotic factors for marine ecosystems. It's so important that scientists classify parts of marine ecosystems—up to three—by the amount of light they receive. The topmost part of a marine ecosystem is the euphotic zone, extending down as far as 200 meters (656 feet) below the surface. At this depth, there is sufficient light for regular photosynthetic activity. Most marine life inhabits this zone. Below the euphotic zone is the dysphotic zone, which can reach from 200 to as deep as 1,000 meters (656 to 3,280 feet) below the surface. At these depths, sunlight is still available, but only enough to facilitate some photosynthesis. Below the dysphotic zone lies the aphotic zone, which does not receive any sunlight.

Types of Marine Ecosystems

There are several types of marine ecosystems : *Estuaries, Salt Marshes, Mangrove Forests, Coral Reefs, The Open Ocean, And The Deep-sea Ocean.*

A.) An **estuary** is a coastal zone where oceans meets rivers. Here, nutrients and salts from the ocean mix with those from the river in regions sheltered from extreme weather. As a result, estuaries are among the most productive places on Earth and support many types of life. In addition, because they are located where rivers join the ocean, estuaries have traditionally supported many human communities and activities like fishing, shipping, and transportation.

B.) **Salt marshes** occur where oceans meets land. These places are rich in nutrients from sediment brought in by the ocean. Marshes are regularly flooded by high tides, making the surrounding ground wet and salty.These ecosystems are dominated by low-growing shrubs and grasses. Mangrove forests are found in tropical areas. These ecosystems are frequently flood with ocean water, submerging the roots of mangrove trees. Animals, such as fish, crabs, shrimp, reptiles, and amphibians, live among the mangrove's roots while its canopy provides a nesting site for birds.

C.) A bit farther out into the tropical sea are **Coral reefs**, euphotic-zone ecosystems built from the exoskeleton secreted by coral polyps.Coral reefs are extremely diverse ecosystems that host sponges, crustaceans, mollusks, fish, turtles, sharks, dolphins, and many more creatures. By some counts, coral reefs can account for a quarter of all ocean species.

D.) Beyond the coral reefs lies the **Open ocean ecosystems** which vary widely as the depth of the ocean changes. At the surface of the ocean, the euphotic zone, the ecosystem receives plenty of light and oxygen, is fairly warm, and supports many photosynthetic organisms. Many of the organisms that we associate with marine ecosystems, such as whales, dolphins, octopi, and sharks, live in the open ocean.

E.) As the depth of the ocean increases, the **Deep sea ecocystems** begins where it gets darker, colder, and with less available oxygen. Organisms living in deep-sea ecosystems within the dysphotic and aphotic zones have unusual adaptations that help them survive in these challenging environments. Some organisms have extremely large mouths that allow them to catch whatever nutrients fall from shallower ocean depths. Others have adapted to get their energy via chemosynthesis of chemicals from hydrothermal vents.

I would like to express my gratitude towards my professors for giving this opportunity to prepare a project on such a crucial topic which helped me gain an insight to the said topic.With this I would like to end my project here.

~ Thank you ~

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TOPIC= ‘AIR-POLLUTION’

SUBJECT= AECC-ENVS

SEMESTER-2

“AIR POLLUTION ”

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I would like to thank my subject teachers of AECC-ENVS for providing me with adequate study materials and information for this topic and encouraging me to do this project systematically.

Other than my respected teachers,I would also like to thank my parents whose timely guidance has helped me to complete my ENVS project nicely!!

INDEX:-

INTRODUCTION:-

Air pollution is the presence of substances in the atmosphere that are harmful to the health of human beings and other living beings,or cause damage to the climate or other materials.

The various kinds of Air Pollutants are:-

1) Gases=ammonia, carbon monoxide,Sulphur dioxide,methane etc.
2) Particulates= Both organic and inorganic
3) Biological Molecules

I have chosen this topic(Air Pollution) amongst all other types of pollution, because I feel ,

it can seriously affect our health .When we breathe polluted air,the pollutants get into our lungs ,then they enter into our blood stream and affect our vital internal organs like our heart, brain, lungs etc. They care extremely detrimental to our health and may cause, Asthma, Cardiovascular diseases,Cancer and hence reduces the life span of a person. Thus awareness on air-polution is of utmost importance…..the reason why I have chosen this topic!!!

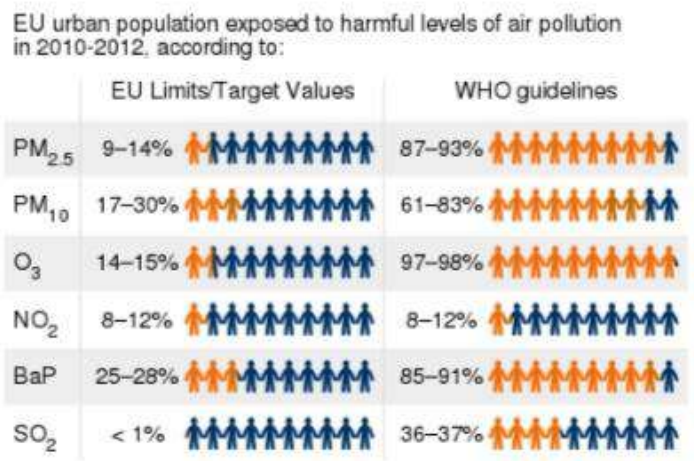
EXPOSURE TO AIR POLLUTION AND ITS HEALTH HAZARDS:-

Air pollution risk is a function of the hazard of the pollutant and the exposure to that pollutant. Air pollution exposure can be expressed for an individual, children living in a country or for an entire population. Eg: one may want to calculate the exposure to a hazardous Air pollutant for a geographical area.

It's seen that a small child's inhalation rate is lesser than an adult.So the child is at a lesser risk to possible health hazards due to Air pollution.

Again a child engaged in vigorous exercise will have higher respiration rate than the same child living a

sedentary life. The air pollutant concentration in each microactivity is summed up to indicate the exposure.

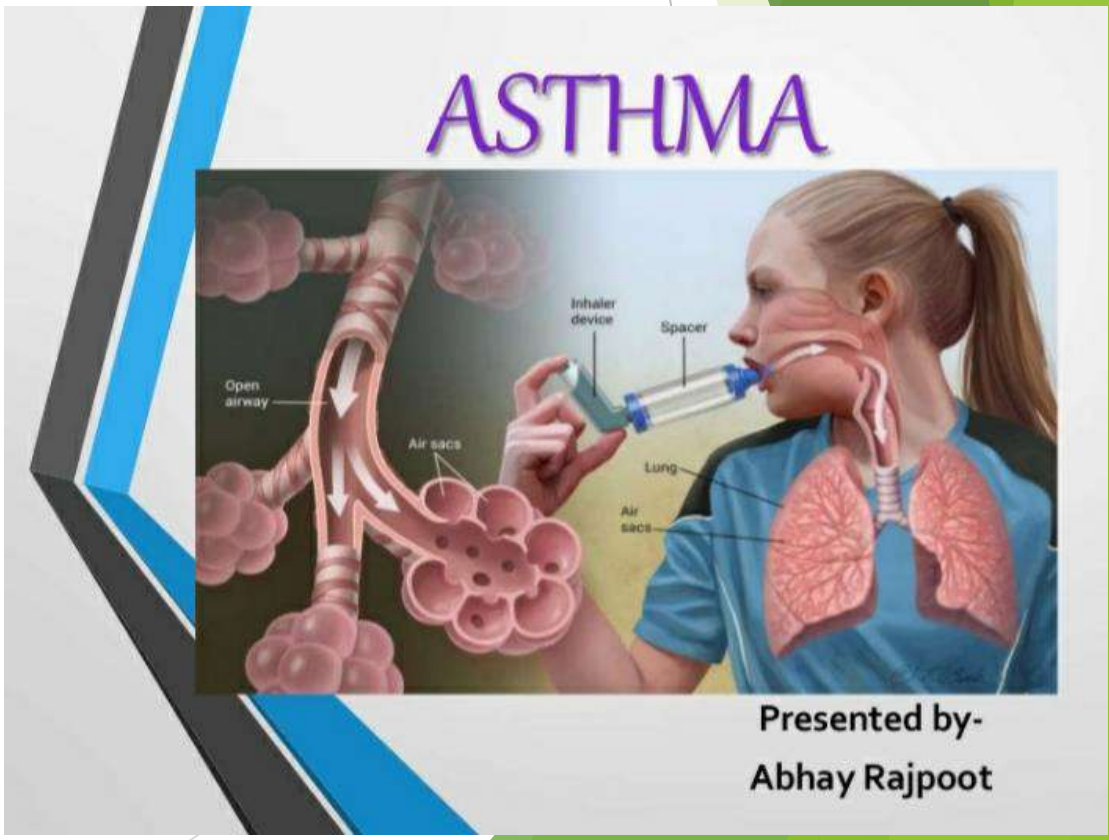


Up to 30 % of Europeans living in cities are exposed to air pollutant levels exceeding EU air quality standards. And around 98 % of Europeans living in cities are exposed to levels of air pollutants deemed damaging to health by the World Health Organization's more stringent guidelines.[43]

HEALTH EFFECTS:-

The health effects caused by air pollution includes:-

1) Difficulty in breathing
2) Stroke and heart diseases
3) Lung cancer
4) COPD
5) Asthma



Mainly the health effects of air pollution include adverse effect on our respiratory and cardiovascular system.

Individual reactions to air pollution depends on the type of pollution a person is exposed to, degree of exposure, an individual's health status and genetics.

Children aged less than 5 yrs. that live in developing countries are the most vulnerable population in terms of total deaths attrubutable to indoor and outdoor air pollution.

AGRICULTURAL EFFECT:-

In 2014, it was reported in India that Air pollution by black carbon and ground levels of ozone had reduced crop yields in the most affected areas by almost half in 2011 when compared to 1980.

ECONOMIC EFFECT:-

Air pollution costs the word economy $5 trillion per year as a result of productivity losses and degraded quality of life(as per world bank).

1 out 10 deaths in 2013 was caused by diseases associated with air pollution. The problem is more

acute in the developing world.Children under 5yrs. age in lower income countries are more than 60 timesaving likely to die from exposure to air pollution as children in high income countries.

HOTSPOTS:-

So now as we have discussed about the various harmful effects of air pollution on our health, economy, agriculture etc…….let’s now focus on the hotspots where individuals have increased risk to health hazards.

Eg: Common hotspots in a country are the urban areas where pollutants are mainly from Traffic and Industrial air pollution.

Here as we can see in the chart, KANPUR, is the most polluting city in India as of 2016!!

Most polluted cities by PM[146]	
Particulate matter, µg/m³ (2016)	City
173	Kanpur, India
172	Faridabad, India
149	Gaya, India
146	Varanasi, India
144	Patna, India
143	Dehli, India
138	Lucknow, India
132	Bamenda, Cameroon
131	Agra, India

Thus air pollution is mostly concentrated in densely populated metropolitan areas esp. in developing countries

where environment regulations are relatively non-existent.

GOVERNING URBAN AIR POLLUTION:-

So now that we have seen the harmful effects of air pollution are mostly in cities(HOTSPOTS), controlling it is the need of the hour!!

Hence in our next slide,there are some rules and regulations that have been taken by government of different countries from time to time:

1) On July 2008, Dieter Janrek Bayern, the "European Court of Justice" ruled that there has to a set of regulations to improve air quality where it's unsatisfactory.

2) In March 2011, the Greater London built up area remains the only UK region in breach of the EC's limit values.

London has dangerous levels of PM-10 concentration, estimated to cause 3000 deaths per year within the city of London.

The Mayor of London, Boris Johnson has criticized the current need for European cities to improve their air quality via proper measures.

Health Risk	Air Quality Health Index	Health Messages[138]	
		At Risk population	General Population
Low	**1–3**	**Enjoy** your usual outdoor activities.	**Ideal** air quality for outdoor activities
Moderate	**4–6**	**Consider reducing** or rescheduling strenuous activities outdoors if you are experiencing symptoms.	**No need to modify** your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
High	**7–10**	**Reduce** or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	**reducing** or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very high	**Above 10**	**Avoid** strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion and should stay indoors.	**Reduce** or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation.

CONCLUSION:-

Thus we can conclude that air pollution is really harmful for all living beings and affects not only human health but also other aspects of our life…like economy, agriculture etc.

It’s the need of the hour to reduce air pollution by proper implementation of government acts and regulations!!

By this we can definitely ‘conserve our environment’.

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_____×_____

THANK YOU!!

ENVS PROJECT

C.U. ROLL NO.- 203223-21-0155

Subject: ENVS

Topic : GREENHOUSE EFFECT

Total no. of pages- 10.

DATE: 03.07.2021

CONTENTS:-

GREENHOUSE EFFECT

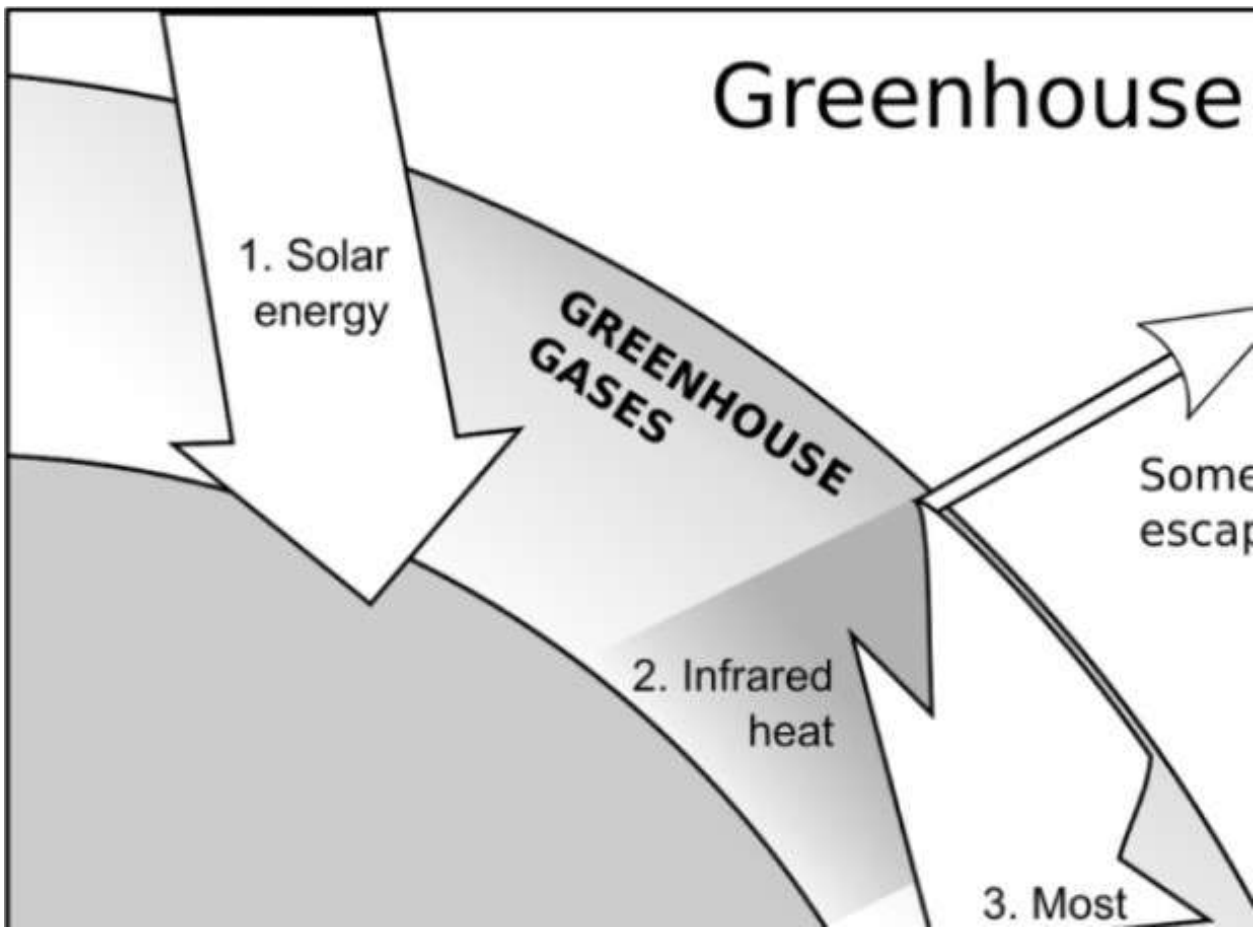
DEFINITION:-

A Greenhouse, as the term suggests, is a structure made of glass which is designed to trap heat inside. Thus, even on cold chilling winter days, there is warmth inside it. Similarly, Earth also traps energy from the Sun and prevents it from escaping back. The greenhouse gases or the molecules present in the atmosphere of the Earth trap the heat of the Sun. This is what we know as the Greenhouse effect.

The trapping of the sun's warmth in a planet's lower atmosphere, due to the greater transparency of the atmosphere to visible radiation from the sun than to infrared radiation emitted from the planet's surface.

The earth's surface is surrounded by an envelope of the air we call the atmosphere. Gasses in this atmosphere trap the infrared radiation of the sun which generates heat on the surface of the earth. In an ideal scenario, this effect causes the temperature on the earth to be around 15c. And without such a phenomenon life could not sustain on earth.

However, due to rapid industrialization and rising pollution, the emission of greenhouse gases has increased multifold over the last few centuries. This, in turn, causes more radiation to be trapped in the earth's atmosphere. And as a consequence, the temperature on the surface of the planet steadily rises. This is what we refer to when we talk about the man-made greenhouse effect.


Greenhouse
1. Solar energy
GREENHOUSE GASES
Some
escap
2. Infrared heat
3. Most

CAUSES OF GREENHOUSE EFFECT

There are broadly two causes of the greenhouse effect:

Natural Causes:-

1. Some components that are present on the Earth naturally produce greenhouse gases. For example, carbon dioxide is present in the oceans, decaying of plants due to forest fires and the manure of some animals produces methane, and nitrogen oxide is present in water and soil.
2. Water vapour raises the temperature by absorbing energy when there is a rise in the humidity.
3. Humans and animals breathe oxygen and release carbon dioxide in the atmosphere.

Man-made Causes:-

1. Burning of fossil fuels such as oil and coal emits carbon dioxide in the atmosphere which causes an excessive greenhouse effect. Also, while digging a coal mine or an oil well, methane is released from the Earth, which pollutes it.
2. Trees with the help of the process of photosynthesis absorb the carbon dioxide and release oxygen. Due to deforestation the

carbon dioxide level is continuously increasing. This is also a major cause of the increase in the greenhouse effect.

3. In order to get maximum yield, the farmers use artificial nitrogen in their fields. This releases nitrogen oxide in the atmosphere.
4. Industries release harmful gases in the atmosphere like methane, carbon dioxide, and fluorine gas. These also enhance global warming.

GREENHOUSE GASES:-

These gases or molecules are naturally present in the atmosphere of the Earth. However, they are also released due to human activities. These gases play a vital role in trapping the heat of the Sun and thereby gradually warming the temperature of Earth. The Earth is habitable for humans due to the equilibrium of the energy it receives and the energy that it reflects back to space.

GLOBAL WARMING AND THE GREENHOUSE EFFECT:-

The trapping and emission of radiation by the greenhouse gases present in the atmosphere is known as the Greenhouse effect. Without this process, Earth will either be very cold or very hot, which will make life impossible on Earth.

The greenhouse effect is a natural phenomenon. Due to wrong human activities such as clearing forests, burning fossil fuels, releasing industrial gas in the atmosphere, etc., the emission of greenhouse gases is increasing.

Thus, this has, in turn, resulted in global warming. We can see the effects due to these like extreme droughts, floods, hurricanes, landslides, rise in sea levels, etc. Global warming is adversely

affecting our biodiversity, ecosystem and the life of the people. Also, the Himalayan glaciers are melting due to this.

HOW TO COUNTER GREENHOUSE EFFECT

1 . DETERMINE THE SIZE OF YOUR CARBON FOOTPRINT

Your carbon footprint is how much carbon you are responsible for releasing into our atmosphere due to your daily habits. Your carbon footprint becomes bigger as you burn more fossil fuels. For instance, a person who rides their bike to and from work each day will have a smaller footprint than a person who drives. You can use a free carbon footprint calculator to determine your own footprint. Have in mind that spending habits, driving habits, diet as well as other factors will be taken into account for calculating your share of carbon that is released into the environment.

2. USE LESS AC & HEAT

Caulking or installing weather stripping around windows and doors and adding insulation to your walls can reduce your costs of heating and cooling by over 25 percent since it reduces the energy you require to heat or cool your house. While sleeping or

gone for the day, turn down the AC or heat. Keep moderate temperatures at all times and install a thermostat that is programmable and set it a couple degrees lower in the wintertime and higher in the summer. This can actually reduce the carbon dioxide contribution each year by 2000 pounds.

3... TRANSPORTATION

Around 28 percent of the total greenhouse gas emissions in the United States are due to transportation. You can decrease your own personal impact by driving less, carpooling, biking, walking, using public transportation instead of cars or buying a vehicle that is more efficient. Drive slower since fuel economy becomes substantially worse when driving above 60 miles per hour. Avoid traveling by air if possible or buy carbon offsets for your flights. Braking and accelerating excessively also reduces efficiency. Don't carry excessive weight in your vehicle trunk, ensure your car is inspected and tuned up regularly and keep your tires inflated. Needless to say, this will also have a positive impact on your health.

4.. USING RENEWABLE ENERGY

In the last few decades, renewables were in the main focus of every national and state government. World's brightest minds search for ways to generate electricity through solar and wind power. Such natural production of energy has major benefits for

our environment. As we go forward traditional sources such as coal and oil will slowly become obsolete which is another reason why we should turn to renewable energy.

5.. PLANT A TREE

Trees are not only meant to provide paper for you and companies like ThePensters where you can get your business case study written for you. They also help the environment. Dig and plant a tree. Trees give off oxygen and absorb carbon dioxide. Just one tree can absorb around a ton of carbon dioxide in its lifetime. In future, such policies and practices will be crucial for reducing greenhouse gas emission and stopping global climate change.

CONCLUSION

All the countries of the world are facing the ill effects of global warming. The Government and non-governmental organizations need to take appropriate and concrete measures to control the emission of toxic greenhouse gases. They need to promote the greater use of renewable energy and forestation. Also, it is the duty of every individual to protect the environment and not use such means that harm the atmosphere. It is the need of the hour to protect our environment else that day is not far away when life on Earth will also become difficult.

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Department – ECONOMICS

AECC ENVS TUTORIAL

PROJECT TOPIC – URBANISATION AND POLLUTION

BATCH – 2020-2023

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INDEX

INTRODUCTION

Throughout many generations we have witnessed a population shift in many areas. But we never wanted to know why did they migrate? Through this project we will see what urbanization and pollution, how pollution over the year have affected the environment and what could be done to help our environment sustain.

URBANIZATION

Urbanization refers to the population shift from rural to urban areas, the corresponding decrease in the proportion of people living in rural areas, and the ways in which societies adapt to this change. It is predominantly the process by which towns and cities are formed and become larger as more people begin living and working in central areas.

POLLUTION

Pollution is the introduction of contaminants into the natural environment that cause adverse change. 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.

Air pollution has always accompanied civilizations. Pollution started from prehistoric times, when man created the first fires. Metal forging appears to be a key turning point in the creation of significant air pollution levels outside the home.

TYPES OF POLLUTION

LAND POLLUTION

Organic material was the largest component of the garbage generated, the EPA said. Paper and paperboard accounted for more than 26%; food was 15% and yard trimmings were 13%. Plastics comprised about 13% of the solid waste, while rubber, leather and textiles made up 9.5% and metals 9%. Commercial or industrial waste is a significant portion of solid waste. According to the University of Utah, industries use 4 million pounds of materials in order to provide the average American family with needed products for one year. Hazardous waste is any liquid, solid or sludge waste that contain properties that are dangerous of potentially harmful to human health or the environment. Industries generate hazardous waste from mining, petroleum refining,

AIR POLLUTION

The air we breathe has a very exact chemical composition; 99% of it is made up of nitrogen, oxygen, water vapor and inert gases. Air pollution occurs when things that aren't normally there are added to the air. A common type of air pollution happens when people release particles into the air from burning fuels. This pollution looks like soot, containing millions of tiny particles, floating in the air.

Another common type of air pollution is dangerous gases, such as sulfur dioxide, carbon monoxide, nitrogen oxides and chemical vapors. These can take part in further chemical reactions once they are in the atmosphere, creating acid rain and smog.

WATER POLLUTION

Water pollution happens when chemicals or dangerous foreign substances are introduced to water, including chemicals, sewage, pesticides and fertilizers from agricultural runoff, or metals like lead or mercury. According to the Environmental Protection Agency (EPA), 44% of assessed stream miles, 64% of lakes and 30% of bay and estuarine areas are not clean enough for fishing and swimming. These come from the most common sources of contaminates, that include agricultural runoff, air deposition, water diversions and channelization of streams.

Water pollution isn't just a problem for the United States. According to United Nations, 783 million people do not have access to clean water and around 2.5 billion do not have access to adequate sanitation. Adequate sanitation helps to keep sewage and other contaminants from entering the water supply.

NOISE POLLUTION

Even though humans can't see or smell noise pollution, it still affects the environment. Noise pollution happens when the sound coming from planes, industry or other sources reaches harmful levels. Research has shown that there are direct links between noise and health, including stress-related illnesses, high blood pressure, speech interference, hearing loss. For example, a study bythe WHO Noise Environmental Burden on Disease working group found that noise pollution may contribute to hundreds of thousands of deaths per year by increasing the rates of coronary heart disease. Under the Clean Air Act, the EPA can regulate machine and plane noise.

Underwater noise pollution coming from ships has been shown to upset whales' navigation systems and kill other species that depend on the natural underwater world. Noise also makes wild species communicate louder, which can shorten their lifespan.

MEASURES TO CONTROL POLLUTION

Pollution prevention is any practice that reduces, eliminates, or prevents pollution at its source. P2, also known as "source reduction," is the ounce-of-prevention approach to waste management. Reducing the amount of pollution produced means less waste to control, treat, or dispose of. Less pollution means less hazards posed to public health and the environment.

Pollution prevention approaches can be applied to all potential and actual pollution-generating activities, including those found in the energy, agriculture, federal, consumer and industrial sectors. Prevention practices are essential for preserving wetlands, groundwater sources and other critical ecosystems - areas in which we especially want to stop pollution before it begins.

In the energy sector, pollution prevention can reduce environmental damages from extraction, processing, transport and combustion of fuels. Pollution prevention approaches include:

Increasing efficiency in energy use;

Use of environmentally benign fuel sources.

Some of the most used techniques are:

- Wastewater treatment.
- Solid-waste management.
- Air pollution control.
- Hazardous-waste management.
- Emissions trading.
- Carbon sequestration.
- Flue gas treatment.
- Electrostatic precipitator.

In homes and schools examples of P2 practices include:

Using reusable water bottles instead of throw-away

Automatically turning off lights when not in use

Repairing leaky faucets and hoses

Switching to "green" cleaners

LIMITATIONS

Pollution control, in environmental engineering, any of a variety of means employed to limit damage done to the environment by the discharge of harmful substances and energies. Specific means of pollution control might include refuse disposal systems such as sanitary landfills, emission control systems for automobiles, sedimentation tanks in sewerage systems, the electrostatic precipitation of impurities from industrial gas, or the practice of recycling. For full treatment of major areas of pollution control, *see* air pollution control, wastewater treatment, solid-waste management, and hazardous-waste management.

Next to the conservation of species from the loss of biological diversity, the control of pollution is the conservation problem of greatest magnitude; it might even be argued that pollution control is more urgent and important. Ultimately, the control of pollution involves a number of social decisions: 1) not to allow the escape into the environment of substances or forms of energy that are harmful to life, 2) to contain and recycle those substances that could be harmful if released into the environment in excessive quantities, and 3) not to release into the environment substances that persist and are toxic to living things. The knowledge and technology needed to put these decisions to work are now available. Pollution control does not mean an abandonment of existing productive human activities but their reordering so as to guarantee that their side effects do not outweigh their advantages.

SOLUTION

Over the course of the twentieth century, growing recognition of the environmental and public health impacts associated with anthropogenic activities (discussed in the chapter Environmental Health Hazards) has prompted the development and application of methods and technologies to reduce the effects of pollution. In this context, governments have adopted regulatory and other policy measures (discussed in the chapter Environmental Policy) to minimize negative effects and ensure that environmental quality standards are achieved.

The objective of this chapter is to provide an orientation to the methods that are applied to control and prevent environmental pollution. The basic principles followed for eliminating negative impacts on the quality of water, air or land will be introduced; the shifting emphasis from control to prevention will be considered; and the limitations of building solutions for individual environmental media will be examined. It is not enough, for example, to protect air by removing trace metals from a flue gas only to transfer these contaminants to land through improper solid waste management practices. Integrated multimedia solutions are required.

CONCLUSION

Ecosystems are impacted by air pollution, particularly sulphur and nitrogen emissions, and ground-level ozone as it affects their ability to function and grow. Emissions of both sulphur dioxide and nitrogen oxides deposit in water, on vegetation and on soils as "acid rain", thereby increasing their acidity with adverse effects on flora and fauna. Ultimately, acidification affects the ability of ecosystems to provide "ecosystem services", such as for example nutrient cycling and carbon cycling, but also water provision, on which the planet and human life is dependent.

Even worse, ultimately human populations are also affected. Harmful concentrations of pollutants may directly enter our drinking water, notably through ground water seepage. Equally, water quality may be deteriorated as air pollution negatively affects vegetation which helps to naturally filter our water systems. Affected vegetation also has negative consequences on another important ecosystem service: that of capturing carbon and thereby reducing the impacts of climate change.

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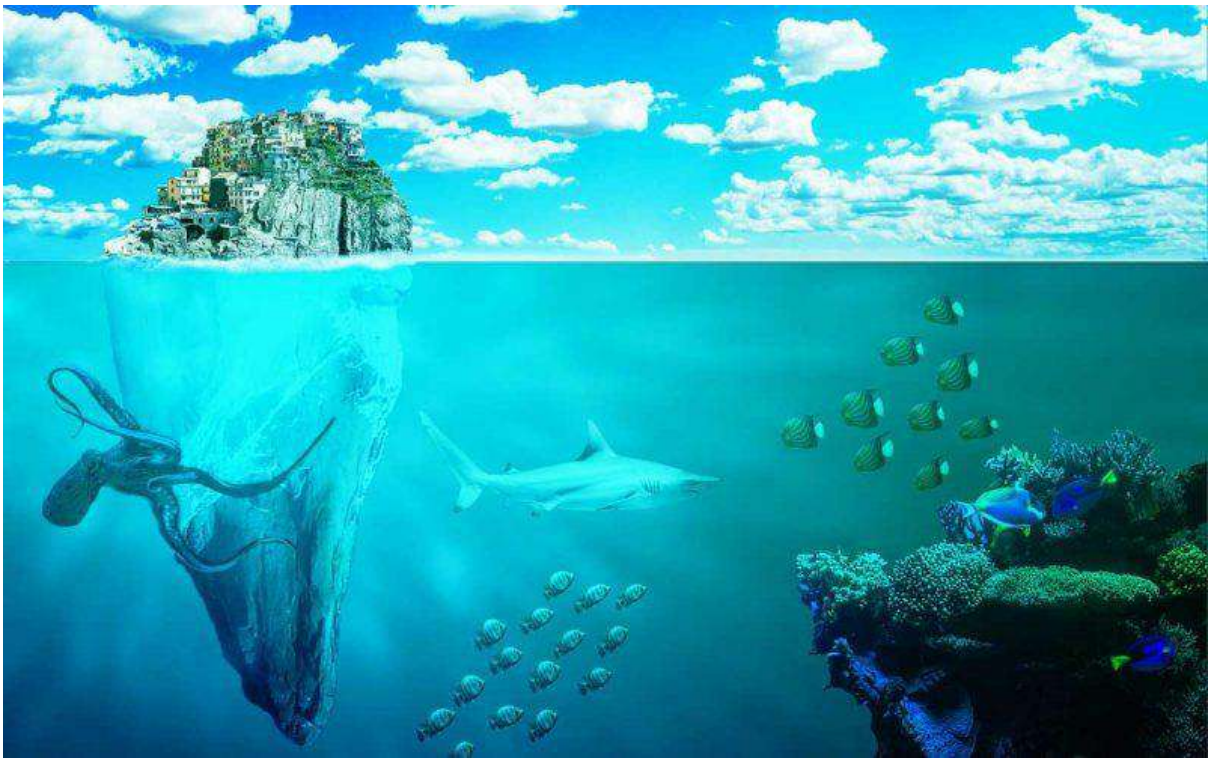
INDEX

INTRODUCTION

An ecosystem is made up of all of the living and nonliving things in an area. This includes all of the plants, animals, and other **living things** that make up the communities of life in an area. An ecosystem also includes nonliving materials—for example, water, rocks, soil, and sand. A swamp, a prairie, an ocean, and a forest are examples of ecosystems.

An ecosystem usually contains many different kinds of life. A grassland, for example, is an ecosystem that contains more than just grass. It includes other plants, mammals, insects, earthworms, and many tiny living things in the soil.



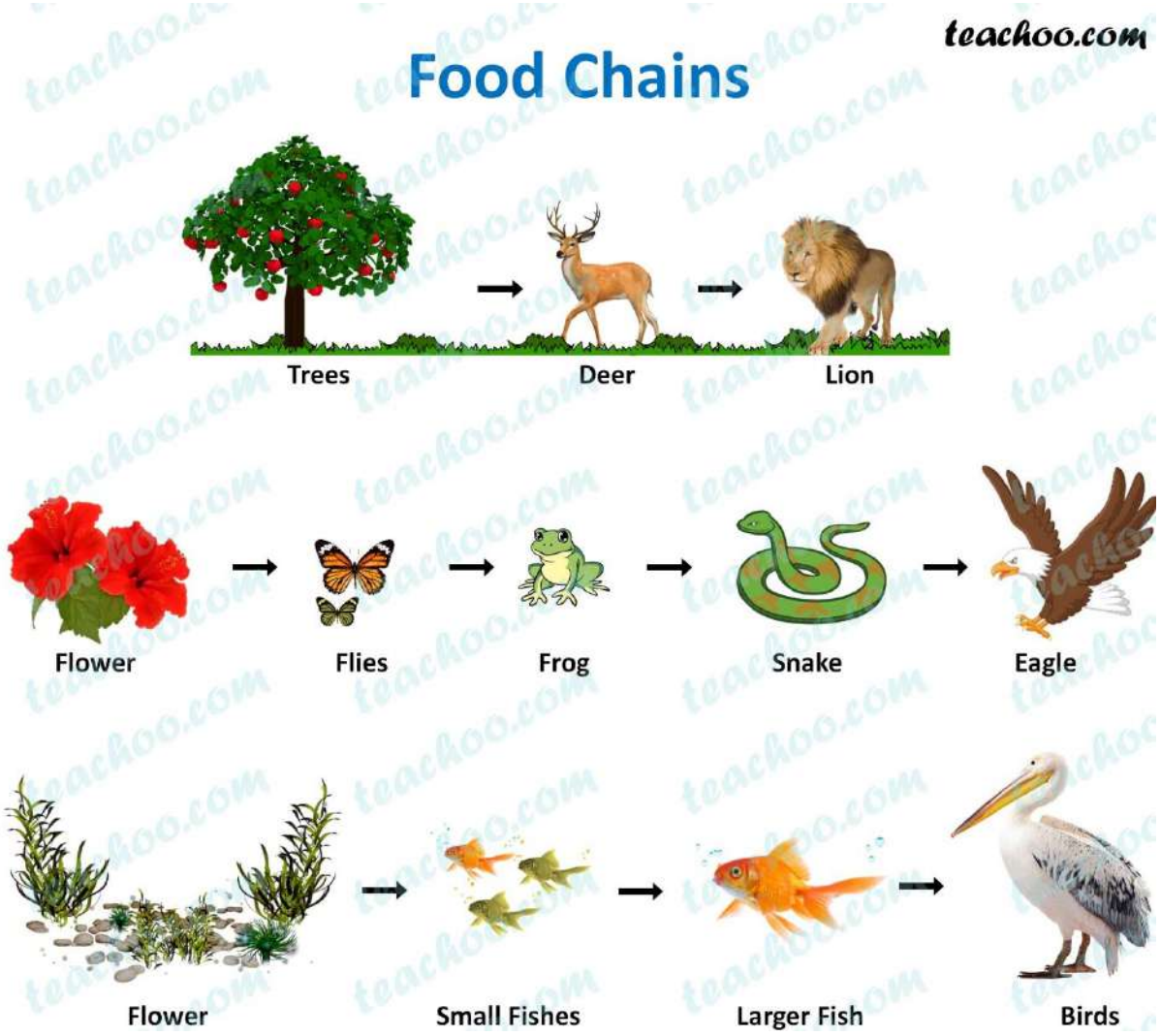
THREE ROLES

Each living thing in an ecosystem has a role to play—as a producer, a consumer, or a decomposer. Green plants are producers. They make their own food through a process called photosynthesis. Animals, including humans, are consumers. They eat, or consume, plants or other animals. Bacteria and other living things that cause decay are decomposers. Decomposers break down the waste products and dead tissue of plants and animals. They return nutrients to the soil, where new plants grow. The way that producers, consumers, and decomposers provide nutrients for one another is called a **food chain**.

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

FEEDING LEVELS

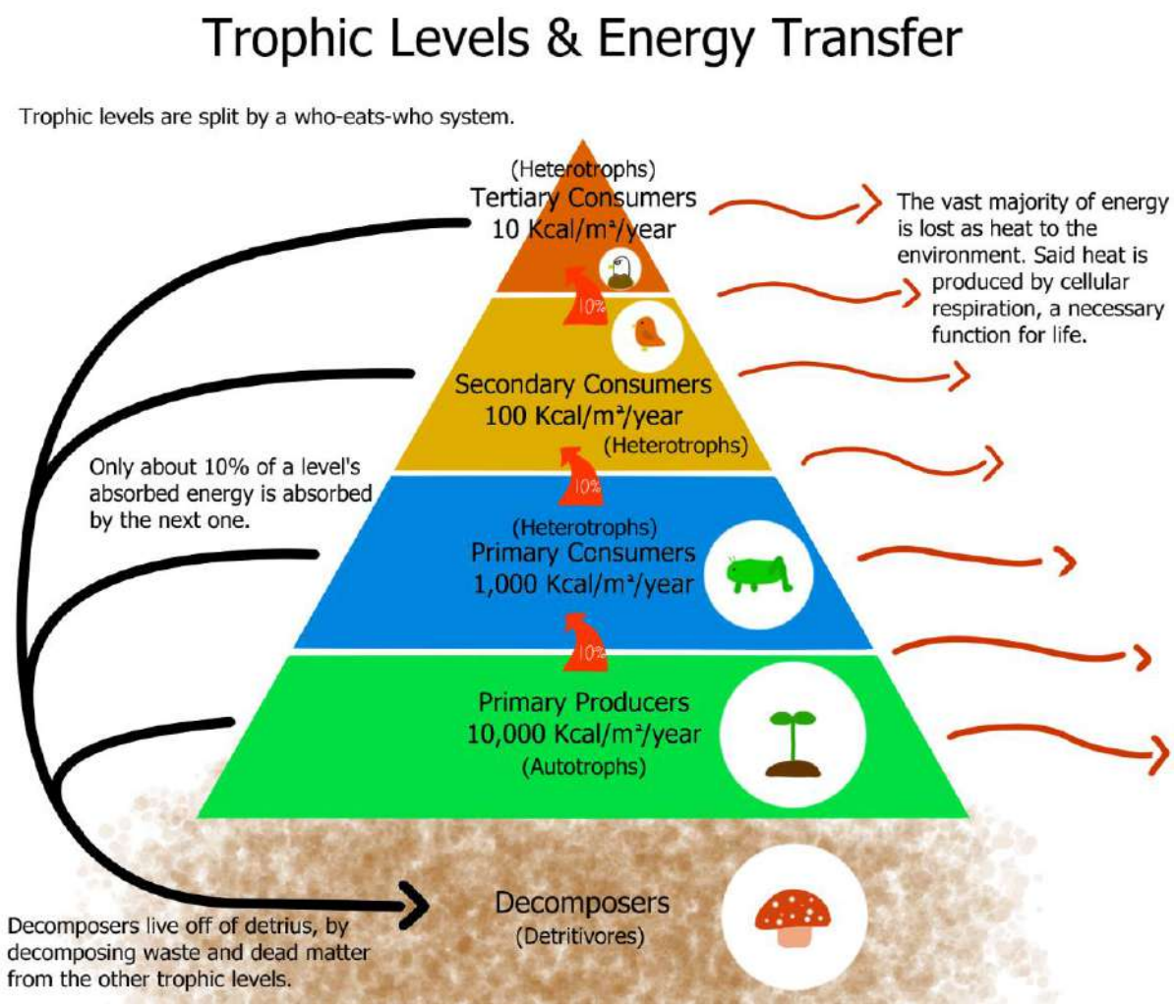
A food chain describes the order in which matter and energy move through the feeding levels of an ecosystem. The levels of a food chain are essentially the same across all ecosystems. The first level is the producers. After that is the consumers. Sometimes consumers are further divided into primary consumers, secondary consumers, and tertiary consumers. The final link in all food chains is the decomposers, which break down dead organisms and natural waste.



ENERGY FLOW

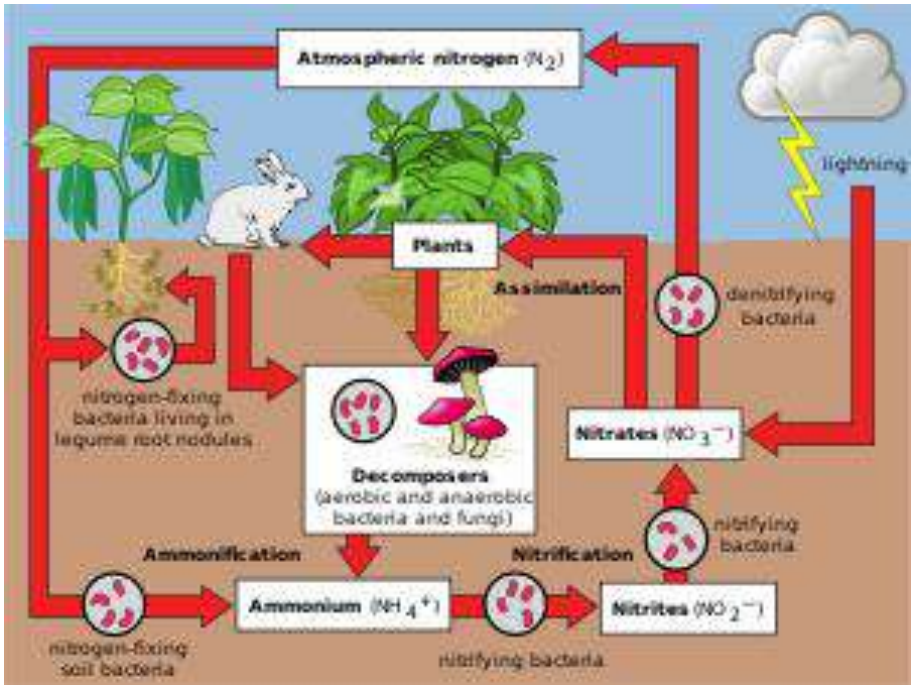
The main source of energy in almost all ecosystems is the Sun's energy. As energy moves through the ecosystem, much of it is lost at each feeding level as heat. This is the main reason why few food chains have more than five feeding levels. Diagrams called energy pyramids are used to show the flow of energy from one feeding level to the next in a food chain. Most ecosystems have more than one food chain. Food chains overlap and connect to form a food web.

The consumers at the top feeding level of a food chain are called top predators. They have no predators. Instead, their population size is controlled through competition.



RECYCLING NUTRIENTS

Water, carbon, nitrogen, and other elements constantly circulate through an ecosystem. Carbon and oxygen from carbon dioxide as well as nutrients from soil enter into plant tissues. When consumers eat the plants, the nutrients enter the consumers' tissues. Consumers that are eaten transfer the nutrients on to the predator at the next feeding level. Consumers that are not eaten die and transfer nutrients in their decaying tissues to the decomposers that feed on them. The decomposers recycle these nutrients back into the ecosystem. They transfer the nutrients back into the soil and air, where the nutrients become available to producers.



A DELICATE BALANCE

An ecosystem's health depends on a delicate balance among all its members and the **environment**. If something disturbs the balance, the ecosystem and all its members may suffer. Natural things that can disturb ecosystems include a changing climate and natural disasters. Human activities that can disturb ecosystems include polluting and clearing land for farms or buildings.

Humans also are responsible for many invasive species. An invasive species is a living thing that spreads through an ecosystem where it did not exist before. Invasive species can threaten the plants and animals that originally made up the ecosystem. For example, Burmese **pythons** were brought to **Florida** as **pets**. Some pythons escaped and began reproducing in the wild. Their skill at hunting has decreased the number of wood rats and storks in the area.

CONCLUSION

Ecology is a scientific approach to the study of of the biosphere. Ecosystems are created by the interrelationships between living organisms and the physical environments they inhabit (land , water, air).

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What is Climate Change?

- Climate is the average weather at a given point and time of year, over a long period (typically 30 years).
- We expect the weather to change a lot from day to day, but we expect the climate to remain relatively constant.
- If the climate doesn't remain constant, we call it climate change.
- The key question is what is a significant change – and this depends upon the underlying level of climate variability

WEATHER IS:

- Short term
- Limited area
- Can change rapidly
- Difficult to predict

WEATHER is what's happening outside of our window right now.

CLIMATE is the average of many years of weather observation.

CLIMATE IS:

- Long term
- Wide area
- Seasonal changes
- Measured over long spans of time

Effects of Climate Change

- An average increase in Earth's temperature during the last century
- Migrating birds are forced to change their time and place of migration
- Melting of glaciers will lead to higher sea level, which will cause floods and put many low-elevation regions at risk of disappearing under water
- Longer summers can disrupt animal habitation
- New and widespread diseases because of warm climate
- Damaged crops due to sudden climate change and floods
- Average precipitation increase around the world
- Melting of polar ice—polar bears and other animals are drowning
- Droughts, heat waves, extreme winters and storms, hurricanes, typhoons

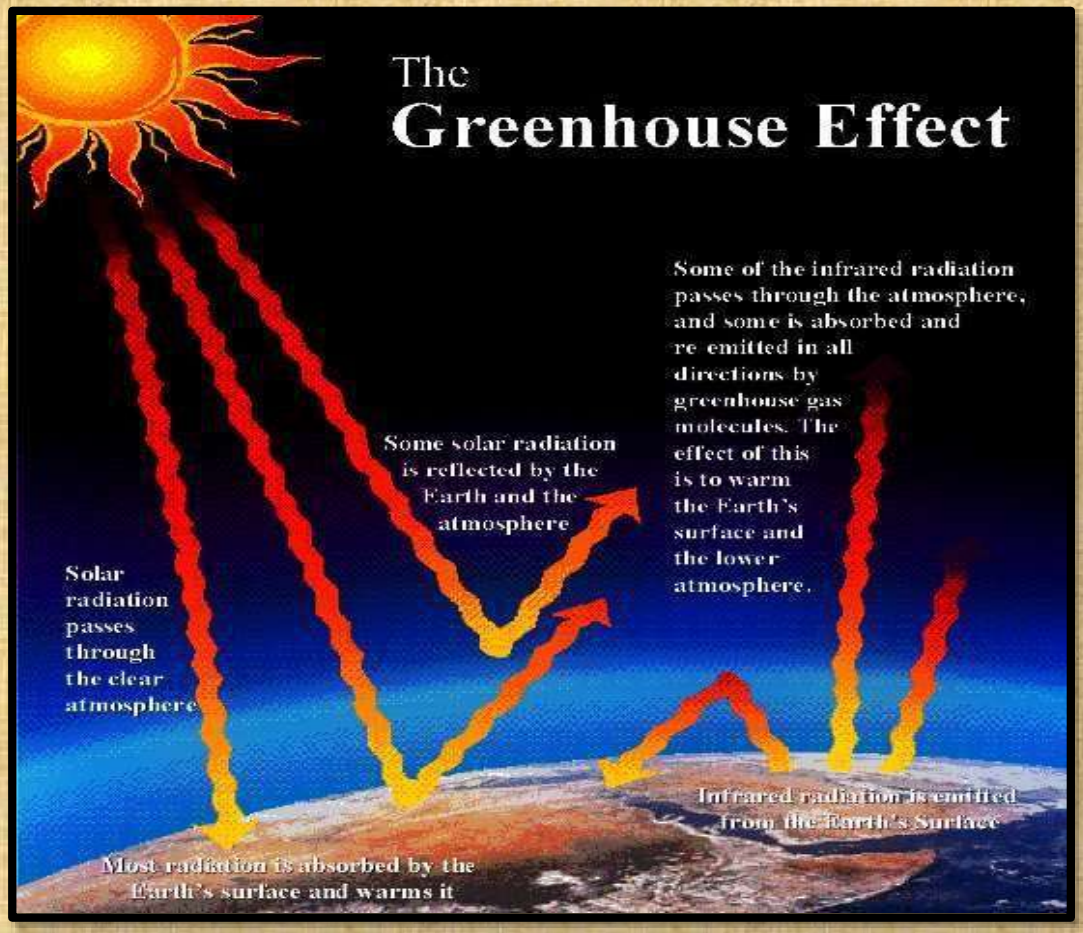
MAIN CAUSES OF CLIMATE CHANGE

1) Human Causes
    i) Greenhouse Effect
    ii) Deforestation
    iii) Burning of Fossil Fuel
2) Natural Causes
    i) Volcanic Eruptions
    ii) Ocean Currents
    iii) Solar Variations

HUMAN CAUSES (Anthropogenic or Man-made cause)

- Greenhouse gases
- Deforestation
- Coal mining
- Burning of fossil fuels
- Industrial processes
- Agriculture

- In a way, the earth is like a glasshouse. The earth has some very important gasses in the atmosphere that keeps us warm. Some of these gases are water vapour, carbon dioxide,
nitrous oxide and methane. When the sun heats the earth, these gases keep the heat
on the earth's surface. Without these gases, heat would escape back into space and Earth’s average temperature would be about 60°F colder.

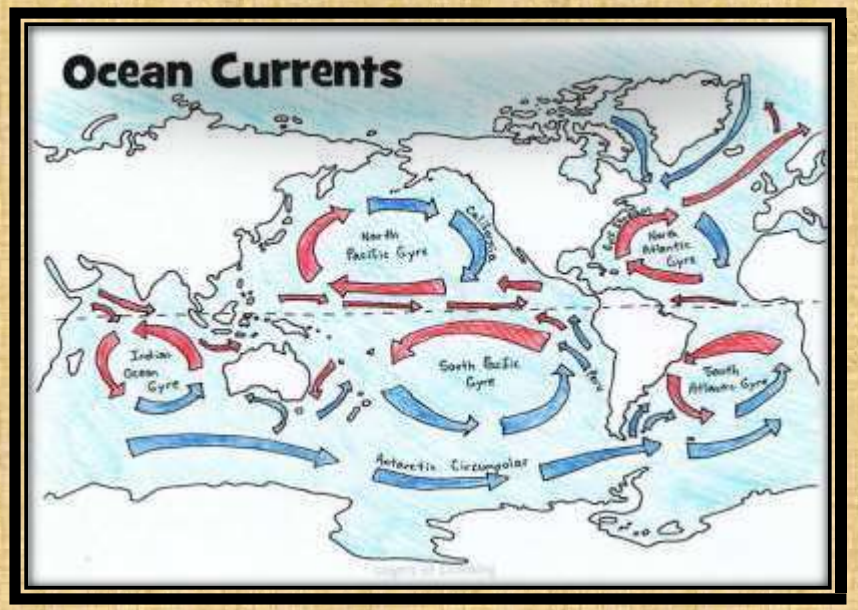


Deforestation, clearance, clear cutting or clearing is the removal of a forest or stand of trees from land which is then converted to a non-forest use. *Deforestation* can involve conversion of forest land to farms, ranches, or urban use.

The **burning of fossil fuels** by humans is the largest source of emissions of carbon dioxide, which is one of the greenhouse gases that allows radioactive forcing and contributes to global warming

NATURAL CAUSES

- Volcanic eruptions
- Ocean currents
- Solar Variation



SOLUTIONS

- **Introduce automobiles with new fuel system which reduces 90% pollution**
- **Engages with businesses to reduce carbon emissions**
- **Make others aware about the problem**
- **Build E-waste recycling factory**
- **Reduce vehicle use**
- **Improve energy-efficiency in buildings**
- **Develop carbon capture and storage processes**
- **Triple nuclear power**
- **Improve soil carbon management strategies**

Summary

◉Global surface temperatures have risen by about 0.6°C since 1900

◉It is likely that this warming is larger than for any century since 200AD, and that the 1990s were the warmest decade in the last millennium.

◉The warming differs in different parts of the world, but over the last 25 years, almost everywhere has warmed, and very few places have cooled.

◉Other changes have occurred, e.g.:

- Sea level has risen by about 20 cm,
- Ocean heat content has increased,
- Almost all mountain glaciers have retreated

◉Coincident with this global warming, levels of CO_2 (and other 'greenhouse' gases) have dramatically increased, to levels higher than those experienced for maybe millions of years.

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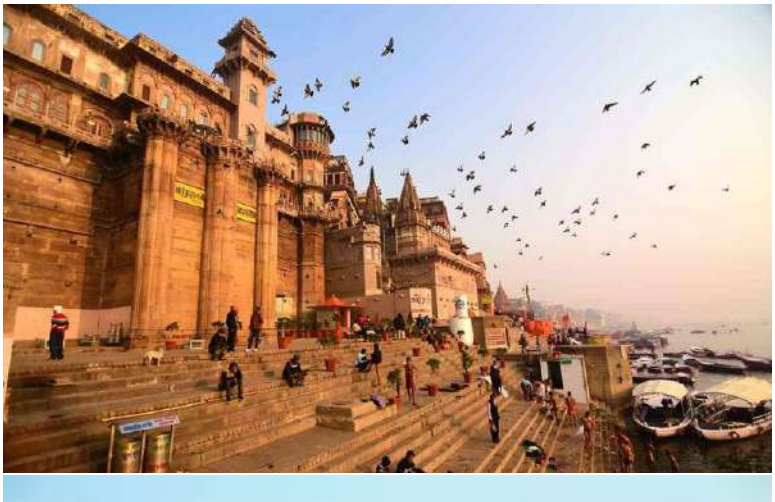
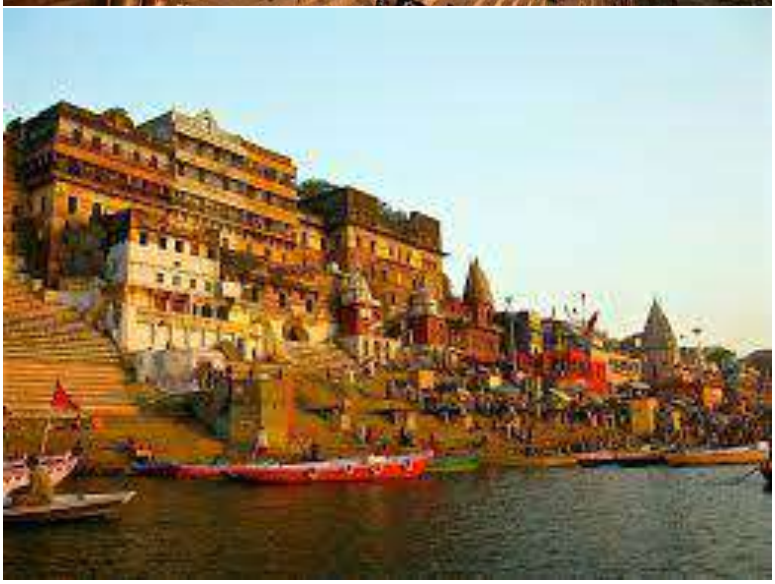




The Pollution of Ganga

PRÉCIS

A report on the Pollution of the most Pious and Important River In India. Ganga is not only a River but a deity, a mother a nourisher. But we have manhandled her and are pushing Gangaji to her Demise.

Introduction

The year was 2011, India had just won the World Cup everything was excellent and Dandy. Amongst all this, a small nugget of news was overlooked by most but impacted me a lot.

The news was bout a Saint, Swami Nigamanand, who had done something Historic.

He had given his Life for GANGA.

Yes, the saint had fasted for 115 days to force the Government into Taking action and clean the River Ganga. But alas, after 115 days, he sadly passed away, and Ganga kept getting Dirtier.

More recently, in 2018, Mr GD Agarwal, an environmentalist and ex-professor of IIT Kanpur, tried to follow in Swami Nigamanand's footsteps.

He, too, went on a fast for 111days to protest the government's alleged inaction in taking measures to make the Ganga free of pollution and free-flowing. But again, after 111 days, he suffered a cardiac arrest and passed away.

So, this project is a tribute to both these gentlemen, who tried to raise their voice against an injustice that has been happening for ages.

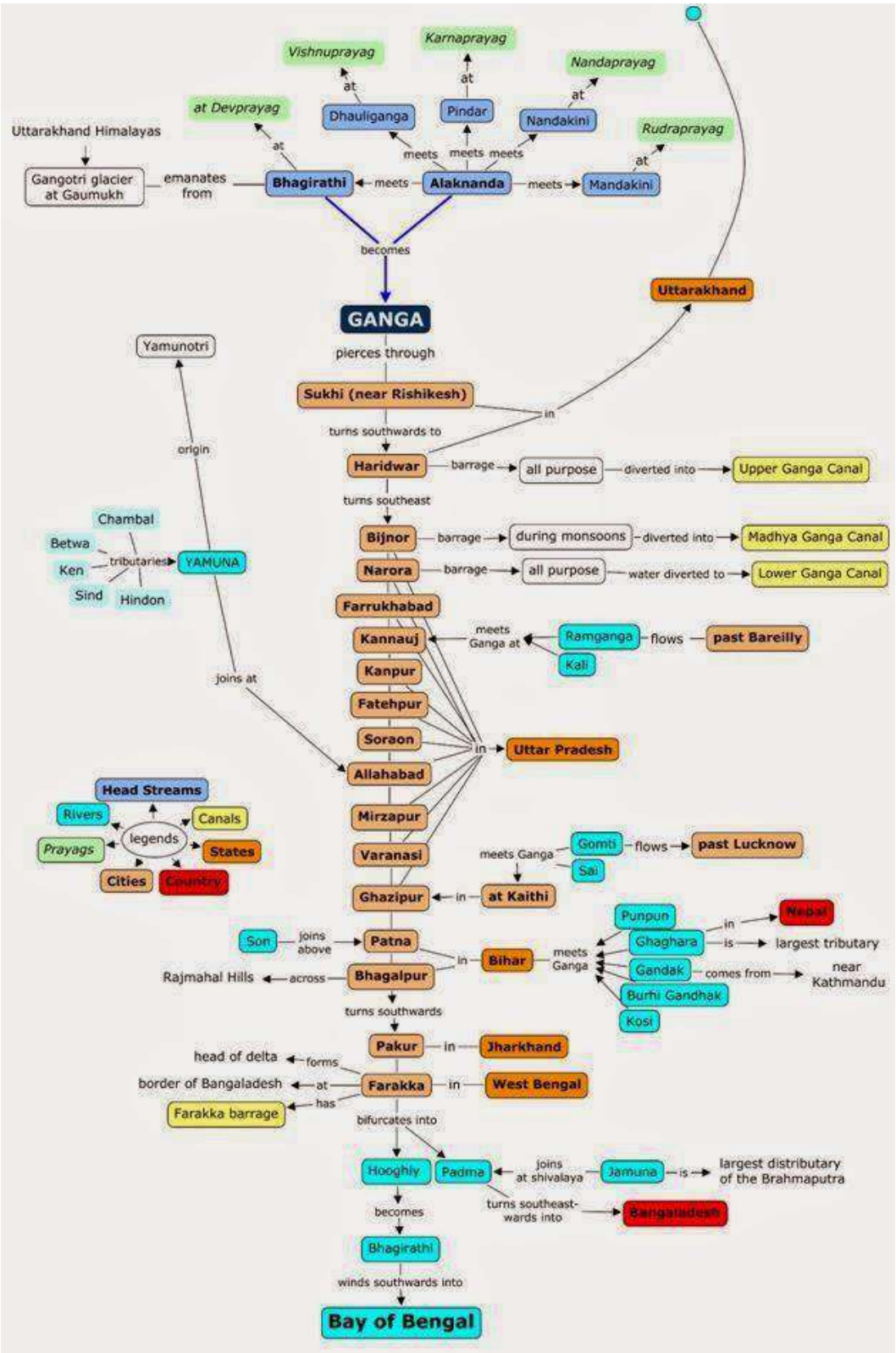
Ganga is the holiest and purest of all the Rivers in Hindu Mythology. Thought to have been an extension of the Milky Way Galaxy Ganga, it has always been worshipped and revered. For centuries civilizations were born and Flourished on its banks. Even today, the world one of the oldest cities, Varanasi, is located on the Banks of Gangaji.

However, this has not stopped us from spitting in Gangaji, even for a moment.

In its 2525 km, Ganga passes through four Major states of India, Uttarakhand, Uttar Pradesh, Bihar, and West Bengal, before draining into the Bay of Bengal near Gangasagar.

In my project, we shall, first, look at the causes of pollution in the Ganges River and then try and see what the Government has done to rectify these problems. In the end, we shall also suggest changes to expedite the cleaning process of the river to End these pollutions of Gangaji.

Flow of Ganga through India



Causes of Pollution of the Ganges

Industries

One of the major contributing factors to the Pollution of the Ganges River is the Industries.

- **Uttarakhand -** There are 4600 industries in Uttarakhand alone, out of which 298 are seriously polluting industries. Many industries have not taken permission from the Uttarakhand pollution control board for their operations. They started their process based on the government's advisory in which the government exempted certain classes of industries from taking permission. The sewage treatment and advanced technology for treating the wastes are not used despite strict government regulations.

Image of Domestic Water Dumping in Ganga at Hardwar

- **Uttar Pradesh -** According to a 2013 CPCB survey, Kanpur is home to about 475 of the total 764 ‘grossly polluting’ industries that have come up along the Ganga as it traverses the country. The CPCB has identified this belt as the one ‘requiring maximum attention

A study was conducted during the summer months of three consecutive years - 2016 to 2018. Researchers concluded that the middle reach of the Ganges (518 km) between Kanpur and Varanasi, to be the most polluted region.

The report states, "***Kanpur flushes 54 million liters per day (MLD) of industrial waste and Assi drain at Varanasi that releases more than 66 MLD of sewage waste into the river***".

Tanneries constitute a significant contributor to the pollution in the river. According to the CPCB, there are about 400 tanneries in the Jajmau area of Kanpur alone, generating about 50 MLD (million litres per day) of waste.

While every tannery must set up an effluent treatment plant (ETP), most ETPs are allegedly lying unused.

Rakesh Jaiswal, the founder of Eco Friends, an NGO working towards the protection of Ganga, claims many tanneries directly discharge waste into the river flouting the environmental norms.

"It has been observed that the primary treatment…is not satisfactory," said a 2016 CPCB report.

Sewage

Sewage is an important source of pollution and contributes 75% to the pollution caused by all sources of pollution. Urban development of different sizes contributes to sewage pollution in the river. The considerable efforts by the Ganga Action Plan are not able to improve the situation.

A report says that despite the failure of the Ganga Action Plan, there is no disapproval on the part of the citizens as well as their representative living in urban areas on the banks of the river. The failure is on the part of the government agencies responsible for the effective implementation of the plan.

The urban citizens residing near the river show a lack of interest in the cleanliness of the river. The representatives of the urban areas are not receiving enough complaints from the citizens, and as a result, they refrain from raising this issue to the higher authorities. Based on the analysis done by the independent sources, the political parties show reluctance to increase the taxes

because they may lose the support of their voters. The tariffs will help the authorities to have financial validity.

The Kanpur Nagar Nigam has to pay operation and management taxes to the Uttar Pradesh Jal Nigam to operate and maintain the services in the Ganga Action Plan.

However, the Kanpur Nagar Nigam is unable to collect taxes from the users of the services of the Ganga Action Plan to pay to the Uttar Pradesh Jal Nigam. So, the government directly transfers the money to the Uttar Pradesh Jal Nigam by cutting the share of the Kanpur Nagar Nigam.

It has been contended that the decentralization of funds and functionaries will help in improving the condition of the governance at the Urban Level. But, the urban local bodies are neither motivated nor passionate to do the assigned duty.

Free draining of Sewerage in Ganga

Municipal Corporation

These are the following factors contributing to the waste in the river:

PLASTIC

The use of plastic by people at large and its improper disposal ultimately reach the river. Plastic pollution has been considered as one of the significant reasons for the pollution in the river. The government has failed to implement Management and Sewage Waste Rules to curb the menace of plastic pollution.

The state should declare a complete ban on the use of plastic. The authorities pay no attention to the rampant use of plastics and the improper treatment of wastes before releasing them in the river. The pollution level of water has exponentially risen because of plastic garbage. The Tribunal to deal with the pollution on Ghats has banned plastic in the vicinity of Ghats.

However, the ban imposed by the Tribunal does not affect the ground level, and the plastics are used rampantly. The plastic bags can be replaced by jute bags, which are nature friendly.

GHATS

The Ghats are also one of the significant sources of pollution in the river. Ganga is one of the essential parts of our Indian culture due to which different kinds of pujas and other religious tasks are performed on the Ghats, and the materials used are disposed of in the river. The materials are non-decomposable, highly toxic and hence pollute the river.

Daily pollution at Ganga Ghats

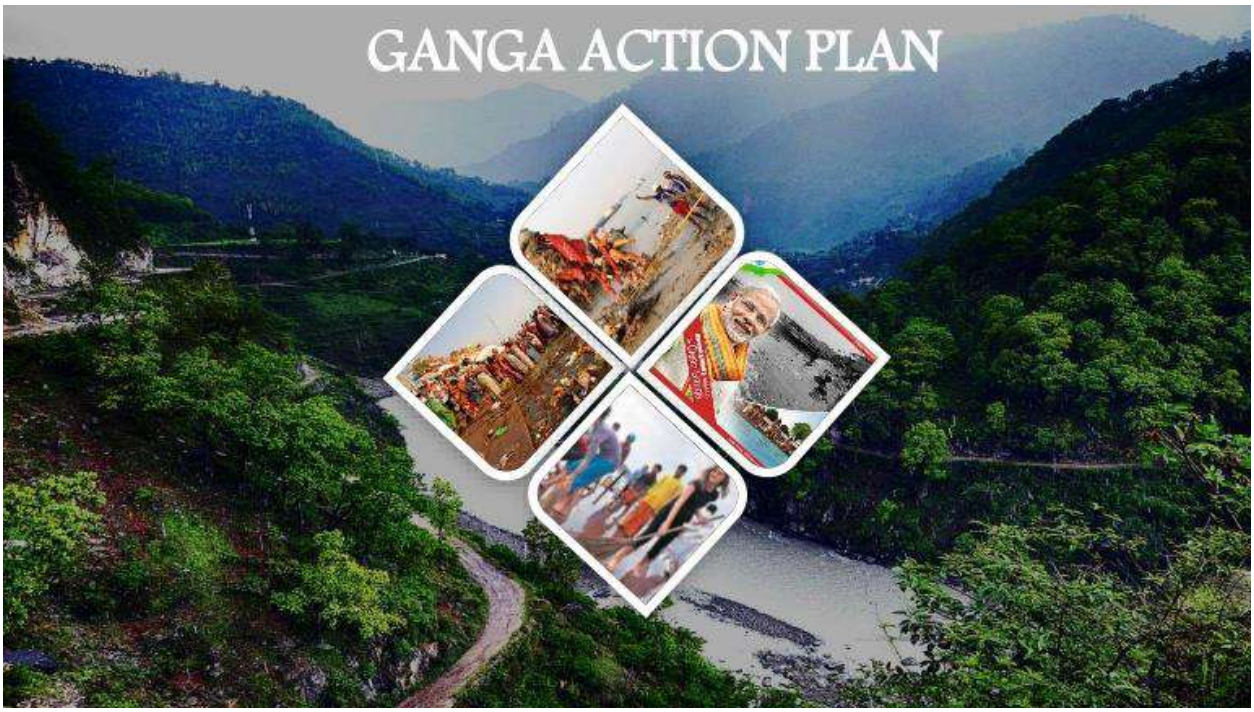
Agriculture Waste

Agricultural water pollution includes 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 different entities. When washed through the irrigation, rain or drainage to the river, large quantities of fertilizers pollute 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.

Effective Measures by Government to stop the Pollution

Ganga Action Plan



The Ganga Action Plan was started in 1986 for control of water pollution in the river Ganga. The primary function of this plan was to make the Ganga River free from pollution. Mainly from the disposal of waste from the cities settled on the banks of the river. The goal 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 they launched a Ganga action plan in 1986 to make the Ganga pollution-free.

The late Rajiv Gandhi inaugurated the first phase of the Ganga action plan at Rajendra Prasad gnat of Banaras.

The National Protection Agency was constituted for its implementation. During the first phase of the Ganga Action Plan, 256 schemes of 462 crores were undertaken in Uttar Pradesh, Bihar and West Bengal. Unique stations have been created to check the quality of water.

The government appointed experts from Bharat Heavy Electricals Limited and National Environment Engineering Research Institute to check the water quality. 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 pollution.

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.

Namami Ganga Programmed

A flagship Namami Ganga Programmed was launched under separate union Water Ministry created under river rejuvenation programme. The project aims to integrate Ganga conservation mission and it is in effect to clean and protect the river and gain socio-economic benefits by job creation, improved livelihoods and health benefits to the population that is dependent on the river.

The key achievement of the Namami Ganga projects are:

1. Creating sewage treatment capacity- 63 sewerage management project under implementation in the states of Uttarakhand, Uttar Pradesh, Bihar and West Bengal. 12 sewerage management projects launched in these projects.

2. Creating riverfront development: 28 riverfront development projects and 33 entry-level projects for construction, management and renovation of 182 Ghats and 118 crematoria has been initiated.

3. River surface cleaning: The river surface cleaning is the collection of solid floating waste on the Ghats and rivers. After collection, these wastes are pumped into the treatment stations.

4. Public Awareness: Various activities such as seminars, workshops and conferences and numerous activities are organized to aware the public and increase the community transmission.

5. Industrial Effluent Monitoring: The Grossly Polluting Industries monitored on a regular basis. Industries are following the set standard of the environmental compliances are checked. The reports are sent directly to the central pollution control board without any involvement of intermediaries.

Suggestions

These are the following suggestion for making the existing machinery robust to expedite cleanliness process of the Ganga:

Development of a comprehensive and basic plan

We need to develop a plan by which we can reach the problem in a holistic way. The already devised plans involve many intermediaries wherein the transparency factor is cornered and only paper works are shown to the people at large.

The strategy should be formulated for different areas according to their demand. The people having apt knowledge of that area should be involved to know the actual problem of pollution in the river. A thorough check should be done and a customer-friendly platform should be formed wherein the views of every individual should be considered.

Measurement of the quality

The apt instruments are required to measure the quality of the water. We have many schemes for the cleanliness of the Ganga but the officials assigned the duty of measuring the quality of water either have authoritarian pressure or lack of knowledge to assess the quality of water. The quality of water should be measured by a recognized testing agency. Further, the research should be made to evolve better machinery for precision in quality measurement.

Getting the institutions right

The main task is to get the involved institution on the right path. The river cleaning task demands leadership, autonomy and proper management. The cities need to be amended. Ultimately they will be the custodians of the networks developed for the cleanliness process. Many cities have weak financial powers and their revenue generation is also weak so they should be given extra incentives. An awareness campaign should be launched in small cities where people have no idea about the pollution of the river and how it affects the environment.

Engaging and mobilizing all the stakeholders

The inhabitants of the river Ganga are people, elected representatives, and the religious leaders who consider the river as a pious and clean river. The mass awareness campaign can launch only when these people will be under sound financial conditions. So, if a portion is invested in these people, then it will help to develop their thinking on a large scale.

A similar situation has arisen in Australia where the government has invested 20% of the funds in creating mass awareness among the people for the cleanliness of the Murray River basin. It has shown a great impact on the productivity of the programmes implemented in Australia. So, when we promote all the stakeholders in one or the other way we can see a holistic development in the situation.

Rejuvenation requires equal attention to quality and quantity

The rejuvenation of rivers requires quality and quantity at the same time. The old adage of "solution to pollution is dilution" should be kept in mind while making any kind of plan.

The improvement of water quality in Ganga during the Kumbh Mela is the result of the release of water barrage of the water upstream. The water in the upper stream is used in the agriculture process by the respective states. So, if the water is released on a regular basis it will also help to improve the quality of the water and reduce the pollution level in the water.

Conclusion

Ganga is considered a holy river in the religious scriptures. The current situation demands holistic Accountability from the authorities and people to make it clean. The cleanliness of our rivers projects the global image.

The river Ganga is a part of our culture, and we have to maintain its sanctity. The government should formulate a more stringent policy to develop the quality of the water in the river. Authorities should make the people follow the environmental laws strictly and punish the violators strictly.

We should not wait for another Swami Nigamanand, Mr GD Agarwal, to come and show us the way. It must be us who take Accountability for the situation and work diligently to make Ganga into Gangaji. Not only in name but also in form.

Acknowledgements

I would like to express my special thanks of gratitude to my teachers of Environmental Studies as well as our HOD who gave me the golden opportunity to do this wonderful project on the topic The Pollution of Ganga which also helped me in doing a lot of Research and I came to know about so many new things.

I am really thankful to them.

Any attempt at any level can‘t be satisfactorily completed without the support and guidance of my parents and friends.

I would also like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project, despite of their busy schedules, they gave me different ideas in making this project unique.

And finally thanks to Bill Gates, Larry Page and Mark Zuckerberg for Microsoft, Google and Facebook. Without them this Project would never have been possible.

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SCOTTISH CHURCH COLLEGE

COLLEGE ROLL NO.- ECOA20M260

UNIVERSITY OF CALCUTTA

C.U. ROLL NO.- 203223-21-0189

C.U. REGISTRATION NO.- 223-1111-0640-20

PROJECT: ENVIRONMENTAL POLLUTION

INTRODUCTION

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 component of the ecosystem i.e. air, water or soil which can cause harmful effects on various forms of life and property.

Any substance which causes harmful effects or uneasiness in the organisms, then that particular substance may be called as the pollutant.

These types of pollution are mostly found in our locality:

AIR POLLUTION

Air pollution is the presence of one or more disadvantageous content in such quantity and for such duration, as it is catastrophic to human health and welfare, animal or plant life. It is the

contaminants of air by the discharge of detrimental substances.

Sources:

Industries, vehicles, power plants, emission and burning of fossil fuels, etc.

Effects:

- Problems in the lungs, respiratory systems and causes asthma and bronchitis.
- Severe headache, irritation to mucous membrane, unconsciousness and death.

- Kidney problems, irritation in eyes, nose and throat, hypertension, heart strain.
- Depletion of ozone layer and global warming.

Control Measures:

- Policy measures.
- Modification of industrial process and selection of suitable fuels and its utilization.
- Collection of pollutants and convert it into less toxic forms by different methods.
- Government Initiatives: National air quality monitoring programme

(NAMP) National ambient air quality standards (NAAQS)

WATER POLLUTION

Addition of certain substances such as organic, inorganic, biological and radiological to the water, which degrades the water quality and makes it unhealthy for use. Water pollution is not

only confined to surface water but also spread to groundwater, sea and ocean.

Sources:

Industries like mining, iron and steel, pharmaceuticals, food processing, soap and detergent and paper and pulp. Agricultural sources, thermal pollution (discharge of hot water by thermal power plants cause deficiency of dissolved oxygen in water) and underground water pollution.

Marine pollution: River discharge, manmade pollution and oil spills, etc.

Effects:

- An excessive amount of mercury in water can cause Minamata disease in humans and dropsy in fishes; Lead in large amount can cause dyslexia, Cadmium poisoning causes Itai – Itai disease etc. Polluted water has less amount of Dissolved oxygen (DO) content which is important for sensitive organisms, thereby eliminates sensitive organisms.
- Excess of nitrate in drinking water is dangerous for infants and human health, excess fluoride cause neuromuscular disorder and teeth deformity, hardening of bones and painful joints.

- Biological magnification and eutrophication.

Control Measures:

- Usage of water should be minimized by changing the techniques involved. Recycling and treatment of water should be used to the maximum extent possible.
- The quantity of discharge of wastewater can be minimized.
- Excessive use of pesticides and fertilizers should be avoided.
- Organic farming and efficient use of animal residues as fertilizers.

SOIL POLLUTION

Addition of unwanted substances to the soil which negatively affects physical,

chemical and biological properties of soil and reduces its productivity.

The factors which disturb the biological balance of the soil and deteriorate the quality, texture and mineral content.

Use of fertilizers, pesticides, insecticides, dumping of solid waste, deforestation and pollution due to urbanization and other anthropogenic substances causes soil pollution.

Sources:

Industrial waste: lead, cadmium, mercury, alkalies, organic substances and chemicals.

Agricultural waste: fertilizers, pesticides, insecticides and manures.

Discarded materials and radioactive elements and plastic bags.

Effects:

- Agriculture: It reduces soil fertility and thus crop yields; increase soil erosion and salinity.
- Ecological imbalance and imbalance in flora and fauna further increases.
- Problems in urban areas like clogging in drains, release of gases, foul smells and
- problems in wastewater management.
- Release of radioactive rays, biomagnification and pollutant gases cause health problems.

Control Measures:

- Afforestation, reforestation and use of organic farming.
- Solid waste management and reduction of waste from the construction area.
- Stop the use of plastic bags and use bags of degradable materials like paper and cloth.
- Biomedical waste should be collected and incinerated in incinerators.

Noise Pollution

The word noise is derived from a Latin word ‘Nausea’ which means sickness in which one feels the need to vomit. Any disturbing or unwanted noise that interferes or harms humans or wildlife is known as noise pollution.

The intensity of sound is measured in decibels (dB). The faintest sound which can be heard by the Human ear is 1 dB.

Sources:

Traffic noise, Air traffic noise, Construction sites, Catering, Night life and Animals, Industrialization, Poor Urban Planning, Social Events, Transportation, Household Chores, Fireworks, Agricultural Machines, Defence Equipment and launching of satellites, Miscellaneous Sources, etc.

Effects:

- Respiratory agitation, racing pulse, headaches and, in case of extremely loud, constant noise, gastritis, colitis and even heart attacks.
- Noise can cause attacks of stress, fatigue, depression, anxiety and hysteria in both humans and animals.
- It may affect people's ability to focus, which can lead to low performance over time. It is also bad for the memory.

Control Measures:

- For people working in noisy installations, ear-protection aids like ear-plugs, ear-muffs, noise helmets, headphones etc. must be provided to reduce occupational exposure.
- Suppression of noise at source.
- Sound Insulation at Construction Stages.
- Planting of Trees
- Legislative Measures

OBJECTIVES OF THE PROJECT

I have many motives behind implementing this project because there is a purpose behind every project.

My purposes behind composing this project:

- To explore new things about our social life, our daily life and specially in the case of knowing every human being.
- To develop new roots and techniques.
- To create awareness among the people.

- To plan for future benefits, etc.

IMPORTANCE OF THE PROJECT

- It estimates the time required for a project to finish through the time management plan.
- Achievement of Strategic Goals: Every successful project delivers our future organisation and help it to accomplish it’s strategic goals.
- Identifies Risk: It is always better to have an insight about the possible financial, social, physical, etc.

- Project planning may encourage creativity and innovation.
- It may motivate employees, students, etc.

ENVIRONMENTAL SCIENCE PROJECT

COLLEGE ROLL NO. :- ECOA20M298
CU ROLL NO. :- 203223-21-0148
CU REGISTRATION NO. :- 223-1111-0498-20

URBAN ECOLOGY

INDEX

URBAN ECOLOGY

Urban ecology is the scientific study of the relation of living organisms with each other and their surroundings in the context of an urban environment. The urban environment refers to environments dominated by high-density residential and commercial buildings, paved surfaces, and other urban-related factors that create a unique landscape dissimilar to most previously studied environments in the field of ecology. The goal of urban ecology is to achieve a balance between human culture and the natural environment.

Central Park represents an ecosystem fragment within a larger urban environment

Urban ecology is a recent field of study compared to ecology as a whole. The methods and studies of urban ecology are similar to and comprise a subset of ecology. The study of urban ecology carries increasing importance because more than 50% of the world's population today lives in urban areas. At the same time, it is estimated that within the next forty years, two-thirds of the world's population will be living in expanding urban centers. The ecological processes in the urban environment are comparable to those outside the urban context. However, the types of urban habitats and the species that inhabit them are poorly documented. Often, explanations for phenomena examined in the urban setting as well as predicting changes because of urbanization are the center for scientific research.

Hyde Park in London represents the same, as Central Park in NYC...

HISTORY

Ecology has historically focused on "pristine" natural environments, but by the 1970s many ecologists began to turn their interest towards ecological interactions taking place in, and caused by urban environments. Jean-Marie Pelt's 1977 book "The Re- Naturalized Human", Brian Davis' 1978 publication "Urbanization and the diversity of insects", and Sukopp et al.'s 1979 article "The soil, flora and vegetation of Berlin's wastelands" are some of the first publications to recognize the importance of urban ecology as adistinct form of ecology the same way one might see landscape ecology as different from population ecology. Forman and Godron's 1986 book "Landscape Ecology" first distinguished urban settings and landscapes from other landscapes by dividing all landscapes into five broad types. These types were divided by the intensity of human influence ranging from pristine natural environments to urban centers.

The creation of an important stream water garden in Metz's centre during the early 70s was one of the materializations of Jean-Marie Pelt's works on urban ecology.

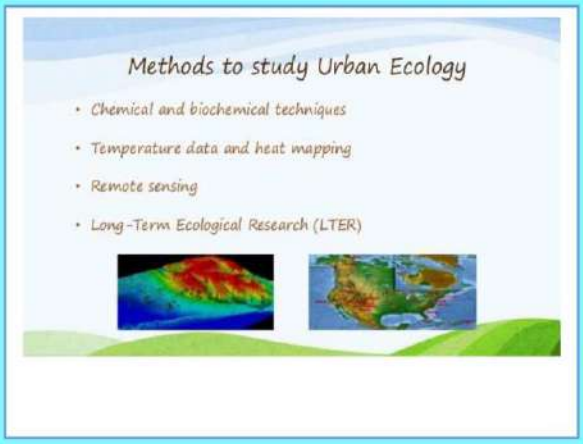
...

Urban ecology is recognized as a diverse and complex concept which differs in application between North America and Europe. The European concept of urban ecology examines the biota of urban areas, the North American concept has traditionally examined the social sciences of the urban landscape, as well as the ecosystem fluxes and processes. The Latin American concept examines the effect of human activity on the biodiversity and fluxes of urban ecosystems. The world's first urban ecology labs were founded, for temperate ecosystems, in 1999 (Urban Ecology Research Laboratory, University of Washington), and for tropical ecosystems, in 2008 Laboratory of Urban Ecology, Universidad Estatal a Distancia of Costa Rica.

Botanical Garden in homage to Jean-Marie Pelt

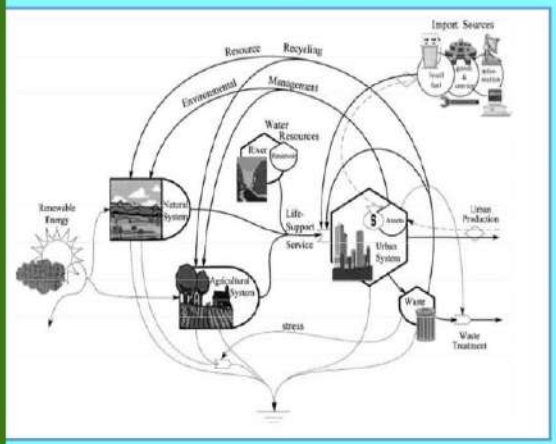
METHODS

Since urban ecology is a subfield of ecology, many of the techniques are similar to that of ecology. Ecological study techniques have been developed over centuries, but many of the techniques use for urban ecology are more recently developed. Methods used for studying urban ecology involve chemical and biochemical techniques, temperature recording, heat mapping remote sensing, and long-term ecological research sites.



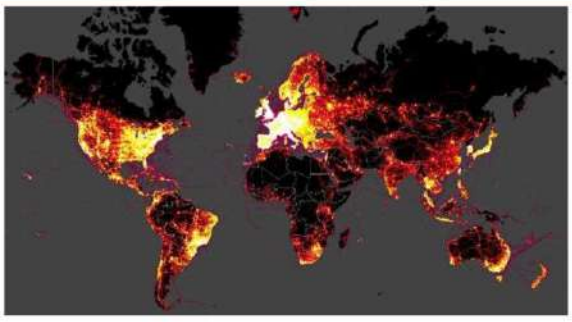
CHEMICAL AND BIOCHEMICAL TECHNIQUES

*Chemical techniques may be used to determine **pollutant concentrations** and their effects. Tests can be as simple as dipping a manufactured test strip, as in the case of pH testing, or be more complex, as in the case of examining the spatial and temporal variation of **heavymetal contamination** due to industrial runoff. Other chemical techniques include tests for **nitrates, phosphates, sulfates,** etc. which are commonly associated with **urban pollutants** such as **fertilizer** and industrial byproducts. These biochemical fluxes are studied in the atmosphere (e.g., **greenhouse gasses**), aquatic **ecosystems** and **soil vegetation**. Broad reaching effects of these biochemical fluxes can be seen in various aspects of both the urban and surrounding rural ecosystems.*



TEMPERATURE DATA AND HEAT MAPPING

Temperature data can be used for various kinds of studies. An important aspect of temperature data is the ability to correlate temperature with various factors that may be affecting or occurring in the environment. Oftentimes, temperature data is collected long-term by the Office of Oceanic and Atmospheric Research (OAR), and made available to the scientific community through the National Oceanic and Atmospheric Administration (NOAA). Heat maps can be used to view trends and distribution over time and space.

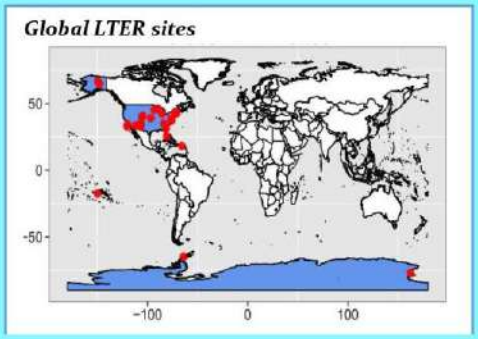


Heat map of the world

REMOTE SENSING & LTERS

Remote sensing of Boston

Remote sensing is the technique in which data is collected from distant locations through the use of satellite imaging, radar, and aerial photographs. In urban ecology, remote sensing is used to collect data about terrain, weather patterns, light, and vegetation. One application of remote sensing for urban ecology is to detect the productivity of an area by measuring the photosynthetic wavelengths of emitted light. Long-term ecological research (LTER) sites are research sites funded by the government that have collected reliable long-term data over an extended period oftime in order to identify long-term climatic or ecological trends. The main purpose of LTERs for urban ecologists



is the collection of vast amounts of data over long periods of time.

URBAN EFFECTS ON THE ENVIRONMENT

*Humans are the driving force behind urban ecology and influence the environment in a variety of ways, such as **modifying** land surfaces and waterways, introducing foreign species, and altering biogeochemical cycles. Some of these effects are more apparent, such as the reversal of the **Chicago River** to accommodate the growing pollution levels and trade on the river. Other effects can be more gradual such as the change in global climate due to urbanization.*

MODIFICATION OF LAND AND WATERWAYS

*Humans place high demand on land not only to build urban centers, but also to build surrounding suburban areas for housing. Land is also allocated for agriculture to sustain the **growing population** of the city. Key examples of this are **Deforestation in the United States** and **Europe**.*

Deforestation in Europe

*Along with manipulation of land to suit human needs, natural water resources such as rivers and streams are also modified in urban establishments. Modification can come in the form of dams, artificial canals, and even the reversal of rivers. Reversing the flow of the Chicago River is a major example. Urban areas in natural desert settings often bring in water from far areas to maintain the human population and will likely have effects on the local desert climate. Modification of **aquatic systems** in urban areas also results in decreased stream diversity and increased pollution.*

Reversing Chicago River took the city out of swamps and turned it into a bustling metropolis.

TRADE, SHIPPING & SPREAD OF INVASIVE SPECIES

*Both local shipping and long-distance trade are required to meet the resource demands important in maintaining urban areas. **Carbon dioxide emissions** from the transport of goods also contribute to accumulating **greenhouse gases** and nutrient deposits in the soil and air of urban environments. In addition, shipping facilitates the unintentional spread of living organisms,and introduces them to environments that they would not naturally inhabit.*

Kudzu unfurling in Lancaster County

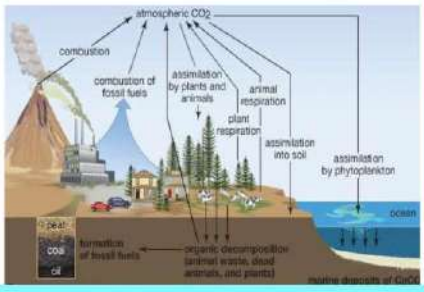
*Alien species often have no natural predators and pose a substantial threat to the dynamics of existing ecological populations in the new environment where they are introduced. Such invasive species are numerous, and include **European starlings**, **brown rats**, **Asian carp**, **Americanbullfrogs**,among others. In Australia, it has been found that removing Lantana (**L. camara**, an alien species) from **urban green spaces** can surprisingly have negative impacts on bird diversity.*

Invasive species on ships

HUMAN EFFECTS ON BIOGEOCHEMICAL PATHWAYS

Urbanization results in a large demand for chemical use by industry, construction, agriculture, and energy

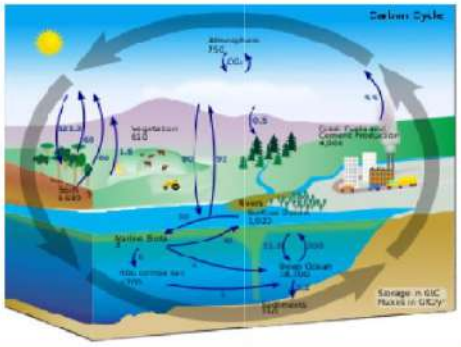
Biogeochemical Cycle



providing services. Such demands have a substantial impact on ***biogeochemical cycles****, resulting in phenomena such as* ***acid rain****,* ***eutrophication****, and* ***global warming****. Furthermore, natural biogeochemical cycles in the urban environment can be impeded due to impermeable surfaces that prevent nutrients from returning to the soil, water, and atmosphere.*

Demand for ***fertilizers*** *to meet agricultural needs exerted by expanding urban centers can alter chemical composition of soil. Such effects often result in abnormally high concentrations of compounds including sulfur, phosphorus, nitrogen, and heavy metals. In addition, nitrogen and phosphorus used in fertilizers have caused severe problems in the form of* ***agricultural runoff****, which alters the concentration ofthese compounds in local rivers and streams, often resulting in adverse effects on native species. A well-known effect of agricultural runoff is the phenomenon of eutrophication. When the fertilizer chemicals from agricultural runoff reach the ocean, an* ***algal bloom*** *results, then rapidly dies off. The dead algae biomass is decomposed by bacteria that also consume large quantities of oxygen, which they obtain from the water, creating a* ***"dead zone"*** *without oxygen for fish or other organisms. A classic example is the dead zone in the* ***Gulf of Mexico*** *due to agricultural runoff into the* ***Mississippi River****.*

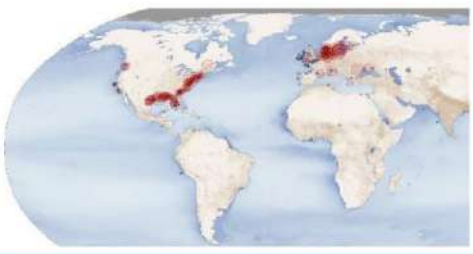
Carbon Cycle



Polluted agricultural runoffs

Just as pollutants and alterations in the biogeochemical cycle alter river and ***ocean ecosystems****, they exert likewise effects in the air. Some stems from the accumulation of chemicals and pollution and often manifests in urban settings, which has a great impact on local plants and animals. Because urban centers are often considered point sources for pollution, unsurprisingly local plants have adapted to withstand such conditions.*

Aquatic Dead Zones

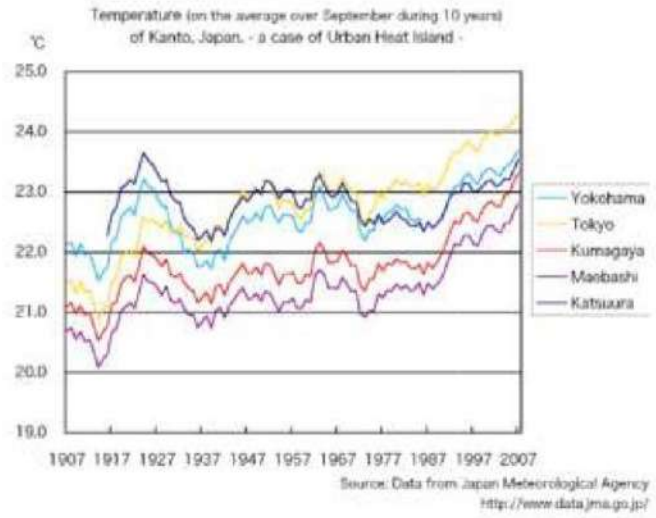


URBAN EFFECTS ON CLIMATE

*Urban environments and outlying areas have been found to exhibit unique local temperatures, **precipitation**, and other characteristic activity due to a variety of factors such as pollution and altered geochemical cycles. Some examples of the urban effects on climate are **urban heat island**, **oasis effect**, **greenhouse gases**, and **acid rain**. This further stirs the debate as to whether urban areas should be considered a unique **biome**. Despite common trends among all urban centers, the surrounding local environment heavily influences much of the climate. One such example of regional differences can be seen through the urban heat island and oasiseffect.*

URBAN HEAT ISLAND EFFECT

*The **urban heat island** is a phenomenon in which central regions of urban centers exhibit higher mean temperatures than surrounding urban areas. Much of this effect can be attributed to low city **albedo**, the reflecting power of a surface, and the increased surface area of buildings to absorb solarradiation. Concrete, cement, and metal surfaces in urban areas tend to absorbheat energy rather than reflect it, contributing to higher urban temperatures. Brazel et al. found that the urban heat island effect demonstrates a positive correlation with population density in the city of Baltimore. The heat island effect has corresponding ecological consequences on resident species. However, this effect has only been seen in temperate climates.*



Graphical representation of the rising temperature in Kanto, Japan due to urban heat island

WAYS TO IMPROVE URBAN ECOLOGY

*Cities should be **planned** and constructed in such a way that minimizes the urban effects on the surrounding environment (urban heat island, precipitation, etc.) as well as **optimizing ecological activity**. For example, increasing the **albedo**, or reflective power, of surfaces in urban areas, can minimize urban heat island, resulting in a lower magnitude of the urban heat island effect in urban areas. By minimizing these abnormal temperature trends and others, ecological activity would likely be improved in the urban setting.*

SPECIES REINTRODUCTION

*Reintroduction of species to urban settings can help improve the local **biodiversity** previously lost; however, the following guidelines should be followed in order to avoid undesired effects:*

- *No predators capable of killing children will be reintroduced to urbanareas.*
- *No introduction of species that significantly threaten human health, pets, crops or property.*
- *Reintroduction will not be done when it implies significant suffering to the organisms being reintroduced, for example stress from capture or captivity.*
- *Reintroduced organisms will receive food supplementation and veterinary assistance asneeded.*
- *Organisms that carry pathogens and whose genes threaten the genetic pool of other organisms in the urban area will not bereintroduced.*
- *Reintroduction will be done in both experimental and control areas to produce reliable assessments (monitoring must continue afterwards to trigger interventions ifnecessary).*
- *Reintroduction must be done in several places and repeated over several years to buffer for stochasticevents*

SUSTAINABILITY & GREEN INFRASTRUCTURE IMPLEMENTATION

With the ever-increasing demands forresources necessitated by urbanization, recent campaigns to move toward sustainable energy and resource consumption, such as LEED certification of buildings, Energy Star certifiedappliances,and zero emission vehicles, have gained momentum. Sustainability reflects techniques and consumption ensuring reasonably low resource use as a component of urban ecology. Techniques such as carbon recapture may also be used to sequester carboncompounds produced in urban centers rather continually emitting more of the greenhouse gas.

Biogas plant in Japan

Urban areas can be converted to areas that are more conducive to hosting wildlife through the application of green infrastructure. Although the opportunities of green infrastructure (GI) to benefit human populations have been recognized, there are also opportunities to conserve wildlife diversity. GI can be defined as features that were engineered with natural elements or natural features. This natural constitution helps prevent wildlife exposure to man- made toxicants. In some cases, GI even preserved comparable measures of biodiversity to natural components.

Green Infrastructure

URBAN GREEN SPACE

In land-use planning, urban green space is open-space areas reserved for parks and other "green spaces", including plant life, water features -also referred to as blue spaces- and other kinds of natural environment. Most urban open spaces are green spaces, but occasionally include other kinds of open areas. The landscape of urban open spaces can range from playing fields to highly maintained environments to relatively naturallandscapes. Generally considered open to the public, urban green spaces are sometimes privately owned,suchas higher education campuses, neighborhood/community parks/gardens, and institutional or corporate grounds. Areas outside city boundaries, are not considered urban open space. Urban greening policies are important for revitalizing communities, reducing financial burdens of healthcare and increasing quality of life.

Eco Park, Newtown, Kolkata- An urban green space

Dallas Trinity Park-An urban green space

The creation of an important stream water garden in Metz's centre during the early 70s was one of the materializations of Jean-Marie Pelt's works on urban ecology.

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INCREASING WILDLIFE HABITAT CONNECTIVITY

Corridors made across European highways for increasing wildlife habitat connectivity

The implementation of wildlife corridors throughout urban areas (and in between wildlife areas) would promotewildlifehabitat ***connectivity****. Habitat connectivity is critical for ecosystem health and wildlife conservation yet is being compromisedbyincreasing* ***urbanization****. Urban green spaces that arelinkedby* ***ecosystem corridors*** *have higher ecosystem health. The usage of* ***green infrastructure*** *that is connected to natural habitats has been shown to reap greater biodiversity benefits than GI implemented in areas far from natural habitats. GI close to natural areas may also increase functional connectivity in natural environments.*

CONCLUSION

Urban ecosystems are expanding around the world as people migrate to cities and the human population continues to grow. What happens to other species as these urban ecosystems expand, and how species live and interact in established urban ecosystems, is the central focus of urban ecology.

Chicago-An urban ecological society

*Urbanization results in a series of both local and far-reaching effectson **biodiversity**, **biogeochemical cycles**, **hydrology**, and **climate**, among many other stresses. Many of these effects are not fully understood, as urban ecology has only recently emerged as a scientific discipline and much more research remains to be done. Research on cities outside the US and Europe remains limited. Observations on the impact of urbanization on biodiversity and species interactions are consistent across many studies but definitive mechanisms have yet to be established. Urban ecology constitutes an important and highly relevant subfield of ecology, and further study must be pursued to more fully understand the effects of human urban areas on the environment.*

Stockholm-Uncovering an urban ecological system

Urban Ecology – **A modern necessity**

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Firstly I want to thank my respected teachers and our principal for giving me this opportunity to do this wonderful project which helped me to learn a lot of new things.
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ENVIRONMENTAL STUDIES
PROJECTWORK

SOME COMMON BIRDS OF WEST BENGAL

ANISH DAS

BSC ECONOMICS SEM 2

CU ROLL NO. :203223-21-0154

CU REG. NO. :223-1112-0220-20

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I Am Thankful to All Respected Professors and Teachers for Advice and Computation with Their Guidance and Supervision. I Have Been Able to Complete This Project. The Project Taught Me A Lot About Study of Common Birds of West Bengal and Way to Preserve It. I Am thankful to My Professor for giving Me This Topic I Have Been Able to Learn a Lot About It. OBJECTIVE To Know How Many Birds are Live in West Bengal. To Know Their Habit and Distribution. To Know the Modern Threats to Birds & His Conservation

CONTENT

INTRODUCTION

Birds are feathered, winged, two-legged, warm-blooded, egg-laying vertebrates, Modern birds are characterised by feathers, a beak with no teeth, the laying of hard-shelled eggs, a high metabolic rate, a four-chambered heart, and a lightweight but strong skeleton. Birds also have digestive and respiratory system that are uniquely adopted for flight. Some birds, especially corvids and parrots are among the most intelligent animal species culturally transmit knowledge across generations. Many species annually migrate great distances and many more perform shorter irregular movements. Birds are social, communicating with visual signals, call and songs.

Birds walk, run, hop, swim, perch, cling, fly and even dig. They live in woodlands, open areas, cities, farms lakes, swamps - even the open ocean. They lay their egg and raise their young in holes in the ground, in nests of varying complexity in vegetation or on the ground, in holes in trees, in human-constructed nest boxes and in or on various parts of buildings.

SOME COMMON BIRDS OF WEST BENGAL

1) INDIAN DOMESTIC PIGEON :-

The Domestic Pigeon is a Pigeon si a Pigeon that derived from the rock Pigeon . The Rock Peigeon is the World's Oldest Domesticated Bird. Scientific Name :- Columba Liviadomestica Distribution :- The Rock Dove has a restricted natural resident range in western and southern Europe, North Africe and Into South Asia. Habitat :- Pigeon habitatl is natural cliffs, usually on coasts. Its domesticated form, the feral pigeon, has been widely introduced elsewhere and is common, especially in cites over much of the world. Bengali Common Name :- " Payera"

2) SPOTTED DOVE :- The spotted dove is a small and somewhat long-tailed pigeon that is a common resident breeding bird across its native range on the Indian subcontinent and Southeast Asia. The species has been introduced into many parts of the world and feral populations have become established. There are considerable plumage variations across populations within its wide range. The species is found in light forests and gardens as well as in urban areas. They fly from the ground with an explosive flutter and will sometimes glide down to a perch. It is sometimes also called the mountain dove, pearl-necked dove, lacenecked dove, or spotted turtle-dove. Scientific Name :- Spilopelia Chinensis. Distribution :- Indian Subcontinent and South East Asia. Habitat :- The spotted dove in its native range in Asia is found across a range of habitats including woodland, scrub, farmland and habitation. In India it tends to be found in the moister regions. Bengali Common Name :- " Chhiteghughu"

3) RED-VENTED BULBUL :- The red-vented bulbul is a member of the bulbul family of passerines. It is resident breeder across the Indian subcontinent, including Sri Lanka extending east to Burma and parts of Tibet. It has been introduced in many other parts of the world and has established itself in the wild on several Pacific islands including Fiji, Samoa, Tonga and Hawaii. It has also established itself in parts of the United Arab Emirates, Bahrain, the United States and Argentina Scientific Name :- Pycnonotus Cafers. Distribution :- Bulbuls are slim long-tailed passerines with small crests. Red -vented Bulbuls are native from Pakistan to Southwest China. Red -whiskered Bulibuls from Southwest China to northen Malaya. Popular cage birds both species have been introduce to many regions of the world, including Australia, New Zealand island in the Indian and Pacific Occans and the United States. Habitat :- This is a bird of dry scrub, open forest, plains and cultivated lands.In its native range it is rarely found in mature forests.

4) RED-WHISKERD BULBUL :- The red-whiskered bulbul, is a passerine bird found in Asia. It is a member of the bulbul family. It is a resident frugivore found mainly in tropical Asia. It has been introduced in many tropical areas of the world where populations have established themselves. It feeds on fruits and small insects. Red-whiskered bulbuls perch conspicuously on trees and have a loud three or four note call. They are very common in hill forests and urban gardens within its range. Scientific Name :- Pycnonotus Jocosus. Distribution :- Tropical Asia and Australia Habitat :- This is a bird of lightly wooded areas, more open country with bushes and shrubs, and farmland. Bengali Common Name :- “ Siphai Bulbuli”

5) INDIAN CORMORANT :- The Indian cormorant or Indian shag is a member of the cormorant family. It is found mainly along the inland waters of the Indian Subcontinent but extending west to Sind and east to Thailand and Cambodia. It is a gregarious species that can be easily distinguished from the similar sized little cormorant by its blue eye, small head with a sloping forehead and a long narrow bill ending in a hooked tip. Scientific Name :- Phalacrocorax fuscicollis. Distribution :- This cormorant fishes gregariously in inland rivers or large wetlands of peninsular India and northern part of Sri Lanka. It also occurs in estuaries and mangroves but not on the open coast. Habitat :- This is a Common and widespread bird species which breeds in freshwater wetlands. 3-6 eggs are laid in a nest in a tree. Bengali Common Name :- " Pankauri "

6) ASHY DRONGO :- The ashy drongo is a species of bird in the drongo family Dicruridae. It is found widely distributed across South and Southeast Asia with several populations that vary in the shade of grey, migration patterns and in the size or presence of white patches around the eye. Scientific Name :- Dicrurus Leucophaeus. Distribution :- The ashy drongo breeds in the hills of tropical southern Asia from eastern Afghanistan east to southern China and Indonesia. Many populations in the northern part of its range are migratory. Habitat :- Prefer forest and wooded area and high rising trees hence happiness in garden and groves even in thickly populated. Visit back yard of house where it find flowering and insects like bees etc. Bengali Common Name :- " Finge "

7) HOUSE CROW :- The house crow , also known as the Indian, greynecked, Ceylon or Colombo crow,is a common bird of the crow family that is of Asian origin but now found in many parts of the world. Scientific Name :- Corvus Splendens. Distribution :- It has a widespread distribution in southern Asia, being native to Nepal, Bangladesh, India, Pakistan, Sri Lanka, Maldives and Laccadive Islands, South West Thailand and coastal southern Iran. Habitat :- Indian House crow are strongly commensally, living in close association with people and relying on food scrops and other waste. They prefer highly disturbed habitats within most types of urban and agricultural landscapes and thrive in small villages. Climeatically, house crows are best suited to tropical

areas . However, the availability of food scraps is probably a more important influence on abundance and distribution. Bengali Common Name :- “ Kak ”

8) HOUSE SPARROW :- The house sparrow is a bird of the sparrow family Passeridae, found in most parts of the world. Asmall bird, it has a typical length of 16 cm (6.3 in) and a mass of 24–39.5 g (0.85–1.39 oz). Females and young birds are coloured pale brown and grey, and males have brighter black, white, and brown markings. The house sparrow is strongly associated with human habitation, and can live in urban or rural settings. Though found in widely varied habitats and climates, it typically avoids extensive woodlands, grasslands, and deserts away from human development. Scientific Name :- Passer Domesticus. Distribution :- All over the world Mainly originated in middle east. Bengali Common Name :- “ Chorei ” Habitat :-The House sparrow is closely associated with Human Habitation and cultivation.

9) ORIENTAL MAGPIE-ROBIN :- The oriental magpie-robin is a small passerine bird that was formerly classed as a member of the thrush family Turdidae, but now considered an Old World flycatcher. They are distinctive black and white birds with a long tail that is held upright as they forage on the ground or perch conspicuously. Scientific Name :- Copsychus Saularis Distribution :- The Magpie Robin is a resident breeder in tropical southern Asia from Bangladesh, interior India, Sri Lanka and eastern pakistan East to Indonesia, Thailand, South China, Malaysia and Singapore .They have been introduced to Australia. Bengali Common Name :- “ Doyel ” PAGE - 10 Habitat :-The oriental magpie-robin is found in open woodland and cultivated areas often to human habitations.

10) COMMON MYNA :- The common myna or Indian myna , sometimes spelled mynah, is a member of the family Sturnidae native to Asia. An omnivorous open woodland bird with a strong territorial instinct, the myna has adapted extremely well to urban environments. The Common Myno is brown with a black head. It has a yellow bill, legs and bare eye skin In flight it shows large white wing patches. Scientific Name :- Acridotheres Tristis. Bengali Common Name :- “ Salikh ” PAGE - 11 Habitat :-This abundant passerine is typically found in open woodland, cultivation and around habitation. Distribution :- It is a species of bird native to Asia with its initial home range spanning from Iran, Pakistan, India, Nepal, Bhutan, Bangladesh and Sri Lanka; as well as Afghanistan, Uzbekistan, Tajikistan, Turkmenistan, Myanmar etc.

11) WHITE-THROATED KINGFISHER :- The white-throated kingfisher also known as the white-breasted kingfisher is a tree kingfisher, widely distributed in Asia from the Sinai east through the Indian subcontinent to the Philippines. This kingfisher is a resident over much of its range, although some populations may make short distance movements. It can often be found well away from water where it feeds on a wide range of prey that includes small reptiles, amphibians, crabs, small rodents and even birds. During the breeding season they call loudly in the mornings from prominent perches including the tops of buildings in urban areas or on wires. Scientific Name :- Halcyon Smyrnensis. Bengali Common Name :- “ Machranga ” Habitat :-White-throated kingfisher is a common species of a variety of habitats, mostly open country in the plains (but has been seen at 7500 ft in the Himalayas[15]) with trees, wires or other perches. The range of the species is expanding. Distribution :- This kingfisher is widespread and populations are not threatened. Average density of 4.58 individuals per km2. has been noted in the Sundarbans mangroves.

ECOLOGICAL IMPORTANCE OF BIRDS

Birds occupy many levels of trophic webs,from mid-level consumers to top predators. As with other native organisms, birds help maintain sustainable population levels of their prey and predator species and, after death, provide food for scavengers and decomposers. Many birds are important in plant reproduction through their services as pollinators or seed dispersers. Some birds are considered keystone species as their presence in an ecosystem affects other species indirectly. Birds also provide critical resources for their many host-specific parasites,including lice that eat only feathers,flies adapted for living on birds,and mites that hitchhike on birds from plant to plant and even between countries.

MODERN THREATS TO BIRDS

Having survived an ice-age, numerous volvanic eruptions and earthquakes, our native species have endured some life-changing circumstance, but nothing has been more disruptive than that arrival of humans.The most devasting threat to the survival of our native species has been the introduction of mammalian pests such as stoats,possums,rats and deer

Other Human-Induced Threats to our Native Wildlife Have Included :-

Felling of Native Forests For Timber. Damming of Lakes and Rivers For Hydro-electric Development. Destruction and Contamination of native Habitats by Mining. Clearing of Native Vegetation and Draining of Wetlands for Farmland. Over - Fishing and By-Catch of Marine Mammals in our Oceans. Ru-off of fertiliser and effluent from agriculture in our waterways

CONSERVATION OF BIRDS OF INDIA

Scientists and Conservation Professionals have developed a number of techiques to protect birds species. These Techniques have had varying

Caption Breeding Reintroduction and Transications Habitat Protection

CONCLUSION

Scientists and Conservation Professionals have developed a number of techiques to protect birds species. These Techniques have had varying Birds qtaching in your backyard. Birds watching also know as birding is one of the fastest growing forms of outdoor recreation in the country. Bird watching is the observation of wild birds rather than caged or domesticated birds.Birding is simply a matter of learing what to look or listen for Bird watcing is a good way for learn the species of birds that live in your specific area and see how they behave.Birds watching is a super reason to visit unique places and thrill to exotic bird species,.You’ll find people birding in just about any city,town or country.

TOPIC: -

ENVIRONMENTAL MOVEMENTS IN INDIA- CHIPKO ANDOLAN, NARMADA ANDOLAN, SILENT VALLEY MOVEMENT.

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INTRODUCTION:-

The environment comprises of all the natural resources such as air water, land, forests, and minerals. It is our duty to protect the natural resources. Nonetheless, due to technical advancement and other reasons, there is rampant misuse of these natural resources, leading to land degradation, water pollution, air pollution, and deforestation. All these factors lead to worsening of environment. Efforts are being made by the Government through legislation, NGOs through awareness and mass mobilization and individuals in order to regain the environment. There are cases where people have revoked and adopted non-violent movements to protect their environment (Arne Kalland, Gerard Persoon, 2013).

ENVIRONMENTAL MOVEMENTS:-

An environmental movement can be defined as a social or political movement, for the conservation of environment or for the improvement of the state of the environment. The terms ‘green movement’ or ‘conservation movement’ is alternatively used to denote the same. The environmental movements favor the sustainable management of natural resources. The movements often stress the protection of the environment through changes in public policy. Many movements are centered on ecology, health and human rights. Environmental movements range from the highly organized and formally institutionalized ones to the radically informal activities. The spatial scope of various environmental movements ranges from being local to the global.

Guha and Gadgil (1989) defined the environmental movements as 'organized social activity consciously directed towards promoting sustainable use of natural resources halting environmental degradation or bringing about environmental restoration'.

Yanki Tong defined environmental movement as a type of “social movement that involves an array of individuals, groups and coalitions that perceive a common interest in environmental protection and act to bring about changes in environmental policies and practices”.

“The environmental movements are conceived as broad networks of people and organizations engaged in collective action in the pursuit of environmental benefits. Environmental movements are understood to be very diverse and complex, their organizational forms ranging from the highly organized and formally institutionalized to the radically informal, the

spatial scope of their activities ranging from the local to the almost global, the nature of their concerns ranging from single issue to the full panoply of global environmental concerns. Such an inclusive conception is consistent with the usage of the term amongst environmental activists themselves and enables us to consider the linkages between the several levels and forms of what activists call ‘the environmental movement (Christopher: 1999: 2).

The environmental movement is global movement, signified by a range of organizations, from the large to grassroots and differs from country to country. Due to its large membership, varying and strong politics, and occasionally theoretical nature, the environmental movement is not always amalgamated in its goals. The movement also includes some other movements with a more specific focus, such as the climate movement. Broadly speaking, the movement includes private citizens, professionals, religious devotees, politicians, scientists, non-profit organizations and individual advocates.

ENVIRONMENTAL MOVEMENTS IN INDIA:-

The concern for environmental protection in India can be traced back to the beginning of twentieth century when people demonstrated against the commercialization of forest resources during the Colonial period (Sahu, Geetanjoy 2007). In Indian context, large number of environmental movements has emerged especially after 1970s and 1980s. In this framework Sahu, Geetanjoy (2007) stated that:

"In India, the environmental movement has grown rapidly over the last three to four decades. It has played a key role in three areas such i.e.

1. creating public awareness about the importance of bringing about a balance between environment and development.
2. opposing developmental projects that are inimical to social and environmental concerns.
3. organizing model projects that show the way forward towards nonbureaucratic and participatory, community-based natural resource management systems.

As per Sharma, Aviram (2007) major reasons of the emergence of environmental movements in India are 1. Control over natural resources 2. False developmental policies of the government 3. Socioeconomic reasons 4. Environmental degradation/ destruction and lastly spread of environmental awareness and media.

The main environmental movements in India are as under:

- Chipko Andolan
- Narmada Dam Andolan
- Silent Valley Movement

THE CHIPKO MOVEMENT:-

- Year: 1973
- Place: In Chamoli district and later at Tehri-Garhwal district of Uttarakhand.
- Leaders: Sundarlal Bahuguna, Gaura Devi, Sudesha Devi, Bachni Devi, Chandi Prasad Bhatt, Govind Singh Rawat, Dhoom Singh Negi, Shamsher Singh Bisht and Ghanasyam Raturi.
- Aim: The main objective was to protect the trees on the Himalayan slopes from the axes of contractors of the forest.

The most effectual and popular environmental movement in India was the Chipko which became known for environmental movements in world. The name of the movement, that is 'Chipko', comes from the word 'embrace', in Hindi. It is locally known as “Angwal”. It is believed that the villagers hugged or embraced or stuck to the trees in the forest to avert them from being felled by the contractors. The strategy of 'embracing'

People holding trees to resist them from falling

thought of by Chandi Prasad Bhatt in a meeting in the Mandal on April 1, 1973. The Chipko movement concentrated world attention on the environmental problems of the Alaknanda catchment area in the midWestern Himalayas (Santra, S. C. 2009). It was started by noted environmentlist Sunderlal Bahuguna in 1970's to safe guard the rich forest of western Himalaya Range. This movement was basically a people movement to resist the cutting of trees. There were frequent floods in the Alkanand River catchment area due to cutting trees for developmental world like the construction of roads, river dam project etc. However, the original 'Chipko movement' was started around 260 years back in the early part of the 18th century in Rajasthan by Bishnoi community. A large group of them from 84 villages led by a lady called Amrita Devi laid down their lives in an effort to protect the trees from being felled on the orders of the Maharaja (King) of Jodhpur. After this incident, the maharaja gave a strong royal decree preventing the cutting of trees in all Bishnoi villages.

The Chipko protests in Uttar Pradesh achieved a major victory in 1980 with a 15- year ban on green felling in the Himalayan forests of that state by the order of Mrs. Indira Gandhi, the then Prime Minister of India. Since then, the movement has spread to many states in the country. In addition to the 15-year ban in Uttar Pradesh, the movement has stopped felling in the Western Ghats and the Vindhyas and has generated pressure for a natural resource policy that is more sensitive to people's needs and ecological requirements.

Some other persons have also been involved in this movement and have given it proper direction. Mr. Sunderlal Bahuguna, a Gandhian activist and philosopher, whose appeal to Mrs. Indira Gandhi, the then Prime Minister of India, resulted in the green- felling ban. Mr. Bahuguna coined the Chipko slogan: 'ecology is permanent economy'. Mr. Chandi Prasad Bhatt, is another leader of the Chipko movement. He encouraged the development of local industries based on the conservation and sustainable

use of forest wealth for local benefit. Mr. Ghanasyam Raturi, the Chipko poet, whose songs echo throughout the Himalayas of Uttar Pradesh. The main demand of the people in these protests was that the benefits of the forests, especially the right to fodder, should go to local people" (Reddy, Ratna V. 1998). In this context Santra, (2000) recorded that in 1960, to maintain border security; a vast network of roads was constructed in this area besides taking up projects of various other types. All this was catastrophic for the forests and also total environment of the area chopping of trees and rolling them down hills loosened the upper soil which eroded further during rain. This had disastrous impact and resulting the devastating flood in the Alaknanda in July 1970, which caused destruction in the upper catchment area.

Reddy (1998) further stated that, "in early 1973, the forest department allotted ash trees to a private company. This incident provoked the Dasholi Gram Swarajya Sangha (DGSS) a local cooperative organization to fight against this injustice through lying down in front of timber trucks and burning resin and timber depots as was done in the quit India movement. When these methods were found unsatisfactory, Chandi Prasad Bhat, one of the leaders, suggested embracing the trees to prevent them from being cut. With its success, the movement has spread to other neighboring areas, and then onwards the movement is popularly known internationally as Chipko movement (Reddy, Ratna V. 1998: 688)."

Karan (1994) indicated that "by the late 1980s, the movement had broken into two groups that have broad grassroots support and advocate participatory methods which respond to local issues in the context of local social and cultural traditions. One group followed a strategy that emphasizes ecologically sound development of forest by local people to meet local needs. The second group followed the deep-ecology paradigm of environmental management" (Karan, P. P. 1994).

Reddy, Ratna and Mukul (1998) indicated that, Chipko movement has had six demands, one of which is complete stoppage of commercial cutting of trees. The other demands include:

1. On the basis of minimum needs of the people, a reorganization of traditional rights should take place.
2. Arid forest should be made green with people's participation and increased tree cultivation.
3. Village committees should be formed to manage forests.
4. Forest related home-based industries should be developed and the raw materials, money and technique for it should be made available.
5. Based on local conditions and requirements, local varieties should be given priority in afforestation (Reddy, Ratna V. 1998).

NARMADA BACHAO ANDOLAN:-

- Year: 1985
- Place: Narmada River, which flows through the states of Gujarat, Madhya Pradesh and Maharashtra.
- Leaders: Medha Patker, Baba Amte, adivasis, farmers, environmentalists and human rights activists.
- Aim: A social movement against a number of large dams being built across the Narmada River.

The most widespread movement in the environmental crusade of India is the movement against the Narmada River Valley Project (Reddy, Ratna V, 1998). Narmada Bachao Andolan is the most powerful mass movement, started in 1985, against the construction of huge dam on the Narmada river. Narmada is the India's largest west flowing river, which supports a large variety of people with distinguished culture and tradition ranging from the

indigenous (Bhils and Gonds) people inhabited in the jungles here to the large number of rural population. The Narmada valley is the location of one of the world's largest versatile water projects. The Narmada River Development Project, which involves the construction of thirty large dams and many small ones on the river and its fifty-one main tributaries. The project renovated the valley and the lives of its residents and will increase food production and hydropower generation in Gujarat, Madhya Pradesh, and Maharashtra. Karan (1994) inferred that more than twenty one million people live in the valley, mostly in villages. The proposed Sardar Sarovar Dam and Narmada Sagar will displace more than 250,000 people. The big fight is over the resettlement or the rehabilitation of these people. The two proposals are already under construction, supported by US$550 million loan by the World Bank.

It is a multi-crore project that will generate a big revenue for the government. The Narmada Valley Development Plan is the most promised and most challenging plan in the history of India. The proponents are of the view that it will produce 1450 MW of electricity and pure drinking water

to 40 million people covering thousands of villages and towns. Some of the dams have been already been completed such as Tawa and Bargi Dams. But the opponent says that this hydro project will devastate human lives and biodiversity by destroying thousands of acres of forests and agricultural land. On the other hand it will overall deprive thousands of people of their livelihood. They believe that the water and energy could be provided to the people through alternative technological means, that would be ecologically beneficial.

Reddy (1998) stated that to start with, this movement was centred on the issue of human rights. The main leaders of the movement at present like Medha Patkar were working towards proper rehabilitation programmes for the dam displaced. Due to improper implementation of the rehabilitation programmes by the state, the human rights activists have become the articulators of antidam protests. Their demands included complete stopping of the dam. The movement, however, gained huge public attention with mobilization and organization of oustees (mostly tribals) and the joining of the eminent social workers like Baba Amte, Sunderlal Bahuguna and Medha Patkar. Though, its public attention is due to its coverage in three states, the most distinguished feature of this movement is the international support it has received (Reddy, Ratna V. 1998). The strong protests throughout the country not only made impact on the local people but has also influenced the several famous celebrities like film star Aamir Khan, who has made open efforts to support Narmada Bachao Andolan. He said he only want that those who have been rendered homeless should be given a roof. He pleaded to the common people to take part in the moment and come up with the best possible solutions. The Narmada Bachao Andolan has been pressurizing the World Bank to withdraw its loan from the project through media. Nepal, Padam (2009) indicated that the Narmada Bachao Andolan has drawn upon a multiplicity of discourses for protests such as: "displacement risks and

resettlement provisions; environmental impact and sustainability issues; financial implications of the project; forceful evictions and violations of civil liberties; issues pertaining to river valley planning and management; implications of Western growth model, and alternative development and appropriate technology among many other. The movement uses various tools of protest such as Satyagraha, Jal Samarpan, Rasta Roko, Gaon Bandh, demonstrations and rallies, hunger strikes and blockade of projects" (Nepal, Padam 2009).

SILENT VALLEY MOVEMENT: -

- Year: 1978
- Place: Silent Valley, an evergreen tropical forest in the Palakkad district of Kerala, India.
- Leaders: The Kerala Sastra Sahitya Parishad (KSSP) an NGO, and the poet activist

  Sughathakumari played an important role in the Silent Valley protests.
- Aim: Inorder to protect the Silent Valley, the moist evergreen forest from being destroyed by a hydroelectric project.

Save Silent Valley was a social movement aimed at the protection of Silent valley, an evergreen tropical forest in the Palakkad district of Kerala, India. It was started in 1973 to save the Silent Valley Reserve Forest in from being flooded by a hydroelectric project. The valley was declared as Silent Valley National Park in 1985.

Silent Valley in Kerala has a rich 89 sq. km biological treasure drove in the enormous expanse of tropical virgin forests on the green rolling hills. Kuntipuzha one of the major rivers takes its origin in the flush green forests of Silent valley. In 1928 the location at Sairandhrion, the Kunthipuzha River was identified as an ideal site for electricity generation. The

Kerala State Electricity Board (KSEB) decided to implement the Silent Valley Hydro-Electric Project (SVHEP) centered on a dam across the Kunthipuzha River in 1973. A study and survey was conducted in 1980 of the area about the possibility of a hydroelectric project of 200 MW and one costing Rs. 17 Crore. (Sheth, Pravin 1997).The resulting reservoir would have flood 8.3 km² of virgin rainforest. The proposed project was not also environmentally feasible, as it would drown a chunk of the valuable rainforest of the valley and threaten the life of a host of endangered species of both flora and fauna (Nepal, Padam 2009). The proposal was enquired by National Committee on Environmental Planning and Co-ordination (NCEPC) and suggested 17 safeguards to be implemented in case the project implemented. A shortage of funds delayed activity. Even then from 1974 to 1975 a very large number of trees were felled in the area. KSEB announced its plan to begin dam construction in 1973.

After the announcement of imminent dam construction, the valley became the focal point of "Save Silent Valley", India's fiercest environmental debate of the decade.

Because of concern about the endangered lion-tailed macaque, the issue was brought to public attention. Romulus Whitaker, founder of the Madras Snake Park and the Madras Crocodile Bank, was probably the first person

to draw public attention to the small and remote area. In 1977 the Kerala Forest Research Institute carried out an Ecological Impact study of the Silent Valley area and proposed that the area be declared a Biosphere Reserve. In 1978 Smt. Indira Gandhi, the Honorable Prime Minister of India, approved the project, with the condition that the State Government enact Legislation ensuring the necessary safeguards. Also that year the IUCN (Ashkhabad, USSR, 1978) passed a resolution recommending protection of Lion-tailed Macaques in Silent Valley and Kalakkad and the controversy heated up. In 1979 the Government of Kerala passed Legislation regarding the Silent Valley Protection Area (Protection of Ecological balance Act of 1979) and issued a notification declaring the exclusion of the Hydroelectric Project Area from the proposed National Park.

The Kerala Sastra Sahitya Parishad (KSSP) an NGO, was working for three decades among masses of Kerala for growing environmental awareness. Kerala Sasthra Sahithya Parishath (KSSP) effectively aroused public opinion on the requirement to save Silent Valley. They also published a Techno-economic and Socio-Political assessment report on the Silent Valley Hydroelectric project. The poet Activist Sugathakumari played an important role in the silent valley protest and her poem "Marathinu Stuthi" (Ode to a Tree) became a symbol for the protest from the intellectual community and was the opening song/prayer of most of the "save the Silent Valley" campaign meetings. Dr. Salim Ali, eminent ornithologist of the Bombay Natural History Society, visited the Valley and appealed for cancellation of the Hydroelectric Project. A petition of writ was filed before the High Court of Kerala, against the clear cutting of forests in the Hydroelectric Project area and the court ordered a stop to the clear cutting. Dr. M.S. Swaminathan, the renowned Agricultural Scientist, and then Secretary to the Department of Agriculture, called at the Silent Valley region and his suggestion was 389.52 km² including the Silent Valley (89.52 km²), New Amarambalam (80 km²), Attappadi (120 km²) in Kerala and Kunda in

Tamilnadu (100 km²) reserve forests, should be made into a National Rainforest Biosphere Reserve, with the aim of "preventing erosion of valuable genes from the area".

In January 1980 the Hon. High Court of Kerala lifted the ban on clear cutting, but then the Hon. Prime Minister of India requested the Government of Kerala to stop further works in the project area until all aspects were fully discussed. In December, the Government of Kelala declared the Silent Valley area, excluding the Hydroelectric Project area, as a National Park.

In 1982 a multidisciplinary committee with Prof. M. G. K. Menon as chairman, was created to decide if the Hydroelectric Project was feasible without any significant ecological damage. Early in 1983, Prof. Menon's Committee submitted its report. After a careful study of the Menon report, the Hon. Prime Minister of India decided to abandon the Project. On October 31, 1984 Indira Gandhi was assassinated and on November 15 the Silent Valley forests were declared as a National Park, though the boundaries of the Silent Valley Park were limited and no buffer zone was created, despite recommendations by expert committees and scientists.

In 2001 a new Hydro project was proposed and the "Man vs. Monkey debate" was revived. The proposed site of the dam (64.5 m high and 275 m long) is just 3.5 km downstream of the old dam site at Sairandhiri, 500 m outside the National Park boundary. The 84 km² catchment of the project area included 79 km² of the Silent Valley National Park. The Kerala Minister for Electricity called The Pathrakkadavu dam (PHEP) an "eco- friendly alternative" to the old Silent Valley project. The PHEP was designed as a run- off-the-river project with an installed capacity of 70 MW in the first phase (105 MW eventually) and an energy generation of 214 million units (Mu) with a minimal gross storage of 0.872 million cubic metres. The claim was that the submergence area of the PHEP would be a negligible .041 km² compared to 8.30 km² submergence of the 1970s (SVHEP). However, the spectacular waterfall between the Neelikkal and Pathrakkadavu hills

bordering the Silent Valley will disappear if the proposed Pathrakkadavu hydro- electric project is implemented.

During January to May 2003 a rapid Environmental Impact Assessment (EIA) was carried out during by the Thiruvananthapuram-based Environmental Resources Research Centre and its report was released in December, stating that forest lost due to the project would be just .2216 km², not including the 7.4 km approach road and land to be acquired for the powerhouse in Karapadam.

Nepal Padam (2009) indicated that the central issue of the Silent Valley protests included, "The protection of the tropical rainforest, maintenance of the ecological balance. The campaigns and petitions were the main strategies adopted by the activists in the movement, grounding it on the non-violent, Gandhian ideological orientation, the protest against the destruction of forest, an opposition to ecologically unsustainable development, and above all, maintenance of the ecological balance (Nepal, Padam 2009).

CONCLUSION: -

To summarize, in contemporary world, numerous grass root environmental movements launched against the developmental activities that have endangered the ecological balance. During the past three decades' people in various regions of India have bent nonviolent action movements to protect their environment, their livelihood, and their ways of life. These environmental movements have emerged from the Himalayan regions of Uttar Pradesh to the tropical forests of Kerala and from Gujarat to Tripura in response to projects that threaten to dislocate people and to affect their basic human rights to land, water, and ecological stability of life-support systems. They share certain features, such as democratic values and decentralized decision making, with social movements operating in India. The environmental movements are slowly progressing toward defining a model of development to replace the current resource-intensive one that has created severe ecological instability. Similar grassroots environmental movements are emerging in Japan, Malaysia, the Philippines, Indonesia, and Thailand. Throughout Asia and the Pacific citizenry organizations are working in innovative ways to reclaim their environment (Rush 1991).

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ENVIRONMENTAL

SCIENCE PROJECT

GREENHOUSE EFFECT

“A walk-in nature walks the soul back home”

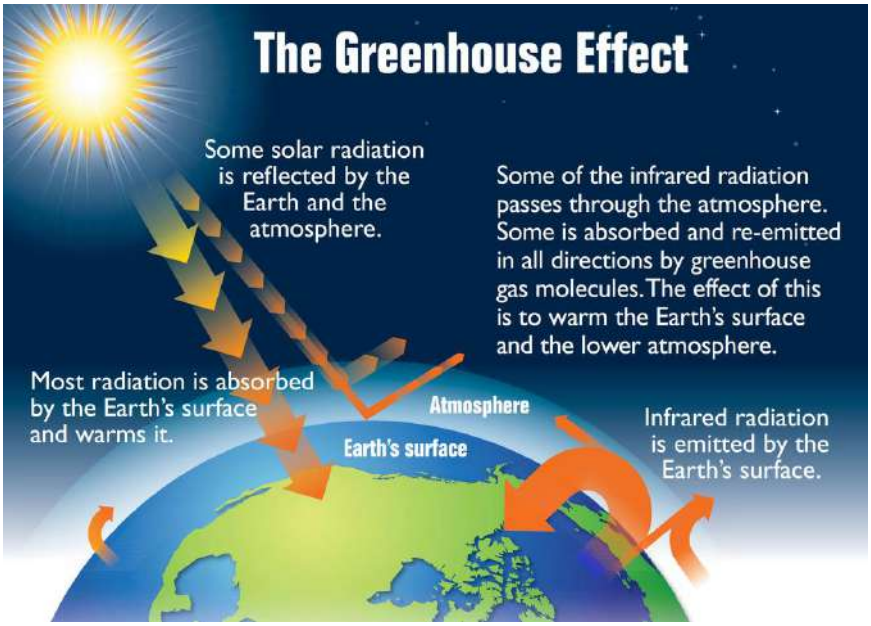
Mary Davis

“All the trees are losing their leaves, and not one of them is worried”

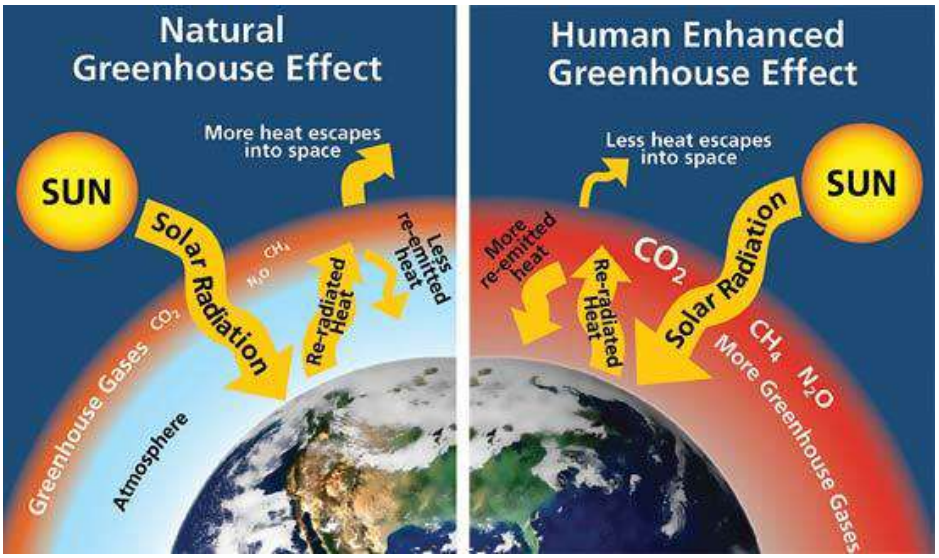
Donald Miller

INTRODUCTION

The existence of the greenhouse effect, while not named as such, was proposed by Joseph Fourier in 1824. The argument and the evidence were further strengthened by Claude Pouillet in 1827 and 1838. John Tyndall was the first to measure the infrared absorption and emission of various gases and vapours. From 1859 onwards, he showed that the effect was due to a very small proportion of the atmosphere, with the main gases having no effect, and was largely due to water vapour, though small percentages of hydrocarbons and carbon dioxide had a significant effect. The effect was more fully quantified by Svante Arrhenius in 1896, who made the first quantitative prediction of global warming due to a hypothetical doubling of atmospheric carbon dioxide. However, the term "greenhouse" was not used to refer to this effect by any of these scientists; the term was first used in this way by Nils Gustaf Ekholm in 1901.



The **greenhouse effect** is the process by which radiation from a planet's atmosphere warms the planet's surface to a temperature above what it would be without this atmosphere.



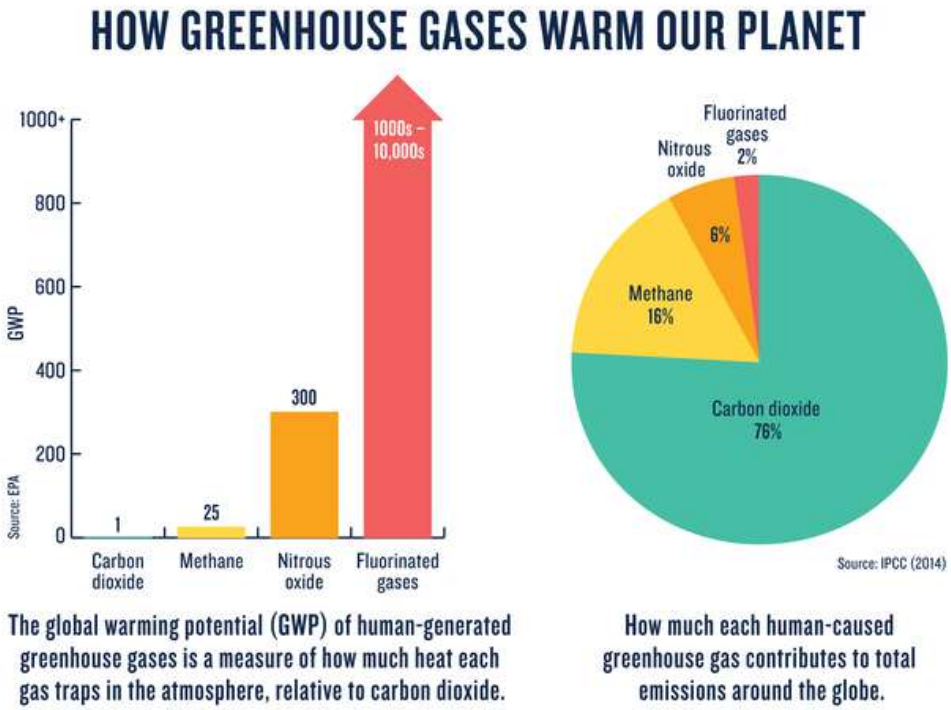
Radiatively active gases (i.e., greenhouse gases) in a planet's atmosphere radiate energy in all directions. Part of this radiation is directed towards the surface, thus warming it. The intensity of downward radiation — that is, the strength of the greenhouse effect — depends on the amount of greenhouse gases that the atmosphere contains. The temperature rises until the intensity of upward radiation from the surface, thus cooling it, balances the downward flow of energy.

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.



The global warming potential (GWP) of human-generated greenhouse gases is a measure of how much heat each gas traps in the atmosphere, relative to carbon dioxide.

How much each human-caused greenhouse gas contributes to total emissions around the globe.

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. There are four main categories: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

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 vapour is a greenhouse gas, more water

absorbs more heat, inducing even greater warming and perpetuating a positive feedback loop.

GREENHOUSE

A **greenhouse** (also called a **glasshouse**, or, if with sufficient heating, a **hothouse**) is a structure with walls and roof made chiefly of transparent material, such as glass, in which plants requiring regulated climatic conditions are grown. These structures range in size from small sheds to industrial-sized buildings. A miniature greenhouse is known as a cold frame.

The interior of a greenhouse exposed to sunlight becomes significantly warmer than the external temperature, protecting its contents in cold weather.

Many commercial glass greenhouses or hothouses are high tech production facilities for vegetables, flowers or fruits. The glass greenhouses are filled with equipment including screening installations, heating, cooling, lighting, and may be controlled by a computer to optimize conditions for plant

growth. Different techniques are then used to evaluate optimality degrees and comfort ratio of greenhouses, such as air temperature, relative humidity and vapour-pressure deficit, in order to reduce production risk prior to cultivation of a specific crop.

Causes of the Greenhouse Effect

- **Burning of Fossil Fuels:** Fossil fuels like coal, oil and natural gas have become an integral part of our life. They are used on large basis to produce electricity and for transportation. When they are burnt, the carbon stored inside them is released which combines with oxygen in the air to create carbon dioxide. With the increase in the population, the number of vehicles have also increased and this has resulted in increase in the pollution in the atmosphere. When these vehicles run, they release carbon dioxide, which is one the main gas responsible for increase in greenhouse effect. Apart from that, electricity-related emissions are high because we are still dependent on coal for electricity generation which releases large amount of C02 into the atmosphere and is still the primary source of fuel for generating electricity.

❖ **Deforestation:** Forests hold a major green area on the planet Earth. Plants and trees intake carbon dioxide and release oxygen, through the process of photosynthesis, which is required by humans and animals to survive. Large scale development has resulted in cutting down of trees and forests which has forced people to look for alternate places for living. When the wood is burnt, the stored carbon in converted back into carbon dioxide

❖ **Increase in Population**: Over the last few decades, there have been huge increase in the population. Now, this has resulted in increased demand for food, cloth and shelter. New manufacturing hubs have come up cities and towns that release some 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.

❖ **Farming**: Nitrous oxide is one the greenhouse gas that is used in fertilizer and contributes to greenhouse effect which in turn leads to global warming.

❖ **Industrial Waste and Landfills**: Industries which are involved in cement production, fertilizers, coal mining activities, oil extraction produce harmful

greenhouse gases. Also, landfills filled with garbage produce carbon dioxide and methane gas contributing significantly to greenhouse effect.

CONSEQUENCES OF THE GREENHOUSE EFFECT

- Thawing of glacial masses:

Glaciers retreat also has its own consequences: reduced albedo — the percentage of solar radiation that the earth's surface reflects or returns to the atmosphere —, a global rise in sea level and the **release of large methane columns** are only some of them, however, they are all dramatic for the plane

- Flooding of islands and coastal cities:

According to Intergovernmental Panel on Climate Change (IPCC, 2014), during the period 1901-2010 **the global average sea level rose 19 centimetres.** It is estimated that by 2100 the sea level will be between 15 and 90 centimetres higher than it is now and will threaten 92 million people.

- Hurricanes will be more devastating

The intensification of the greenhouse effect does not cause these extreme climatic events, but it does increase there intensity. **Hurricanes formation are connected with sea temperature —** they only form over waters that have a temperature of at least 26.51 ºC —

- Migration

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 droughts or violent floods could reach 140 million.**

- Impact on agriculture and livestock

Global warming has already altered the length of the growing season in large parts of the planet. Similarly, changes in temperatures and seasons are influencing the proliferation of insects, invasive weeds and diseases that can affect crops. The same is happening with livestock: **climatic changes are directly affecting important species in multiple ways: reproduction, metabolism, diseases, etc.**

- Food shortages

The United Nation's Food and Agriculture Organization (FAO) states that climate

change **is raising serious doubts about food availability:** in its last biennial report on the state of world food and agriculture, it warns that a decline in agricultural production would result in food shortages, most severely affecting sub-Saharan Africa and South Asia.

The spread of diseases and pandemics

In addition to the problems derived directly from pollution, the World Health Organization (WHO) states that **global warming will cause** infectious diseases **such as malaria, cholera or dengue to spread to many more areas of the planet.** On the other hand, extreme heat will increase and aggravate cardiovascular and respiratory problems.

CONCLUSION:

Without the greenhouse effect, the Earth would not be able to support life. But if the greenhouse effect becomes too strong, the earth will be too hot to support life. Even a little too much heat could hurt the animals, plants, and everything else on the planet. Without the gases that surround the planet, heat would escape back into space, causing the earth's average temperature to be about 60 degrees colder.

ACKNOWLEDGEMENT:

I would like to thank my Head of the Department for giving me the opportunity to do this project. I would like to thank my subject teacher for suggesting the topic of the projects.

ENVIORONMENTAL SCIENCE PROJECT
WILDLIDE CONSERVATION

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CONTENTS

INTRODUCTION

Wildlife conservation **refers to the practice of protecting wild** species **and their** habitats **in order to maintain healthy wildlife species or populations and to restore, protect or enhance natural** ecosystems**. Major threats to wildlife include** habitat destruction**, degradation, fragmentation, overexploitation, poaching, pollution and climate change.**
The IUCN **estimates that 27,000 species of the ones assessed are at risk for extinction. Expanding to all existing species, a 2019 UN report on** biodiversity **put this estimate even higher at a million species. It is also being acknowledged that an increasing number of ecosystems on Earth containing endangered species are disappearing. To address these issues, there have been both national and international governmental efforts to preserve Earth's wildlife. Prominent conservation agreements include the 1973** Convention on International Trade in Endangered Species of Wild Fauna and Flora **(CITES) and the 1992** Convention on Biological Diversity **(CBD). There are also numerous** nongovernmental organizations **(NGO's) dedicated to conservation such as the** Nature Conservancy**,** World Wildlife Fund**, and** Conservation International.

Threats to Wildlife :

A forest burned for agriculture in southern Mexico.

Habitat destruction

Habitat destruction decreases the number of places wildlife can live in. Habitat fragmentation breaks up a continuous tract of habitat, often dividing large wildlife populations into several smaller ones. Human-caused habitat loss and fragmentation are primary drivers of species declines and extinctions. Key examples of human-induced habitat loss include deforestation, agricultural expansion, and urbanization. Habitat destruction and fragmentation can increase the vulnerability of wildlife populations by reducing the space and resources available to them and by increasing the likelihood of conflict with humans. Moreover, destruction and fragmentation create smaller habitats. Smaller habitats support smaller populations, and smaller populations are more likely to go extinct.

Overexploitation

Overexploitation is the harvesting of animals and plants at a rate that's faster than the species' ability to recover. While often associated with Overfishing, overexploitation can apply to many

groups including mammals, birds, amphibians, reptiles, and plants. The danger of overexploitation is that if too many individuals of a species are taken, then the species may not recover.For example, overfishing of top marine predatory fish like tuna and salmon over the past century has led to a decline in fish sizes as well as fish numbers.[1]Illegal wildlife trade confiscated skins.Confiscated animal pelts from the illegal wildlife trade.

Poaching

Poaching for illegal wildlife trading is a major threat to certain species, particularly endangered ones whose status makes them economically valuable. Such species include many large mammals like African elephants, tigers, and rhinoceros. [traded for their tusks, skins, and horns respectively]. Less well-known targets of poaching include the harvest of protected plants and animals for souvenirs, food, skins, pets, and more; because poachers tend to target threatened and endangered species, poaching causes already small populations to decline even further.

Culling

Culling is the deliberate and selective killing of wildlife by governments for various purposes. An example of this is shark culling, in which "shark control" programs in Queensland and New South Wales (in Australia) have killed thousands of sharks, as well as turtles, dolphins, whales, and other marine life .The Queensland "shark control" program alone has killed about 50,000 sharks — it has also killed more than 84,000 marine animals. There are also examples of population culling in the United States, such as bison in Montana and swans, geese, and deer in New York and other places.

Aerial view of the BP Deepwater Horizon oil spill in 2010.

Pollution

A wide range of pollutants negatively impact wildlife health. For some pollutants, simple exposure is enough to do damage (e.g. pesticides). For others, it's through inhaling (e.g. air pollutants) or ingesting it (e.g. toxic metals). Pollutants affect different species in different ways so a pollutant that is bad for one might not affect another.

- **Air pollutants**: Most air pollutants come from burning fossil fuels and industrial emissions. These have direct and indirect effects on the health of wildlife and their ecosystems. For example, high levels of sulfur oxides (SO_x) can damage plants and stunt their growth. Sulfur oxides also contribute to acid rain, harming both terrestrial and aquatic ecosystems. Other air pollutants like smog, ground-level ozone, and particulate matter decrease air quality.

- **Heavy metals**: Heavy metals like arsenic, lead, and mercury naturally occur at low levels in the environment, but when ingested in high doses, can cause organ damage and cancer. How toxic they are depends on the exact metal, how much was ingested, and the animal that ingested it. Human activities such as mining, smelting, burning fossil fuels , and various industrial processes have contributed to the rise in heavy metal levels in the environment.
- **Toxic chemicals**: There are many sources of toxic chemical pollution including industrial wastewater, oil spills, and pesticides. There's a wide range of toxic chemicals so there's also a wide range of negative health effects. For example, synthetic pesticides and certain industrial chemicals are persistent organic pollutants. These pollutants are long-lived and can cause cancer, reproductive disorders, immune system problems, and nervous system problems.

Climate change

Humans are responsible for present-day climate change currently changing Earth's environmental conditions. It is related to some of the aforementioned threats to wildlife like habitat destruction and pollution. Rising temperatures, melting ice sheets, changes in precipitation patterns, severe droughts, more frequent heat waves, storm intensification, and rising sea levels are some of the effects of climate change. Phenomena like droughts, heatwaves, intense storms, and rising sea levels, directly lead to habitat destruction. Meanwhile, a warming climate, fluctuating precipitation, and changing weather patterns will impact species ranges. Overall, the effects of climate change increase stress on ecosystems, and species unable to cope with rapidly changing conditions will go extinct. While modern climate change is caused by humans, past climate change events occurred naturally and have led to extinctions of Species.

Leatherback sea turtle (*Dermochelys coriacea*)

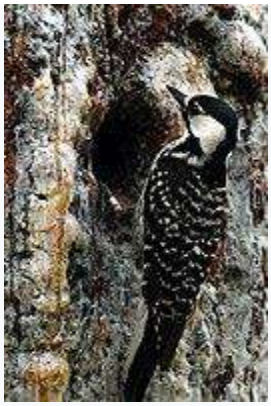
It is estimated that, because of human activities, current species extinction rates are about 1000 times greater than the background extinction rate (the 'normal' extinction rate that occurs without additional influence). According to the IUCN, out of all species assessed, over 27,000 are at risk of extinction and should be under conservation. Of these, 25% are mammals, 14% are birds, and 40% are amphibians. However, because not all species have been assessed, these numbers could be even higher. A 2019 UN report assessing global biodiversity extrapolated IUCN data to all species and estimated that 1 million species worldwide could face extinction. Yet, because resources are limited, sometimes it is not possible to give all species that need conservation due consideration. Deciding which species to conserve is a function of how close to extinction a

species is, whether the species is crucial to the ecosystem it resides in, and how much we care about it.

Leatherback sea turtle

The leatherback sea turtle (*Dermochelys coriacea*) is the largest turtle in the world, is the only turtle without a hard shell, and is endangered. It is found throughout the central Pacific and Atlantic Oceans but several of its populations are in decline across the globe (though not all). The leatherback sea turtle faces numerous threats including being caught as bycatch, harvest of its eggs, loss of nesting habitats, and marine pollution. In the US where the leatherback is listed under the Endangered Species Act, measures to protect it include reducing by-catch captures through fishing gear modifications, monitoring and protecting its habitat (both nesting beaches and in the ocean), and reducing damage from marine pollution. There is currently an international effort to protect the leatherback sea turtle.

Habitat conservation



Red-cockaded woodpecker (*Picoides borealis*)

Habitat conservation is the practice of protecting a habitat in order to protect the species within it. This is sometimes preferable to focusing on a single species especially if the species in question has very specific habitat requirements or lives in a habitat with many other endangered species. The latter is often true of species living in biodiversity hotspots, which are areas of the world with an exceptionally high concentration of endemic species (species found nowhere else in the world). Many of these hotspots are in the tropics, mainly tropical forests like the Amazon. Habitat conservation is usually carried out by setting aside protected areas like national parks or nature reserves. Even when an area isn't made into a park or reserve, it can still be monitored and maintained.

Red-cockaded woodpecker

The red-cockaded woodpecker (*Picoides borealis)* is an endangered bird in the southeastern US. It only lives in longleaf pine savannas which are maintained by wildfires in mature pine forests. Today, it is a rare habitat (as fires have become rare and many pine forests have been cut down for agriculture) and is commonly found on land occupied by US military bases, where pine forests are kept for military training purposes and occasional bombings (also for training) set fires that maintain pine savannas. Woodpeckers live in tree cavities they excavate in the trunk. In an effort to increase woodpecker numbers, artificial cavities (essentially birdhouses planted

within tree trunks) were installed to give woodpeckers a place to live. An active effort is made by the US military and workers to maintain this rare habitat used by red-cockaded woodpeckers.

Conservation genetics

Florida panther (*Puma concolor coryi*)

Conservation genetics studies genetic phenomena that impact the conservation of a species. Most conservation efforts focus on ensuring population growth but genetic diversity also greatly affect species survival. High genetic diversity increases survival because it means greater capacity to adapt to future environmental changes. Meanwhile, effects associated with low genetic diversity, such as inbreeding depression and loss of diversity from genetic drift, often decrease species survival by reducing the species' capacity to adapt or by increasing the frequency of genetic problems. Though not always the case, certain species are under threat because they have very low genetic diversity. As such, the best conservation action would be to restore their genetic diversity.

Florida panther

The Florida panther is a subspecies of puma (specifically *Puma concolor coryi)* that resides in the state of Florida and is currently endangered. Historically, the Florida panther's range covered the entire southeastern US. In the early 1990s, only a single population with 20-25 individuals was left. The population had very low genetic diversity, was highly inbred, and suffered from several genetic issues including kinked tails, cardiac defects, and low fertility. In 1995, 8 female Texas pumas were introduced to the Florida population. The goal was to increase genetic diversity by introducing genes from a different, unrelated puma population. By 2007, the Florida panther population had tripled and offspring between Florida and Texas individuals had higher fertility and less genetic problems. In 2015, the US Fish and Wildlife Service estimated there were 230 adult Florida panthers and in 2017, there were signs that the population's range was expanding within Florida.

Conservation methods

Wildlife population monitoring

Non-invasive monitoring of dhole is crucial for knowledge about its conservation status. More research is needed in chinese wilderness.

Monitoring of wildlife populations is an important part of conservation because it allows managers to gather information about the status of threatened species and to measure the effectiveness of management strategies. Monitoring can be local, regional, or range-wide, and can include one or many distinct populations. Metrics commonly gathered during monitoring include population numbers, geographic distribution, and genetic diversity, although many other metrics may be used.

Monitoring methods can be categorized as either "direct" or "indirect". Direct methods rely on directly seeing or hearing the animals, whereas indirect methods rely on "signs" that indicate the animals are present. For terrestrial vertebrates, common direct monitoring methods include direct observation, mark-recapture, transects, and variable plot surveys. Indirect methods include track stations, fecal counts, food removal, open or closed burrow-opening counts, burrow counts, runaway counts, knockdown cards, snow tracks, or responses to audio calls.

For large, terrestrial vertebrates, a popular method is to use camera traps for population estimation along with mark-recapture techniques. This method has been used successfully with tigers, black bears and numerous other species. Trail cameras can be triggered remotely and automatically via sound, infrared sensors, etc. Computer vision-based animal individual re-identification methods have been developed to automate such *sight resight* calculations. Mark-recapture methods are also used with genetic data from non-invasive hair or fecal samples. Such information can be analyzed independently or in conjunction with photographic methods to get a more complete picture of population viability.

Government involvement

In the US, the Endangered Species Act of 1973 was passed to protect US species deemed in danger of extinction. The concern at the time was that the country was losing species that were scientifically, culturally, and educationally important. In the same year, the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) was passed as part of an international agreement to prevent the global trade of endangered wildlife. In 1980, the World Conservation Strategy was developed by the IUCN with help from the UN Environmental Programme, World Wildlife Fund, UN Food and Agricultural Organization, and UNESCO. Its purpose was to promote the conservation of living resources important to humans. In 1992,

the Convention on Biological Diversity (CBD) was agreed on at the UN Conference on Environment and Development (often called the Rio Earth Summit) as an international accord to protect the Earth's biological resources and diversity.

According to the National Wildlife Federation, wildlife conservation in the US gets a majority of its funding through appropriations from the federal budget, annual federal and state grants, and financial efforts from programs such as the Conservation Reserve Program, Wetlands Reserve Program and Wildlife Habitat Incentives Program. A substantial amount of funding comes from the sale of hunting/fishing licenses, game tags, stamps, and excise taxes from the purchase of hunting equipment and ammunition.

Non-government involvement

In the late 1980s, as the public became dissatisfied with government environmental conservation efforts, people began supporting private sector conservation efforts which included several non-governmental organizations (NGOs) . Seeing this rise in support for NGOs, the U.S. Congress made amendments to the Foreign Assistance Act in 1979 and 1986 “earmarking U.S. Agency for International Development (USAID) funds for [biodiversity]”. From 1990 till now, environmental conservation NGOs have become increasingly more focused on the political and economic impact of USAID funds dispersed for preserving the environment and its natural resources. After the terrorist attacks on 9/11 and the start of former President Bush's War on Terror, maintaining and improving the quality of the environment and its natural resources became a “priority” to “prevent international tensions” according to the Legislation on Foreign Relations Through 2002.and section 117 of the 1961 Foreign Assistance Act

Non-governmental organizations

Many NGOs exist to actively promote, or be involved with, wildlife conservation:

- The Nature Conservancy is a US charitable environmental organization that works to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.
- World Wide Fund for Nature (WWF) is an international non-governmental organization working on the issues regarding the conservation, research and restoration of the environment, formerly named the World Wildlife Fund, which remains its official name in Canada and the United States. It is the world's largest independent conservation organization with over 5 million supporters worldwide, working in more than 90 countries, supporting around 1300[4] conservation and environmental projects around the world. It is a charity, with approximately 60% of its funding coming from voluntary donations by private individuals. 45% of the fund's income comes from the Netherlands, the United Kingdom and the United States.

Wildlife management

Wildlife management is the management process influencing interactions among and between wildlife, its habitats and people to achieve predefined impacts. It attempts to balance the needs of wildlife with the needs of people using the best available science. Wildlife management can include wildlife conservation, gamekeeping and pest control. Wildlife management draws on disciplines such as mathematics, chemistry, biology, ecology, climatology and geography to gain the best results.[6]

Wildlife management aims to halt the loss in the Earth's biodiversity,[7][8] by taking into consideration ecological principles such as carrying capacity, disturbance and succession, and environmental conditions such as physical geography, pedology and hydrology.[9][10][11][12] Most wildlife biologists are concerned with the conservation and improvement of habitats; although rewilding is increasingly being undertaken.[13] Techniques can include reforestation, pest control, nitrification and denitrification, irrigation, coppicing and hedge laying.

Gamekeeping is the management or control of wildlife for the well-being of game and may include the killing of other animals which share the same niche or predators to maintain a high population of more profitable species, such as pheasants introduced into woodland. In his 1933 book *Game Management*, Aldo Leopold, one of the pioneers of wildlife management as a science, defined it as "the art of making land produce sustained annual crops of wild game for recreational use".

Pest control is the control of real or perceived pests and can be used for the benefit of wildlife, farmers, gamekeepers or human safety. In the United States, wildlife management practices are often implemented by a governmental agency to uphold a law, such as the Endangered Species Act.

In the United Kingdom, wildlife management is undertaken by several organizations including government bodies such as the Forestry Commission, Charities such as the RSPB and The Wildlife Trusts and privately hired gamekeepers and contractors. Legislation has also been passed to protect wildlife such as the Wildlife and Countryside Act 1981. The UK government also give farmers subsidies through the Countryside Stewardship Scheme to improve the conservation value of their farms.

Types of wildlife management

There are two general types of wildlife management:

- **Manipulative management** acts on a population, either changing its numbers by direct means or influencing numbers by the indirect means of altering food supply, habitat, density of predators, or prevalence of disease. This is appropriate when a population is to be harvested, or when it slides to an unacceptably low density or increases to an unacceptably high level. Such densities are inevitably the subjective view of the land owner, and may be disputed by animal welfare interests.

- **Custodial management** is preventive or protective. The aim is to minimize external influences on the population and its habitat. It is appropriate in a national park where one of the stated goals is to protect ecological processes. It is also appropriate for conservation of a threatened species where the threat is of external origin rather than being intrinsic to the system. Feeding of animals by visitors is generally discouraged.

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*T*he control of wildlife through killing and hunting has been criticized by animal rights and animal welfare activists. Critics object to the real or perceived cruelty involved in some forms of wildlife management. They also argue against the deliberate breeding of certain animals by environmental organisations—who hunters pay money to kill—in pursuit of profit. Additionally, they draw attention to the attitude that it is acceptable to kill animals in the name of ecosystem or biodiversity preservation, yet it is seen as unacceptable to kill humans for the same purpose; asserting that such attitudes are a form of discrimination based on species-membership i.e. speciesism.

Environmentalists have also opposed hunting where they believe it is unnecessary or will negatively affect biodiversity. Critics of game keeping note that habitat manipulation and predator control are often used to maintain artificially inflated populations of valuable game animals (including introduced exotics) without regard to the ecological integrity of the habitat.

Gamekeepers in the UK claim it to be necessary for wildlife conservation as the amount of countryside they look after exceeds by a factor of nine the amount in nature reserves and national parks.

Management of hunting seasons

Wildlife management studies, research and lobbying by interest groups help designate times of the year when certain wildlife species can be legally hunted, allowing for surplus animals to be removed. In the United States, hunting season and bag limits are determined by guidelines set by the United States Fish and Wildlife Service for migratory game such as waterfowl and other migratory gamebirds. The hunting season and bag limits for state regulated game species such as deer are usually determined by State game Commissions, which are made up of representatives from various interest groups, wildlife biologists, and researchers.

Open and closed season on deer in the UK is legislated for in the Deer Act 1991 and the Deer Act (Scotland) 1996.

Open season

Open season is when wildlife is allowed to be hunted by law and is usually not during the breeding season. Hunters may be restricted by sex, age or class of animal, for instance there may be an open season for any male deer with 4 points or better on at least one side.

Limited entrance

Where the number of animals taken is to be tightly controlled, managers may have a type of lottery system called limited. Many apply, few are chosen. These hunts may still have age, sex or class restrictions.

Closed season

Closed season is when wildlife is protected from hunting and is usually during its breeding season. Closed season is enforced by law, any hunting during closed season is punishable by law and termed as illegal hunting or poaching.

Type of weapon used

In wildlife management one of the conservation principles is that the weapon used for hunting should be the one that causes the least damage to the animal and is sufficiently effective so that it hits the target. Given State and Local laws, types of weapon can also vary depending on type, size, sex of game and also the geographical layout of that specific hunting area.

Conservation Projects in India

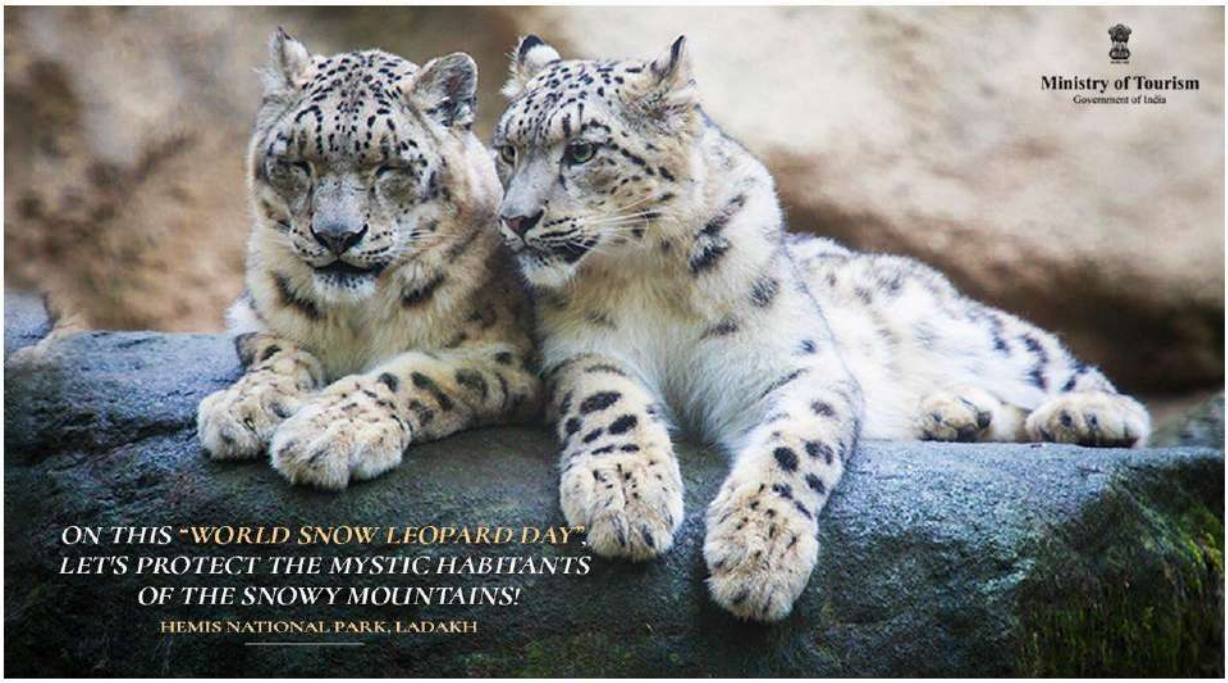
Project Snow Leopard

The species of Snow Leopard inhabits the Himalayan landscape as well as states such as Jammu and Kashmir, Uttarakhand, Arunachal Pradesh, Sikkim, and Himachal Pradesh. Schedule I of the Wildlife Protection Act, 1972 and IUCN declare the species as a 'vulnerable' category. Additionally, the species is listed in CITES and CMS which reveals that the highest conservation status has been accorded to them, both nationally and internationally.

The International Snow Leopard Day is celebrated on 23rd October each year. The Government of India launched the 'First National Protocol on Snow Leopard Population Assessment' in 2019. This involves the use of technology such as camera traps and scientific surveys. This initiative was developed under the global protocol of Global Snow Leopard and Ecosystem Protection Program. This program is an intergovernmental alliance of 12 snow leopard range countries, India, Pakistan, Nepal, Russia, China, Bhutan, Afghanistan, Tajikistan, Uzbekistan, Kazakhstan, Kyrgyzstan, Mongolia. The Population Assessment of World's Snow Leopard (PAWS) is a collaborative effort of these countries.

The primary threats to snow leopards were loss of habitat, poaching, and man-animal conflict. In *Sansar Chand vs State of Rajasthan* (2010), the organized nature of wildlife crime has been highlighted. In this case, it was mentioned that an FIR was filed against his younger brother who

was also involved in illicit trade of wild animals.



Project Snow Leopard launched in 2009, aims to promote inclusivity and participatory approach for the conservation of the species.

To add to this project, SECURE Himalaya (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems) is another initiative taken to conserve high altitude biodiversity. This is operational in Sikkim, Himachal Pradesh, Uttarakhand, and Jammu & Kashmir. The key component of the project is the protection of snow leopards and other endangered species. The six-year-long project also focuses on securing livelihoods of the local public and enhancing enforcement to reduce wildlife crime. The government has allocated 130 crores for the project, to protect around 200 snow leopards in the Trans and Greater Himalayan Region.

In addition, SOS or Save Our Snow Leopards is an initiative launched by WWF India in collaboration with Tata Housing Development Company in 2014. The project aims at assessing the status and distribution of snow leopards through setting up camera traps. It also aims to promote conservation strategies.

The Protected Areas include:

1. The Sacred Himalayan Landscape
2. Kibber Wildlife Sanctuary
3. Great Himalayan National Park
4. Hemis National Park
5. Dibang Wildlife Sanctuary
6. Pin Valley National Park

The Ladakh region is setting a prime example for the other states through its conservatory practices to protect the Snow Leopards. Efficient collaboration among the NGOs, local public and Wildlife Department has helped in the prevention of man-animal conflict.

WWF-India installed around 13 Predator Proof Corral Pens which positively impacted the families living in 13 villages of Ladakh. Corrals are enclosures for capturing or confining livestock. It was established through a study that if people were compensated for the loss of their livestock, they would not resort to 'revenge-killing.' This has led to less killing of the snow leopards.

The Jammu and Kashmir forest officials, in 2018, began working on estimation of the population of snow leopards in Ladakh. This estimation is based on the protocols of All India Tiger Estimation. This initiative requires a combined effort of the State Forest Department, Ministry of Environment and Forest at the Centre and Wildlife Institute of India.

Project Tiger

The population of Indian Tigers was drastically declining towards the end of the 20th century. Resultantly, a nation-wide Tiger Census was conducted in 1972 to estimate the population of tigers.

Large scale development activities including dams, mines, railway projects and establishment of industries led to deforestation and further loss of habitat. Since the body parts of the tigers are used for traditional Chinese medicine, they were killed in high numbers. All these factors collectively led to a decline in the population of tigers.

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. He was allegedly involved in 57 wildlife cases between 1974 and 2005. He was convicted in all the offences registered against him. The Supreme Court also requested the Central and the State Government to take stringent actions against such offenders.

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 punishment under S.428 is imprisonment for two years and under S.429, imprisonment for five years.

In 1973, Project Tiger was launched in the Palamau Tiger Reserve, Jim Corbett National Park, Uttarakhand. This is a centrally sponsored scheme of the Ministry of Environment and Forests. It is primarily governed under the Wildlife Act, 1972 itself.The project is administered by the National Tiger Conservation Authority, which was established in December 2005.

The aim of the project is the protection of tigers from extinction, by ensuring that there is a viable population of the species in their natural habitats. The Project began from nine reserves in 1973-74 and has substantially grown to fifty reserves. The Project has seen significant success in the recovery of the habitat and the population of the tigers in the reserved areas.

Measures Taken For Conservation of Tigers under the Wildlife Act, 1972

Legal Measures

1. The Project has been 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 38Z of 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, and Bangladesh for controlling trans-boundary illegal wildlife trade and for tiger conservation.

Administrative Measures

1. Anti-poaching activities have been strengthened, especially monsoon patrolling. This involves deploying anti-poaching squads.
2. A National Tiger Conservation Authority has been constituted.
3. A Special Tiger Protection Force has been established.
4. Tiger Conservation Foundation has been created.

Financial Measures

Pecuniary measures include the provision of financial and technical help via Centrally Sponsored Schemes through the Project itself and Integrated Development of Wildlife Habitats.

Tiger Task Force

It is essential that for proper implementation of the Project, a statutory authority having sufficient legal backing is established. The National Board for Wildlife recommended the set-up of a Task Force to look into the issues arising in the implementation of tiger conservation initiatives across the country. This led to the creation of the Tiger Task Force. The TTF recommended the establishment of the National Tiger Conservation Authority (NTCA).

Core and Buffer Zones

The Wildlife Protection Act, 1972 under Section 38V lays down the tiger conservation plan. Under sub-section (4), it is laid down that the State Government shall ensure the overall development of the people living in tiger bearing forests or a tiger reserve. For this purpose, under Section 38V(4)(i), the core or critical tiger habitat areas are established in national parks and sanctuaries. Under Section 38V(4)(ii), the buffer or peripheral area is identified and established.

- **Core Zones**

(i) The areas included in the core zones are notified by the State Government after its consultation with an Expert Committee which is constituted for the purpose.

(ii) It is a requirement that these areas are solely used for tiger conservation but should not infringe upon the rights of the Scheduled Tribes or other forest dwellers.

(iii) Further, this area must be kept free from biotic disturbances and forestry operations. The collection of minor forest produce, grazing and other human disturbances are not allowed within this zone.

- **Buffer Zones**

(i) The buffer zone is the area that stands peripheral to the core tiger habitat. It acts as a supplementary habitat and also offers scope for the co-existence of human activities.

(ii) The area is determined by the concerned Gram Sabha after its consultation with an Expert Committee which is constituted for the purpose.

Project Elephant

Project Elephant 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 spread over 26 elephant reserves but only 65% of the elephant corridors are in protected areas.

The protection of elephants is also important because it has been declared as a national heritage of the country. This was done by the Government of India in 2010 after the Standing Committee on the National Board of Wildlife gave its recommendations. This step was taken to create awareness about the dwindling population of the elephants so that people would actively participate in its conservation.

The objectives of the project are:

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

This project is crucial because it protects the elephants from hunters and poachers and thereby curb illegal trading of ivory.

In *Balram Kumawat* vs. *Union of India & 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 CITES.

The Court cited the case of *State of West Bengal vs. Union of India (1962)* wherein it was said that the legislative intent should be derived by taking the entire statute into consideration, not just some provisions. The Court held that the ban on ivory trading extended to ivory of every description, so that elephant poaching could be curbed.

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.

The Court held that the use of ivory for commercial purposes is explicitly banned. The Court interpreted that the words 'ivory imported into India' as defined under Section 49B(1)(a)(i) includes all descriptions of ivory, whether elephant or mammoth. It dismissed the writ petition.

In *Indian Handicrafts Emporium and Ors. vs. Union of India & Ors. (2003)*, the Supreme Court upheld the constitutional validity of the clause 'ivory imported into India' as defined under Section 49B(1)(a)(i). It said that the restrictions imposed were reasonable as the legislative intent was to plug the loopholes in the Act.

In this case, the appellants imported ivory from African countries and manufactured several articles out of them. They filed a writ petition questioning the constitutional validity of the 1991 Wildlife (Protection) Amendment Act as the Act prohibited trade of imported ivory, which affected their rights under Article 19(1)(g) of the Indian Constitution.

The famous case of Veerappan also highlights the extent of wildlife crime. He killed 138 people and 1000 elephants for the purposes of poaching and smuggling. He was later killed in October 2004 in Operation Cocoon.

Ecological restoration of the natural habitats and migratory routes is another important feature of this project. An elephant task force was also established by the Ministry of Environment and Forests to spread the idea of friendship between elephants and people (Take Gajah to the Prajah).

Elephant Corridors

Elephant Corridors are narrow strips of forested lands which act as a bridge to larger elephant habitats. This conduit is essential for the movement of the elephants and to enhance the survival rate of the species in the wild. The National Green Tribunal in the case of *Rohit Chaudhary vs. Union of India & Ors. (2016)* has ruled that elephants have the first right on the forests. It ordered the demolition of a boundary wall in the middle of an elephant corridor in Assam's Deopahar Reserve Forest. The elephants also have a right to passage.

In this case, some elephants died after the wall was built. It was determined that there was a destruction of the environment through the establishment of the wall. Hence, Numaligarh Refinery Limited was held liable to pay the environmental compensation based on the 'polluters pay principle' and the 'precautionary principle'.

It was held in the case of *Vellore Citizens Forum vs. Union of India (1996)*, that these aforementioned principles are essential features of sustainable development. Further, it was ruled that no power fencing could be erected on the elephant corridors. This judgment was upheld by the Supreme Court.

There are approximately 88 elephant corridors in India and are distributed in the following manner.

Location	Number of Corridors
South India	20
North-Western India	12
North West Bengal	14
Central India	20
North-Eastern India	22

The corridors are categorized into high ecological priority and medium priority. The categorization is on the basis of the regularity of elephant movement, the size of the population, the area of habitats connected and the presence of other routes nearby. The corridors are also graded on the basis of conservation feasibility. Further, only about 77.3% of these corridors are regularly being used by the species.

The major threat to these corridors is the loss of habitat due to fragmentation of forests and other protected areas. The fragmentation is due to an increase in human activities and industrialization, which includes mining activities.

The Supreme Court ordered restraining all kinds of mining and related activities along the Kaziranga National Park area, in the case of *In Re: T.N. Godavarman Thirumulpad vs. Union of India & Ors. (2019)*

It is crucial that there should be a fusion of elephant corridors with nearby protected areas and reserved forests. In other areas, ecologically sensitive areas or conservation reserves can be declared. This is because the elephants have a habit of constantly foraging for food and water, and they are threatened due to habitat loss, degradation or shrinkage. These paths allow them to move freely and uninterrupted. It is important that awareness is spread and sensitization takes place.

The Supreme Court in the case of *A. Rangarajan* vs. *Union of India* (2018), passed an order in 2018 to shut down 27 resorts and hotels that were built illegally on the Nilgiris Elephant Corridors without prior approval. This endangered the safe passage, which is the basic purpose of an elephant corridor.

Measures for Protection of Elephants

Apart from the project, there are other programs which have been implemented for the protection of elephants.

- **Monitoring of Illegal Killing of Elephants Program (MIKE)**

This program began in 2003 in South Asia. MIKE was established under CITES by resolution 10.10. There are approximately 45 countries across the world which are included in the program. The aim is to provide information which the elephant range countries require for making proper arrangements and enforcement decisions. It is also for the promotion of institutional capacity in these States for long term conservation and management of the elephants.

The objectives of the program are to measure the rate of illegal poaching of elephants, to determine factors responsible for changes in the elephant population, and collection of data on a monthly basis from all MIKE sites.

- **Haathi Mere Saathi**

This campaign was launched by the Ministry of Environment and Forest in collaboration with Wildlife Trust of India. The aim is to improve the protection, conservation and welfare of elephants in India. The campaign was launched at the Elephant-8 ministerial meeting held in Delhi, in 2011.

The objective of the campaign is to spread public awareness and for developing friendship and companionship between the local public and elephants. The campaign also envisions setting up

of Gajah Centres in elephant landscapes across the country, to spread awareness about their plights and invoke public participation. The mascot of the campaign is Gaju.

Project Hangul

In the 1970s, 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 came to be known as Project Hangul.

Hangul or Kashmir Red Stag is a subspecies of the Central Asian Red Deer, which is native to northern India. It is mostly found in the dense riverine forests of Kashmir Valley, some parts of Himachal Pradesh, Sindh Valley, Dachigam National Park and in the forests of Kishtwar. It is also the state animal of Jammu and Kashmir. The project was started since Hanguls were enlisted in the critically endangered species list prepared by IUCN. The species is scattered through an area of 141 square kilometres in the Dachigam National Park.

The population of these deers was once approximately 5,000 in number. Problems such as overgrazing of domestic livestock in the habitat of Hanguls and criminal activities like poaching, illicit trading lead to the decline in the population of Hangul. Then, their population dwindled to as low as 150 by the end of 1970. The aim of the project was to create enclosures for artificial breeding of the species.

After the implementation of the project, the numbers rose to 340 by 1980. But over a course of time, the project however failed due to several factors. As per the census of 2008, their population was approximately 160.

Fallacies in Project Hangul

The project faced a major setback because the State Government allowed sheep breeding and research farms to be set up in the park. This covered almost 100 hectares of the park area.

Over a period of time, this proved to be a major disturbance. It is believed that several infectious zoonotic diseases could have been transmitted through the sheep to the stags. Due to habitat fragmentation and biotic interference, it posed a threat to their population. It took the government 12 years to arrive at the decision of relocation of sheep from Dachigam National Park. This has led to a tussle between the wildlife department and the sheep husbandry department. Although the state government passed an order in 2005 to relocate the sheep, it continued to exist because the successive regimes failed to find a place for relocation.

Further, there was no local participation of the people in the project. The Gujjars, Bakerwals, Nambardars, Chowkidars and Patwaris were not actively involved in

it.

The Government also allowed the establishment of cement factories around the Park. Lastly, the onset of militant activities in the area was the final straw in the failure of the conservation project.

In 2009, the project was reintroduced as '**Save Kashmir's Red Deer Hangul'**. Plans were made to breed them in captivity so as to increase their chances of survival. Funds were released for their captive breeding. Conservation breeding centres were opened in Pulwama, Sikargah Tral and Kangan. As per the latest census of 2017, there is an increase in the population of Hanguls. There are now 182 Hanguls in the Dachigam National Park.

Crocodile Conservation Project

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. Apart from this, there was a loss of habitat due to the increasing development projects and industrialization.

In light of this situation, Project Crocodile was introduced in 1975. The primary focus was on breeding and rearing in captivity. The initiative was taken by the Government of India in association with the Food and Agriculture Organization and United Nations Development Fund. 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.

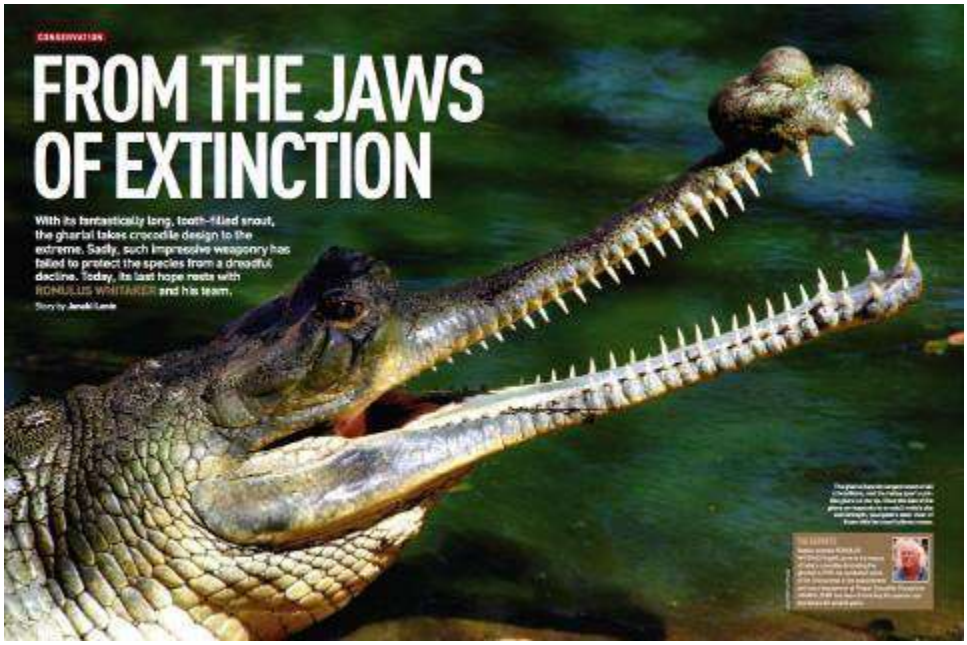
There are mainly three species of crocodilians:

1. Gharial or *Gavialis Gangeticus*
2. Mugger or *Crocodylus Palustris*
3. Saltwater Crocodile or *Crocodylus Porosus*

The strategy adopted for rehabilitation of these species was to offer them protection in their own habitats. The practice of captive rearing was followed and subsequently, they were released. The methods of ‘grow and release’ and ‘rear and release’ were used.

The objective of this project is to protect the remaining population of the species, to promote research which would help in improving management, to promote the rebuilding of their habitat and to encourage local public participation.

The project has saved the species from the verge of extinction, as they were enlisted as critically endangered in the IUCN Red List. It has also been helpful in the creation of wetland sanctuaries which has led to active management of other species as well. These species include turtles, Gangetic dolphins, lizards and others.



Conclusion

It can be concluded that the conservation of wildlife is important to maintain stability in the ecosystem. The expansion of human activities into the 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 these projects for mitigating 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 the 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.

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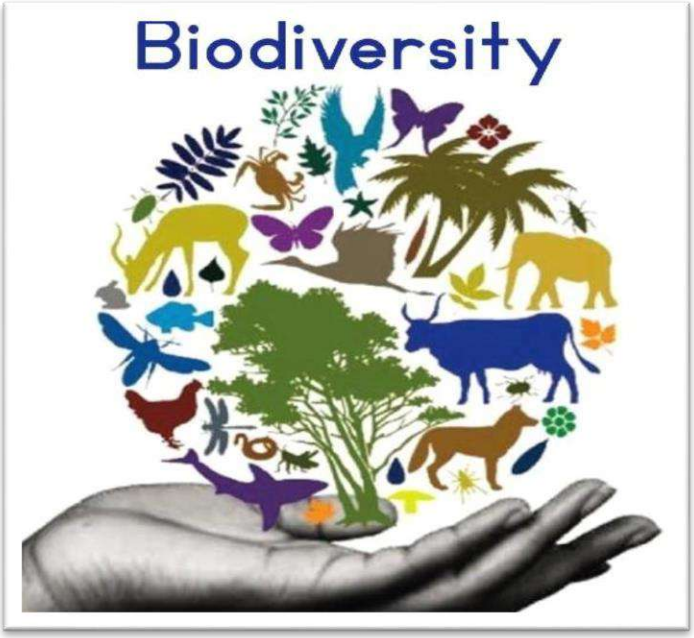
PROJECT on

BIODIVERSITY



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CONTENTS

INTRODUCTION

Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain. Biologists most often define biodiversity as the "totality of genes, species, and ecosystems of a region".

Biodiversity refers to the variety and variability of all types of microbes, plants and animals on the earth. It includes not only the many species that exist, but also the diversity of population that makes up a species, the genetic diversity among individual's life form and the many different habitats and ecosystems around the globe.

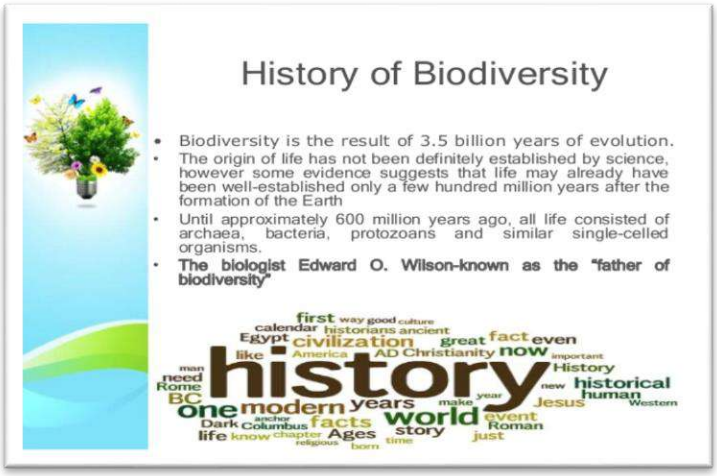
Biodiversity holds ecological and economic significance. It provides us with nourishment, housing, fuel, clothing and several other resources. It also extracts monetary benefits through tourism. Therefore, it is very important to have a good knowledge of biodiversity for a sustainable livelihood.

The term biodiversity was coined in 1985. It is important in natural as well as artificial ecosystems. It deals with nature's variety, the biosphere. It refers to variabilities among plants, animals and microorganism species.

Biodiversity includes the number of different organisms and their relative frequencies in an ecosystem. It also reflects the organization of organisms at different levels.

HISTORY OF BIODIVERSITY

Biodiversity today is huge, and it has a long history. Identifying rules for the heterogeneity of modern biodiversity—the high to low species richness of different clades—has been hard. There are measurable biodiversity differences between land and sea and between the tropics and temperate-polar regions. Some analysts suggest that the net age of a clade can determine its extinction risk, but this is equivocal. New work shows that, through geological time, clades pass through different diversification regimes, and those regimes constrain the balance of tree size and the nature of branching events. Charles Darwin identified the first principle of the origin of modern biodiversity, namely that all species were linked in a single great phylogeny, or tree of life, and that all could be traced back to a presumed single original species at some distant time in the geological past. The origin of life is now dated at 3.5–4 billion years ago, deep in the Precambrian Era.

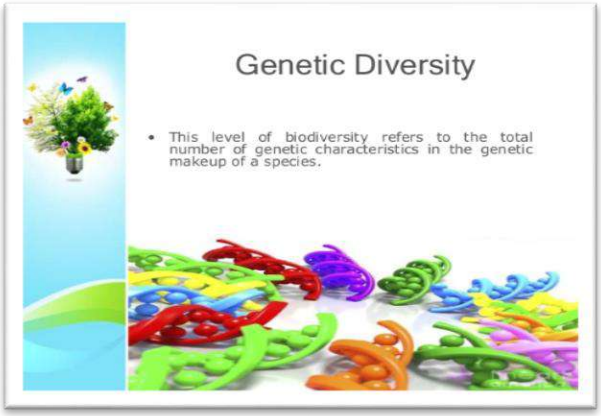


TYPES OF BIODIVERSITY

Biodiversity is the sum of all the different species of animals, plants, fungi ad microbial organisms living on Earth and the variety of habitats in which they live. Biodiversity includes three main types: diversity within species (Genetic Diversity), between species (Species Diversity) and between ecosystems (Ecosystem Diversity).

- Genetic Diversity

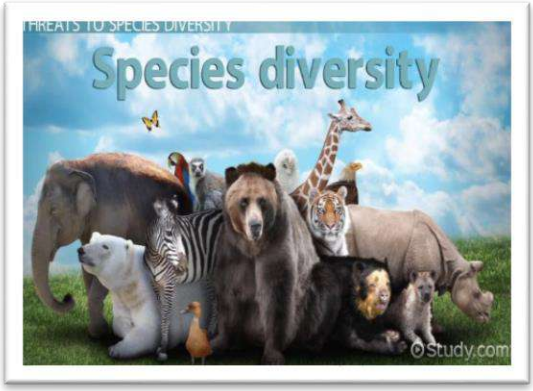
  Every species on Earth is related to every other species through genetic connections. The more closely related any two species are, the more genetic information they will share, and the more similar they will appear. An organism's closest relatives are members of its own species, or organisms with which it has potential to mate and produce offspring. Members of a species share genes, the bits of biochemical information that determine, in part, how the animals look, behave and live. One eastern grey squirrel, for example, shares the vast majority of its genes with other eastern gray squirrels, whether they live in the same area or are separated by thousands of miles. Members of a species also share complex mating behaviours that enable them to recognise each other as potential mates. For virtually every species there is a similar and closely related species in an adjacent habitat.



- Species Diversity

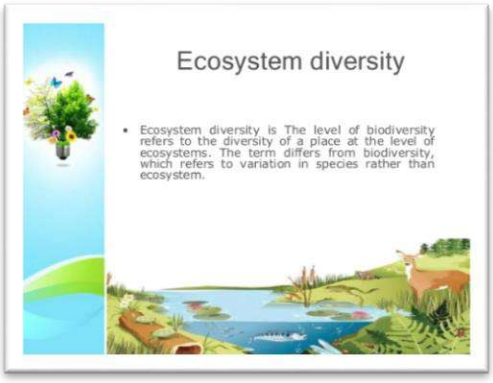
  Species diversity is a variety of species within a habitat or a region. Species are the basic units of biological classifications and thus the normal measure of biological diversity. Species richness is the term that describes the

number of different species in a given area. The world total is estimated at five to 10 million species, though only 1.75 million have been named specifically so far. Some habitats, such as rainforests and coral reefs, have many species. For example, tropical North and South has about 85,000 flowering plant species, tropical and subtropical Africa has about 35,000. By contrast, all of Europe has 11,300 vascular plants. Yet other areas, such as salt flats or a polluted stream, have fewer species. Species are grouped together into families according to shared characteristics.



- Ecological Diversity

Ecological diversity is the intricate network of different species present in local ecosystems and the dynamic interplay between them. An ecosystem consists of organisms from many different species living together in a region and their connections through the flow of energy, nutrients and matter. Those connections occur as the organisms of different species interact with one another. The ultimate source of energy in almost every ecosystem is the sun. Te sun's radiant energy is converted to chemical energy by plants. That energy flows through the systems when animals eat the plants and then are eaten by other animals. Fungi derive energy by decomposing organisms, which releases nutrients back into the soil. Thus, an ecosystem is a collection of living components (microbes, plants, animals and fungi) and nonliving components (climate and chemicals) that are connected by energy flow. Measuring ecological diversity is difficult because each of Earth's ecosystems merges into the ecosystems around it.



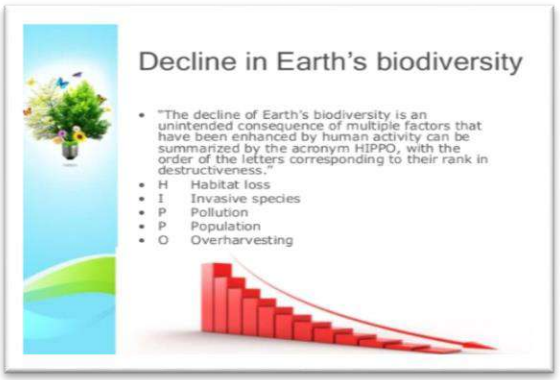
BIODIVERSITY AGREEMENTS

Concern about environmental destruction led to the signing of several national and international agreements. In 1972, the United Nations Conference on the Human Environment resolved to establish the United Nations Environment Program. Governments signed in for a number of regional and international agreements to tackle specific issues, such as protecting wet lands and regulating the international trade in endangered species. Those agreements, along with controls on toxic chemicals and pollution, have helped slow the tide of destruction – but they have not reversed it.

An international treaty known as the Conservation on International Trade in Endangered species of Wild Fauna and Flora went into effect in 1975 to outlaw the trade of endangered animals and animal parts. In the United States, the Endangered Species Act was enacted in 1973 to protect endangered or threatened species and their habitats. In 1987, the World Commission on Environment and Development concluded that economic development must become less ecologically destructive. Then in 1992, at the United Nations Conference Environment and Development in Rio de Janeiro, Brazil, a set of binding agreements was signed at the Convention on Biological Diversity. It was the first global agreement on the conservation and sustainable use of biological diversity. More than 150 governments signed the document at that conference, and since then more than 187 countries have ratified the agreement. The convention has three main goals: the conservation of biodiversity, sustainable use of the components of biodiversity and sharing the benefits arising from commercial and other uses of genetic resources in a fair and equitable way.

LOSS OF BIODIVERSITY

Biodiversity Loss or Loss of Biodiversity, is a decrease in biodiversity within a species, an ecosystem, a given geographic area, or Earth as a whole. It describes the decline in the number, genetic variability, and variety of species, and the biological communities in a given area. This loss in the variety of life can lead to a breakdown in the functioning of the ecosystem where decline has happened. The idea of biodiversity is most often associated with species richness i.e. the count of species in an area, and thus biodiversity loss is often viewed as species loss from an ecosystem or even the entire biosphere. However associating biodiversity loss with species loss alone overlooks certain subtle phenomenon that threaten long term ecosystem health. Sudden population decline may upset social structure in certain species which may create problems for the surviving males and females from finding mates, which may them produce further population decline. Even though a species is not eliminated from the ecosystem or from the biosphere its niche (the role the species play in the ecosystems its inhabits) diminishes as its number fall. If the niche's, as it has been described above, filled by a single species or a group of species are critical to or proper functioning of the ecosystems, a sudden decline in numbers may produce significant changes in the ecosystem structure. For example, clearing trees from a forest eliminates the shading, temperature and moisture regulation, animal habitat and nutrient transport services they provide to the ecosystem.



IMORTANCE OF BIODIVERSITY

At least 40 percent of the world's economy and 80 percent of the needs of the poor are derived from biological resources. In addition, the richer the diversity of life, the greater the opportunity for medical discoveries, economical development, and adaptive responses to such new challenges as climate change. Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play. For example, (1) a larger number of plant species means a greater variety of crops, (2) greater species diversity ensures natural sustainability for all life forms and (3) healthy ecosystems can better withstand and recover from a variety of disasters.

Thus while we dominate this planet, we still need to preserve the diversity in wildlife.

BENEFITS OF BIODIVERSITY

Although it is easy to give a definition to the word "biodiversity," it is not quite so easy to explain exactly why we should be interested in and concerned about the biodiversity of an ecosystem. There are, though, specific benefits to biodiversity that affect every one of us on this planet.

1. Consumptive use Value: The direct utilisation of timber, food, fuel wood, fodder by local communities.

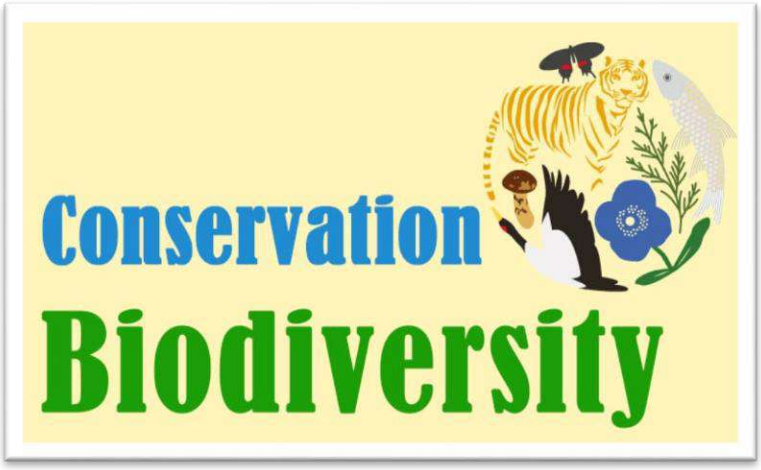
2. A variety of industries such as pharmaceuticals are highly dependent on identifying compounds of great economic value from the wide variety of wild species of plants located in undisturbed natural forests. This is called biological prospecting.

3. Social Values: The consumptive and productive value of biodiversity is closely linked to social concerns in traditional communities. 'Ecosystem people' value biodiversity as a part of their livelihood as well as through cultural and religious sentiments. A great variety of crops have been cultivated in traditional

agricultural systems and this permitted a wide range of produce to be grown and marketed throughout the year and acted as an insurance against the failure of one crop.

In recent years farmers have begun to receive economic incentives to grow cash crops for national or international markets, rather than to supply local needs. This has resulted in local food shortages, unemployment (cash crops are usually mechanised), landlessness and increased vulnerability to drought and floods.

4. Ethical and Moral Values: Ethical values related to biodiversity 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 of species. Indian civilization has over several generations preserved nature through local traditions. This has been an important part of the ancient philosophy of many of our cultures. We have in our country a large number of sacred groves or 'Deorais' preserved by tribal people in several States. These sacred groves around ancient sacred sites and temples act as gene banks of wild plants.



CONSERVATION OF BIODIVERSITY

"Biodiversity conservation refers to the protection, upliftment, and management of biodiversity in order to derive sustainable benefits for present and future generations." Biodiversity conservation is important because biodiversity provides certain services and resources that are essential for life on earth. Biodiversity also provides social benefits.

Biodiversity conservation has three main objectives: (a) to preserve the diversity of species, (b) sustainable utilization of species and ecosystem, and (c) to maintain life-supporting systems and essential ecological processes.

Biodiversity refers to the variability of life on earth. It can be conserved in the following ways:

In-situ Conservation: In-situ conservation of biodiversity is the conservation of species within their natural habitat. In this method, the natural ecosystem is maintained and protected.

The in-situ conservation has several advantages. Following are the important advantages of in-situ conservation:

(i) It is a cost-effective and a convenient method of conserving biodiversity.

(ii) A large number of living organisms can be conserved simultaneously.

(iii) Since the organisms are in a natural ecosystem, they can evolve better and can easily adjust to different environmental conditions.

Certain protected areas where in-situ conservation takes place include national parks, wildlife sanctuaries and biosphere reserves.

Ex-situ Conservation: Ex-situ conservation of biodiversity involves the breeding and maintenance of endangered species in artificial ecosystems such as zoos, nurseries, botanical gardens, gene banks, etc. There is less competition for food, water and space among the organisms.

Ex-situ conservation has the following advantages:

(i) The animals are provided with a longer time and breeding activity.
(ii) The species bred in captivity can be reintroduced in the wild.
(iii) Genetic techniques can be used for the preservation of endangered species.

CONCLUSION

The existence and welfare of the human race depends on health and well-being of other life forms in the biospheres. Marine biodiversity tends to be highest along coasts in the Western Pacific, where sea surface temperature is highest and in mid-latitudinal band in all oceans. Biodiversity is our life. If the biodiversity got lost at this rate then in our near future, the survival of human being will be threatened. So, it is our moral duty to conserve biodiversity as well as our environment. Long term maintenance of species and their management requires co-operative efforts across entire landscapes. Biodiversity should be dealt with at scale of habitats or ecosystems rather than at species level.

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CU ROLL NO. - 203223-11-0098

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COLLEGE ROLL NO. - ECOA20F300

COURSE - Bsc. Hons (ECONOMICS)

SEMESTER - II

ENVIRONMENTAL STUDIES

AECC 2

PROJECT ASSIGNMENT

RENEWABLE
AND
NON-RENEWABLE
RESOURCES

INTRODUCTION

NATURAL RESOURCES - These refers to all the materials available in our environment which help us to satisfy our needs and wants. These natural substances are known as natural resources. Natural resources are the raw materials for all human requirements.

Thus, anything that can be transformed to be a form that becomes valuable and useful to humans is termed as a resource. An item becomes a resource with time and developing technology.

The benefits of resource utilization may include increased wealth, proper functioning of a system, or enhanced well-being. Resources can be classified upon variable factors but the most common factor is availability - where they are classified into renewable and non-renewable resourses.

CLASSIFICATION OF NATURAL RESOURCES ON THE BASIS OF AVAILABILITY :

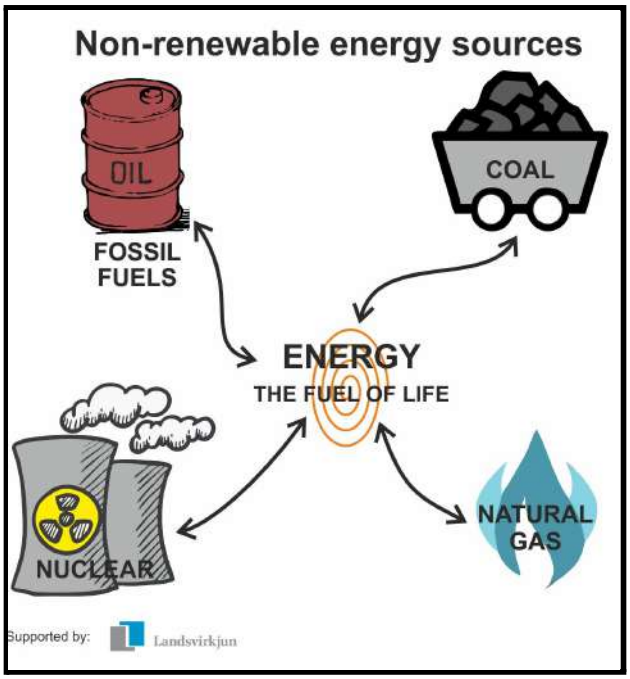
1.*RENEWABLE RESOURCES* - It is also known as a flow resource which will replenish to replace the portion depleted by usage and consumption, either through natural reproduction or other recurring processes in a finite amount of time on the human time scale. They are also often referred to as clean energy.

While renewable energy is often thought of as a new technology, harnessing nature's power has long been used for heating, transportation, lighting and more.

Now that we have increasingly innovative and less expensive ways to capture and retain wind and solar energy, renewables are becoming a more important power source.

2.NON-RENEWABLE RESOURCES - They are those natural resources that cannot be replenished by natural means. These resources once used up have very little chance of recovery or resynthesis. A nonrenewable resource is a substance that is being used up more quickly than it can replace itself and hence it's supply is finite.

An example is carbon-based fossil fuels. The original organic matter, with the aid of heat and pressure, becomes a fuel such as oil or gas which are all considered non-renewable resources.



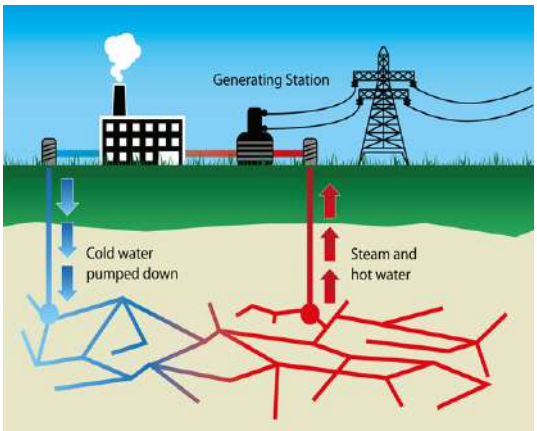
PRESENTATION

EXAMPLES OF RENEWABLE RESOURCES :

There are various types of renewable energy that are now available like solar, wind and many more are yet to come in the market.

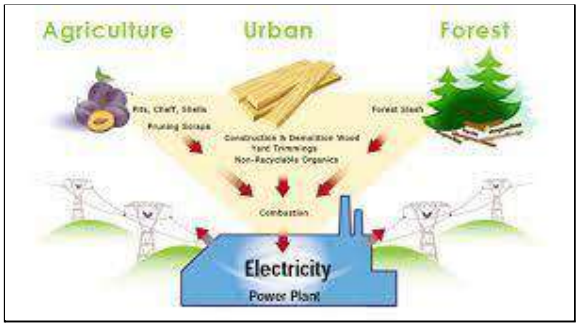
a.GEOTHERMAL ENERGY - It is the thermal energy in the Earth's crust which originates from the formation of the planet and from radioactive decay of materials. It's then used to generate geothermal power which is an electrical power.

Geothermal power is considered to be a sustainable renewable source of energy because the heat extraction is small compared with the Earth's heat content.



As a source of renewable energy for both power and heating, geothermal has the potential to meet 3-5% of global demand by 2050. With economic incentives, it is estimated that by 2100 it will be possible to meet 10% of global demand.

b.BIOMASS ENERGY - Its an energy source derived from organic material such as animal or plant matter and it is growing in popularity. Proponents increasingly favour biomass use over fossil fuels due to the low levels of carbon emitted when the material is burned, and see it as the answer to fighting climate change.

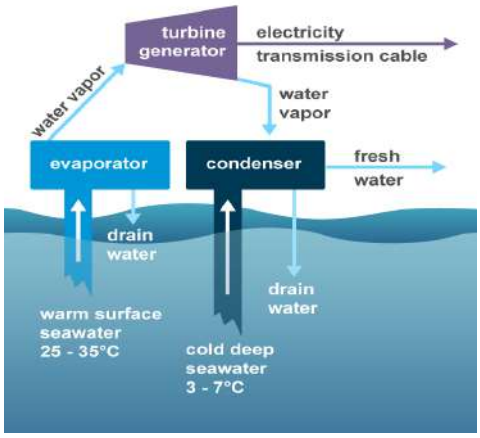


Biomass is an incredibly versatile substance, able to produce energy through being burned directly, converted into liquid biofuels or harvested as a gas from landfills or anaerobic digesters. Its own source of energy comes from the sun, and as plant matter can be regrown relatively quickly, it is classed as renewable.

While a number of waste materials can be used to create biomass – such as sawdust from lumber mills, crop residue, and even chicken litter – it is predominantly sourced from wood. This practice is deemed sustainable by biomass advocates as it can utilise by-products of forest management or help to clear dead or sick trees from an area.

c.OCEAN THERMAL ENERGY - Ocean thermal energy conversion (OTEC) is a process or technology for producing energy by harnessing the temperature differences between ocean surface waters and deep ocean waters.

Energy from the sun heats the surface water of the ocean. In tropical regions, surface water can be much warmer than deep water. This temperature difference can be used to produce electricity and to desalinate ocean water. OTEC systems use a temperature difference (at least 77° F) to power a turbine to produce electricity. Warm surface water is pumped through an evaporator containing a working fluid. The vaporized fluid drives a turbine/generator. The vaporized fluid is turned back to a liquid in a condenser cooled with cold ocean water pumped from deeper in the ocean. OTEC systems using seawater as the working fluid can use the condensed water to produce desalinated water.



EXAMPLES OF NON-RENEWABLE RESOURCES :

There are plenty of energy resources on this earth which are non-renewable in nature. Some of which are listed down below.

a.NATURAL GAS - It's a non-renewable fossil fuel formed from the remains of tiny sea plants and animals that died 300-400 million years ago. Approximately 90% of natural gas is composed of methane, but it also contains other gases such as propane and butane.

We use natural gas for heating and cooking. Natural gas can also be burned to generate electricity. We rely on

natural gas to give power to lights, televisions, air conditioners, and kitchen appliances in our homes. Natural gas can also be turned into a liquid form, called liquid natural gas (LNG). LNG is much cleaner than any other fossil fuels. Liquid natural gas takes up much less space than the gaseous form. The amount of natural gas that would fit into a big beach ball would fit into a ping-pong ball as a liquid! LNG can be easily stored and used for different purposes. LNG can even be a replacement for gasoline.

b.COAL - It is a combustible black or brownish-black sedimentary rock with a high amount of carbon and hydrocarbons. Coal is classified as a nonrenewable energy source because it takes millions of years to form.

Coal contains the energy stored by plants that lived hundreds of millions of years ago in swampy forests. Layers of dirt and rock covered the plants over millions of years. The resulting pressure and heat turned the plants into the substance we call coal.

It is used vastly and extensively both in raw form and its byproducts. The steel industry uses coal indirectly as coal coke to smelt iron ore into iron to make steel. The high temperatures created by burning coal coke give steel the strength and flexibility needed for bridges, buildings, and automobiles. Coal-fired power plants burn coal to make steam and the steam turns turbines to generate electricity. Coal can be turned into gases and liquids that can be used as fuels or processed into chemicals to make other products. These gases or liquids are sometimes called synthetic fuels or synfuels.

c.OIL - Oil is a non-renewable energy resource. It is the world's primary fuel source for transportation. Most oil is pumped out of underground reservoirs, but it can also be found embedded in shale and tar sands.

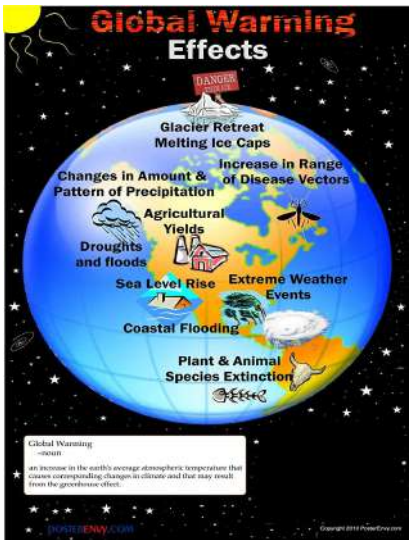
Once extracted, crude oil is processed in oil refineries to create fuel oil, gasoline, liquefied petroleum gas, and other non-fuel products such as pesticides, fertilizers, pharmaceuticals, and plastics. We depend on oil and other fossil fuels because they are energy-rich and relatively cheap to process. That is why they are not replenished with the speed at which they are consumed, making them a finite resource.

Crude oil is a liquid fuel fossil fuel that is used mostly to produce gasoline and diesel fuel for vehicles, and for the manufacturing of plastics. It is found in rocks below Earth's surface and is pumped out through wells.

CONCLUSION

IMPACT OF RENEWABLE & N0N-RENEWABLE RESOURCES ON THE ENVIRONMENT :

Unfortunately, human society is for the time being dependent on nonrenewable resources as its primary source of energy. Approximately 80 percent of the total amount of energy used globally each year comes from fossil fuels. We depend on fossil fuels because they are energy-rich and relatively cheap to process. But a major problem with fossil fuels, aside from their being in limited supply, is that burning them releases carbon dioxide into the atmosphere. Rising levels of heat-trapping carbon dioxide in the atmosphere is the main cause of global warming.



Ongoing concerns about climate change have made renewable energy sources an important component of the world energy consumption portfolio. Renewable energy technologies could reduce CO2 emissions by replacing fossil fuels in the power generation industry and the transportation sector.

Because of some negative and irreversible externalities in conventional energy production, it is necessary to develop and promote renewable energy supply technologies and demand for renewable energy. Power generation using renewable energy sources should be increased in order to decrease the unit cost of generation. Energy consumption depends on several factors including economic progress, population, energy prices, weather, and technology.

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For doing this project I have done a lot of research and taken help from some sites which are listed below;

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- Irene.org
- Solar Schools.org

B.Sc. Semester II (HONOURS)

2020-2021

ENVIRONMENTAL STUDIES

PROJECT

ON

WATER POLLUTION

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COLLEGE ROLL NO: ECOA20F253

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I WOULD ALSO LIKE TO THANK MY PARENTS AND FRIENDS WHO HELPED ME A LOT TO DO THIS PROJECT WITHIN THE LIMITED TIME .

CONTENTS:

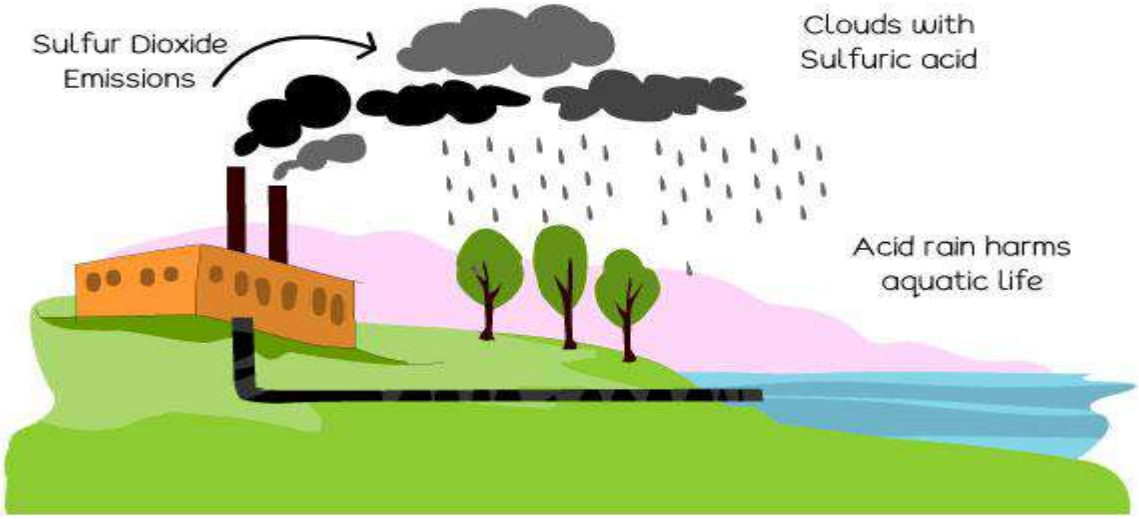
INTRODUCTION :

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 DUE INDUSTRIAL ACTIVITIES



TYPES OF WATER POLLUTION

Surface water pollution: 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. In industrialized areas rain can be acidic because of dissolved oxides of sulfur 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.

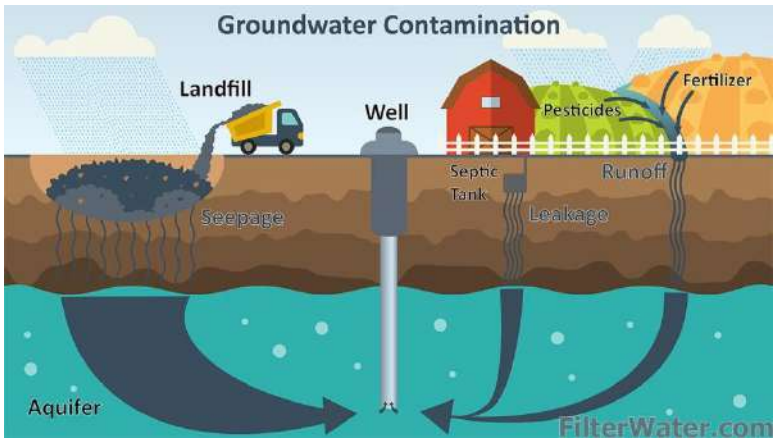
Marine pollution: One common path of entry by contaminants to the sea are rivers. An example is directly discharging sewage and industrial waste into the ocean. Pollution such as this occurs particularly in developing nations. In fact, the 10 largest emitters of oceanic plastic pollution worldwide are, 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.

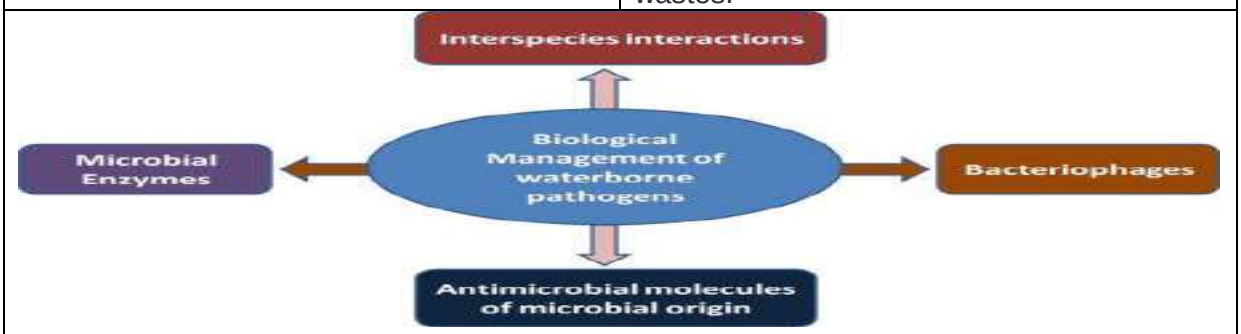
There are a variety of secondary effects stemming not from the original pollutant, but a derivative condition. An example is silt-bearing surface runoff, which can inhibit the penetration of sunlight through the water column, hampering photosynthesis in aquatic plants.

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.[19] 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.

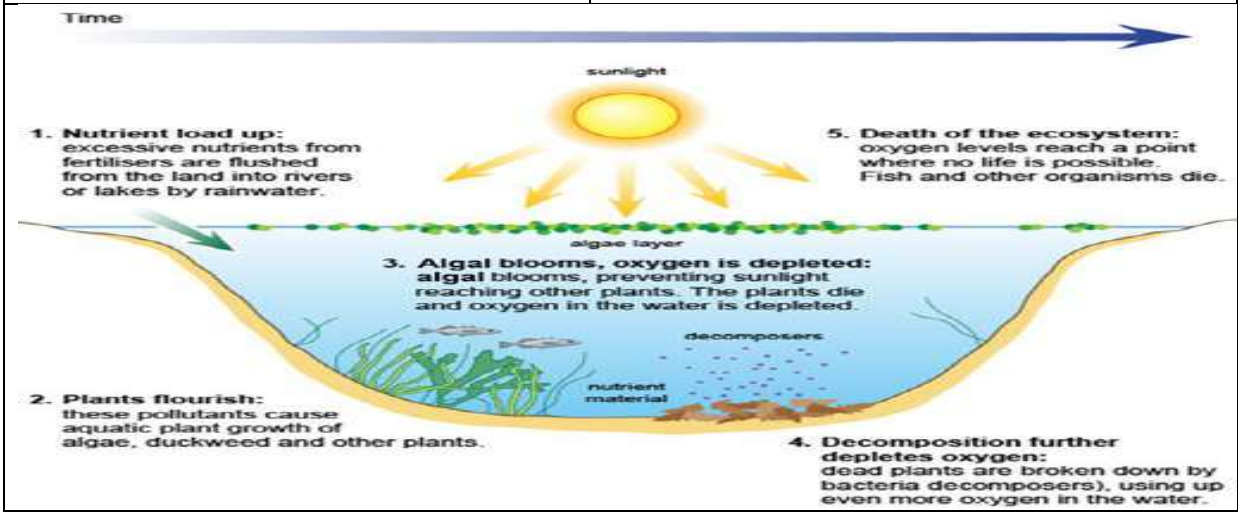
Analysis of groundwater contamination may focus on soil characteristics and site geology, hydrogeology, hydrology, and the nature of the contaminants. Causes of groundwater pollution include: naturally-occurring (geogenic), on-site sanitation systems, sewage, fertilizers and pesticide, commercial and industrial leaks, hydraulic fracturing, landfill leachate .



EFFECTS OF WATER POLLUTANTS:

Sediments and suspended solids	Sediments and suspended solids consist of fine particles of mostly inorganic material. **Inorganic material** is derived from non-living sources and includes mud, sand and silt washed into a river as a result of land cultivation, construction, demolition and mining operations, where these take place. One of the most common sources of suspended solids and sediment is **soil erosion,** where the soil is washed away into rivers by rainwater run-off. The presence of solid particulate material suspended in the flowing water is the reason why many rivers look brown in colour, especially in the rainy season. The particles are called **suspended solids** while they are carried (suspended) in flowing water and **sediments** when they settle to the bottom. Large quantities of suspended solids may reduce light penetration into the water, which can affect the growth of plants. Sediments may even suffocate organisms on the river bed.
Organic matter	**Organic matter**, such as human and animal wastes, is derived from living organisms. As organic matter decomposes, it removes oxygen from the water and this can have a damaging effect on fish and other aquatic organisms that are sensitive to poor water quality. If a large quantity of organic matter is present in surface water, this can lead to anaerobic conditions. be stagnant and smell unpleasant.
Biological pollutants	These are the infectious agents (bacteria, viruses, protozoa and helminths) that are harmful to humans and other forms of life. Biological pollutants may get into water with dust from the air as rain falls but the most likely source is from water that is contaminated with human and animal wastes.
	

Plant nutrients	Nitrates and phosphates are common pollutants generated from residential areas and agricultural run-off. They are usually associated with human and animal wastes or fertiliser that has been washed into surface water bodies by rain. Nitrates and phosphates are plant nutrients, so they stimulate plant growth. If present in large quantities, they can encourage excessive plant growth in the water causing the phenomenon known as an algal bloom, which means a sudden increase in the population of microscopic algae (simple plants). There may also be an increase in larger plants such as the invasive water hyacinth. When the increased population of aquatic plants dies, the decay of the organic plant material by bacteria can cause deoxygenation of the water, resulting in the death of other organisms such as fish. If a water body has high nutrient levels it is said to be eutrophic and the process is known as eutrophication. The following figure illustrates the process.



Other chemical pollutants	Heavy metals such as arsenic, copper, lead, mercury and cadmium are chemical pollutants that may be found in lakes, rivers and groundwater. These heavy metals can harm aquatic organisms and humans. Farmers who use river water polluted by urban wastes for irrigation in the cultivation of fruits and vegetables may find their crops affected by the accumulation of these chemicals. (You will look at a case study on this later on in this study session.Pesticides include insecticides, herbicides and fungicides. There are several thousand different types in use and almost all of them are possible causes of water pollution. Pesticides such as DDT (dichlorodiphenyltrichloroethane), malathion, parathion and others have been sprayed in the environment for long periods of time for the control of disease vectors such as mosquitoes and other pests.Heavy metals and some pesticides are particular problems because they are persistent in the environment, meaning they do not break down and their effects continue over time, even long after their use may have stopped.

Possible sources of water pollution:

i.Human excreta: Open defecation and poorly constructed pit latrines are obvious sources of human waste and can easily pollute surface and groundwater. Where water-flushed sewerage systems are present, inadequately treated sewage can also be a major source of human waste.

ii. Manufacturing and industrial plants: The range of different uses and processes can produce waste in the form of many different types of organic and inorganic material in suspension or in solution. In many cases, much of the water used can be recycled but there is almost always an effluent discharge that requires treatment.Food as carbohydrates, proteins and fats. Factories producing chemicals often generate low volumes of highly toxic waste streams. Toxic effluents can also be produced in the paper, leather and electroplating industries. For example, cyanides and heavy metals may be present in wastewaters from electroplating. These plants can also be the source of highly acidic wastes.

iii. **Agriculture and animal rearing:** The intensive rearing of animals results in large volumes of organically polluted washwater from cleaning animal houses. This slurry is often stored in lagoons or tanks prior to spreading on land. However, problems occur when these lagoons or tanks leak or overflow, allowing the slurry to flow into watercourses or infiltrate groundwater. Other agricultural pollutants include pesticides and fertilisers.

iv. **Domestic and industrial solid waste sites:** Domestic and commercial solid waste should be disposed of in a properly designed and constructed landfill site. Many landfill sites, particularly those that are older and less well designed and managed, such as the one shown in the Figure , generate leachate, which is highly polluting. Leachate can contain dissolved organic matter and many different types of inorganic components depending on the type of waste. Where industrial waste has been dumped, a toxic chemical stream may also be produced. These leachates should be collected and treated so that pollution of groundwater and rivers does not arise.

IMPACTS OF THE WATER POLLUTION ON THE ENVIRONMENT

Pollution of water affects both humans and aquatic life. Most water sources close to cities and urban centres are polluted by garbage and dumping of chemicals, legally or illegally. Below are some of the common as well as adverse effects of polluting water bodies.

i. **IMPACTS ON HUMAN BEINGS :** Life is a cycle, and humanity's irresponsible behaviour often comes back to haunt it. Adding contaminants to water bodies has affected the human family in several ways. According to a 2017 WHO report, 2.1 billion people do not have access to safe water. In 2019, it stated that 785 million people lack access to essential drinking water.
One of the main effects of this is diseases. World Health Organisation notes that there are about 120,000 cholera-related deaths annually. Also, the Fukushima tragedy, for example, increased the prevalence of thyroid cancer in exposed infants by 70%.

ii. **DEATH OF AQUATIC LIFE:** Animals and plants that depend on water for life are the most affected by polluted water. Statistics from the Centre for Biological Diversity on the effects of the Deep Horizon spill provides a useful glimpse of the impact of pollution on aquatic life. In the report, the 2010 spill on the Gulf of Mexico harmed over 82,000 birds, 25,900 marine animals, 6165 sea turtles, and an unknown number of fish and invertebrates.

iii. **FOOD CHAIN DISRUPTION:** Pollution disrupts the food chain by moving the toxins from one level in the chain to higher levels. In some cases, pollution can wipe out an entire part of the food chain. Such affect the other organisms by either causing excessive growth, in case the predator dies or death (if it wipes out the prey).

Iv. DESTRUCTION OF ECOSYSTEMS: The introduction or elimination of certain microorganisms distorts the ecosystem. Nutrient pollution, for example, leads to an increase in algae, which depletes the water of oxygen, thereby leading to the death of fish and other aquatic life.

v. Impacts on Aquatic Life: The effect of water pollution is more on aquatic life, because their existence depends on water and when there is any disturbance in their ecosystem, the impact is maximum on them. In polluted water, due to abundant growth of algae, the oxygen content becomes lesser, causing the death of fishes and other organisms. It is estimated that during the last twenty years, there is a decrease of about 40 per cent in aquatic life.

STEPS ADOPTED BY GOVERNMENT OF INDIA TO CONTROL WATER POLLUTION

- 1. Preparation of action plan for sewage management and restoration of water quality in aquatic resources by State Governments.

- 2. Installation of Online Effluent Monitoring System to check the discharge of effluent directly into the rivers and water bodies.

- 3. Setting up of monitoring network for assessment of water quality.

- 4. Action to comply with effluent standards is taken by SPCBs / PCCs to improve the water quality of the rivers.

- Financial assistance for installation of Common Effluent Treatment Plants for cluster of Small Scale Industrial units.

- 6. Issuance of directions for implementation of Zero Liquid Discharge.

- 7. Issuance of directions under Section 5 of Environment (Protection) Act, 1986 to industries and under Section 18(1)(b) of Water (Prevention and Control of Pollution) Act, 1974.

- 8. Implementation of National Lake Conservation Plan (NLCP) and National Wetland Conservation Programme (NWCP) for conservation and management of identified lakes and wetlands in the country which have been merged in February, 2013 into an integrated scheme of National Plan for Conservation of Aquatic Eco-systems (NPCA) to undertake various conservation activities including interception, diversion and treatment of waste water, pollution abatement, lake beautification, biodiversity conservation, education and awareness creation, community participation etc.

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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SEMESTER – 2

DEPARTMENT – ECONOMICS

ENVS AECC TUTORIAL

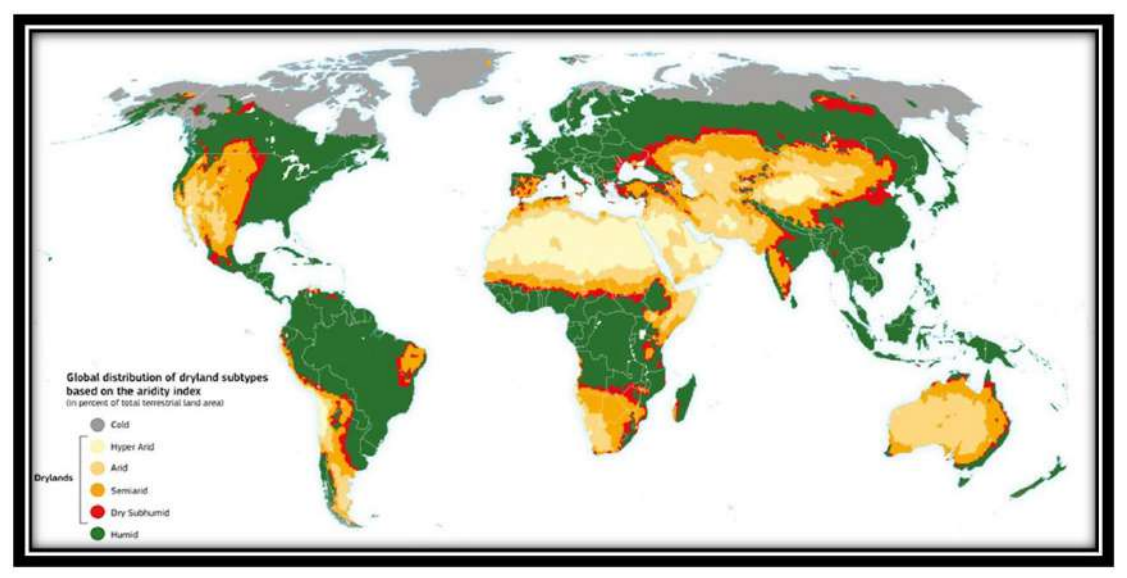
PROJECT TOPIC – DEFORESTATION

INDEX

1. Introduction:

Definition of Desertification

The word **Desertification** invokes images of sand dunes blowing over abandoned farms as some irresistible, dark force steadily transforms fertile fields into inhospitable wasteland. The United Nations' official definition says desertification is land degradation in typically dry areas resulting from various factors, including climatic variations and human activities. Scientists who studied the matter categorized the definition to be too broad; however, "The definition encompasses things like **drought**, **overgrazing**, and **inadvisable cropping**," says Prince. All of these conditions do suppress the ability of the land to support plant growth.

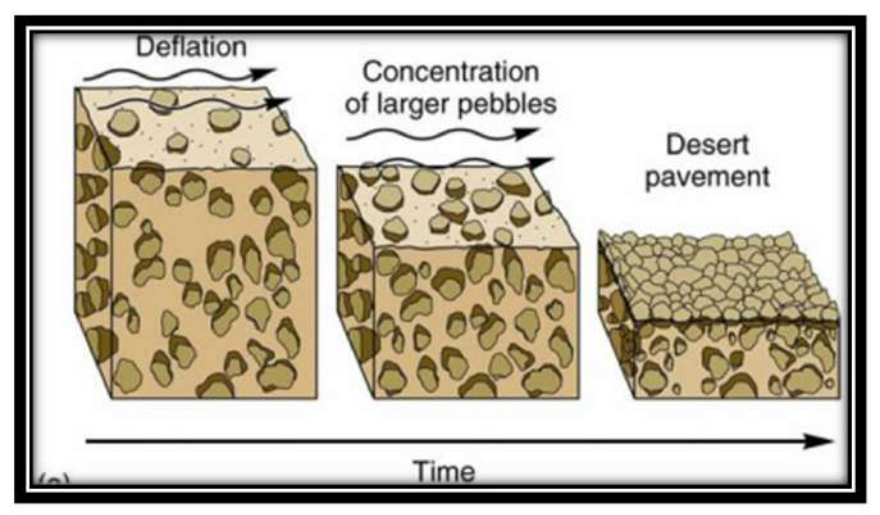


(Fig. 1.1) The observed distribution of different aridity levels, based on data for 1981-2010. Shading color indicates regions defined as cold (grey), humid (green), dry subhumid (red), semiarid (dark orange), arid (pale orange) and hyper arid (pale yellow).
Map produced by the European Commission's Joint Research Unit.

Nowadays scientists are lead to believe that desertification is a **reduction in the productivity of the land that is not reversible**. Many factors can induce desertification such as **drought**, **overgrazing, fire**, and **deforestation** which can thin out vegetation, leaving exposed soil. If the nutrient-rich top soil blows or washes away, plants may not be able to return back to normalcy. When a land cannot support **cattle and agriculture**, and is unable to recover, then that land is proclaimed as desertified.

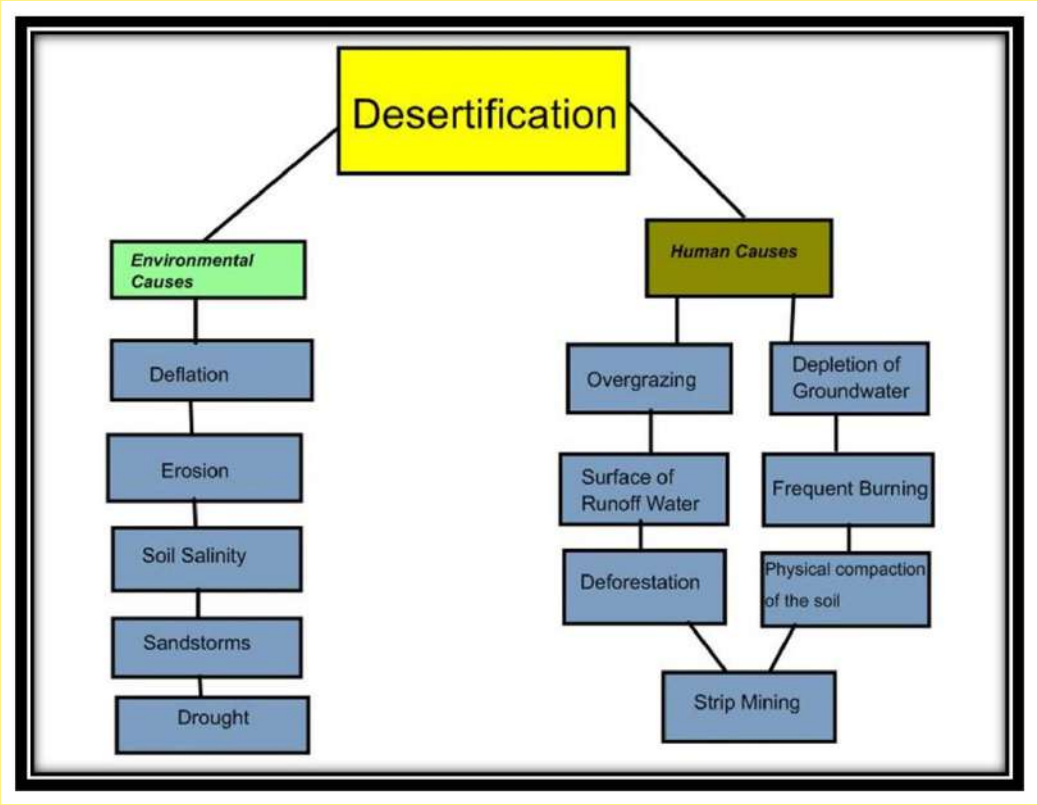
Process of Desertification

As **desertification occurs gradually** and continuously, and the processes responsible for it are established, it can often be avoided by planning or reversed before irreparable damage occurs. The distinctive features of land undergoing desertification include continuing loss of mature, stabilizing vegetation from the ecosystem, or loss of agricultural crop cover during periods of drought or economic infeasibility, and a resulting loss of drifted topsoil, known as **deflation**. Erosion by wind and water then disperses the fine-grained silt and clay particles from the soil; substantial dust storms were essentially composed of blowing topsoil. Continued irrigation of desertified land increases soil salinity, and contaminates groundwater.



(Fig. 1.2) Process of occurrence of Deflation (Source: manutd.ru)

Eventually, ongoing wind and water erosion leads to development of gullies and sand dunes across the deflated land surface. The forces causing these physical transformations to occur may be divided into natural, human or cultural, and administrative causes. Among the natural forces are wind and water erosion of soil, long-term changes in rainfall patterns, and other changes in climatic conditions. The role of drought is variable and related in part to its duration; a prolonged drought accompanied by poor land management may be catastrophic, while a shorter drought might not have lasting consequences.



(Fig. 1.3) Flowchart representation of factors causing desertification

As culmination of these phenomena, drought thus stresses the ecosystem without necessarily degrading it permanently in general. Rainfall similarly plays a variable role on account of its duration, the cyclic pattern of its occurrence, and its congruous distribution. The list of human or cultural influences on desertification includes vegetation loss by overgrazing, depletion of groundwater, surface runoff of rainwater, frequent burning, deforestation, which has a long historical record; there is evidence of such damage caused around the Tigris and Euphrates rivers in ancient Mesopotamia. Poverty stricken economic conditions also contribute to degradation of croplands. During crisis, farmers confront with bankruptcy and a decade-long drought, and they left millions of acres of plowed, bare crop land unplanted.

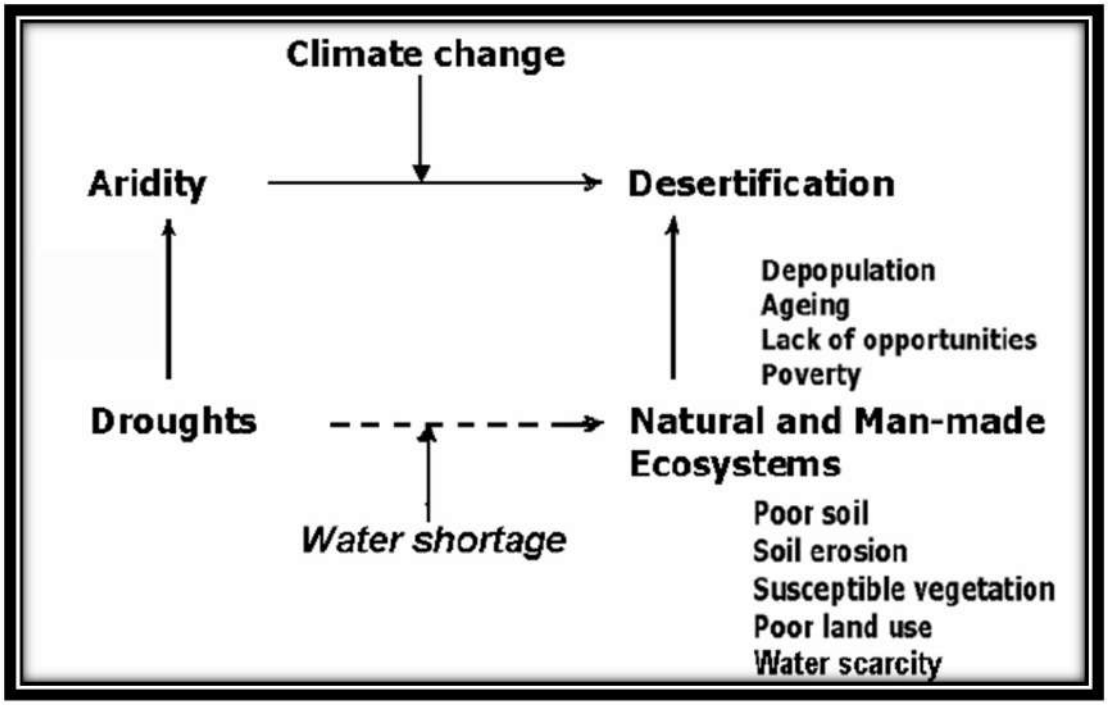
Characteristic features of desertification

The following are the characteristics of this phenomenon:

- The vulnerability of land to desertification is mainly due to the climate, the topography, the state of the soil, the natural vegetation, and the ways in which these resources are used. Climate affects the chemical and biological deterioration of the soil and conditions water and wind erosion. The state of the soil is the major susceptible factor, particularly in the dry sub-humid zones where the influence of climatic factors is meager. Natural and cultivated vegetation plays an essential role in protecting the soil. Lastly, even under the same climatic conditions, topography,

soils, vegetation, and cover status, among others could vary widely depending on the land-use system and human activities.

- Droughts occur frequently in the areas affected by desertification, and are generally a natural feature of the climate of such regions. The correlational link between desertification and drought on the one hand, and human influence on the other, are unknown and complex. Occasional droughts and long-term severe droughts can both be caused by the influence of man on the environment. Henceforth, human activities can accelerate desertification and aggravate its negative consequences on people. Furthermore, land degradation can hasten the effects of drought by reducing the chances of locals to face difficult, dry periods.
- The implacibility of desertification depends on factors which vary from one region, country, or year to another. These include:
  (i) The severity of the climatic conditions during the period considered;
  (ii) Population pressure and the standard of living of the people involved;
  (iii) The level of the country's development and the quality of the preventive measures taken.



(Fig. 1.4) Flow-chart representation of the process of Desertification (source:Researchgate.net)

2. Objectives:

The Objective of this project work on "Desertification" is as follows:

i) To coin out the specific problem of desertification as far it's definition and process of occurrence followed by the characteristics

ii) To quantify statistically, as far as possible, the extent of desertification in the world as well as in India

iii) To access the readily available impact of desertification on the surrounding Nature as well as on the human beings.

iv) To find out some effective remedial measures in order to control or mitigate such an environmental problem on desertification.

(Fig. 2) Desertification

3. Area of Study

Area of discussion: Desertification in India

Cultivated lands in India are in the grips of desertification. The country's Green Revolution pockets are especially prone to the problem. The biggest threat of desertification emanates from the major crops of the Green Revolution — wheat and paddy.

Sardara Singh Johl, a Padma Bhushan-award agricultural economist and chancellor of Central University of Punjab, has suggested that if agricultural land in Punjab is to be protected from desertification, the best way is to shift wheat and paddy cultivation to 5 million hectares of land in the Indo Gangetic plains of Uttar Pradesh, Bihar and West Bengal.

Johl's mantra, unfortunately, doesn't provide concrete measures to pause desertification. The senior agricultural economist should have counteracted Green Revolution which gave birth to the problem. Transferring a disease from one geographical area to the other is not a remedy because we do not know how to get rid of the causal agent of the disease.

Causes for Desertification in India:

Man-Made Causes:

Overgrazing

It reduces the efficacy, productivity, and biodiversity of the land. India lost 31% of grasslands between 2005 and 2015.

Deforestation

A forest acts as a carbon sink. Deforestation releases carbon dioxide back into the atmosphere contributing to the greenhouse effect.

Farming Practices

Slash and burn agriculture exposes state to soil erosion hazards. Heavy spading and over irrigation disturbs mineral composition of the soil.

Urbanization

As urbanization increases, the demand for resources increases drawing more resources and leaving lands that easily succumb to desertification.

Climate Change

It may aggravate desertification through alteration of spatial and temporal patterns in temperature, rainfall, solar radiation and winds.

Overexploitation of Resources

Increasing demand for land resources due to issues like overpopulation leaves land vulnerable to desertification.

Natural Causes:

Natural Disasters

Natural Disasters like Floods, Droughts, landslides results into

Water Erosion

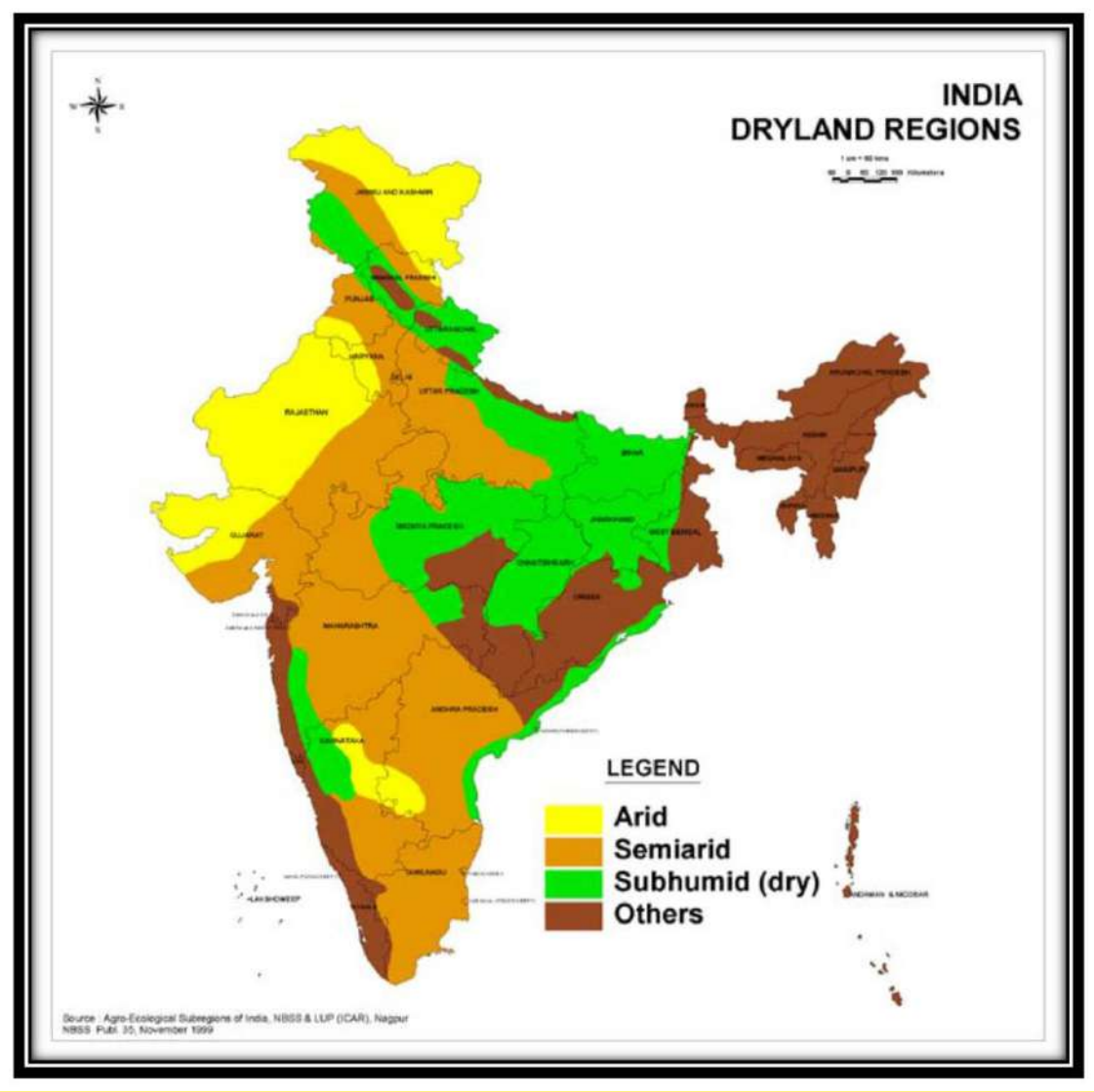
Displacement of fertile soil.

Water erosion

It results into Badland Topography which itself is an initial stage of desertification.

Wind Erosion

Sand encroachment by wind reduces fertility of the soil making the land susceptible to desertification.



(Fig. 3.2.1) Map of India showing the areas under desertification

Desertification in different Indian states:

More than 60% of the desert lies in the Indian state of Rajasthan, and it extends into Gujarat, Punjab, and Haryana, and the Pakistani province of Sindh. We are going to discuss the cause and effect of desertification in the above stated desert states of India.

- **Desertification in Rajasthan:** Approximately 92% of the total land area in Rajasthan is currently engulfed by desertification, with about 76% from wind erosion, 13% by water erosion, and another 4% area is affected by water logging and salinity/alkalinity (as of a 2006 study). Water erosion and salinity also affect agriculture, aggravating poverty and threatening the food and water security in this area. Understanding the causes of land degradation in Rajasthan is crucial to help the Indian government draft policy to protect and improve the livelihoods of the communities residing there.

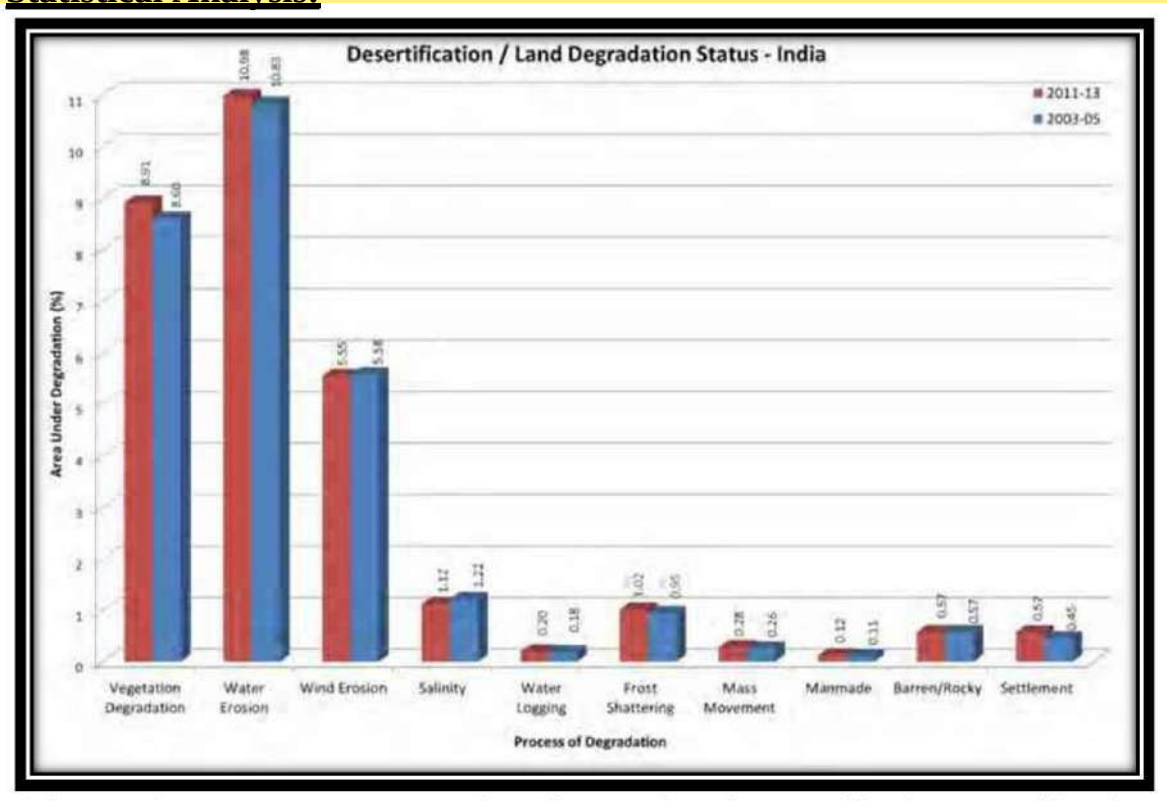
- **Desertification in Jharkhand:** Jharkhand is among the five states (the others are Rajasthan, Delhi, Gujarat and Goa) where 50 per cent of the total area is under desertification and land degradation, according to the Land degradation and Desertification Atlas prepared by the Space Application Centre,Ahmedabad.

- **Desertification in Gujarat:** Gujarat has the third highest area of desertification in the country. The second being Jharkhand and first, Rajasthan. Around 52% of the geographical area of 1.96 crore hectares in the state is under desertification; along with an increase of nearly 1.85 lakh hectare of 0.94% of the total geographical area. The area under desertification in Jharkhand is 68.98% followed by Rajasthan at 62.90% and Gujarat.

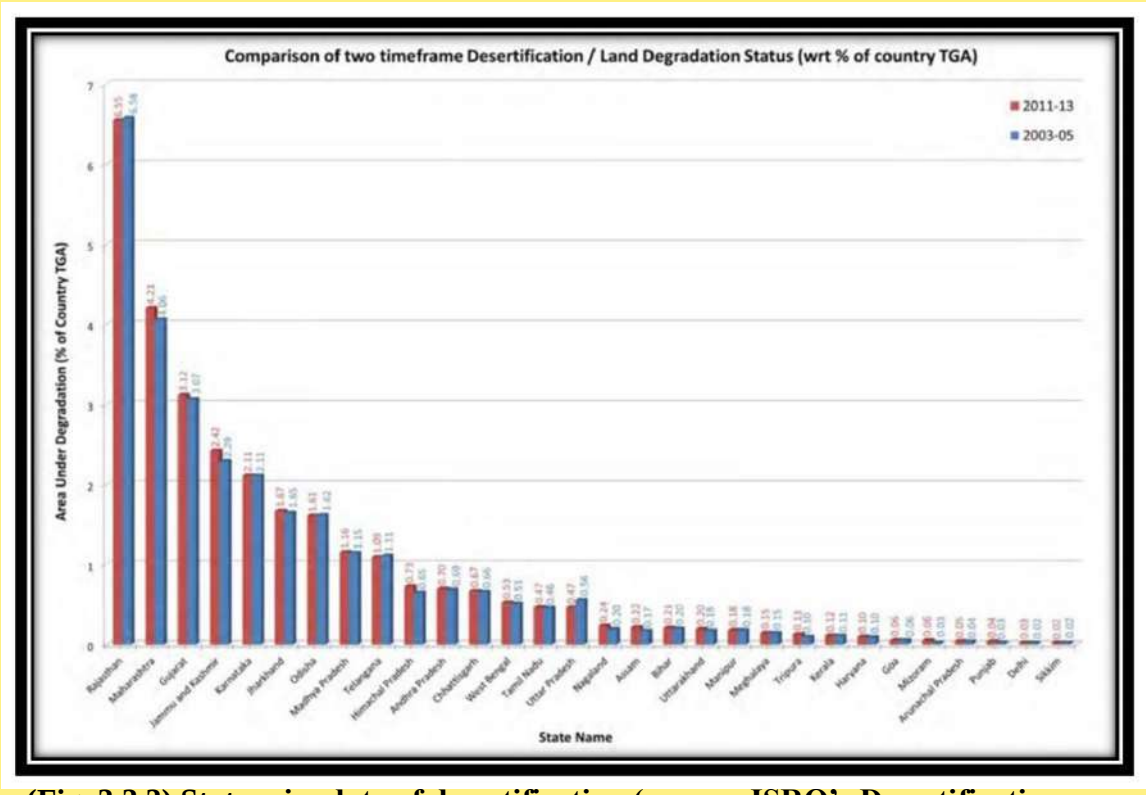
- **Desertification in Punjab:** The biggest problem in Punjab is the fall in water level, and its pollution. Punjab has the highest use of fertilizer per unit of land in the country, and the water table is decreasing 25-30cm every year. With the Bhakra Dam, a lot of water was diverted to Delhi and Haryana, and Punjab's allocation fulfills just 20 per cent of its agricultural needs, so groundwater accounts for the rest. Drinking water in Punjab can only be found at 350-500 feet with a deep tube well. In two or three decades, groundwater for drinking might not be available. Punjab is predicted become a desert if this continues.

- **Desertification in Delhi:** Land degradation is worsening by the day as populations go up in countries around the world, even as the ill-effects of chemical fertilizers and pesticides make themselves felt and climate change weakens the ability of the soil to recover. A feat of this is observed as Delhi as in the latest UN summit taking over from China, India declared that Delhi has begun facing severe problems regarding desertification. Although declared recently, the problem is growing at an alarming rate and preventions to achieve "Zero net desertification" area foot.

Statistical Analysis:

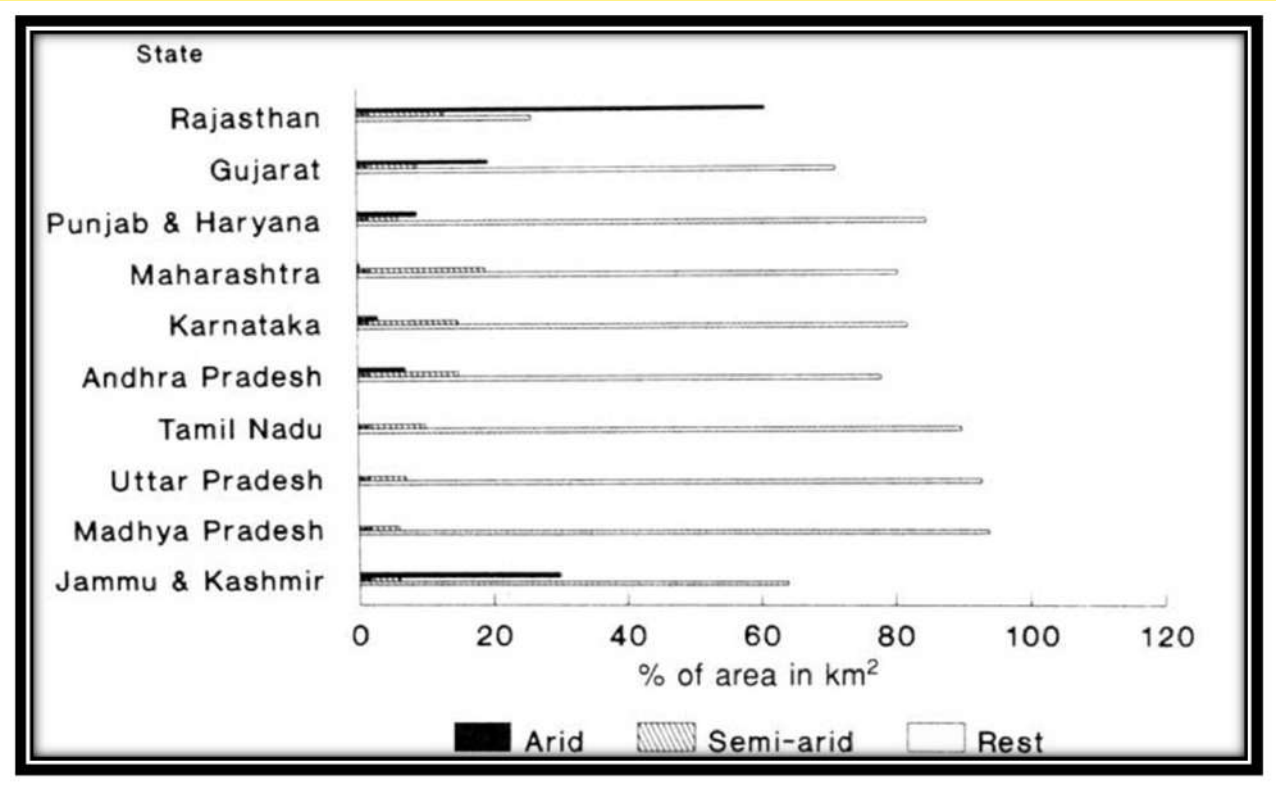


(Fig. 3.2.2) Bar graph representation of the various factors affecting desertificationin India and its comparison between a 2003-2005 study to a 2011-2013 study(source:ISRO's Desertification and Land Degradation Atlas ofIndia)



(Fig. 3.3.3) State-wise data of desertification (source: ISRO's Desertification andLand Degradation Atlas of India)

The arid zone of India covers about 12 percent of the geographical area including (31.9 billion km²) of hot desert located in parts of Rajasthan (61 per cent), Punjab and Haryana (9 per cent), and Andhra Pradesh and Karnataka (10 per cent). The cold arid tracts are located in the north-west Himalayas, namely Ladakh, Kashmir, and Lahaul Spiti (Himachal Pradesh). The Indian arid zone is by far the most populated arid zone in the world. The state-wise distribution of arid zones in India is shown in above, and they are mapped in the following figure:



(Fig. 3.3.4) Arid and semi-and zones in India, by state (Source: Maheshwari, 1989)

4. Method of Study:

In order to achieve the point of objectives, this project work has followed the following methodological steps:

i) Relevant books, periodicals and articles have been consulted to have an initial ideaon desertification.

ii) Relevant and adequate search engines have been utilized to access specific websites and internet pages to consult the areas affected causes and impacts of the discussed environmental problems.

iii) Statistical Data table wherever available with global and regional maps gave also been considered mentioning the sources of those in discussion

iv) As an important analytical step available Statistical data have been converted into bar or pie diagrams, in order to make a clear statistical analysis.

v) As a conclusive step, some effective remedial measures have been coined out to mitigate such environmental problems.

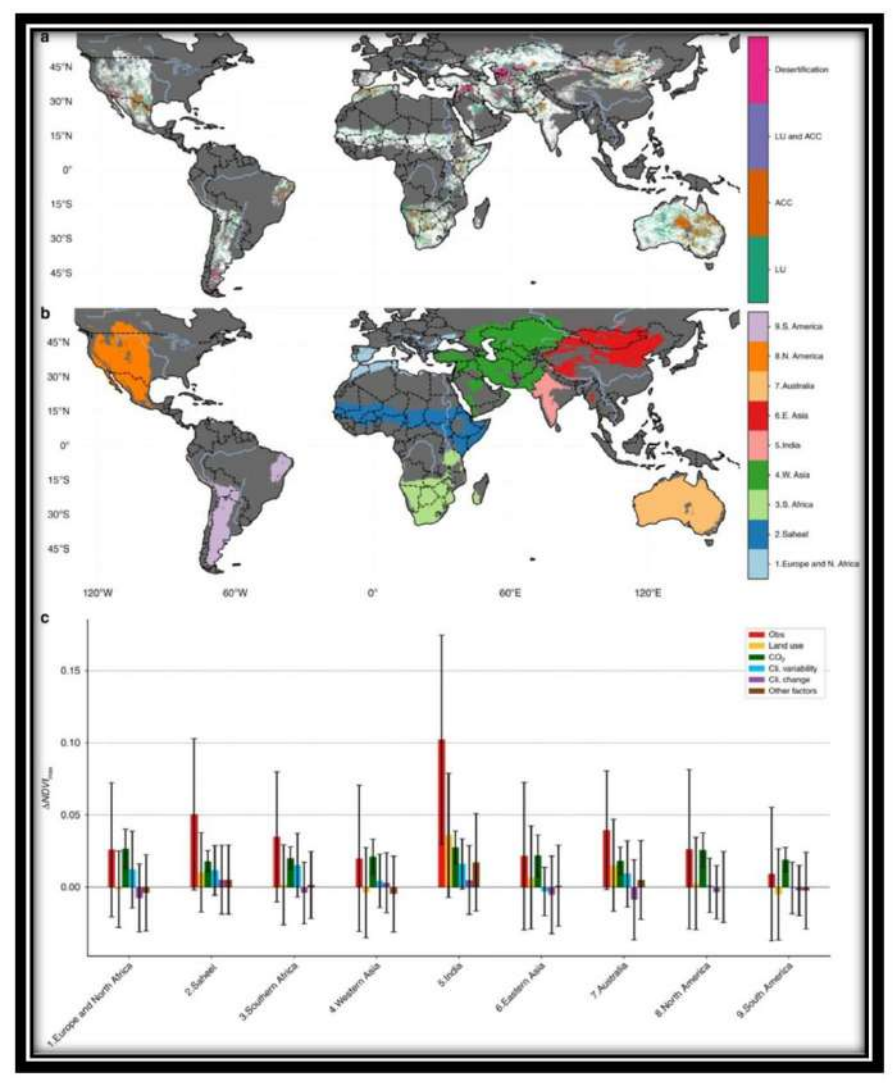
5. Causes of desertification:

The causes of desertification can be broadly divided into two categories; Natural causes and Man-made causes.

Natural causes of Desertification

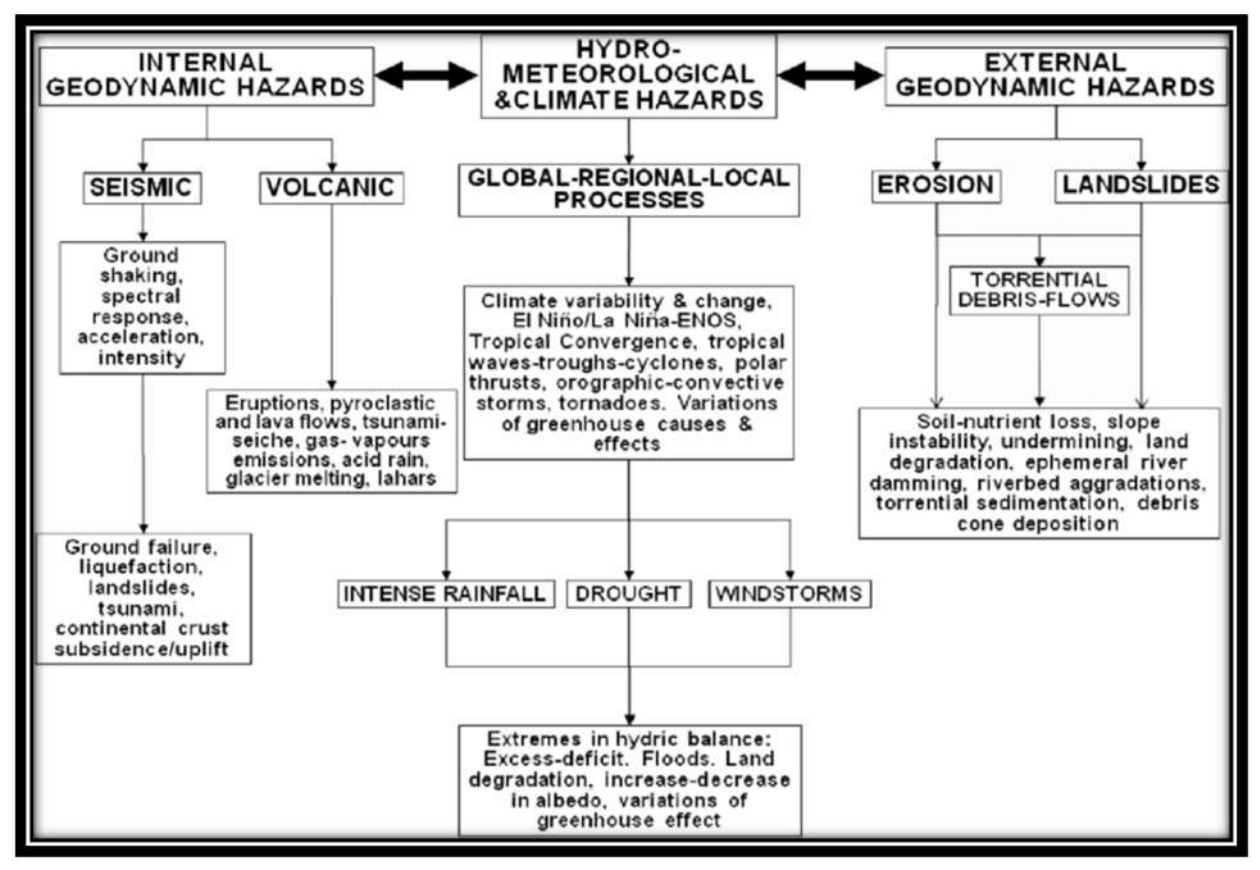
The natural phenomenon causing desertification are as follows:

Climate change: Climate change plays a huge role in the process of desertification. As the days get warmer and periods of drought become more frequent, desertification becomes more and more eminent. Due to this drastic climate change huge areas of land will become desert and some of those areas may even become uninhabitable in the meantime. This climate change mainly results from deforestation. Due to the absence of vegetation on the land as a result of deforestation there remains no moisture in the soil to evaporate and form clouds that cause rainfall. This leads to less rainfall which results in draught conditions and ultimately leads to desertification.

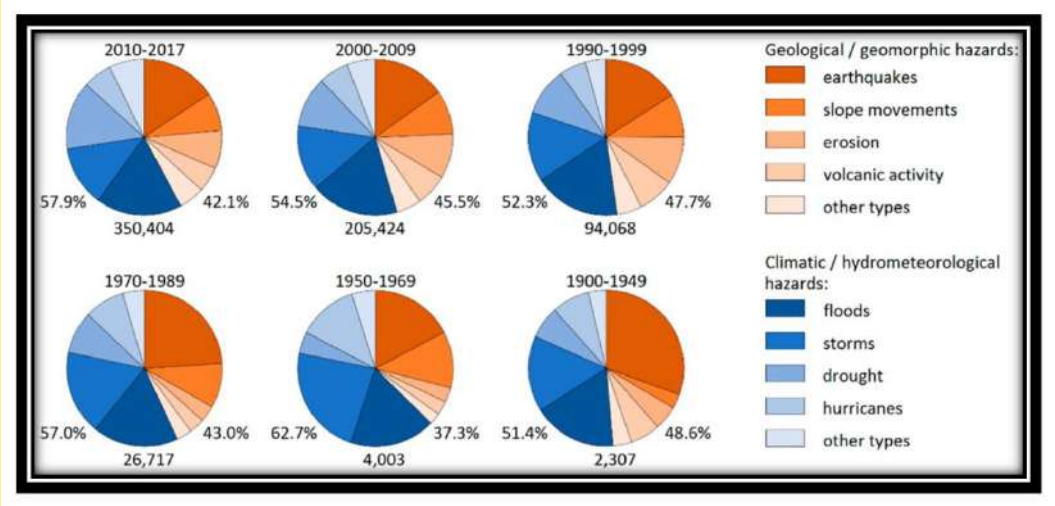


(Fig. 5.1.1) Desertification risk and regional drivers (source: nature.com)

Natural disasters: A natural disaster also leads to desertification. A huge number of lands get damaged as a result of natural disasters and result in draughts. These lands then due to other causes like climatic change and soil erosion undergoes the process of desertification. Thus, natural disasters ultimately lead to desertification.



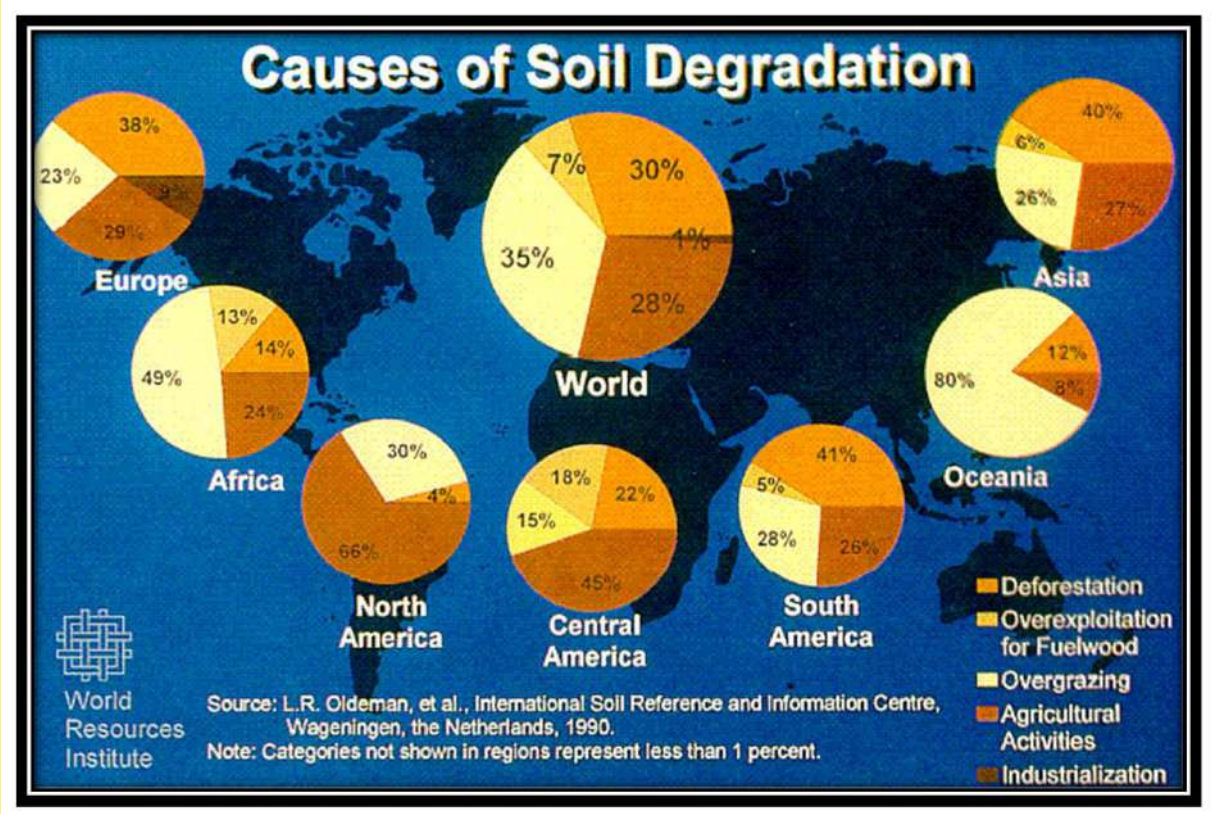
(Fig. 5.1.2.1) Types of natural disasters that lead to desertification



(Fig. 5.1.2.2) Studies showing frequency of natural disasters

Soil erosion: Deforestation increases the rate of soil erosion, which in turn is the result of increased rainfall, runoff, and reduced ground debris. Desertification becomes worse with the increasing aridity of soil and the absence of plant cover and roots that work together to hold the soil in place.

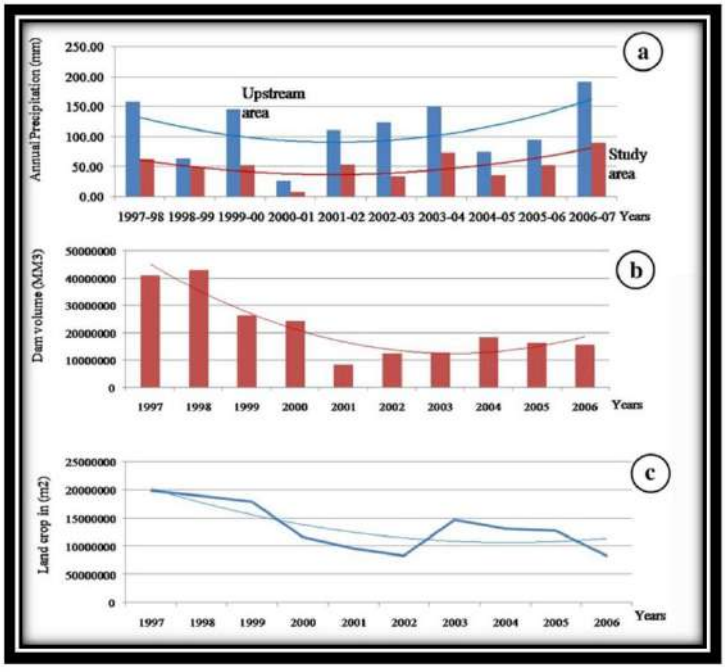
(Fig. 5.1.3.1) Extreme case of soil erosion in Ukraine (source: dreamstime.com)



(Fig. 5.1.3.2) Distribution of soil degradation in the world

Draught: Draught also plays a major role in the process of desertification. It is the result of deficiency in rainfall. Draughts are a major threat and can have a drastic impact in the following ways. Climatic (increase in temperature); Hydrological (a decrease in surface water, drying up of rivers, lakes and springs, decrease in groundwater level); Agronomical (drying out or loss of crops, including dry-land crops); Geological (drying out of soil and an increase in salinity levels); Desertification can be considered as a severe case of drought (both in intensity and in duration) which leads to conditions generating landscapes similar to that of a desert. It sometimes causes irreversible changes to biodiversity, the soil and vegetation. Under extreme drought conditions, swarms of locusts can have catastrophic consequences for the environment and the economy of vulnerablecountries.

(Fig. 5.1.4) Effect on domestic animas due to draught in Kenya (source: WHO)



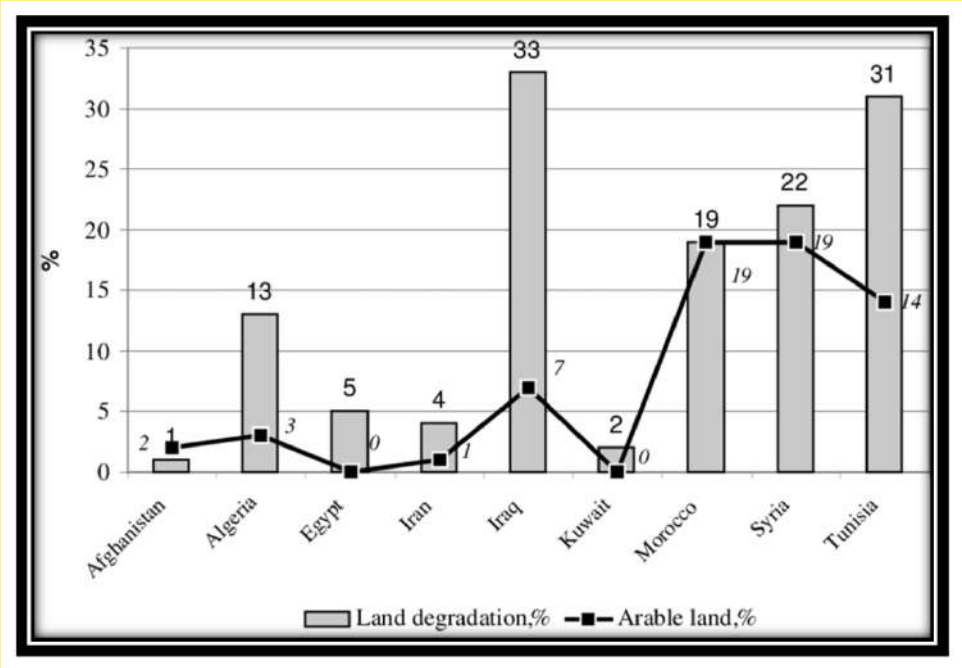
Using the numerical acquired data from the archives of IMPETUS Project, the same trend is evidentin changing precipitation (Fig .a), water storage in dams (Fig. b), and condition of land crop (Fig. c) were recorded in the Draa Valley. This validates the relationship between drought, water and vegetation cover (soil quality and productivity) found in this investigation. As explored in the given graphs climatic and hydrological parameters are deeply connected. The correlation between these two types of variables leads to mitigate the impact of the drought (Mishra and Singh2010).

Man-made causes of desertification

The anthropogenic causes of desertification are as follows:

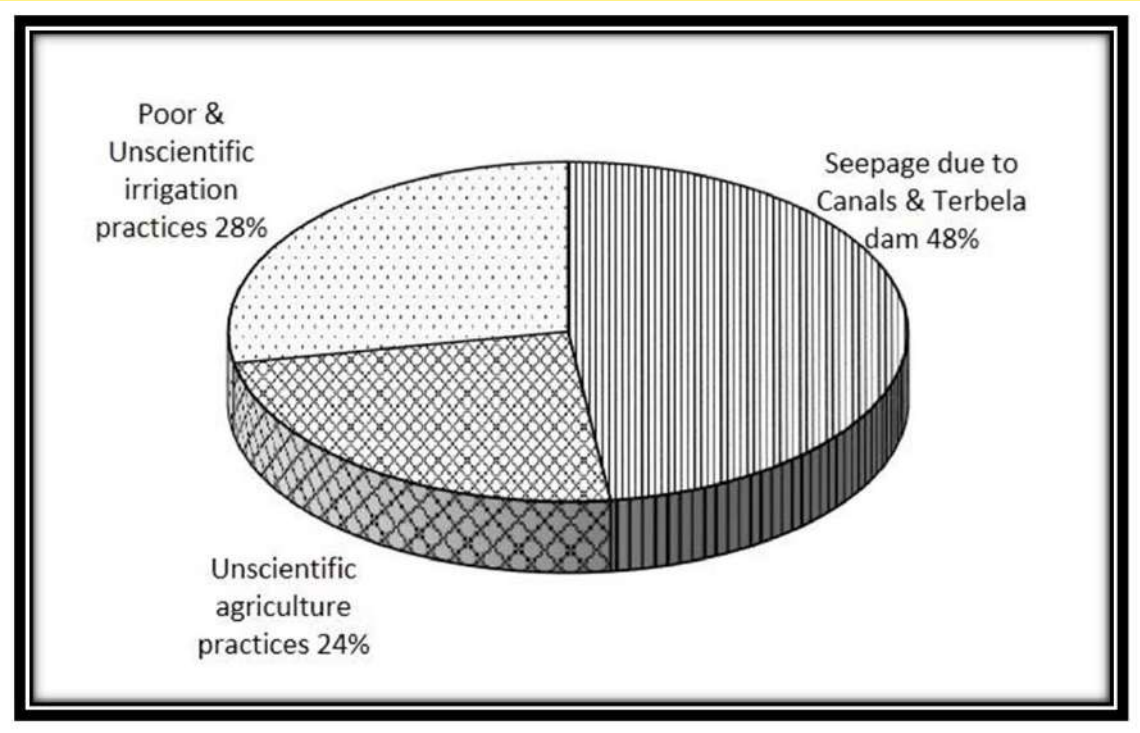
Intensive use of agricultural land: Unsustainable land use, explicitly poor farming practices and policies, have led to a wide range of challenges in many rapidly- developing countries. In addition to drought and land degradation, we are experiencing climate change, increased air pollution and water scarcity. Scientists have stated that by taking systems focus and selecting the right combination of agricultural techniques that improve the resilience and productivity of farms while combating drought, land degradation, climate change and air and water pollution.

(Fig. 5.2.1.1)An example of intensive farming (source: everythingconnects.org)



(Fig. 5.2.1.2) Effect of poor agricultural practices in eastern countries (source:researchgate.org)

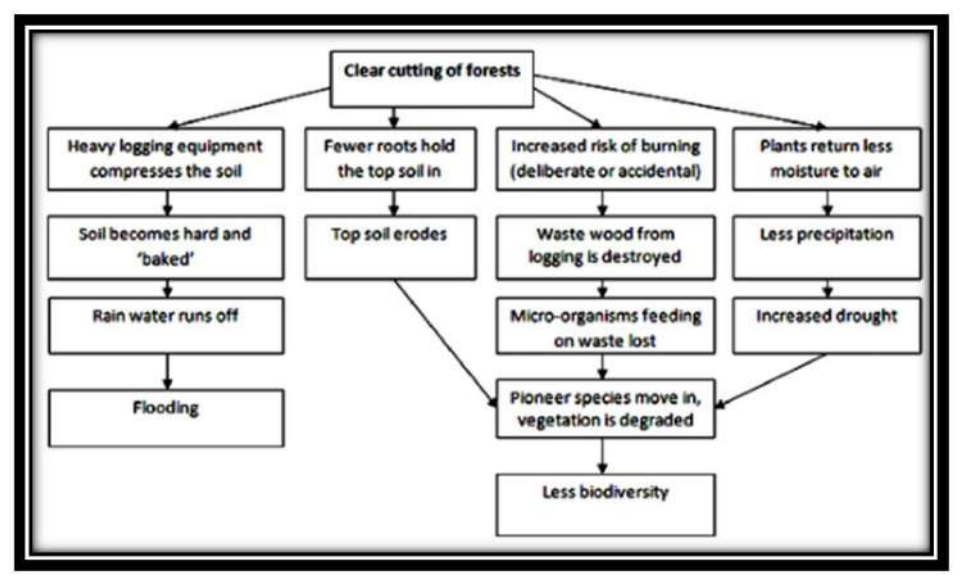
Poor irrigation practices: In some areas, the increase in cultivation has been driven by increased irrigation which has often been unsustainable. Irrigation can cause environmental problems such as water logging, salinization, water pollution, eutrophication, and excessive groundwater use. On the whole, irrigation has had a strong impact on inland waters, causing a decline in biodiversity and further desertification.



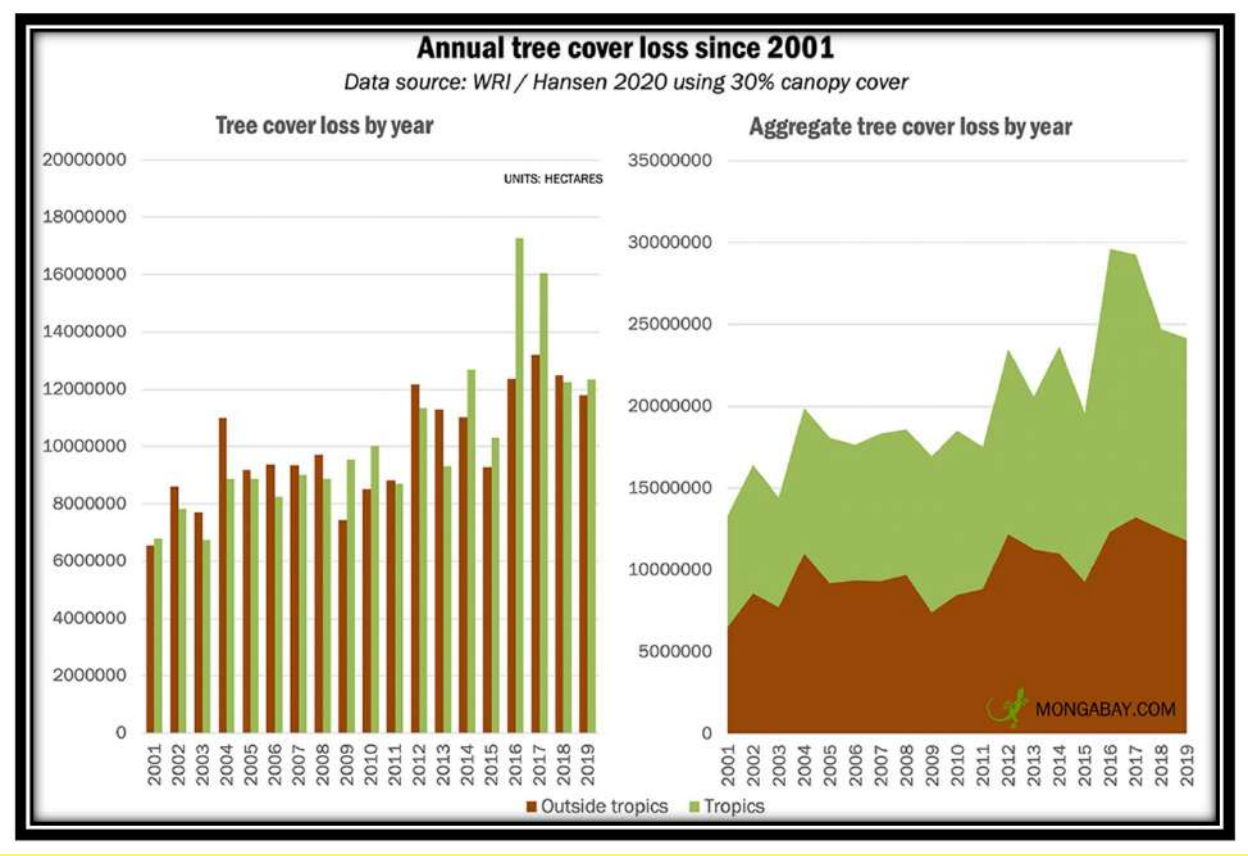
(Fig. 5.2.2.1) According to a study by APRN Journal of agriculture 28% ofdesertification was caused by poor irrigation practices in a village in a rural districtSwabi, Pakistan.

(Fig. 5.2.2.2) Demonstration of poor irrigation practices in Gujarat, Sorkheh (source:researchgate)

Deforestation: Deforestation is one of the leading human induced issues that lead to desertification. Alike to overgrazing, once the trees are cut down there is nothing left to prevent the soil from blowing and washing away. This process can result in soil degradation meaning the soil eventually turns to dust and the nutrients in the soil are degenerated making the soil unfit for use causing desertification overtime. It is quite frightening because trees are being cut down and used as fuel at a faster pace closer than ever.



(Fig. 5.2.3.1) Consequences of deforestation (source: toppr.com)

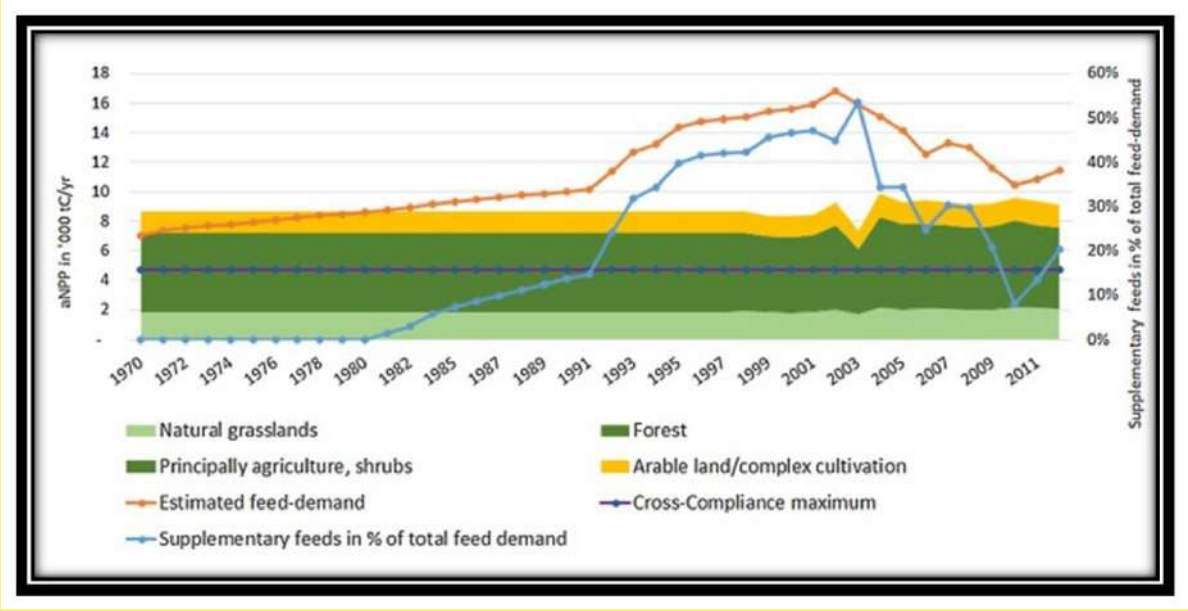


(Fig. 5.2.3.2) Annual loss of forest cover since 2001

Overgrazing: Overgrazing occurs when farmers allow cattle to graze to the point where they damage the vegetation. This can happen when farmers have too many livestock in a small area of land or when they keep livestock in an area for a prolonged time.

Deforestation is the process of removing trees and transforming a forest into cleared land. This is often done to make room for farming or shelter for the growing human population. Both overgrazing and deforestation can lead to desertification because they remove or damage the vegetation that is protecting the land and keeping it moist and fertile.

(Fig. 5.2.4.1) Overgrazing occurring in the plains of Europe (source: European soil datacenter)



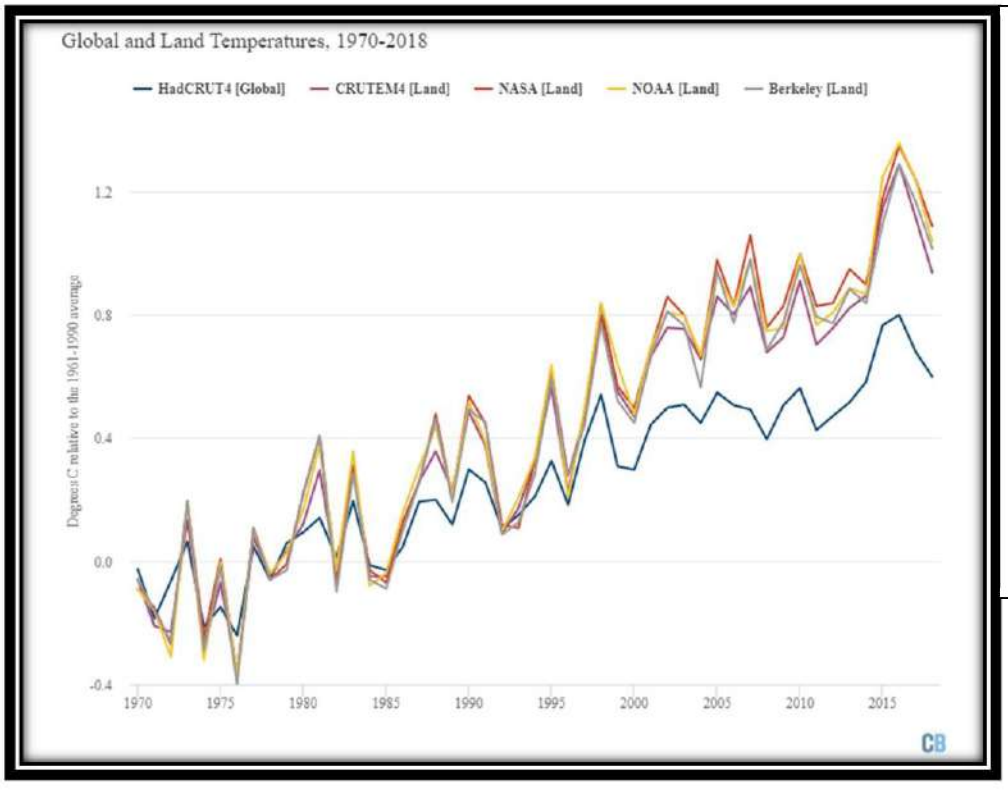
(Fig. 5.2.4.2) Increasing rate of overgrazing in the Greek islands (source:sciencedirect.com)

6. Environmental impact of desertification

The impact of desertification is faced by both nature and the beings residing in it i.e. Man. We are elaborately going to discuss these effects in the following area by categorizing them separately under impacts on nature and impacts on human beings.

Impact of desertification on nature

Climate change: By far the biggest most harmful impact of desertification in climate change. Climate Change often comes as a logical bi-product of excessive desertification because vegetation plays a major role in the climate of an area and since desertification has harmful effects of vegetation, climate change occurs in an area. A third of the Earth's total landmass has become a victim of desertification, threatening the livelihood of a billion people in over 100 countries. The Intergovernmental Panel on Climate Change (IPCC), the global body for assessing the state of climate change and its impacts, released its 1,500-page report on August 8, echoing the United Nations Convention to Combat Desertification's finding. IPCC sounded a clear warning for the world: adopt sustainable land management practices or face the consequences of land degradation, climate change and desertification. Climate Change defines desertification as land degradation occurring in drylands — arid, semi-arid and dry sub-humid areas. Desertification and climate change go hand-in-hand and it is possible for scientists to fairly predict the outcome of climate change in the recent future. It has been predicted that by 2050, climate change will lead to a 29 per cent spike in cereal prices, warns the report. It found that increased concentration of CO2 in the atmosphere will reduce nutritional quality of food. Crop yield, too, is expected to fall in tropical and semi-tropical areas due to rising temperature.

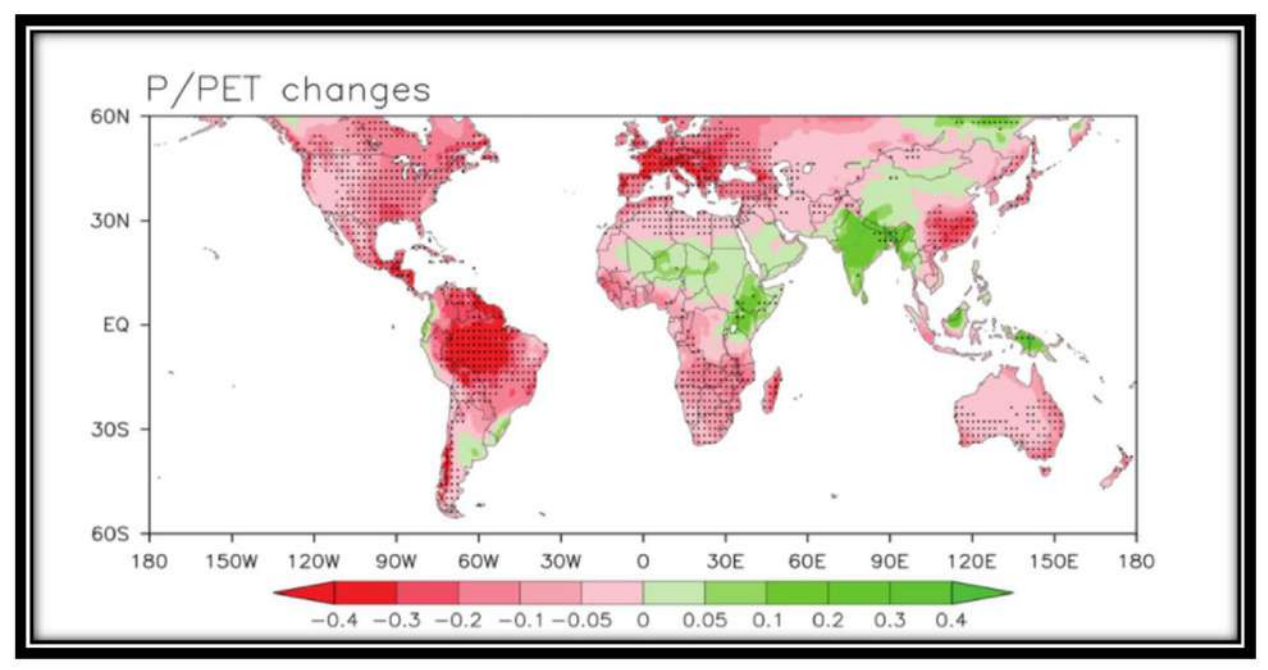


Global average land temperatures from four datasets: CRUTEM4 (purple), NASA (red), NOAA (yellow) and Berkeley (grey) for 1970 to the present day, relative to a 1961-90 baseline. Also shown is global temperature from the HadCRUT4 record (blue).(source: CarbonBrief)

Climate changes may have brought down rainfall over the years, but it has increased the intensity of rain. An IPCC report shows a three-fold increase in extreme rain events in central India during 1950-2015. This has influenced several land degradation processes, including soil erosion.

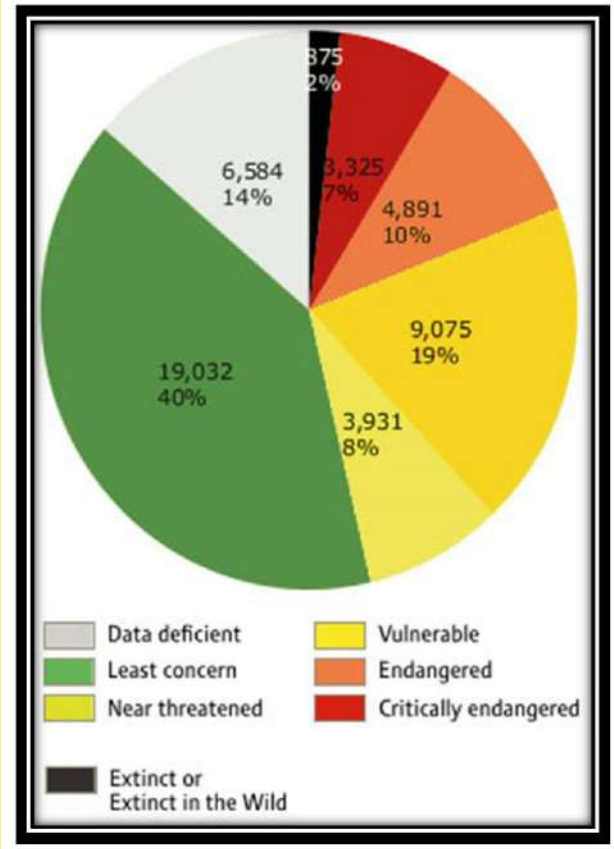
In many dryland areas, invasive plants have contributed to desertification and loss of ecosystem in the past century. Extensive woody plant encroachments have resulted in soil erosion because the bare soil between shrubs is susceptible to water erosion during high-intensity rains. Rising CO2 levels due to global warming favors rapid expansion of some invasive plants in some regions.

The latest IPCC report does not clearly link climate change to desertification, but it does say desertification is a "function of both human activity and climate variability and change". It is quite clear that climate change poser great threat to the planet and there must be taken essential steps for minimizing desertification if it provides us a chance of atleast slowing down this creeping danger rather than accelerate it more.



Projected changes in aridity index (the ratio of rainfall to PET), simulated over land by27 CMIP5 climate models by 2100 under the RCP8.5 scenario. (Source: Sherwood & Fu(2014))

Biodiversity loss: In general, the destruction of habitats and desertification may also contribute to a loss of biodiversity. While some species may be able to adjust to the altered environmental conditions properly, many species will not be able to do so and may suffer from serious declines in population.



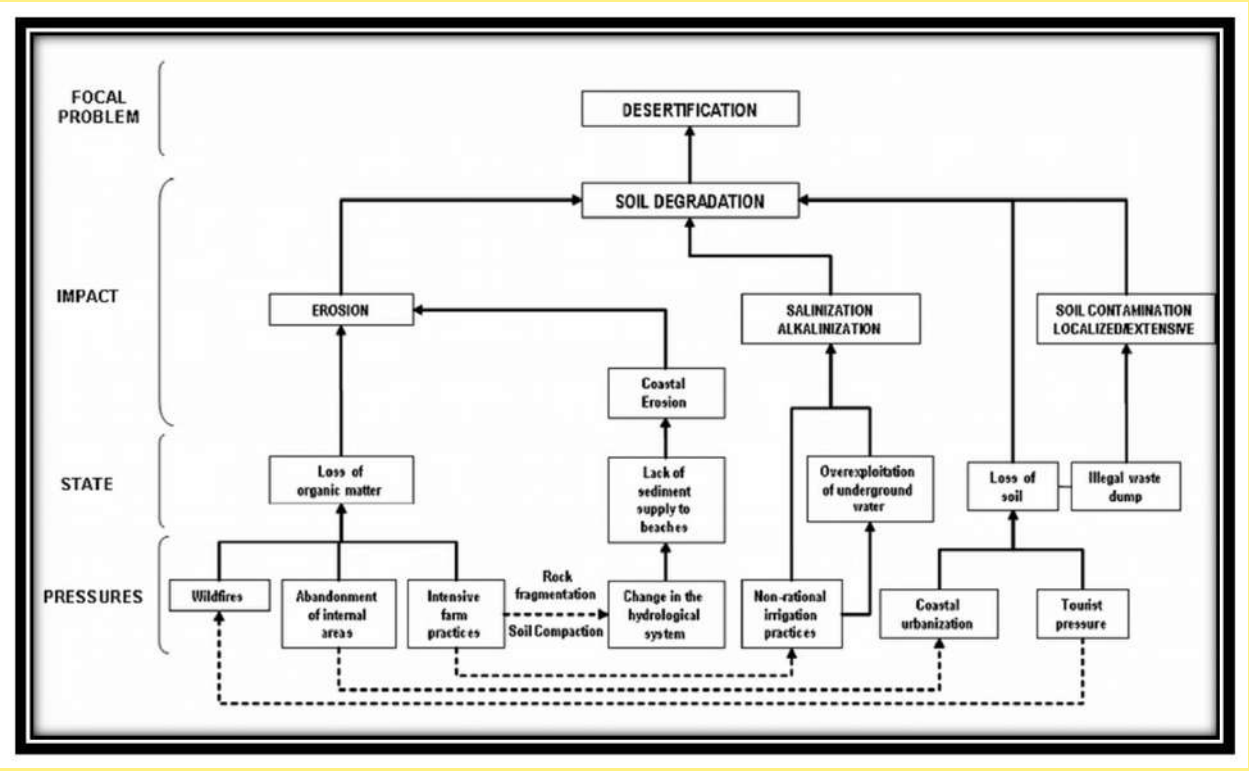
Endangerment and Extinction of Species: The desertification results in a decline in population for which species may become endangered or even extinct. This problem is especially severe for species that are already endangered as the small number of animals or plants that remains may also die off over time, which may even lead to the extinction of species.

Destruction of Habitats: Desertification often leads to a loss of habitats for many animals and plants. Desertification may alter the living conditions of the local flora and fauna that makes it impossible for animals and plants to sustain their populations.

After desertification, regions suffer from water shortages due to climate change and animals may suffer and die since water is vital for all life on our planet.

Impact of desertification on human beings

Difficulty in farming: If an area becomes a desert, then it's almost impossible to grow substantial crops there without special technologies. This can cost a lot of money to try and do, so many farmers will have to sell their land and leave the desert areas. Furthermore, degraded land becomes a liability in case of farming and irreversible degradation in harmful especially for farmers. Therefore, poor agricultural practices are to be strictly avoided.



Linkage between poor farming and desertification

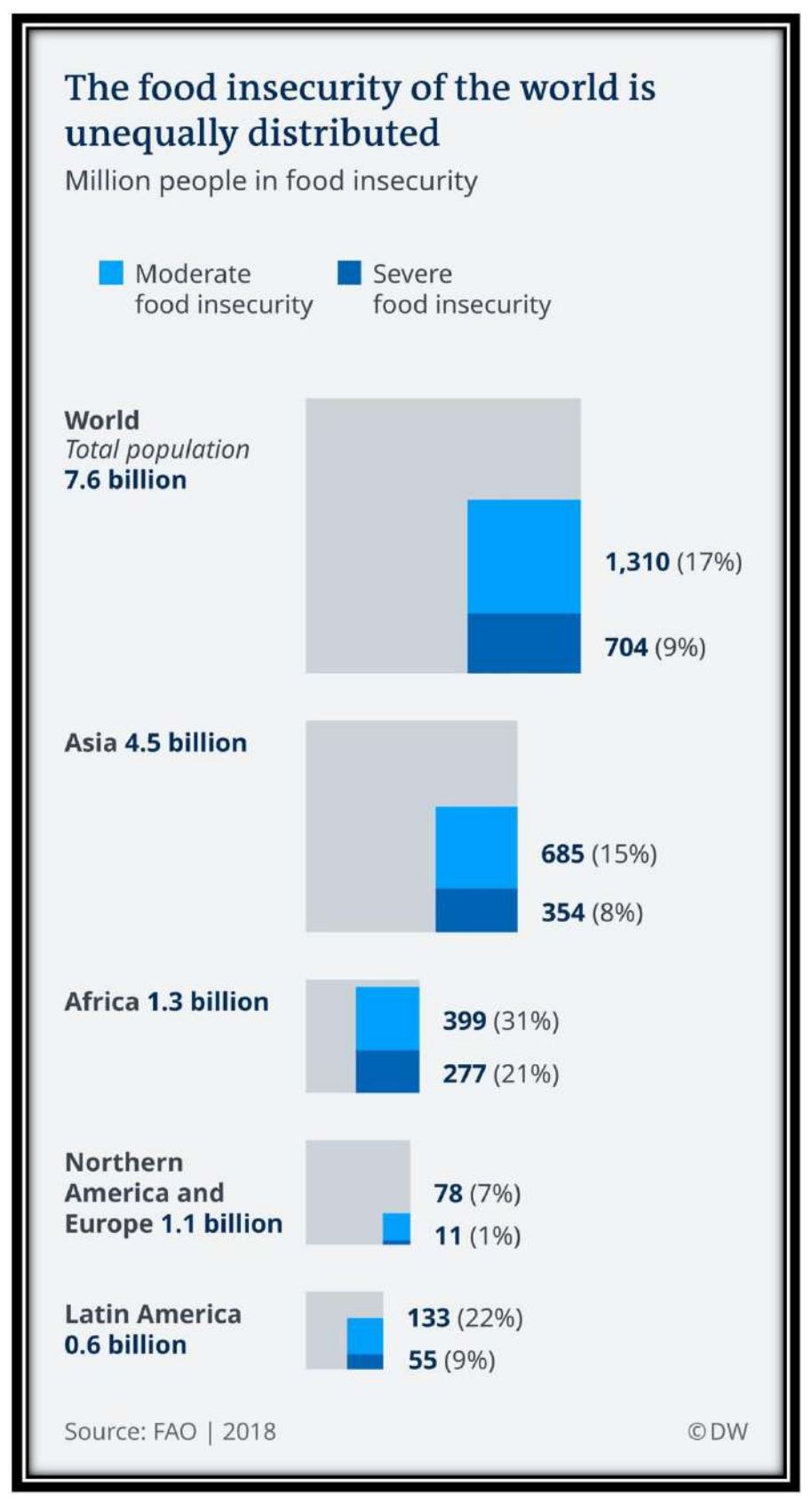
Decrease in crop yields: A major effect of desertification is the decrease in crop yields. Once land turns from arable to arid, it is often on longer suitable for farming purposes anymore.

In turn, many farmers may lose their livelihood, since they often solely rely on farming as their single source of income. If their land becomes arid, they may no longer be able to provide sufficient crop yields to make a living out of it.

Hunger: Without farms in these areas, the food that those farms produce will become much scarcer, and the people who live in those local areas will be a lot more likely to try and deal with hunger problems. Animals will also go hungry, which will cause even more of a food shortage.

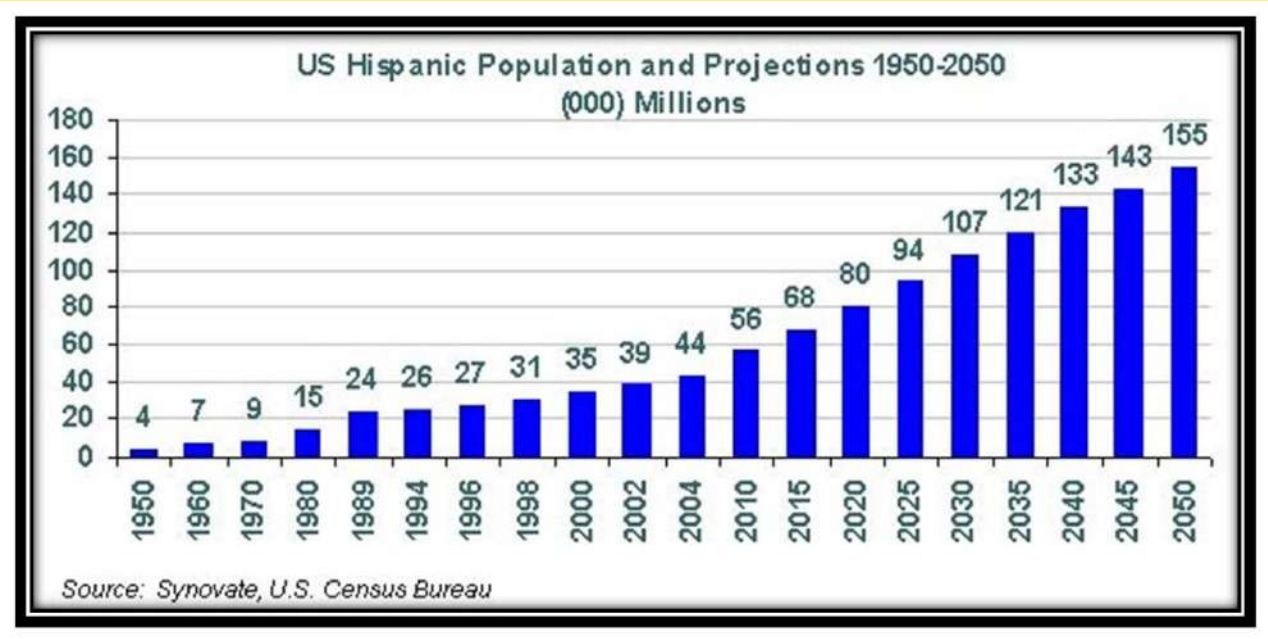
Flooding: Without plant life in an area, flooding is a lot more imminent. Not all deserts are dry; those that are wet could experience a lot of flooding because there is nothing to stop the water from gathering and going all over the place. Flooding can also negatively affect the water supply, which we will discuss next.

Poor water quality: If an area becomes a desert, the water quality is going to become a lot worse than it would have been otherwise. This is because plant life plays a significant role in keeping the water clean and clear; without its presence, it becomes a lot more difficult for you to be able to do that.



Overpopulation: When areas start to become desert, animals and people will go to other areas where they can actually thrive. This causes crowding and overpopulation, which will, in the long run, end up continuing the cycle of desertification that started this whole thing anyway.

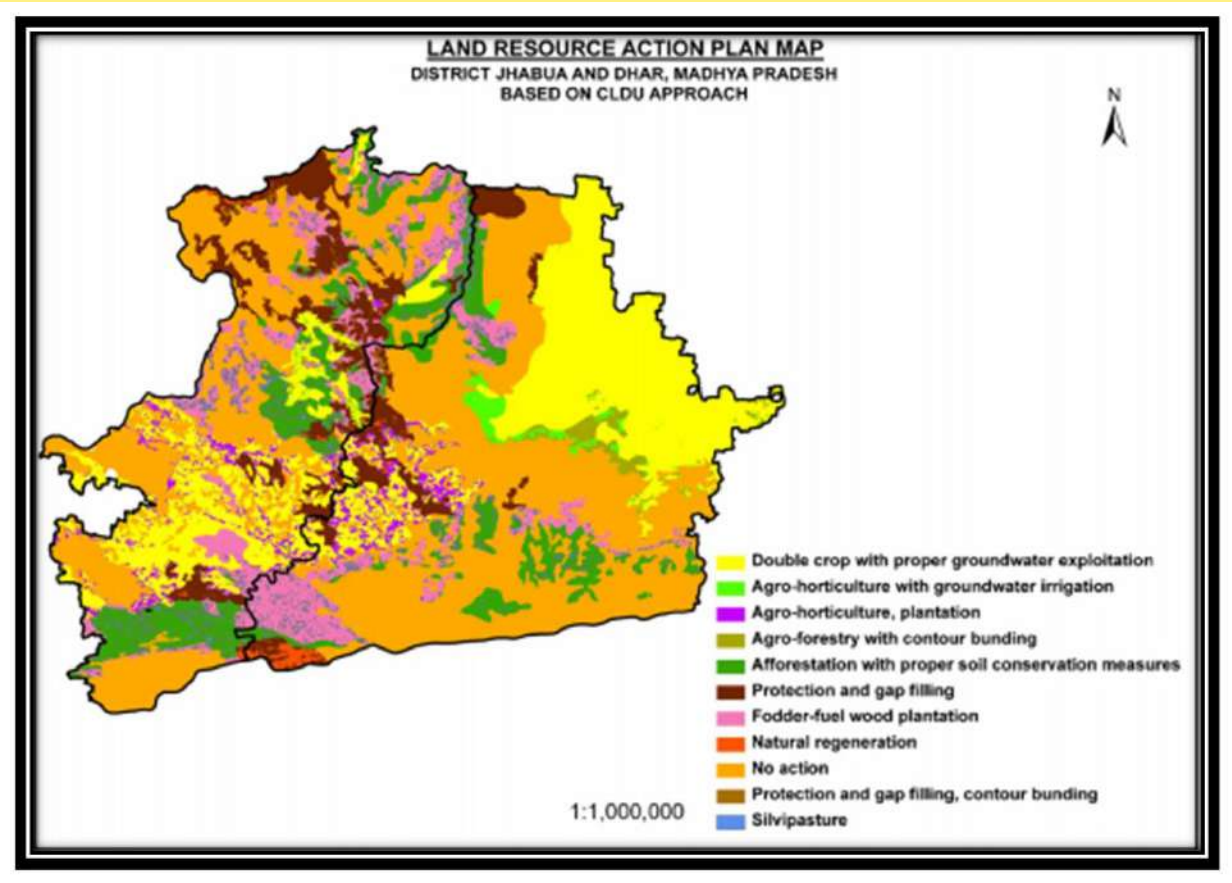
Poverty: All of the issues that we've talked about above (related to the problem of desertification) can lead to poverty if it is not kept in check. Without food and water, it becomes harder for people to thrive, and they take a lot of time to try and get the things that they need.



7. Observation:

Case Study 1: districts Dhar and Jhabua, Madhya Pradesh

Abstract: Combating desertification and land degradation, one of the major challenges worldwide, was first addressed by United Nations Convention to Combat Desertification (UNCCD) in 1994. UNCCD defines desertification as 'Land degradation in arid, semi-arid, and dry sub humid areas resulting from various factors including climatic variations and human activities', where 'land' is defined as terrestrial bio-productive system and 'land degradation' is defined as reduction or loss in biological and economic productivity (UNCCD 1994). Districts of Jhabua and Dhar of Madhya Pradesh state were selected as the study area (figure 1). The total area of these two districts extends from about 23◦55' to 23◦14'N latitude and from 74◦ to 74◦42'E longitude. These districts were identified in DPAPas priority districts. It is pertinent to note here that during the past few years, these districts have faced drought several times. Added to this, the relentless exploitation of the natural resources in the form of soil cover, vegetative cover, and ground water due to increased biotic pressure mounted pressure on the fragile eco-system. Rural poverty and extensive unemployment amongst the casual farm and non-farm workers indicate inadequate work opportunities. As a consequence, the livelihood of rural people in agricultural areas has always been under constant threat.



Desertification combat plan that was implemented

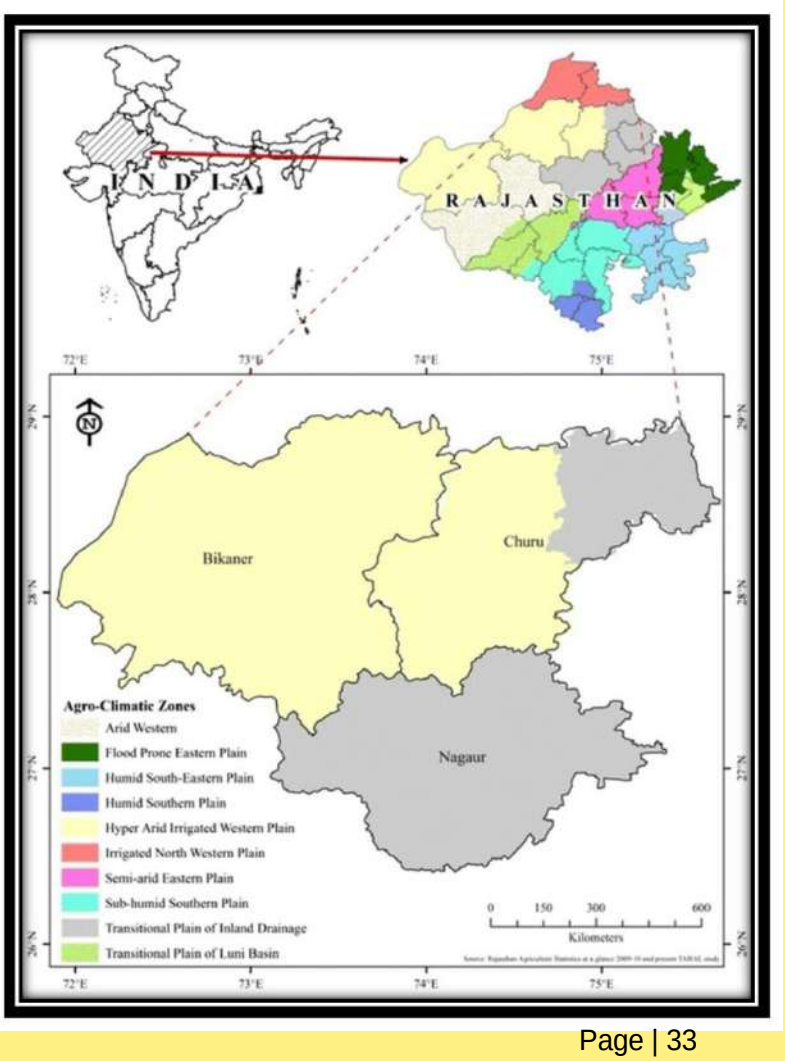
Case Study 2: Saurashtra region of Gujarat state of India

Abstract: Sequential changes in soil properties along forest, grassland, degraded land and desert ecosystems, with different vulnerabilities to degradation, were assessed to understand the process for the development of desert-like landscapes in semi-arid zone of Saurashtra region of Gujarat state of India. The concentration of fine soil particles (clay and silt) decreased whereas; it increased for sand particles with the deterioration of ecosystem. Bulk density was maximum at degraded land ecosystem and consequently pore space was minimum. Water holding and field capacity of soil decreased with the degradation of ecosystem and exhibited a positive correlation with the clay content of soil. Eventually, desertification causes progressive drier condition of soil.

Desertification and land degradation in Gujarat	2003-05	2011-13	Change
Water Erosion	37,88,099	38,59,497	71,398
Vegetation Degradation	22,55,417	23,19,826	64,409
Settlement	1,17,447	1,65,578	48,131
Wind Erosion	11,79,548	11,77,105	-2,443
Salinity	26,43,828	26,45,405	1,578
Water Logging	3,375	3,375	0
Barren/Rocky	39,218	39,218	0
Total Area under Desertification	1,00,77,455	1,02,61,641	1,84,186
No Apparent Degradation	87,18,876	85,33,439	-1,85,437
GEOGRAPHICAL AREA OF STATE (HECTARES) 1,96,24,400			

Case Study 3: Desertification in western Rajasthan (India)

Abstract: In the study shown here, rain-use efficiency (RUE) method was used for monitoring vegetation degradation and, substantially, the process of desertification in western Rajasthan. It is noteworthy that depletion of vegetation cover plays a key role in land degradation; in fact reduction in plants and perennial cover is regarded as an indicator of the onset of desertification. Temporal analysis of satellite-based NDVI is one of the major remote sensing tools which can identify the depletion of vegetation cover.



Case Study 4: Land degradation in Punjab

Abstract: With the increase of total crop production in Punjab, the consumption of chemical fertilizers (NPK) was also increased from 1220 Thousand Tonnes in 1990-11 to 1713 Thousand Tonnes in 2013-14 and 1677 Thousand Tonnes in 2014-15(P). As shown in Table-1.4, consumption of Fertilizers also increased as production of crops increased in Punjab. High usage of nitrogenous fertilizers with relative under-utilization of other fertilizers and micro nutrients has led to imbalance in micro nutrient in soils of the Punjab. Although agricultural production in Punjab is increasing yet consumption of pesticides and insecticides also increasing at the same pace. As shown in 1.5, consumption of insecticides/pesticides has been doubled from 1980 to 2017.

(R) (P)	1990-91	2000-01	2010-11	2011-12	2012-13	2013-14	2014-15
Total NPK	1220	1313	1911	1918	1972	1713	1677
Niterogenous (N)	877	1008	1403	1416	1486	1364	1321
Phosphatic P_2O_5	328	282	435	448	462	325	326
Potassic (K_2O	15	23	73	54	24	24	30

Source: Director of Agriculture, Punjab

Consumption of fertilizers (000 nutrient tonne)

Year	Consumption in Technical Grade (M.T)
1980-81	3200
1990-91	6500
1995-96	7200
2000-01	6970
2005-06	5970
2006-07	5975
2007-08	5900
2008-09	5760
2009-10	5745
2010-11	5600
2011-12	5690
2012-13	5725
2013-14	5720
2014-15	5699
2015-16	5721
2016-17	5843
2017-18 (T)	6374

Source: Department of Agriculture, Government of Punjab

Consumption of insecticides/pesticides in Punjab as of 2019

8. Conclusion

In order to prevent and reverse desertification, major policy interventions and changes in management approaches are needed. Such interventions should be implemented at local to global scales, with the active engagement of stakeholders and local communities.

Societal and policy actions need to adjust to the degree of desertification that a society faces or is likely to face. In areas where desertification processes are at the early stages or are relatively minor, it is possible to stop the process and restore key services in the degraded areas. Prevention is a lot more cost-effective than rehabilitation, and this should be taken into account in policy decisions.

Addressing desertification is critical and essential to meeting the Millennium Development Goals which aim to eradicate extreme poverty and ensuring environmental sustainability amongst other objectives.

On average, human populations in drylands have a lower quality of life than people in other areas. Worldwide, approximately half of the people living below the poverty line live in drylands and their societies are particularly vulnerable as a result of dryland ecosystem conditions and poverty. Addressing desertification would therefore contribute to the eradication of extreme poverty and hunger.

Preventive measures of desertification:

The creation of a "culture of prevention" can go a long way toward protecting drylands when desertification is just beginning and even when it is ongoing. It requires a change in governments' and peoples' attitudes. It has been shown that dryland populations, building on long-term experience and active innovation, can stay ahead of desertification by improving agricultural and grazing practices in a sustainable way.

Preventive actions include:

- Integrating land and water management to protect soils from erosion, salinization ,and other forms of degradation.
- Protecting the vegetative cover which can be a major instrument for soil conservation against wind and water erosion.
- Integrating the use of land for grazing and farming where conditions are favorable, allowing for a more efficient cycling of nutrients within the agricultural systems.
- Applying a combination of traditional practices with locally acceptable and locally adapted land use technologies.
- Giving local communities the capacity to prevent desertification and to manage dry land resources effectively.
- Turning to alternative livelihoods that do not depend on traditional land uses, such as dryland aquaculture, greenhouse agriculture and tourism-related activities, is less demanding on local land and natural resources, and yet provides sustainableincome.

Measures to reverse desertification:

Rehabilitation and restoration approaches can help restore ecosystem services that have been lost due to desertification. Restoration aims to reestablish a previous ecosystem state and all its functions and services, while rehabilitation seeks to repair specific parts of the systems, in order to regain ecosystem productivity.

Effective restoration and rehabilitation of desertified drylands require a combination of policies and technologies and the close involvement of local communities.

Examples of actions to restore and rehabilitate ecosystems include:

- establishing seed banks,
- reintroducing selected species,
- countering erosion through terracing and other rmeasures,
- enriching the soil with nutrients, and
- planting of trees.

Policies that create incentives for rehabilitation include capacity building, capital investment, and supportive institutions.

The success of rehabilitation practices depends on the availability of human resources, sufficient funds and infrastructures, as well as on the degree of dependence on external technologies and cultural perceptions. Adequate access to these resources can lead to successful rehabilitation of some ecosystem services and also help reduce poverty. When these conditions are not met, efforts to rehabilitate fail.
Restoring degraded dryland services may thus be difficult even with major policy and technology interventions.

Places where action is being taken against desertification:

Stream Restoration of the Besor / Beersheva Streams

Recently, two restoration plans for the Besor and Beersheva streams were approved by the planning authorities under the jurisdiction of a regional River Authority. Included in the plan are stream bank stabilization and other erosion control activities, which will reduce the steady gulley erosion in the watershed. Additional measures include a ban on quarrying near the stream, earthwork to stabilize lands, and a range of plantings to increase groundcover in the affected areas. As desertification in Israel is conspicuous alongside stream banks, the expanded focus of the restoration plan constitutes an important precedent for future activities. A treatment facility is under construction that would capture and treat raw sewage from Hebron before it continues south to Beersheva.

Monitoring Desertification and Carbon Sequestration in Yatir

The replanted Yatir forest, the largest in Israel, is a key factor in preventing desertification processes in the arid region, north-east of Beersheba. Since 2000, the forest has actually been serving as a living laboratory, with a sophisticated Long Term Ecological Research (LTER) monitoring station that checks natural data - precipitation, moisture, growth, the trees' natural development mechanisms, their emission of gases, the air's composition, and other factors. The research at this station is important for afforestation efforts in arid areas, as it is the only monitoring station located in a forest receiving only 200 mm of annual rainfall.

Runoff Agro-Forestry to Combat Desertification, Turkana, Kenya

The BIDR investigators established a runoff agroforestry system in the dry Turkana district of Northern Kenya. Growing shallow-rooting annuals and deep-rooting perennials, the system takes advantage of blue leaf wattle (Acacia saligna) as the tree component, due to its drought resistance, and sorghum (Sorghum bicolor) and cowpea (Vigna unguiculata) as intercrops. Studies showed that trees grew particularly well, and when the soil was deep enough, large volumes of runoff water could be stored underground, producing high yields of intercrops.

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*Other references that have been used for sources of diagram and images have been mentioned within brackets in the caption.

PROJECT on

BIODIVERSITY

AECC ENVS TUTORIAL

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CONTENTS

INTRODUCTION

Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain. Biologists most often define biodiversity as the "totality of genes, species, and ecosystems of a region".

Biodiversity refers to the variety and variability of all types of microbes, plants and animals on the earth. It includes not only the many species that exist, but also the diversity of population that makes up a species, the genetic diversity among individual's life form and the many different habitats and ecosystems around the globe.

Biodiversity holds ecological and economic significance. It provides us with nourishment, housing, fuel, clothing and several other resources. It also extracts monetary benefits through tourism. Therefore, it is very important to have a good knowledge of biodiversity for a sustainable livelihood.

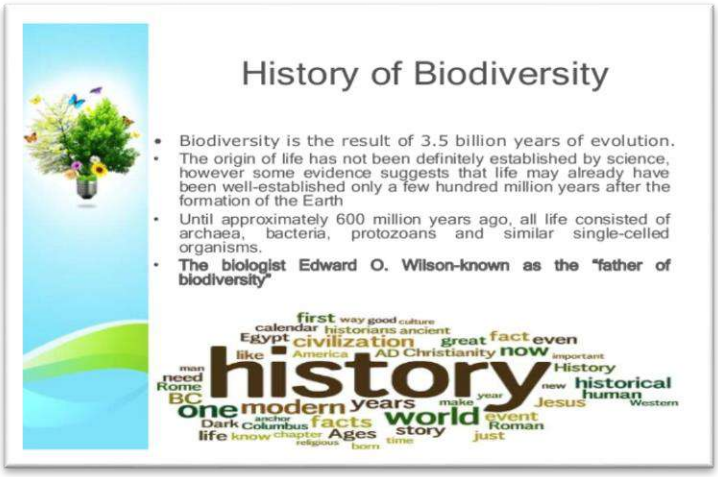
The term biodiversity was coined in 1985. It is important in natural as well as artificial ecosystems. It deals with nature's variety, the biosphere. It refers to variabilities among plants, animals and microorganism species.

Biodiversity includes the number of different organisms and their relative frequencies in an ecosystem. It also reflects the organization of organisms at different levels.

HISTORY OF BIODIVERSITY

Biodiversity today is huge, and it has a long history. Identifying rules for the heterogeneity of modern biodiversity—the high to low species richness of different clades—has been hard. There are measurable biodiversity differences between land and sea and between the tropics and temperate-

polar regions. Some analysts suggest that the net age of a clade can determine its extinction risk, but this is equivocal. New work shows that, through geological time, clades pass through different diversification regimes, and those regimes constrain the balance of tree size and the nature of branching events. Charles Darwin identified the first principle of the origin of modern biodiversity, namely that all species were linked in a single great phylogeny, or tree of life, and that all could be traced back to a presumed single original species at some distant time in the geological past. The origin of life is now dated at 3.5–4 billion years ago, deep in the Precambrian Era.

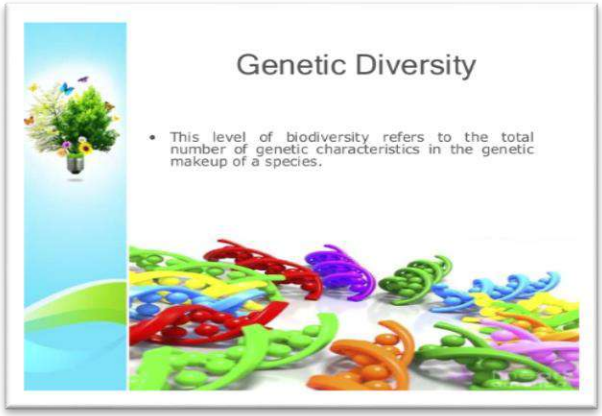


TYPES OF BIODIVERSITY

Biodiversity is the sum of all the different species of animals, plants, fungi ad microbial organisms living on Earth and the variety of habitats in which they live. Biodiversity includes three main types: diversity within species (Genetic Diversity), between species (Species Diversity) and between ecosystems (Ecosystem Diversity).

- Genetic Diversity

  Every species on Earth is related to every other species through genetic connections. The more closely related any two species are, the more genetic information they will share, and the more similar they will appear. An organism's closest relatives are members of its own species, or organisms with which it has potential to mate and produce offspring. Members of a species share genes, the bits of biochemical information that determine, in part, how the animals look, behave and live. One eastern grey



squirrel, for example, shares the vast majority of its genes with other eastern gray squirrels, whether they live in the same area or are separated by thousands of miles. Members of a species also share complex mating behaviours that enable them to recognise each other as potential mates. For virtually every species there is a similar and closely related species in an adjacent habitat.

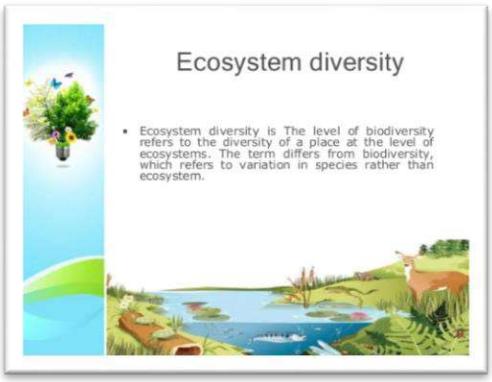
- Species Diversity

Species diversity is a variety of species within a habitat or a region. Species are the basic units of biological classifications and thus the normal measure of biological diversity. Species richness is the term that describes the number of different species in a given area. The world total is estimated at five to 10 million species, though only 1.75 million have been named specifically so far. Some habitats, such as rainforests and coral reefs, have many species. For example, tropical North and South has about 85,000 flowering plant species, tropical and subtropical Africa has about 35,000. By contrast, all of Europe has 11,300 vascular plants. Yet other areas, such as salt flats or a polluted stream, have fewer species. Species are grouped together into families according to shared characteristics.

- Ecological Diversity

Ecological diversity is the intricate network of different species present in local ecosystems and the dynamic interplay between them. An ecosystem consists of organisms from many different species living together in a region and their connections through the flow of energy, nutrients and matter. Those connections occur as the organisms of different species interact with one another. The ultimate source of energy in almost every ecosystem is the sun. Te sun's radiant energy is converted to chemical energy by plants. That energy flows through the systems when animals eat the plants and then are eaten by other

animals. Fungi derive energy by decomposing organisms, which releases nutrients back into the soil. Thus, an ecosystem is a collection of living components (microbes, plants, animals and fungi) and nonliving components (climate and chemicals) that are connected by energy flow. Measuring ecological diversity is difficult because each of Earth's ecosystems merges into the ecosystems around it.



BIODIVERSITY AGREEMENTS

Concern about environmental destruction led to the signing of several national and international agreements. In 1972, the United Nations Conference on the Human Environment resolved to establish the United Nations Environment Program. Governments signed in for a number of regional and international agreements to tackle specific issues, such as protecting wet lands and regulating the international trade in endangered species. Those agreements, along with controls on toxic chemicals and pollution, have helped slow the tide of destruction – but they have not reversed it.

An international treaty known as the Conservation on International Trade in Endangered species of Wild Fauna and Flora went into effect in 1975 to outlaw the trade of endangered animals and animal parts. In the United States, the Endangered Species Act was enacted in 1973 to protect endangered or threatened species and their habitats. In 1987, the World Commission on Environment and Development concluded that economic development must become less ecologically destructive. Then in 1992, at the United Nations Conference Environment and Development in Rio de Janeiro, Brazil, a set of binding agreements was signed at the Convention on Biological Diversity. It was the first global agreement on the conservation and sustainable use of biological diversity. More than 150 governments signed the document at that conference, and since then more than 187 countries have ratified the agreement. The convention has three main goals: the conservation of biodiversity, sustainable use of the components of biodiversity and sharing the benefits arising from commercial and other uses of genetic resources in a fair and equitable way.

LOSS OF BIODIVERSITY

Biodiversity Loss or Loss of Biodiversity, is a decrease in biodiversity within a species, an ecosystem, a given geographic area, or Earth as a whole. It describes the decline in the number, genetic variability, and variety of species, and the biological communities in a given area. This loss in the variety of life can lead to a breakdown in the functioning of the ecosystem where decline has happened. The idea of biodiversity is most often associated with species richness i.e. the count of species in an area, and thus biodiversity loss is often viewed as species loss from an ecosystem or even the entire biosphere. However associating biodiversity loss with species loss alone overlooks certain subtle phenomenon that threaten long term ecosystem health. Sudden population decline may upset social structure in certain species which may create problems for the surviving males and females from finding mates, which may them produce further population decline. Even though a species is not eliminated from the ecosystem or from the biosphere its niche (the role the species play in the ecosystems its inhabits) diminishes as its number fall. If the niche's, as it has been described above, filled by a single species or a group of species are critical to or proper functioning of the ecosystems, a sudden decline in numbers may produce significant changes in the ecosystem structure. For example, clearing trees from a forest eliminates the shading, temperature and moisture regulation, animal habitat and nutrient transport services they provide to the ecosystem.

IMORTANCE OF BIODIVERSITY

At least 40 percent of the world's economy and 80 percent of the needs of the poor are derived from biological resources. In addition, the richer the diversity of life, the greater the opportunity for medical discoveries, economical development, and adaptive responses to such new challenges as climate change. Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play. For example, (1) a larger number of plant species means a greater variety of crops, (2) greater species diversity ensures natural sustainability for all life forms and (3) healthy ecosystems can better withstand and recover from a variety of disasters.

Thus while we dominate this planet, we still need to preserve the diversity in wildlife.

BENEFITS OF BIODIVERSITY

Although it is easy to give a definition to the word "biodiversity," it is not quite so easy to explain exactly why we should be interested in and concerned about the biodiversity of an ecosystem. There are, though, specific benefits to biodiversity that affect every one of us on this planet.

1. Consumptive use Value: The direct utilisation of timber, food, fuel wood, fodder by local communities.

2. A variety of industries such as pharmaceuticals are highly dependent on identifying compounds of great economic value from the wide variety of wild species of plants located in undisturbed natural forests. This is called biological prospecting.

3. Social Values: The consumptive and productive value of biodiversity is closely linked to social concerns in traditional communities. 'Ecosystem people' value biodiversity as a part of their livelihood as well as through cultural and religious sentiments. A great variety of crops have been cultivated in traditional agricultural systems and this permitted a wide range of produce to be grown and marketed throughout the year and acted as an insurance against the failure of one crop.

In recent years farmers have begun to receive economic incentives to grow cash crops for national or international markets, rather than to supply local needs. This has resulted in local food shortages, unemployment (cash crops are usually mechanised), landlessness and increased vulnerability to drought and floods.

4. Ethical and Moral Values: Ethical values related to biodiversity 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 of species. Indian civilization has over several generations preserved nature through local traditions. This has been an important part of the ancient philosophy of many of our cultures. We have in our country a large number of sacred groves or 'Deorais' preserved by tribal people in several States. These sacred groves around ancient sacred sites and temples act as gene banks of wild plants.

CONSERVATION OF BIODIVERSITY

"Biodiversity conservation refers to the protection, upliftment, and management of biodiversity in order to derive sustainable benefits for present and future generations." Biodiversity conservation is important because biodiversity provides certain services and resources that are essential for life on earth. Biodiversity also provides social benefits.

Biodiversity conservation has three main objectives: (a) to preserve the diversity of species, (b) sustainable utilization of species and ecosystem, and (c) to maintain life-supporting systems and essential ecological processes.

Biodiversity refers to the variability of life on earth. It can be conserved in the following ways:

In-situ Conservation: In-situ conservation of biodiversity is the conservation of species within their natural habitat. In this method, the natural ecosystem is maintained and protected.

The in-situ conservation has several advantages. Following are the important advantages of in-situ conservation:

(i) It is a cost-effective and a convenient method of conserving biodiversity.

(ii) A large number of living organisms can be conserved simultaneously.

(iii) Since the organisms are in a natural ecosystem, they can evolve better and can easily adjust to different environmental conditions.

Certain protected areas where in-situ conservation takes place include national parks, wildlife sanctuaries and biosphere reserves.

Ex-situ Conservation: Ex-situ conservation of biodiversity involves the breeding and maintenance of endangered species in artificial ecosystems

such as zoos, nurseries, botanical gardens, gene banks, etc. There is less competition for food, water and space among the organisms.

Ex-situ conservation has the following advantages:

(i) The animals are provided with a longer time and breeding activity.
(ii) The species bred in captivity can be reintroduced in the wild.
(iii) Genetic techniques can be used for the preservation of endangered species.

CONCLUSION

The existence and welfare of the human race depends on health and well-being of other life forms in the biospheres. Marine biodiversity tends to be highest along coasts in the Western Pacific, where sea surface temperature is highest and in mid-latitudinal band in all oceans. Biodiversity is our life. If the biodiversity got lost at this rate then in our near future, the survival of human being will be threatened. So, it is our moral duty to conserve biodiversity as well as our environment. Long term maintenance of species and their management requires co-operative efforts across entire landscapes. Biodiversity should be dealt with at scale of habitats or ecosystems rather than at species level

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BATCH – 2020-23

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INDEX

Introduction

- Natural resources are all around us and literally under our feet. A natural resource is something that is found in nature and can be used by people. Earth's natural resources include soil, air, water, plants, animals, light, stone, minerals, and fossil fuels. People need some natural resources to stay alive. They use others to make their lives better. We have to conserve our natural resources since many of them are limited. Conserve means to protect something from harm or destruction. Many people are committed to taking care of earth’s natural resources. These people are called conservationists. Conservationist is a long word, but anyone can be one—even you. Come let’s talk about resources we use all of the time, but probably don’t think about very often.

NATURAL RESOURCES

- **Natural resources** are resources that exist without any actions of humankind. This includes the sources of valued characteristics such as commercial and industrial use, aesthetic value, scientific interest and cultural value.
- On Earth, it includes sunlight, atmosphere, water, land, all minerals along with all vegetation, and animal life. Natural resources can be part of our natural heritage or protected in nature reserves.

- Particular areas (such as the rainforest in Fatu-Hiva) often feature biodiversity and geodiversity in their ecosystems. Natural resources may be classified in different ways. Natural resources are materials and components (something that can be used) that can be found within the environment. Every man-made product is composed of natural resources (at its fundamental level). A **natural resource** may exist as a separate entity such as fresh water, air, as well as any living organism such as a fish, or it may exist in an alternate form that must be processed to obtain the resource such as metal ores, rare-earth elements, petroleum, and most forms of energy.

Classification

There are various methods of categorizing natural resources which are:

- On the **basis of origin**, natural resources may be divided into two types:

➢ Biotic - Biotic resources are obtained from the biosphere (living and organic material), such as forests and animals, and the materials that can be obtained from them. Fossil fuels such as coal and petroleum are also included in this category because they are formed from decayed organic matter.

➢ Abiotic - Abiotic resources are those that come from non-living, non-organic material. Examples of abiotic resources include land, fresh water, air, rare-earth elements, and heavy metals including ores, such as gold, iron, copper, silver, etc.

- Considering their **stage of development**, natural resources may be referred to in the following ways:

➢ *Potential resources* — Potential resources are those that may be used in the future—for example, petroleum in sedimentary rocks that, until drilled out and put to use remains a *potential* resource.

➢ *Actual resources* — Those resources that have been surveyed, quantified and qualified, and are currently used in development, such as wood processing, and are typically dependent on technology.

➢ *Reserve resources* — The part of an actual resource that can be developed profitably in the future.

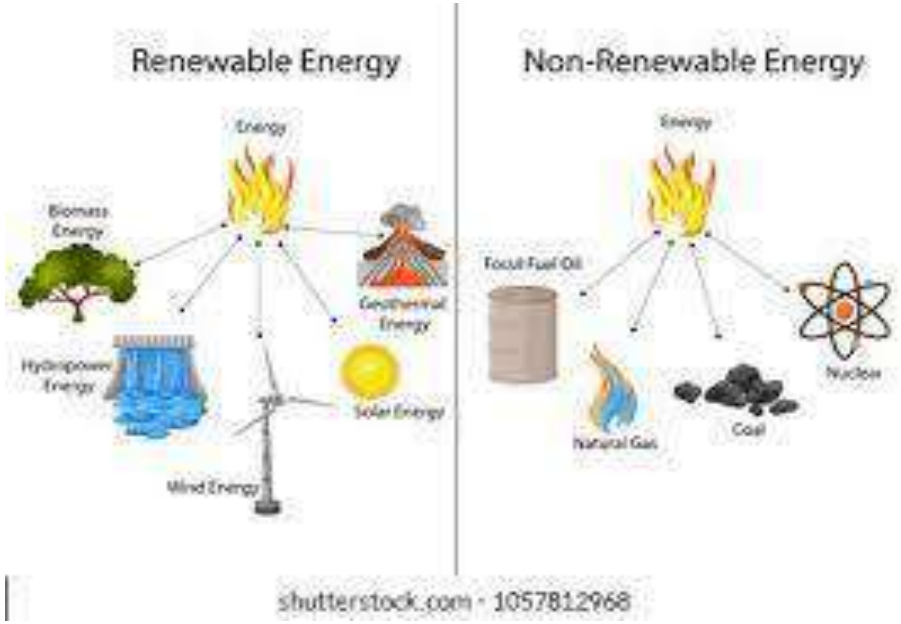
➢ *Stock resources* — Those that have been surveyed, but cannot be used due to lack of technology—for example, hydrogen.

- *Stock resources* — Those that have been surveyed, but cannot be used due to lack of technology—for example, hydrogen.

- On the **basis of recovery rate**, natural resources can be categorized as follows:

- Renewable Resources - Renewable resources can be replenished naturally. Some of these resources, like sunlight, air, wind, water, etc. are continuously available and their quantities are not noticeably affected by human consumption. Though many renewable resources do not have such a rapid recovery rate, these resources are susceptible to depletion by over-use. Resources from a human use perspective are classified as renewable so long as the rate of replenishment/recovery exceeds that of the rate of consumption. They replenish easily compared to non-renewable resources.

- Non-renewable resources either form slowly or do not naturally form in the environment. Minerals are the most common resource included in this category. From the human perspective, resources are non-renewable when their rate of consumption exceeds the rate of replenishment/recovery; a good example of this are fossil fuels, which are in this category because their rate of formation is extremely slow (potentially millions of years), meaning they are considered non-renewable. Some resources naturally deplete in amount without human interference, the most notable of these being radio-active elements such as uranium, which naturally decay into heavy metals. Of these, the metallic minerals can be re-used by recycling them, but coal and petroleum cannot be recycled. Once they are completely used they take millions of years to replenish.



P.T.O

Extraction

- Resource extraction involves any activity that withdraws resources from nature. This can range in scale from the traditional use of preindustrial societies to global industry. Extractive industries are, along with agriculture, the basis of the primary sector of the economy. Extraction produces raw material, which is then processed to add value. Examples of extractive industries are hunting, trapping, mining, oil and gas drilling, and forestry. Natural resources can add substantial amounts to a country's wealth ; however, a sudden inflow of money caused by a resource boom can create social problems including inflation harming other industries ("Dutch disease") and corruption, leading to inequality and underdevelopment, this is known as the "resource curse".

Extractive industries represent a large growing activity in many less-developed countries but the wealth generated does not always lead to sustainable and inclusive growth. People often accuse extractive industry businesses as acting only to maximize short-term value, implying that less-developed countries are vulnerable to powerful corporations. Alternatively, host governments are often assumed to be only maximizing immediate revenue. Researchers argue there are areas of common interest where development goals and business cross.

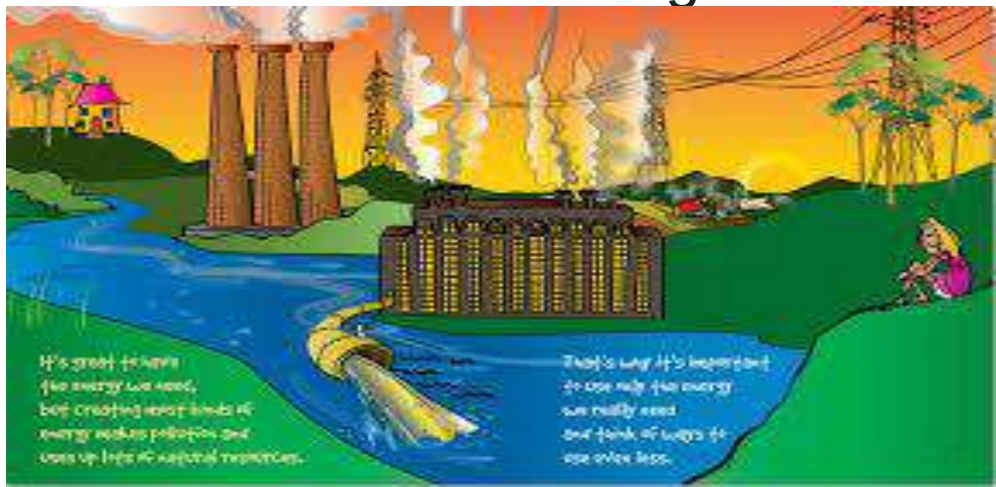
- These present opportunities for international governmental agencies to engage with the private sector and host governments through revenue management and expenditure accountability, infrastructure development, employment creation, skills and enterprise development, and impacts on children, especially girls and women. A strong civil society can play an important role in ensuring the effective management of natural resources. Norway can serve as a role model in this regard as it has good institutions and open and dynamic public debate with strong civil society actors that provide an effective checks and balances system for the government's management of extractive industries, such as the Extractive Industries Transparency Initiative (EITI), a global standard for the good governance of oil, gas and mineral resources. It seeks to address the key governance issues in the extractive sectors.

Depletion of Resources

- In recent years, the depletion of natural resources has become a major focus of governments and organizations such as the United Nations (UN). This is evident in the UN's Agenda 21 Section Two, which outlines the necessary steps for countries to take to sustain their natural resources. The depletion of natural resources is considered a sustainable development issue. The term sustainable development has many interpretations, most notably the Brundtland Commission's 'to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs'; however, in broad terms it is balancing the needs of the planet's people and species now and in the future. In regards to natural resources, depletion is of concern for sustainable development as it has the ability to degrade current environments and the potential to impact the needs of future generations.
- Depletion of natural resources is associated with social inequity. Considering most biodiversity are located in developing countries, depletion of this resource could result in losses of ecosystem services for these countries. Some view this depletion as a major source of social unrest and conflicts in developing nations.

P.T.O

- At present, there is a particular concern for rainforest regions that hold most of the Earth's biodiversity. According to Nelson, deforestation and degradation affect 8.5% of the world's forests with 30% of the Earth's surface already cropped. If we consider that 80% of people rely on medicines obtained from plants and ¾ of the world's prescription medicines have ingredients taken from plants, loss of the world's rainforests could result in a loss of finding more potential life-saving medicines.
- The depletion of natural resources is caused by 'direct drivers of change' such as Mining, petroleum extraction, fishing, and forestry as well as 'indirect drivers of change' such as demography (e.g. population growth), economy, society, politics, and technology.
- The current practice of Agriculture is another factor causing depletion of natural sources. For example, the depletion of nutrients in the soil due to excessive use of nitrogen and desertification. The depletion of natural resources is a continuing concern for society.This is seen in the cited quote given by Theoder Roosevelt,a well-known conservationist and former United States president, who was opposed to unregulated natural resource extraction.



Management and Protection

- In 1982, the United Nations developed the World Charter for Nature, which recognized the need to protect nature from further depletion due to human activity. It states that measures must be taken at all societal levels, from international to individual, to protect nature. It outlines the need for sustainable use of natural resources and suggests that the protection of resources should be incorporated into national and international systems of law. To look at the importance of protecting natural resources further, the World Ethic of Sustainability, developed by the IUCN, WWF and the UNEP in 1990, set out eight values for sustainability, including the need to protect natural resources from depletion. Since the development of these documents, many measures have been taken to protect natural resources including establishment of the scientific field and practice of conservation biology and habitat conservation, respectively.
- Conservation biology is the scientific study of the nature and status of Earth's biodiversity with the aim of protecting species, their habitats, and ecosystems from excessive rates of extinction. It is an interdisciplinary subject drawing on science, economics and the practice of natural resource management.
- Habitat conservation is a land management practice that seeks to conserve, protect and restore habitat areas for wild plants and animals, especially conservation reliant species, and prevent their extinction, fragmentation or reduction in range.

- Natural resource management is a discipline in the management of natural resources such as land, water, soil, plants, and animals—with a particular focus on how management affects quality of life for present and future generations. Hence, sustainable development is followed according to judicial use of resources to supply both the present generation and future generations. The disciplines of fisheries, forestry, and wildlife are examples of large subdisciplines of natural resource management.
- Management of natural resources involves identifying who has the right to use the resources, and who does not, for defining the boundaries of the resource. The resources may be managed by the users according to the rules governing when and how the resource is used depending on local condition or the resources may be managed by a governmental organization or other central authority.
- A "...successful management of natural resources depends on freedom of speech, a dynamic and wide-ranging public debate through multiple independent media channels and an active civil society engaged in natural resource issues...", because of the nature of the shared resources the individuals who are affected by the rules can participate in setting or changing them. The users have rights to devise their own management institutions and plans under the recognition by the government. The right to resources includes Land, water, fisheries and pastoral rights.

- *Value of Natural resources by Country (in USD trillions), 2021*

COUNTRY	VALUE
Russia	79
United States	45
Saudi Arabia	34.4
Canada	33.2
Democratic Republic of Congo	24
Brazil	23
Australia	19.9
Venezuela	14.3
India	0.10

Suggestion

1. **Reduce, reuse, and recycle**. Cut down on what you throw away. Follow the three "R's" to conserve natural resources and landfill space.
2. **Volunteer**. Volunteer for cleanups in your community. You can get involved in protecting your watershed, too.
3. **Educate**. When you further your own education, you can help others understand the importance and value of our natural resources.
4. **Conserve water**. The less water you use, the less runoff and wastewater that eventually end up in the ocean.
5. **Choose sustainable**.
6. **Shop wisely**. Buy less plastic and bring a reusable shopping bag.
7. **Use long-lasting light bulbs**. Energy efficient light bulbs reduce greenhouse gas emissions. Also flip the light switch off when you leave the room!
8. **Plant a tree**. Trees provide food and oxygen. They help save energy, clean the air, and help combat climate change.
9. **Don't send chemicals into our waterways**. Choose non-toxic chemicals in the home and office.
10. **Bike more**. Drive less.

Conclusion

- As the population of the world is increasing at an alarming rate, the consumption of natural resources is also increasing. Hence, these resources should be conserved to maintain ecological balance and save them for future generations. The proper management of a resource to prevent its destruction or exploitation is called conservation.
- Nature provides us with all the essentials for our daily needs. Due to overpopulation and human negligence we started to over-exploit our resources. If this continues, there will no resources left for our future generation. The need to conserve the resources are :

➢ To support life by supporting ecological balance

➢ To ensure that the future generations will be able to access the resources

➢ To preserve the biodiversity

➢ To make sure human race survives.

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TOPIC : TIGER CONSERVATION

TIGER CONSERVATION

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.

This is why tiger conservation efforts are needed if we want to give these animals a shot at having a sustainable future. As the number of tigers is decreasing day by day, we need to take preventive measures to save them from getting extinct. The habitat required by the Tigers should be made proper, and any cutting of trees in that area should be avoided. Being the national animal of India, it is our duty that we safeguard the wildlife properly. Many projects taken by India has led to a decrease in the depletion of tigers.

Causes for Tiger Depletion

1. **Habitat loss and prey depletion:** The key findings from many years of study of tiger population have indicated that in many sites, tigers decline in numbers because of habitat loss and prey depletion rather than being killed directly. A tiger needs to eat about 50 deer-sized animals or 6,600 pounds of living prey every year. Wherever prey-base is adequate and good protection measures are in place tiger populations reach high numbers simply because the species breeds quickly.

2. **Degradation of habitats:** Big cats need secure and disturbance-free habitat to maintain a viable population. But haphazard development activities in the landscape of the protected areas (PAs) pose big threat to tigers. For instance, Buxa Tiger Reserve is one place, which is in the midst of a high density of human population and faces heavy pressure from people living in and around it

3. **Illegal wildlife trade:** According to Interpol $32 billion was the value of illegal wildlife trade in the world in 2011. The agency also says that this is the fastest growing illegal activity in the world. Approximate figures, prevalent in 2006, show that tigers were killed for just Rs. 5,000 in India by gullible villagers, but were sold in international market for a hefty price of up to $50,000 by big traders, middlemen and smugglers

4. **Man-animal conflict:** Man-animal conflict is another major factor that affects the big cats. As humans move deeper into the territory of tigers, chances of conflict between both sides increase many fold. Men and livestock often become the victim of tiger attacks. This infuriates villagers who resort to revenge killing

5. **Lack of protection infrastructure :** Forest and wildlife do not figure on the priority lists of states, consequently forest departments usually suffer from the paucity of funds. This leads to delayed disbursal of money to the protection staff. Contrary to this poachers flaunt sophisticated arms and technology. There are also cases of corrupt forest officials who connive with poachers in their sinister designs. They are said to provide information on tigers' location in exchange for bribes.

Project launched by Government

Among many projects launched by government of India with aim of conservation of tiger and its habitat, *PROJECT TIGER* was biggest and most successful of them. It was first initiated in the year April 1, 1973, and is still going on.

This project was started to save tigers. The much-needed project was launched in Jim Corbett National Park, Uttrakhand under the leadership of Indira Gandhi. The objectives of the Project Tiger was clear- saving Royal Bengal Tigers from getting extinct.

The major cause of their depletion is humans, and so all the conservation areas are made human free. They made sure that the place that tigers lived in was also safe and secure.

Project Tiger has been successful in increasing the population of the tigers significantly. The project team has been doing its work with full dedication, and all national parks are putting efforts in doing the project. There are around fifty national parks and sanctuaries that are involved in this project.

Jim Corbett, Bandipur, Ranthambore, Nagarhole, Nazgira, Dudhwa, Gir, Kanha, Sunderbans, Bandhavgarh, Manas, Panna, Melghat, Palamau, Similipal, Periyar, Sariska, Buxa, Indravati, Namdapha, Mundanthurai, Valmiki, Pench, Tadoba Andhari, Dampa, Bhadra, Pench (Maharashtra), Pakke, Nameri, Satpura, Anamalai, Udanti- Sitanadi, Satkosia, Kaziranga, Achanakmar, Dandeli Anshi, Sanjay- Dubri, Mudumalai, Nagarhole

(Karnataka), Parambikulam, Sahyadri, Bilgiri, Kawal, Sathyamangalam, Mukandra, Srisailam, Amrabad, Pilibhit, Bor, Rajaji, Orang and Kamlang are the National parks in India involved in the Project Tiger.

Recent additions to this project are are: Ratapani Tiger Reserve(Madhya Pradesh), Sunabeda Tiger Reserve (Odisha), and Guru Ghasidas (Chhattisgarh).

There were many obstacles in the project like poaching and the Forest Rights Act, but all were handled well by the government, and the project is running in full speed.

The success of Project Tiger:

The journey of increasing tiger population has not been easy. Around the 1970s the tiger count was only 1200, but according to the recent census, it has increased to 5000. In fact, there has been a thirty per cent rise in the population in the last eight years.

Human interference in any of the reserves and forests is not allowed. A proper habitat has been created for the Tigers to hunt, live and survive. The world has recognised this project as the 'Most successful project'.

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, it has almost stopped.

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. Although these efforts has significantly reduced the depth of the problem but still there is a long way ahead to go.

The Picture of Royal Bengal Tiger

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Department-: Economics

ENVS AECC TUTORIAL

Project Topic-: Acid Rain and its effects : Case Study.

Batch : 2020-2023

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Contents

1.0 Introduction

What is Acid Rain?

Acid Rain is rainfall or any other kind of precipitation which possess acidic properties, this means that they have elevated levels of hydrogen ions (low pH level). It usually occurs due to emission of Nitrogen Oxide and Sulphur Dioxide, which reacts with atmospheric moisture to produce acids. Acid Rain has an adverse impact on forests, freshwater, soil and it also causes corrosion of steel structures, etc.

Process of Acid Rain.

The emission of Nitrogen Oxide and Sulphur Dioxide from factories and volcanoes mix with the atmospheric moisture to form Acid Rain. The process is as follows:

Gas Phase Chemistry

In this phase, Sulphur Dioxide reacts with hydroxyl radical to get oxidised.

$$SO_2 + OH\cdot \rightarrow HOSO_2\cdot$$

Which is followed by:

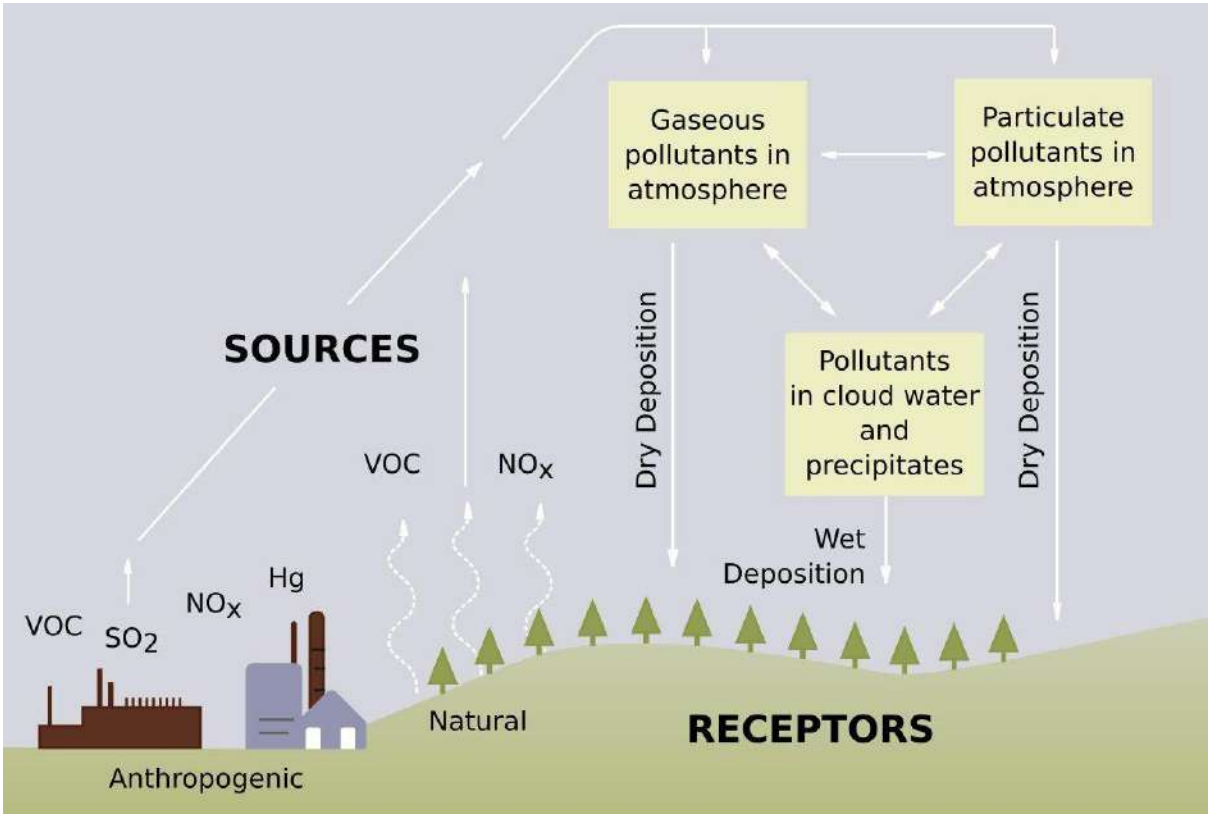
$$HOSO_2\cdot + O_2 \rightarrow HO_2\cdot + SO_3$$

In the presence of water, Sulphur Trioxide(SO_2) gets rapidly converted to Sulphuric Acid.

$$SO_3\,(g) + H_2O\,(l) \rightarrow H_2SO_4\,(aq)$$

Nitric acid is formed when Nitrogen Oxide reacts with OH.

$$NO_2 + OH\cdot \rightarrow HNO_3$$



Characteristic Features of Acid Rain

Acid Rain has the following characteristics:

- Acid Rain occurs in different precipitation forms such as rain, snow, sleet, hail, fog, and tiny bits of dry materials that settle to Earth.
- It has a pH value that generally ranges between 4.3 and 4.4 (pH level gets more acidic as the number reduces below 7).
- Acid Rain can affect the landscapes and the living things that reside within them even when precipitation is not occurring, with the presence of dry particles and gases which can affect landscapes during moisture less periods.

2.0 Objectives

The Objectives of this project work on "Acid Rain" is as follows :

1. To coin out the specific problem of "Acid Rain" as far as its definition and process of occurrence is concerned, followed by the characteristics of "Acid Rain"

2. To quantify statistically as well as graphically, as far as possible, the extent of "Acid Rain" in the world as well as in India.

3. To assess the readily available impact of "Acid Rain" on the surrounding Environment and Nature as well as on the Human Beings.

4. To find out some effective remedial measures in order to control or mitigate such an environmental problem of "Acid Rain"

3.0 Area of Study

Acid Rain, with its large-scale effect on nature and living beings, has attracted the interest of lots of research institutes and scientists in the last few decades. These people have been trying to know everything there is to know about Acid Rain and how to prevent it.

3.1 Distribution of Acid Rain in The World

Asia - The policies of different Asian nations to reach a certain level of development has raised the required amount of energy consumption which in turn has facilitated the formation and potential damage from Acid Rain in these regions. These regions include Japan, North and South Korea, Southern China and the mountainous region of Southeast Asia and Southwestern India. (Bhatti et al., 1992, 541-562)

North America - Approximately 100 samples collected from across the continental United States and Canada and searched for their mean pH and H^+ deposition showed that the north-eastern United States exhibits the highest rate of acidic precipitation, along with remaining proportion of the eastern United States, states along the western coastline and in a small region in western Colorado also experiences acid precipitation. (Wisniewski & Keitz, 1983,327-339) Parts of Canadian Shield in Eastern Canada were also identified to have acidic precipitation. (Government of Canada, 2010) The activities along the Gulf of Mexico are of great economics and employment importance. These activities are a major cause of acidic precipitation in this region. Thus the Gulf of Mexico region along the coast of Mexico is a receiver of acid rain. (Echeverría et al., 2018, 317-330)

Oceania - Due to the demographic structure of this region, isolation from other countries (having high industrial emission) and less use of sulphur-fuels, they have a very low risk of Acid Rain. Industrial emissions in a few local regions may pose a local problem but studies have shown that the pH level of precipitation in these regions are still higher than that of the precipitation that occurs in North America or Asia. Whatever is the industrial emission of NO_x and SO_2, it is largely associated with urban industrial hubs which receive very less rainfall, so acid rain is very less likely. (Murray, 1989, 131-136)

Europe - Black Triangle (insert europe graph)

4.0 Method of Study

In order to achieve the points of Objectives mentioned before, this project work has followed the following methodological steps :

1. Relevant books, periodicals, and articles have been consulted to have an initial idea on the topic of "Acid Rain"

2. Relevant and adequate search engines have been utilised to access specific websites and internet pages to consult the areas affected, causes and impact of the discussed environmental problem.

3. Statistical data tables wherever available with relevant global and regional maps have also been considered mentioning the source of those discussions.

4. As an important analytical step, available statistical data has been converted into bar or pie diagrams, in order to make a clear statistical analysis.

5. As a conclusive step, some effective remedial measures have been coined to mitigate such environmental problems.

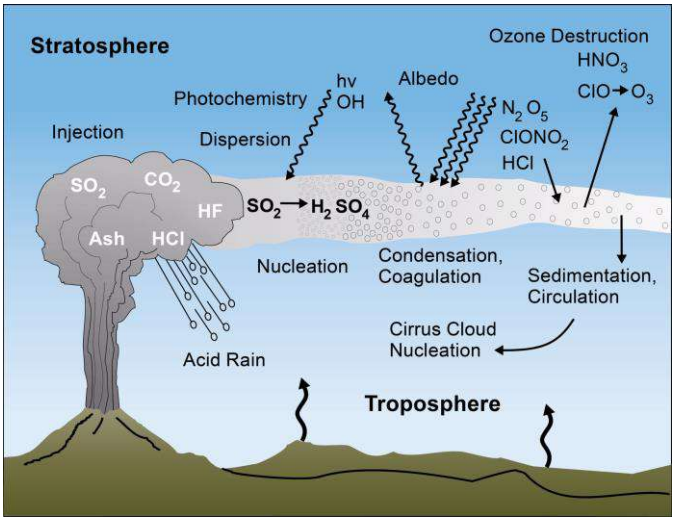
5.0 Causes of Acid Rain

Acid Rain is caused by Man-made as well as Natural causes. Here, we are going to talk about a few of those causes in detail.

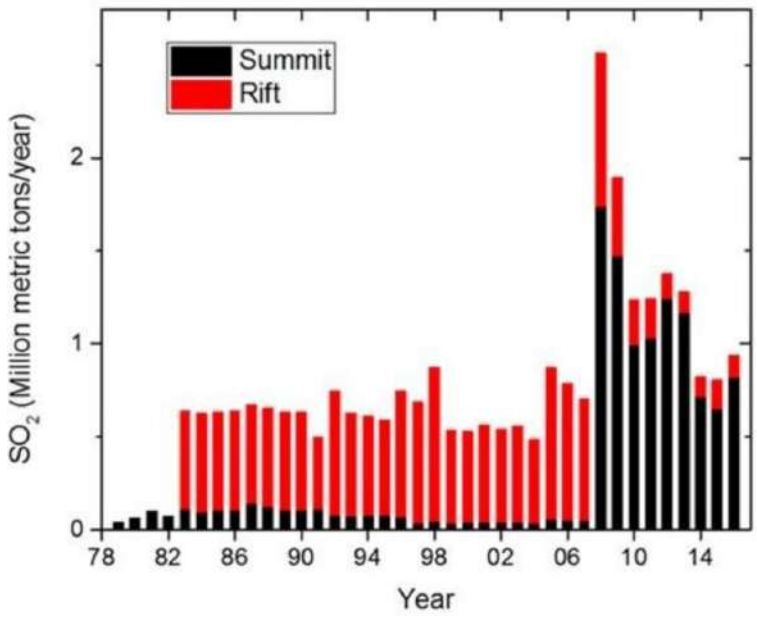
5.1 Natural Causes of Acid Rain

Although the major causes of Acid Rain are Man-made, there are a few naturally occurring things that contribute to the formation of Acid Rain. A few of them are :

5.1.1 Volcanic Eruptions - Volcanoes can severely impact the climatic condition. When a volcano erupts, it ejects huge amounts of volcanic gases, aerosol droplets and ash particles into the atmosphere. The volcanic gases include huge volumes of Sulphur Dioxide (SO_2) which when mixed with the water vapour, that escapes with the volcanic gases, and the atmospheric moisture can lead to Acid Rain. (USGS)



Kilauea Volcano situated on the Hawanian Islands is the most eruptive active volcano in that region. Between 1983 and 2018, its eruptive activities were almost continuous thus adding to the climate its own share of Sulphur Dioxide.



(Elias et al., 2020)

5.1.2 Lightnings -The most unheard of cause of Acid Rain is Lightning. The saying that milk turns sour during lightning is not the only thing that was found to be correct by the scientists, but a geologist in Athens, Georgia also found that acid rain becomes worse during thunderstorms. The occurrence of lightning generates reactive chemicals that speed up the acid production in the atmosphere. When lightning occurs, there is rapid heating and cooling of the cool atmospheric air at the higher levels of the atmosphere. This rapid heating and cooling leads to production of Nitric Oxide (NO) and Nitrogen Dioxide (NO_2), which further combines with the atmospheric moisture to produce Nitric Acid (HNO_3).

Bruce Railsback of the University of Georgia discovered the relationship while studying how the acidity of rainfall changes during the storm. “Studies of rainfall pH have typically used sampling intervals of one day or longer”, he said. “Variation of pH within events has received little attention”

Some samples collected from northwestern Georgia during their monsoon season were tested. It was observed that the rain water samples that were collected right after a lightning had occurred had a lower pH level (as low as 3.63) as compared to those collected when no thunder was heard (average pH level of 4.05). In addition to this, the sample collected after the lighting from lesser populated areas had a higher pH level as compared to samples collected from densely populated and industrialized regions like Atlanta. (Bruce, 1997, 233-241)

Of all the sources of NO_x in the troposphere, the most uncertain source is Lightning. The amount of NO_x produced by lightning ranges somewhere between 2-20 N Tg/yr. (DeCaria et al., 2000, 11,601-11,616)

The following table shows the NO_x levels recorded at different stations during that experiment.

Table 2. Statistical scores (correlations, root mean square error (RMSE), and bias) calculated with hourly time-series data for EMEP (O_3, NO_2, PM_{10}) and AERONET (AOD) stations.

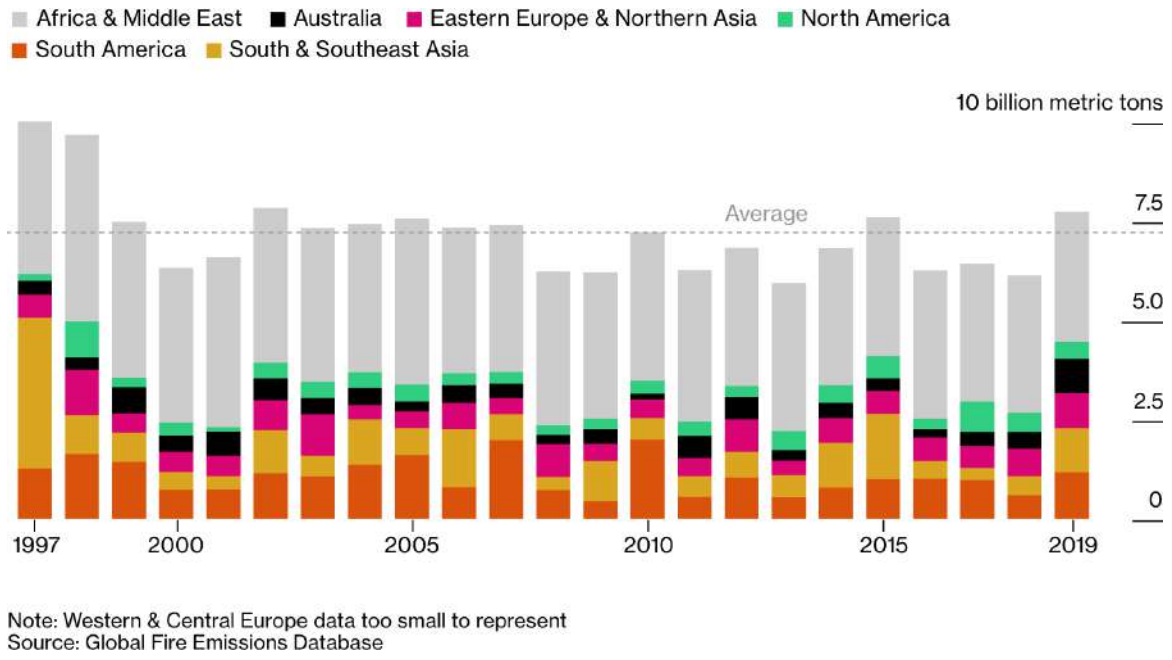
Variable	Run	R_s	R_t	RMSE	Bias
O_3	noLiNOx	0.61	0.64	1.29	−2.22
	LiNOx	0.62	0.64	1.31	−1.84
NO_2	noLiNOx	0.75	0.28	3.43	−0.52
	LiNOx	0.74	0.31	3.43	−0.53
PM_{10}	noLiNOx	0.87	0.27	3.32	−4.23
	LiNOx	0.86	0.26	3.98	−3.93
AOD	noLiNOx	0.81	0.30	1.18	−0.08
	LiNOx	0.81	0.31	1.14	−0.08

(Source : Impact of Lightning NOx Emissions on Atmospheric Composition and Meteorology in Africa and Europe)

5.1.3 Natural Fires - Natural and Forest WildFires are also a major natural occurring source of the toxic gases which produce acid rain. When there is an uncontrolled fire over a large area, that region emits huge quantities of smoke. This smoke contains harmful greenhouse gases such as Nitric Oxides (NO_x), Sulphur Dioxide (SO_2), Carbon Monoxides (CO) and Carbon Dioxides(CO_2). These greenhouse gases, when released into the environment, become quite harmful for the environment and the living beings. Nitric Oxides and Sulphur Dioxides mix in the atmosphere to form Acid Rain.

Over the past few decades, due to the reduction of Wildfires, there has been a reduction in the amount of harmful gases released into the environment due to these fires. The years 2019 and 2020 marked a devastating year for all the important hotspots of flora and fauna and the habitats which housed one of the most exotic and endangered species. With mammoth wildfires engulfing the expansive and important forests like the Amazon, forests of Indonesia, fires in the Arctic Circle followed by another heart wrenching fire disaster of Australia's BushFire. These fires not only destroyed the forest region but it also emitted tonnes of harmful greenhouse gases in the atmosphere.

The gaseous emissions from these regions were not so high till the middle of 2019, but these fire disasters caused the emissions to rise by 26% to 7.8 billion metric tonnes. The highest since 2002. (Lombrana et al., 2020)



5.2 Man Made Causes of Acid Rain

Now, coming to the major cause of Acid Rain, The Anthropogenic Causes of Acid Rain. As man has progressed in life and has been successful in making his life more and more comfortable, what he has missed out in his comfort equation is the well-being of the environment. As technology is advancing, the level of environmental pollution is also on the rise. Few of the "Anthropogenic Causes of Acid Rain" are :

5.2.1 Food Production - With the increase in population, there has also been a substantial increase in the global food requirement. The per-capita food requirement has also increased substantially over time. Food production also has an impact on the climate by production of acidic compounds such as Ammonia (NH_3) by Haber-Bosch process (a nitrogen fixation process used to produce ammonia artificially). Though 90% of the ammonia used for food production is not used up by the crops, instead it is lost atmospherically. (Galloway, 261) The ammonia(NH_x) lost to the environment, when deposited on terrestrial ecosystems, gets nitrified to produce Nitric Acid(HNO_3). For the purpose of comparison, the quantity of ammonia absorbed into the atmosphere from cropland or animal waste is 50 Tg N/yr globally, compared to the 26 TgN emitted into the atmosphere due to the production of fossil fuel. (Galloway, 261)

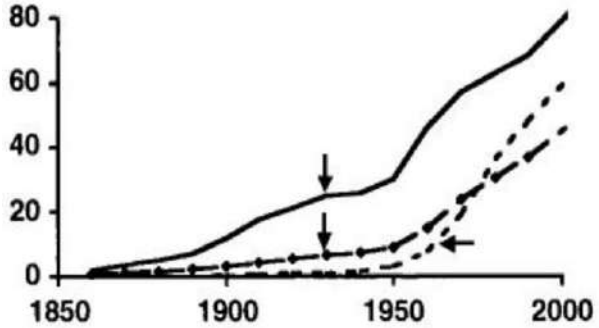


Figure 2. Global emissions of NOx (dashed line, diamonds), SO_2 (solid line) and NH_3. Arrows indicate the approximate time that human emissions became equal to natural terrestrial emissions.

Source	SO_2 emission (in Tg N per year)
Croplands and Animal Waste	50 Tg N/yr
Fossil Fuel	26 Tg N/yr

(Galloway, 2001, 17-25)

5.2.2 Energy Production - Energy in all forms is essential for the existence of humans. With a substantial increase in the population in the last century, there has really been a boost in the demand for energy. The increase in the demand for energy calls for different methods for the production of the desired amount of it. Since the beginning of time, fossil fuels have been regarded as the one of the most efficient methods of producing energy. In the process of producing energy through fossil fuels, fossil fuels are burnt to obtain energy. Production of energy through the burning of fossil fuels leads to the formation of NO and SO_2, which when comes in contact with the atmospheric moisture and water vapour, gets converted to form "Acid Rain". Currently the production rate of these two gases artificially (through man-made methods) exceeds the natural rate of production by 8 and 4 times respectively, globally. Tests in certain locations on the planet (eg - North America) show that the anthropogenic rates of production of these gases in these locations exceed the natural rate of production by 100 times. This substantial increase in the rate of NO and SO_2 level in the environment will result in substantial increase in the level of acidity in the precipitation.

It shows in a few records that the Han Dynasty, up until the 19th Century, used biomass as a means of energy production. Fossil Fuels were started to be used as a means of producing energy since the start of the 20th Century. It was not until the end of the 20th Century that the regional level of acidification became something of importance. The track of how humans use resources to produce energy is quite interesting. It is seen that the human population increases with time. With the increase in population, the energy requirement of humans increases. Crude Oil, a source of energy which has led to a large-scale acidification of the environment, was founded in the 19th Century. There was no new discovery in the energy production sector that would further acidify the environment, but still there was an upward rising trend in the level of acidity of the environment. This was due to the gradual increase in the population level, with an increase in the energy demand of the people. This face is evident from the graph provided below.

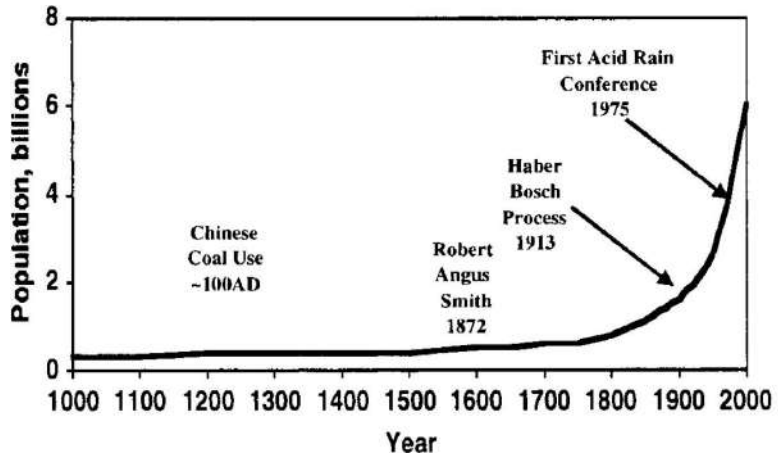


Figure 1. World population trends 1000 AD to 2000 AD and significant events in environmental acidification.

(Galloway, 2001, 17-25)

5.2.3 Vehicles - Among different anthropogenic causes of formation of "Acid Rain", vehicular emissions are one of the most highlighted ones because of the recent increase in its demand and the level of harm it does to the environment in the form of its exhaust. Vehicles lead to acidity of the environment due to the burning of fuel which helps in the production of energy. Vehicles generally use gasoline. These fuels contain sulphur, nitrogen, oxygen compounds and traces of metal. When these minerals are ignited to produce energy, it combines with the atmospheric acid to produce Nitric Oxide (NO) and Sulphur Dioxide (SO_2). These gases further combine with the atmospheric water vapour to produce "Acid Rain".

Source Contribution Analysis, a method of obtaining and analyzing the atmospheric impurities, when used in few of the major counties in the world showed very astonishing data. In Beijing, it showed that approximately 77% and 40% of the NO and CO_2 emission of that region was due to mobile sources of pollution such as vehicles. (Jiming et al., 2001, 215-228)

A similar analysis was done in the North Indian Industrial City of Jamshedpur. The data and analysis of the vehicular emissions of that city is as follows.

With the rapid industrialization and urbanization of that region, there has been a rapid increase in vehicular movement in that geographical region. This has resulted in the increase in atmospheric concentration of NO_x and SO_2. Data was collected from Regional Transportation Office (RTO) regarding the type of traffic and the different types of traffic junctions such as National Highway(NH), State Highways(SH), and intra-city roads. The data is as follows:

Vehicular Emission Rates in Jamshedpur City

Road	Vehicle density (PCU/h)		Emission rate / 10000 (kg km/h)	
			SO2	NOX (as NO2)
Inter-state highway (NH-33)	1734		0.5	3.2
State highway (Dimna road)	1116		0.2	1.5
Intracity roads (six roads)	906		0.1	0.9
Average	1252		0.3	1.9

(Bhanarkar et al., 2005, 7745-7760)

6.0 Environmental Impact of Acid Rain

Occurence of "Acid Rain" has a very heavy toll on the area in which it occurs. The area in which it occurs, it gets rid of all the nutrients that occur in the soil to support the plant, hence taking away the lifeline of the plants in that area. It also acidifies the local freshwater lakes that are home to a variety of aquatic animals. Not only does "Acid Rain" impact nature but it is also very harmful for humans as well. Here we are going to discuss the impact of "Acid Rain" on nature as well as on humans.

6.1 Impact of Acid Rain on Nature

6.1.1 Endangers Aquatic Life Forms : The aquatic ecosystem and the life forms are very complex in themselves, and introduction of a foreing substance in the form of acidified water makes matter even worse. A small alteration in any one of the components of the aquatic ecosystem can put an end to the status-quo. A change in the composition of one organism or species due to acidification can affect the entire ecosystem due to the predator-prey relationships of the food web. Initially the effect of the acid precipitation may be very subtle, but as the acidity increases, there is a gradual increase in the number of plants and animals that are affected due to acidity and they decline and disappear.

Water pH level	Affect on the Ecosystem
pH >= 6	As the pH level of water approaches 6, certain changes occur in the ecosystem. Crustaceans, insects, and some plankton species begin to disappear.
6 > pH >=5	As the pH level of water approaches 5, major alterations occur in the makeup of the plankton community. The less likely species of mosses and plankton may begin to invade the ecosystem. There is a possibility of loss of some fish population. The more complex and valued species are generally less tolerant to acidified water and are one of the first to succumb to such an occurrence.
pH < 5	At this level of acidity, the water does not have fishes any longer and the bottom is covered with undecayed material and the

	coastal areas may be dominated by mosses.

The terrestrial animals that depend on the aquatic waterbodies for water or food are also affected. For example - waterfowl depend on aquatic beings for nourishment and nutrients. With the reduction and elimination of these sources of food, the quality of habitat declines and the reproductive success of birds is also affected.
(Mehta, 2010, 123-132)

6.1.2 Effect on Terrestrial Plant Life - Some of the effects that acidified precipitation has on the terrestrial plant life are :

1. It can affect both natural vegetation and crops.
2. Alter the protective waxy surface of leaves, thus lowering disease resistance.
3. It may restrain plant germination and reproduction.
4. It acts as a catalyst in the process of soil weathering and removal of nutrients.
5. It makes toxic elements like aluminium more soluble. The increased solubility makes aluminium more soluble in the soil which can cause problems in the uptake and use of nutrients and minerals by the plants.

A study showed that in the last few years, there has been a very slow rate of growth of some forests for no reason at all. The expected rate of growth of the trees is not being met. The trees are quilting and dying instead of turning green. This is due to acid rain. Acid rain does not kill the trees immediately instead it kills it slowly by killing all the means of nutrients that a tree has. It destroys its leaves, or it seeps into the ground and poisons the trees with toxic chemicals that get absorbed by the trees from the acidified soil. When acid rain occurs, the nutrients and the helpful minerals get dissolved from the soil. These minerals then get washed away before the trees and other plants can use them to grow.
Not only do the acidic precipitation devoid the soil of nutrients for plants, they also release harmful elements like aluminium into the soil. Such a deposition occurs because such elements naturally occur in the soil but are not in a dissolvable state. When acid rain occurs, these elements combine with the hydrogen ions of the rain and get dissolved into the soil along with the rocks and small bound soil particles. This dissolution of rocks and small bound soil particles causes soil erosion during heavy rainfall season. Frequent acid rain also leads to leaves losing their waxy protective coating which helps them to retain water during the process of photosynthesis. Due to the hampering of the process of photosynthesis, the

leaves are unable to produce enough food for the plants to remain healthy. Once the plant is weak, it is more vulnerable to external stimuli such as diseases, insects, cold weather, etc which may ultimately lead to the end of the life of these plants. Sometimes when acid rain runs off crop fields, it carries fertilizers with it, which help to stimulate the growth of algae because of the presence of extreme amounts of nitrogen in it. The algae which forms in the water bodies due to this runoff causes death of fishes. Due to the decomposition of fishes in these ponds, the oxygen present in these ponds gets absorbed in the process of decomposition. This lack of oxygen leads to further death of the surviving fishes. (Mehta, 2010, 123-132)

6.2 Impact of Acid Rain on the Human Society

Human beings and the things created by humans to fulfill their needs are a part of human society. With the development power of humans itching its height, they are unstoppable, but with this unstoppable development comes the retaliation of nature in the form of "Acid Rain". Humans are such fragile beings that a slight change in their environmental composition will greatly affect them. So is the case with the things built by them. Some of the impact of "Acid Rain" on human society are :

6.2.1 Effect on Human Beings : The most gruesome and evident impact of "Acid Rain" is on Human Beings. "Acid Rain" can harm humans through various modes, such as, through atmosphere, soil on which the food grows, or through water. Harmful chemicals naturally occur in the soil in their natural form, mixed with other elements. These metals are toxic and harmful but when mixed with other elements, they are harmless. When acidic precipitation occurs, it breaks these metals and they might get absorbed in drinking water, crops or animals that humans consume. It is believed by scientists and researchers that the entry of a metal, Aluminium, is the probable reason for Alzheimer's disease.

One of the serious side effects of acid rain on humans is respiratory problems. Nitrogen oxide (NO) and sulphur dioxide (SO_X) may cause respiratory problems such as dry coughs, asthma, headaches, eye, nose, and throat irritation. Acidified rainfall is especially harmful for people suffering with respiratory problems, but it can also cause some health hazards for healthy humans as well due to the pollutants contained in the precipitation. Acid rain can aggravate a person's ability to respirate and may even cause diseases which could lead to death. (Mehta, 2010, 123-132)

The effect of those dissolved toxic metals due to acid rain, on children can be seen in the following table :

Lowest observed effect (lead level in blood, μg Pb/dL)	Effect Observed	Significance
10	ALA-D inhibited Py-5' - N inhibited	Accumulation of ALA, distributed heme biosynthesis Disrupted pyrimidine metabolism in red blood cells
15-20	EP elevation	Signals reduced heme formation in tissue and general mitochondrial injury
15-20	EEG disturbances	Indicates central nervous system dysfunction but the significance in terms of performance is presently

		unclear
15-20	Reduced 1,25-(OH)2 vitamin D synthesis	There is disturbed absorption and availability of calcium for essential metabolic needs.
30	Reduced nerve conduction velocities in adults, probably at this level in children	There is an indication of peripheral nervous system dysfunction.
	Reduced haemoglobin Increased urinary ALA Elevated coproporphyrin	These are indices of significant heme biosynthesis impairment.
40	Cognitive deficits	Deficits in intelligence and ability to learn at this level of lead are presently being debated.
50 and above	Cognitive defects, renal dysfunction, and over signs of neurotoxicity	Entering the range of overt toxicity of lead to a number of organs.

(Goyer et al., 1985, 355-368)

7.0 **Conclusion**

Acid Rain is a very serious, and dangerous issue that plagues our world as we know it today. It is formed when sulfur dioxide and carbon dioxide mix with the water in the atmosphere creating sulfuric acid and carbonic acid. The sulfur dioxide and carbon dioxide are both released in large amounts through the burning of different fuels such as coal and fossil fuels. Acid Rain hurts the environment by damaging the soil, killing plant life, damaging wildlife, and even serverly hurting us humans. The damage it causes leads to very serious issues, and it even can effect the lives of those around you. One way you can stop it, you can start searching for cleaner forms of energy, such as solar power and electric cars. It may not seem as though Acid Rain is much of an issue, but it can cause more that you can even imagine.

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CU REGISTRATION NO. :-

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SEMESTER :- 2

DEPARTMENT :- ECONOMICS

ENVS AECC TUTORIAL

PROJECT TOPIC :- ***GLOBAL WARMING***

ENVS

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ENVS

Contents

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INTRODUCTION

What is Global Warming :-

Global warming is when the earth heats up (the temperature rises). It happens whengreenhouse gases (carbon dioxide, water vapor, nitrous oxide, and methane) trap heat andlight from the sun in the earth's atmosphere, which increases the temperature. This hurtsmany people, animals, and plants. Many cannot take the change, so they die.Glaciers are melting, sea levels are rising, cloud forests are drying, and wildlife isscrambling to keep pace. It's becoming clear that humans have caused most of the pastcentury's warming by releasing heat-trapping gases as we power our modern lives. Calledgreenhouse gases, their levels are higher now than in the last 650,000 years.We call the result global warming, but it is causing a set of changes to the Earth's climate,or long-term weather patterns, that varies from place to place. As the Earth spins each day,the new heat swirls with it, picking up moisture over the oceans, rising here, settling there.It's changing the rhythms of climate that all living things have come to rely upon.What will we do to slow this warming? How will we cope with the changes we've alreadyset into motion? While we struggle to figure it all out, the face of the Earth as we knowit—coasts, forests, farms and snow-capped mountains—hangs in the balance.

Its Causes :-

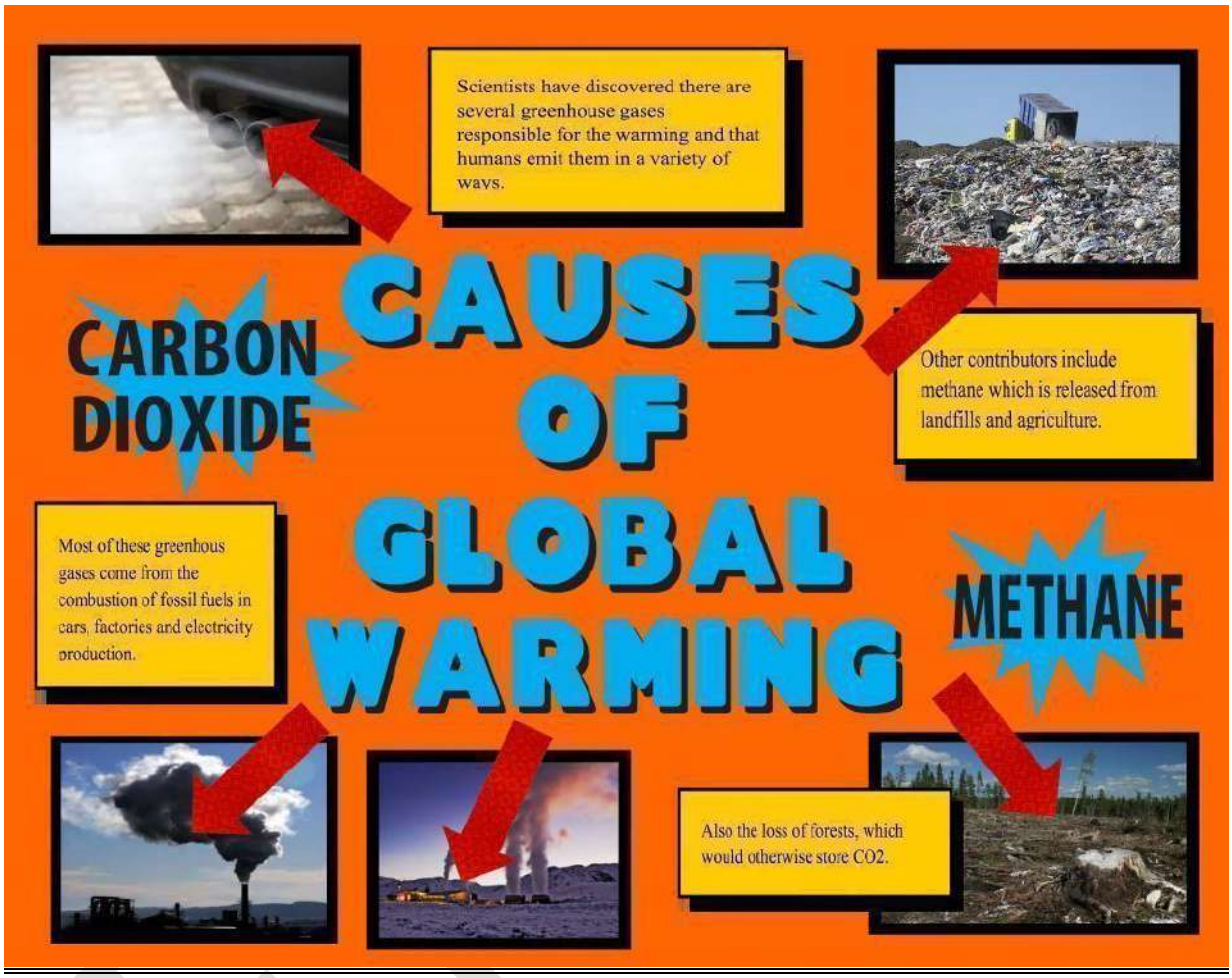
Many things cause global warming. One thing that causes global warming is electricalpollution. Electricity causes pollution in many ways, some worse than others. In mostcases, fossil fuels are burned to create electricity. Fossil fuels are made of dead plantsand animals. Some examples of fossil fuels are oil and petroleum. Many pollutants(chemicals that pollute the air, water, and land) are sent into the air when fossil fuels areburned. Some of these chemicals are called greenhouse gasses.We use these sources of energy much more than the sources that give off lesspollution. Petroleum, one of the sources of energy, is used a lot. It is used fortransportation, making electricity, and making many other things. Although this sourceof energy gives off a lot of pollution, it is used for 38% of the United States' energy.Some other examples of using energy and polluting the air are:

- Turning on a light
- Using hair dryer
- Using air conditioner
- Using microwave
- Riding Car
- Etc

When you do these things, you are causing more greenhouse gasses to be sent into theair. Greenhouse gasses are sent into the air because creating the electricity you use to dothese things causes pollution. If you think of how many times a day you do these things,it's a lot. You even have to add in how many other people do these things! That turnsout to be a lot of pollutants going into the air a day because of people like us usingelectricity. The least amount of electricity you use, the better.

When we throw our garbage away, the garbage goes to landfills. Landfills are those big hills that you go by on an expressway that stink. They are full of garbage. The garbage is then sometimes burned. This sends an enormous amount of greenhouse gasses into the air and makes global warming worse. Another thing that makes global warming worse is when people cutdown trees. Trees and other plants collect carbon dioxide (CO_2), which is a greenhousegas.Carbon dioxide is the air that our body lets out when we breathe. With fewer trees, it isharder for people to breathe because there is more CO_2 in the air, and we don't breatheCO_2, we breathe oxygen. Plants collect the CO_2 that we breathe out, and they give backoxygen that we breathe in. With less trees and other plants, such as algae, there is less airfor us, and more greenhouse gases are sent into the air. This means that it is veryimportant to protect our trees to stop the greenhouse effect, and also so we can breatheand live.This gas, CO_2, collects light and heat (radiant energy), produced by the sun, and thismakes the earth warmer. The heat and light from the sun is produced in the center of thesun. (The sun has layers just like the earth.) This layer is called the core. Just like a coreof an apple, it is in the middle. Here there is a very high temperature, about27,000,000°F. This heat escapes out of this layer to the next layer, the radiative zone.This layer is cooler, about 4,500,000°F. Gradually, the heat and light will pass throughthe convection zone at a temperature of around 2,000,000°F. When it gets to the surface,the temperature is about 10,000°F. Finally, the heat and light is sent into space. This iscalled radiant energy (heat and light). The radiant energy reaches the earth'satmosphere. As a result of this process we get light and heat. When you pollute, yousend

chemicals into the air that destroy our atmosphere, so more heat and light cannotescape from the earth's atmosphere.



Industrial PollutionScientists have spent decades figuring out what is causing global warming. They'velooked at the natural cycles and events that are known to influence climate. But theamount and pattern of warming that's been measured can't be explained by these factorsalone. The only way to explain the pattern is to include the effect of greenhouse gases(GHGs) emitted by humans.To bring all this information together, the United Nations formed a group of scientistscalled the International Panel on Climate Change, or IPCC. The IPCC meets every fewyears to review the latest scientific findings and write a report summarizing all that isknown about global warming. Each report represents a consensus, or agreement, amonghundreds of leading scientists.One of the first things scientists learned is that there are several greenhouse

gasesresponsible for warming, and humans emit them in a variety of ways. Most come from the combustion of fossil fuels in cars, factories and electricity production. The gasresponsible for the most warming is carbon dioxide, also called CO2. Other contributorsinclude methane released from landfills and agriculture (especially from the digestivesystems of grazing animals), nitrous oxide from fertilizers, gases used for refrigerationand industrial processes, and the loss of forests that would otherwise store CO2.Different greenhouse gases have very different heat-trapping abilities. Some of them caneven trap more heat than CO2. A molecule of methane produces more than 20 times thewarming of a molecule of CO2. Nitrous oxide is 300 times more powerful than CO2.Other gases, such as chlorofluorocarbons (which have been banned in much of the worldbecause they also degrade the ozone layer), have heat-trapping potential thousands oftimes greater than CO2. But because their concentrations are much lower than CO2, noneof these gases adds as much warmth to the atmosphere as CO2 does.In order to understand the effects of all the gases together, scientists tend to talk about allgreenhouse gases in terms of the equivalent amount of CO2. Since 1990, yearlyemissions have gone up by about 6 billion metric tons of "carbon dioxide equivalent"worldwide, more than a 20% increase.

Its Effect :-

Global climate change has already had observable effects on the environment. Glaciers have shrunk, ice on rivers and lakes is breaking up earlier, plant and animal ranges have shifted and trees are flowering sooner.

Effects that scientists had predicted in the past would result from global climate change are now occurring: loss of sea ice, accelerated sea level rise and longer, more intense heat waves.

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.

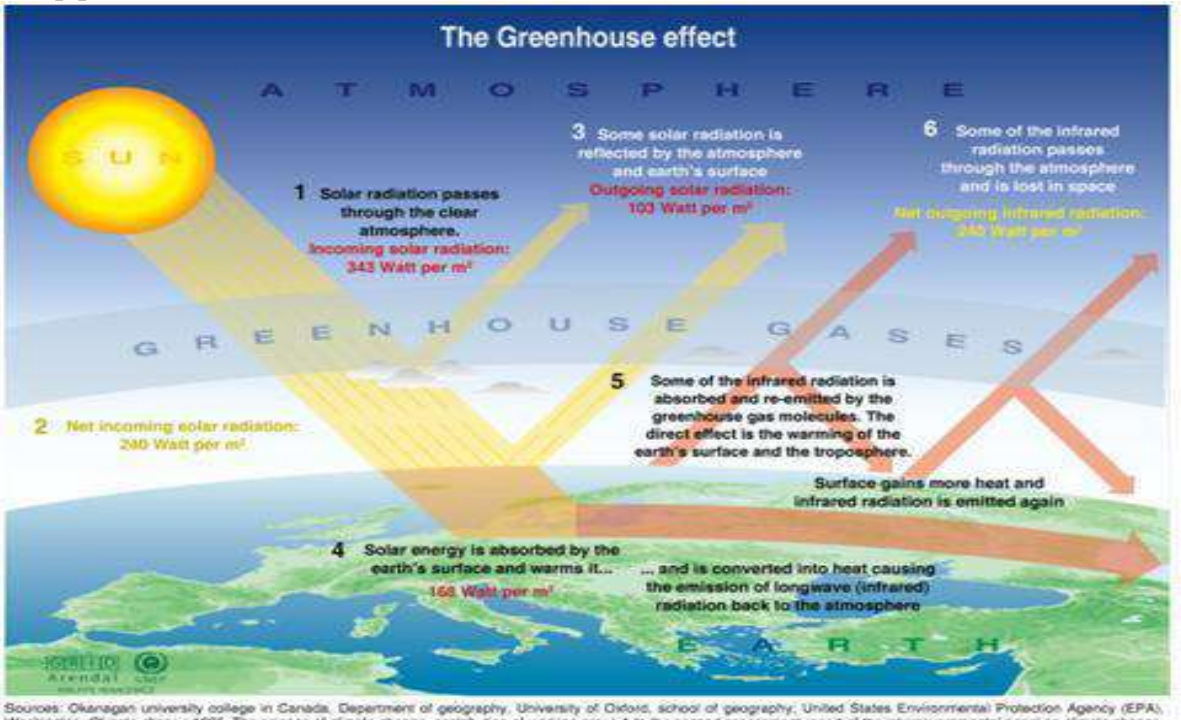
Green House Effect :-

The greenhouse effect is when the temperature rises because the sun's heat and light istrapped in the earth's atmosphere. This is like when heat is trapped in a car. On a veryhot day, the car gets hotter when it is out in the

parking lot. This is because the heat andlight from the sun can get into the car, by going through the windows, but it can't getback out. This is what the greenhouse effect does to the earth. The heat and light can getthrough the atmosphere, but it can't get out. As a result, the temperature rises. The sun's heat can get into the car through the windows but is then trapped.

Step 1: Solar radiation reaches the Earth's atmosphere - some of this is reflected back into space.
Step 2: The rest of the sun's energy is absorbed by the land and the oceans, heating the Earth.
Step 3: Heat radiates from Earth towards space.
Step 4: Some of this heat is trapped by greenhouse gases in the atmosphere, keeping the Earth warm enough to sustain life.
Step 5: Human activities such as burning fossil fuels, agriculture and land clearing are increasing the amount of greenhouse gases released into the atmosphere.
Step 6: This is trapping extra heat, and causing the Earth's temperature to rise.

This makes what ever the place might be, a greenhouse, a car, a building, or the earth's atmosphere, hotter. This diagram shows the heat coming into a car as visible light (light you can see) and infrared light (heat). Once the light is inside the car, it is trapped and the heat



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The planet is warming, from North Pole to South Pole, and everywhere in between.Globally, the mercury is already up more than 1 degree Fahrenheit (0.8 degree Celsius),and even more in sensitive polar regions. And the effects of rising temperatures aren'twaiting for some far-flung future. They're happening right now. Signs are appearing allover, and some of them are surprising. The heat is not only melting glaciers and sea ice,it's also shifting precipitation patterns and setting animals on the move.Some impacts from increasing temperatures are already happening. Ice is melting worldwide, especially at the Earth's poles. This includes mountain glaciers, ice sheets covering West Antarctica and Greenland, and Arctic sea ice.

Sea levels are expected to rise between 7 and 23 inches (18 and 59 centimeters) by theend of the century, and continued melting at the poles could add between 4 and 8inches (10 to 20 centimeters).Hurricanes and other storms are likely to become stronger.Species that depend on one another may become out of sync. For example, plantscould bloom earlier than their pollinating insects become active.Floods and droughts will

become more common. Rainfall in Ethiopia, where droughtsare already common, could decline by 10 percent over the next 50 years.Less fresh water will be available. If the Quelccaya ice cap in Peru continues to melt atits current rate, it will be gone by 2100, leaving thousands of people who rely on it fordrinking water and electricity without a source of either.Some diseases will spread, such as malaria carried by mosquitoes.Ecosystems will change—some species will move farther north or become moresuccessful; others won't be able to move and could become extinct. Wildlife researchscientist MartynObbard has found that since the mid-1980s, with less ice on which tolive and fish for food, polar bears have gotten considerably skinnier. Polar bearbiologist Ian Stirling has found a similar pattern in Hudson Bay. He fears that if seaice disappears, the polar bears will as well.

ENV S

Steps to prevent Global Warming :-

- **Stimulating Public Discussion about the Introduction of Daylight Saving Time**

The Government should stimulate a multi-faceted public discussion on the introduction of daylight saving time. This discussion will provide an opportunity to adopt a system that effectively uses daylight during the summer season so each individual can be friendlier to the global environment. More specifically, the "Citizens' Conference to Think about the Global Environment and Daylight Saving Time" (tentative name) should be held during the summer of 1998. By encouraging the participation of the public, businesses, the national Government, and local authorities, this discussion should reach a conclusion during fiscal 1998.

- **Securing Social Conditions Leading to Promotion of Safe and Appropriate Use of Bicycles**

Bicycle use should be encouraged to ease traffic congestion and reduce fossil fuel consumption. To encourage the use of bicycles, the Government should improve roads for bicycle use, provide parking for bicycles, and allow bicycles to be taken onto trains by providing extra space in train cars and special lines for bicyclists. In addition, cities and towns should establish comprehensive policies for bicycle parking.

- **Improvement of Structures for Education/Awareness Raising and Information Dissemination**

To promote action by all citizens, including children, the Government should improve environmental education, with emphasis placed on the problem of global warming and the role of forests. Furthermore, education on energy issues should be improved and offered at a variety of settings: schools, local communities, and homes.

1. **Improving Environmental Education and Energy Education at Schools**
2. **Promoting Education on the Environment and Energy at Various Sites**
3. **Improving Public Relations**
4. **Establishing a "Global Warming Prevention Month**
5. **Providing Information about CFC Alternatives (HFC, PFC and SF_6)**

- **Expansion of Greening Activities as Measures to Prevent Global Warming**

To increase CO_2 sinks, the Government should actively expand public greening activities by developing citizen greening movements including those relating to Green Week (23 - 29 April) and Urban Greenery Month (October); providing funding to afforesting activities by the Midori no Bokin fund, citizen greening activities by the Toshi Ryokka Kikin (Urban Green Fund), etc.; promoting public-involved afforestation led by Forest Instructors, Tree Doctors, and All Japan Junior Green Friends' Federation; using school forests; implementing 'Kodomo Happa Hanteishi' activities to involve primary and secondary school students in research to measure the amount of CO_2 absorbed by trees; and creating biotopes, i.e., habitats for birds, dragonflies, and other living things.

CONCLUSION

The 'Conclusion' confirms that global warming is the major challenge for our global society. There is very little doubt that global warming will change our climate in the next century. So what are the solutions to global warming? First, there must be an international political solution. Second, funding for developing cheap and clean energy production must be increased, as all economic development is based on increasing energy usage. We must not pin all our hopes on global politics and clean energy technology, so we must prepare for the worst and adapt. If implemented now, a lot of the costs and damage that could be caused by changing climate can be mitigated.

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DEPARTMENT: ECONOMICS

TOPIC: CASE STUDY ON BHOPAL GAS TRAGEDY

CONTENTS

INTRODUCTION

The Bhopal disaster, also referred to as the Bhopal Gas Tragedy, was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. It is considered among the world's worst industrial disasters. Over 500,000 people were exposed to methyl isocyanate (MIC) gas. The highly toxic substance made its way into and around the small towns located near the plant.

THE UCIL PESTICIDE PLANT IN BHOPAL

Estimates vary on the death toll. The official immediate death toll was 2,259. In 2008, the Government of Madhya Pradesh had paid compensation to the family members of 3,787 victims killed in the gas release, and to 574,366 injured victims.

The Indian government and local activists argue that slack management and deferred maintenance created a situation where routine pipe maintenance caused a backflow of water into a MIC tank, triggering the disaster. Union Carbide Corporation (UCC) argues that water entered the tank through an act of sabotage.

THE DISASTER

On the night of December 2, 1984, disaster struck. Due to faulty safety mechanisms, water accidentally entered a pipe and poured into a giant tank of methyl isocyanate. This started a chemical reaction that turned the chemical into gas, which built up pressure and eventually burst out of the factory. Over the next 45 minutes, somewhere between 30 and 45 tons of toxic gas entered the air.

Gasses like this are heavier than the atmosphere, so rather than dissipating high in the sky, they formed a dense cloud of noxious fumes at ground level and caught the winds heading straight for Bhopal. As the cloud of gas hit the town, people woke from their sleep choking, gasping, and vomiting. Many were immediately affected, their skin burning and lungs failing. Those who survived the initial wave tried to flee, causing a massive panic in the densely packed town.

By the morning of December 3, thousands were dead. The **official counts ranged from 2,259 to 3,787 dead**, although local workers who collected bodies claimed that there were upwards of 15,000 victims. The government sent relief workers to Bhopal, but it became quickly apparent that they were unprepared to deal with a catastrophe of this scale.

CAUSES OF THE DISASTER

There are two main lines of argument involving the disaster:

- The "Corporate Negligence" point of view argues that the disaster was caused by a potent combination of under-maintained and decaying facilities, a weak attitude towards safety, and an undertrained workforce, culminating in worker actions that inadvertently enabled water to penetrate the MIC tanks in the absence of properly working safeguards. This point of view also argues that management (and to some extent, local government) underinvested in safety, which allowed for a dangerous working environment to develop.

- The "Worker Sabotage" point of view argues that it was not physically possible for the water to enter the tank without concerted human effort, and that extensive testimony and engineering analysis leads to a conclusion that water entered the tank when a rogue individual employee hooked a water hose directly to an empty valve on the side of the tank. This point of view further argues that the Indian government took extensive actions to hide this possibility in order to attach blame to UCC.
  Theories differ as to how the water entered the tank. At the time, workers were cleaning out a clogged pipe with water about 400 feet from the tank. They claimed that they were not told to isolate the tank with a pipe slip-blind plate. The operators assumed that owing to bad maintenance and leaking valves, it was possible for the water to leak into the tank.

EFFECTS ON HEALTH

The initial effects of exposure were coughing, severe eye irritation and a feeling of suffocation, burning in the respiratory tract, blepharospasm, breathlessness, and stomach pains and vomiting. People awakened by these symptoms fled from the plant. Those who ran inhaled more than those in vehicles. Owing to their height, children and other residents of shorter stature inhaled higher concentrations, as methyl isocyanate gas is approximately twice as dense as air and, therefore, in an open environment has a tendency to fall toward the ground.

CHILD BORN WITH DEFORMITIES AFTER THE BHOPAL GAS TRAGEDY

Thousands of people had died by the following morning. Primary causes of deaths were choking, reflexogenic circulatory collapse and pulmonary oedema. Findings during autopsies revealed changes not only in the lungs but also cerebral oedema, tubular necrosis of the kidneys, fatty degeneration of the liver and necrotising enteritis. The stillbirth rate increased by up to 300% and the neonatal mortality rate by around 200%.

A total of 36 wards were marked by the authorities as being "gas affected," affecting a population of 520,000. Of these, 200,000 were below 15 years of age, and 3,000 were pregnant women. The official immediate death toll

was 2,259, and in 1991, 3,928 deaths had been officially certified. Ingrid Eckerman estimated 8,000 died within two weeks.

The government of Madhya Pradesh confirmed a total of 3,787 deaths related to the gas release.

Later, the affected area was expanded to include 700,000 citizens.

A government affidavit in 2006 stated the leak caused 558,125 injuries including 38,478 temporary partial injuries and approximately 3,900 severely and permanently disabling injuries.

A cohort of 80,021 exposed people was registered, along with a control group, a cohort of 15,931 people from areas not exposed to MIC. Nearly every year since 1986, they have answered the same questionnaire. It shows overmortality and overmorbidity in the exposed group. Bias and confounding factors cannot be excluded from the study. Because of migration and other factors, 75% of the cohort is lost, as the ones who move out are not followed.

A number of clinical studies are performed. The quality varies, but the different reports support each other. Studied and reported long-term health effects are:

- **Eyes:** Chronic conjunctivitis, scars on cornea, corneal opacities, early cataracts
- **Respiratory tracts**: Obstructive and/or restrictive disease, pulmonary fibrosis, aggravation of tuberculosis and chronic bronchitis
- **Neurological system**: Impairment of memory, finer motor skills, numbness, etc.
- **Psychological problems**: Post traumatic stress disorder (PTSD).

Missing or insufficient fields for research are female reproduction, chromosomal aberrations, cancer, immune deficiency, neurological sequelae, post-traumatic stress disorder (PTSD) and children born after the disaster. Late cases that might never be highlighted are respiratory insufficiency, cardiac insufficiency, cancer and tuberculosis. Bhopal now has high rates of birth defects and records a miscarriage rate 7x higher than the national average.

IMMEDIATE AFTERMATH

In the immediate aftermath, the plant was closed to outsiders (including UCC) by the Indian government, which subsequently failed to make data public, contributing to the confusion. The initial investigation was conducted entirely by the Council of Scientific and Industrial Research (CSIR) and the Central Bureau of Investigation. The UCC chairman and CEO Warren Anderson, together with a technical team, immediately travelled to India. Upon arrival Anderson was placed under house arrest and urged by the Indian government to leave the country within 24 hours. Union Carbide organized a team of international medical experts, as well as supplies and equipment, to work with the local Bhopal medical community, and the UCC technical team began assessing the cause of the gas leak.

The health care system immediately became overloaded. In the severely affected areas, nearly 70% were under-qualified doctors. Medical staff were unprepared for the thousands of casualties. Doctors and hospitals were not aware of proper treatment methods for MIC gas inhalation.

Within a few days, trees in the vicinity became barren and bloated animal carcasses had to be disposed of. 170,000 people were treated at hospitals and temporary dispensaries, and 2,000 buffalo, goats, and other animals were collected and buried. Supplies, including food, became scarce owing to suppliers' safety fears. Fishing was prohibited causing further supply shortages.

EFFECT OF THE GAS LEAK ON WILDLIFE

Formal statements were issued that air, water, vegetation and foodstuffs were safe, but warned not to consume fish. The number of children exposed to the gases was at least 200,000. Within weeks, the State Government established a number of hospitals, clinics and mobile units in the gas-affected area to treat the victims.

ENVIRONMENTAL REHABILITATION

When the factory was closed in 1986, pipes, drums and tanks were sold. The MIC and the Sevin plants are still there, as are storages of different residues. Isolation material is falling down and spreading. The area around the plant was used as a dumping area for hazardous chemicals. In 1982 tubewells in the vicinity of the UCIL factory had to be abandoned and tests in 1989 performed by UCC's laboratory revealed that soil and water samples collected near the factory and inside the plant were toxic to fish. Several other studies had also shown polluted soil and groundwater in the area. Reported polluting compounds include 1-naphthol, naphthalene, Sevin, tarry residue, mercury, toxic organochlorines, volatile organochlorine compounds, chromium, copper, nickel, lead, hexachloroethane, hexachlorobutadiene, and the pesticide HCH.

In order to provide safe drinking water to the population around the UCIL factory, Government of Madhya Pradesh presented a scheme for improvement of water supply. In December 2008, the Madhya Pradesh High Court decided that the toxic waste should be incinerated at Ankleshwar in Gujarat, which was met by protests from activists all over India. On 8 June 2012, the Centre for incineration of toxic Bhopal waste agreed to pay $250 million (US$3.5 million) to dispose of UCIL chemical plants waste in Germany. On 9 August 2012, Supreme Court directed the Union and Madhya Pradesh Governments to take immediate steps for disposal of toxic waste lying around and inside the factory within six months.

GOVERNMENT'S RESPONSE

Until then, the Indian government had never dealt with a disaster like this. Legal proceedings between India, UCC and the US began right after the catastrophe. The government passed the Bhopal Gas Leak Act in March 1985, which allowed it to act as the legal representative for victims. While the UCC initially offered a $5 million relief fund to India, the government turned down the offer and demanded $3.3 billion. Eventually, an out-of-court settlement was reached in February 1989, Union Carbide agreed to pay $470 million for damages caused. The Supreme Court of India also laid down guidelines for the money—the family of the dead were to be given Rs. 100,000-300,000. In addition, fully or partially disabled were to get Rs. 50,000-500,000 and those with a temporary injury, Rs. 25,000-100,000. The apex court asked UCIL to "voluntarily" fund a hospital in Bhopal to treat victims of the tragedy. In June 2010, seven former employees of UCIL, who were all Indian nationals, were convicted of causing death by negligence and sentenced to two years of imprisonment. However, they were later released on bail.

WAITING FOR RELIEF

COMPENSATION				
Paid	₹705cr		**Demanded**	₹7,728cr
For death	5,295 people	₹10 lakh each		
For injury/ disability	5.5 lakh	₹50,000 average		
Actual no. of dead	**20,000**			
But 1.5 lakh permanently disabled people classified as 'temporary'				
Curative petition pending in SC for 6 years without hearing				
HEALTH				
51 months since SC ordered computerisation of complete medical history of all victims and issuance of health cards etc, not much progress				
Contempt notice pending in MP high court				
REMEDIATION OF TOXIC WASTE				
Govt plans to incinerate 345 MT of toxic waste near Indore				
Actual toxic material	1.1 million MT			

CONCLUSION

The tragedy of Bhopal continues to be a warning sign at once ignored and heeded. Bhopal and its aftermath were a warning that the path to industrialization, for developing countries in general and India in particular. If the Provisions Relating to Hazardous Processes would be present at the time of accident and other safety, health and welfare provisions would be followed, we would never had to face such Industrial disaster. Some moves by the Indian government, including the formation of the Ministry of Environment and Forests (MoEF), have served to offer some protection of the public's health from the harmful practices of local and multinational heavy industry and grassroots organizations that have also played a part in opposing rampant development.

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I would like to express my special thanks of gratitude to my teachers as well as our Principal who gave me the golden opportunity to work on this wonderful project topic. This project encouraged me to do a lot of research and I came to know many new things. I would also like to thank my parents and my friends who helped me a lot in finishing this project within the deadline.

I am overwhelmed in all humbleness and gratefulness to acknowledge to all those who have helped me to put these ideas, well above the level of simplicity and into something concrete.

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Topic: Waste Management.

INTRODUCTION

Waste Management is collection, transport, processing, recycling of disposal of waste material. This term usually relates to materials produced by human activity and is generally undertaken to reduce effect on health, the environment and aesthetics, management may differ in developing nation to under developing nation, urban to rural area and residential to industrial setup.

WASTE MANAGEMENT DONE THROUGHOUT THE WORLD

Colombia's municipalities produce around 28,800 tonnes of solid waste per day, with 10,000tonnes of this waste being generated by the main cities of Bogota, Cali, Medellin and Barranquilla . To overcome these serious issues they came up with the idea of ECOBOT-a recycling initiative that promotes the culture of recycling across the country. Every time you deposit a transparent plastic bottle (PET) or the caps, you receive a coupon offered by associated companies called Eco partner. From restaurant coupons to movie tickets to shopping dollars this machine covers it all.

Malang, a city in Indonesia, generated more than 55,000 tonnes of waste every day. It was also a city where a majority of people did not have health insurance .These two issues may seem unconnected, but Dr. Gamala Albinsaid, a healthcare entrepreneur and CEO of health company Indonesia Medika saw this as a huge social opportunity. He created Garbage Clinical Insurance which let people trade garbage for medical services and medicines. This scheme aims to tackle both poverty and waste in Indonesia, a country where more than 10% live below the poverty line. The scheme inspires low income households to recycle their trash because by doing so they will be able to finance their health micro-insurance. The clinic takes in the trash from people and sells it to recyclers for recycling. The money collected from recyclers is then spent on giving people basic health insurance.

Less than one percent of Sweden's household waste goes into the landfill dump; the rest is recycled in different ways. The 32 waste management plants in Sweden today produce heat for 810,000 Swedish households and electricity for about 250,000 private houses. The country has adopted a recycle policy which funnels all the energy generated by burning waste into the national heating network. This provides an efficient way to heat homes through the freezing Swedish winter.

It aims at promoting waste treatment options in line with the waste hierarchy, notably favouring preparation for use and recycling over disposal operations such as landfilling. EU legislation includes recycling targets for municipal, construction and demolition, and electronic waste. This

briefing shows that there is significant potential to increase recycling from all of these streams. However, to fully exploit this potential, current barriers need to be overcome, E.g. - price competition from virgin resource alternatives, infrastructure capacity and the complexity of certain waste products. Implementing new policy measures, some of which are already included in Europe's 2020 circular economy action plan, can both directly and indirectly exploit the potential for increased recycling.

WASTE MANAGEMENT IN INDIA

Industrialization becomes very significant for developing countries like India having large no. of population. Rapid increase in urbanization and per capita income lead to high rate of municipal solid waste generation. In recent times, E-waste and plastic waste also contribute considerably to total waste stream due to utilization of electronic and other items. These wastes may cause a potential hazard to human health or environment if any of the aspects of solid waste management is not managed effectively. In India, approach towards Solid waste management is still unscientific. Solid Waste collection efficiency in India is around 70%, while same is almost 100% in a developed countries. Even today, large portion of solid waste is dumped indiscriminately on outskirts of towns or cities without any prior treatment. This leads to groundwater contamination and increase in air pollution due to leachate percolation and release of gases respectively. Various study reveals that out of total solid waste, 80% can be utilized again either by recycling or reusing. Improper waste segregation and other factors lead recycling sector to work on outdated technology. However, plastic and paper recycling have been especially growing due to continuous increasing consumption of both the commodities. This study describes about current status of municipal solid waste management in different regions of India. It further summarizes a collective, systematic effort

which improves implementation of legal institutional arrangement, financial provisions, technology, operations management, human resource development and awareness of Integrated SWM systems.

CASE STUDY

Waste is an unavoidable by product of most human activity. Economic development and rising living standard in my locality have led to increase in the quantity and complexity of generated waste.

Locality: College Street,Kolkata

TYPES OF WASTE GENERATED IN MY LOCALITY

Municipal Solid Waste –It is generated from households, offices, hotels, shops, schools and other institutions. The major components are food waste, paper, plastics, rags, metal and glass.

Industrial Solid Waste – It includes paper, packaging materials, oils, solvents, resins, paints, glass, ceramics, stones, metals, plastics, rubber, leather, cloth, straw, abrasives etc...

Liquid Waste – Human and animal excreta, household waste water, cooking oil, fats and grease.

HOW WASTE MANAGEMENT IS DONE IN OUR HOME AS WELL AS IN OUR NEIGHBOURHOOD

- **We Say no to plastic bag**

Plastic bags are nothing more than waste, so we think it is best to use cloth bags instead of the plastic ones. When we are going to any grocery store, try to carry our own reusable bags instead of taking the cheap quality plastic bags given at the store. However, the usage of the cloth bags must not be just limited to grocery shopping. We make sure that we use them when we go to shop for clothes, tools and other items as well.

- **Buy foods with less packaging**

One of the smart ways to reduce our home waste is by buying foods with less packaging. Because when we buy foods that are wrapped in plastic with individually wrapped packets within, then we are obviously producing excess of waste in the form of so many plastic packets. In contrast to that, if we buy foods that have got minimal packaging especially of plastic, then the amount of home waste produced daily will automatically reduce.

- **Donate old unused items**

You'll be surprised to see how much of home garbage can be reduced just by donating old and unused items. If we have old clothes, tools, electronics or other items that we do not use but are in decent condition, then we donate those items to charity rather than dumping those as wastes. This will not just help us manage the waste of our home but will also come to the help of individuals who may be in dire need of those goods.

- **Reuse what we can**

Simply by reusing, we can reduce garbage to a good extent. We use the durable containers a number of times before throwing them in the garbage. All the bottles, bags and the boxes can serve a second purpose only if we know how to reuse them properly.

Let me give you some ideas that how we reuse the unused things:

- Using the plastic bags as dustbins.
- The food-grade glass containers may be used for storing the dry foods and the leftovers.
- Even the plastic containers may be used for storage purposes.

HOW WASTE IS DISPOSED BY OUR LOCALITY

- **Segregation of Waste:**

It is very important to segregate waste before disposing of it. Segregating waste reduces the waste you put out and makes it simpler to recycle and compost. Waste can be segregated as-

- **Dry waste:** keep separate plastic for dry waste like flowers, papers, plastic, glass and metal as they can be reused and recycled.
- **Wet waste:** wet waste like vegetables, kitchen waste, fruit peels, tea leaves, egg shells and fish scales etc. are kept in separate plastic and they are used as compost.
- **Hazardous waste:** Hazardous waste includes e-waste i.e. batteries, wires, electronic toys, remotes, bulbs, tube lights; toxic waste i.e. paints, insecticides, their containers; and biomedical waste i.e. expired medicines, tubes, used cosmetics, thermometer and used syringes. Although they seem to make up a little percentage of total waste, yet we are careful while disposing them.

- **Collective Efforts:**

All the residents should take collective actions for reducing and managing the waste generated in their apartment. All residents should segregate their waste. There should be separate waste collection bins for different waste. There should be a common compost bin for all residents. The association should create awareness among residents regarding proper waste management.

- **To Promote 'Waste to Wealth' or Allow as Much Valuable Material to be Recovered, Reused or Recycled from the Waste Collected.**

Residents of our locality securely wrap used sanitary waste like diapers and pads in the pouches provided by the manufacturers of or in a suitable wrapping material. In the case of broken glass, blades, and used needles, they wrap tightly in the newspaper while handing them over for collection.

WASTE PROCESSING BY KOLKATA MUNICIPAL CORPORATION

They are responsible for collection of solid waste which is produced day by day from different areas of Kolkata

- **Garbage Collection Procedure:** Kolkata Municipal Corporation is responsible for collecting the garbage from different areas of Kolkata. Municipal Authority is collecting this garbage in a regular manner. There are numbers of big dust bins in several areas of the city and several wards share each big dust bins. Garbage is accumulated in this bin from adjacent areas. In each block three sweepers are working. For the garbage collection procedure, 250 persons are involved. They are involving in sweeping the roads and collecting the garbage and transferring the waste into the bins. The collection of waste from these dust bins is frequently done where numbers of sweepers involved are more. The collected garbage is carried by small cart, tractors or trucks which are dedicated for collection purpose.
- **Transportation of garbage:** Collected garbage is transported to the disposal areas in specific manner. It starts from small dumper and ends into big dust bins. Among the collected garbage, both degradable and non-degradable wastes are present. It is alarming that several plastic products are dumped into the dust bins. Several types of vehicles are used for transporting garbage to disposal sites which are as follows: **Tri cycle cart, Tractor, Three tri cycle carts** are provided in each ward for collection of garbage from door to door. But in market area extra two tri cycle carts are provided. There are 22 tractors which are used for transporting garbage from different areas. The tractors carrying waste are not covered or partially covered during the journey and waste tends to spill on the roads. The loading and unloading of waste is done through manual as well as mechanical system.
- **Disposal of waste:** Normally the collected garbage is disposed without treatment and recycling. So till now there is no recycling procedure of garbage according to the normal specification i.e. Municipal Solid Waste (Management & Handling) Rules 2000 of solid waste treatment.

WORK DONE BY OUR LOCAL COUNCIL

Our local council has setup recycling initiative where recycling waste such as plastics, paper, glass , and metals are to be disposed of in white plastic bags designated for recycling rather than the usual black plastic bag. Recyclable wastes are collected on different days of the week then non-recyclable waste.

OUR SUGGESTIONS

Schools and local councils should do more to conserve of our local environment.

Our suggestions are that apart from this local councils should setup an initiative where each household should have two garbage bins, one dedicated for recycling waste and one dedicated for non-recyclable waste .This is to reduce the amount of waste which may be left in the street since plastic bags can be damaged by stray animals and rats.

Education also has an important role to play in reducing waste. Educational programmes should encourage students like ourselves to reduce the amount of waste and recycle more at school and at home. We should also reduce the demand for several substances since most of our waste is created due to unhealthy lifestyles.

CONCLUSION

Most of the developing countries are not able to provide proper facilities for collection and disposal of communal solid waste to whole population. Solid waste is being dumped openly along roadsides. Effects of waste which we had faced:

Before an initiative was taken by our local council some months back , in our locality lots of waste were dumped along the sides of the streets creating an landfill like area and its harmful effects were felt by the people who used to live nearer to dumping area. Waste can lead to an increase in land pollution where harmful chemicals degrade the local habitats. Following negative impacts are being faced due to open dumping of solid waste:

Dust and Filthy Dirt: Strong wind and storm are spreading dust and filth from the open dumps of solid waste to adjacent areas.

Odour: Nearby areas to the open dump sites is being affected due to odour emitting from these dumps.

Rats and other Vermin: Open dumps of communal solid waste are providing attractive habitat to rats and other vermin.

Toxic Gases: Toxic gases are continuously exposed to the atmosphere.

Leachate: Percolating rainwater through the open dump contaminating ground water resources.

Health and Sanitation: Open dumps of solid waste are a serious threat to human health and sanitation.

Therefore some initiations were taken by our local council for which we are grateful.

My View:

The generation of large quantities of MSW in Kolkata metropolitan areas has become a serious environmental issue. The major problems in MSW management at KMA are due to lack of waste segregation at source, low percentage of house-to house collection, large number of open vats, low operational efficiency of waste transport system with old vehicles, low collection efficiency in newly added areas, and an inefficient informal recycling system. Moreover, house-to-house collection of MSW should be organized through methods like collection on regular pre-informed timing and scheduling. The collection bins must be appropriately designed with features like metallic containers with lids, and to have a large enough capacity to accommodate 20% more than the expected waste generation in the area, with a de-sign for mechanical loading and un-loading, placement at appropriate locations, etc. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. Proper maintenance of the MSW transportation vehicles must be conducted, and the Dumper Placer should replace the old transportation vehicles in a phased manner. Recyclables could be straightway transported to recycling units that in turn would pay a certain amount to the corporations, thereby adding to their income. This would help in formalizing the existing informal set up of recycling units. Rag pickers and scavengers involved in salvaging recyclable inorganic solid waste could be involved in the organized process of recycling of solid waste. Such involvement would improve the socio-economic conditions of the scavengers/rag pickers.

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TOPIC: POLLUTION

POLLUTION

EARTH IS SICK OF POLLUTION

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I would like to express my special thanks of gratitude to my teachers as well as our principal who gave me the golden opportunity to do this wonderful project on the topic pollution, which also helped me in doing a lot of Research and I came to know about so many new things I am really thankful to them. Secondly I would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

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CONTENT:

INTRODUCTION

Pollution occurs when any form of impurity is introduced into a clean source. It is most often used in an environmental concept like air or water pollution. There are mainly four types of pollution air, water, soil and land.

Pollution can come in 4 different types affecting different types of areas in the world. Air pollution affects the air, water pollution affects the water and marine life, land pollution affects the land destroying life and the environment and there is also noise pollution that can affect our hearing.

Pollution is dangerous. It effects everything from land to water, air, noise and more. Really pollution is just muck. Harmful substances cause by everything. Pollution kills, so reduce it. China is the most polluted country in the world.

POLLUTION AND IT'S TYPES:

THERE ARE 4 TYPES OF POLLUTION.THEY ARE:

AIR POLLUTION

WATER POLLUTION

NOISE POLLUTION

LAND POLLUTION

AIR POLLUTION

Air pollution is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or cause damage to the natural environment or built environment, into the atmosphere.

Air pollutant is known as a substance in the air that can cause harm to humans and the environment. Pollutants can be in the form of solid particles, liquid droplets, or gases. In addition, they may be natural or man-made. E.g. Sulphur dioxide, Smoke, Fly ash.

CAUSES

1. Carbon dioxide is one the main pollutants that causes air pollution. This is because, although living beings do exhale carbon dioxide, this gas is harmful when emitted from other sources, which are caused due to human activity. An

additional release of carbon dioxide happens due to various such activities. Carbon dioxide gas is used in various industries such as the oil industry and the chemical industry. The combustion of fossil fuels and the harmful effects of deforestation have all contributed towards the same. Scientists have now therefore identified carbon dioxide as one of those elements that have contributed to global warming.

2. The combustion of fuels in automobiles, jet planes etc all cause the release of several primary pollutants into the air. The burning of fossil fuels in big cities which is seen at most factories, offices and even a large number of homes, it is no wonder that air pollution is increasing at an alarming rate. The release of other harmful gases all adds to the state that we see today. Although carbon dioxide plays an important role in various other processes like photosynthesis, breathing an excess of the same also causes harmful effects towards one's health.

3. Carbon monoxide is another such gas which, although was present in the atmosphere earlier, is now considered to be a major pollutant. An excess of the same has a harmful effect on our system. There are many reasons why carbon monoxide can be released into the atmosphere as a result of human activities. This is also produced due to any fuel burning appliance and appliances such as gas water heaters, fireplaces, woodstoves, gas stoves, gas dryers, yard equipments as well as automobiles, which add to the increased proportion of this gas into the atmosphere.

4. Sulphur dioxide is yet another harmful pollutant that causes air pollution. Sulphur dioxide is emitted largely to the excessive burning of fossil fuels, petroleum refineries, chemical and coal burning power plants etc. Nitrogen dioxide when combined with sulphur dioxide can even cause a harmful reaction in the atmosphere that can cause acid rain.

5. Nitrogen dioxide is one more gas that is emitted into the atmosphere as a result of various human activities. An excess of nitrogen dioxide mainly happens due to most power plants seen in major cities, the burning of fuels due to various motor vehicles and other such sources, whether industrial or commercial that cause the increase in the levels of nitrogen dioxide.

EFFECTS

The effects of air pollution on humans are fatal and life threatening. WHO statistics report that over 2 million people succumb to the fatalities attributed to air pollution. Consistent exposure to the pollutants leads to the development of:

1. Premature mortality
2. Heart attack
3. Asthma
4. Difficulty in breathing
5. Wheezing and coughing
6. Cystic fibrosis
7. Chronic obstructive pulmonary disease
8. Chronic bronchitis Poisonous gases get trapped into our atmosphere and cause Global Warming.

Air pollution has also caused a hole in our ozone layer that allows the ultra-violet rays of the sun to enter the earth's atmosphere that can cause diseases like skin cancer.

NOISE POLLUTION

Noise can be defined as an unwanted or undesired sound. Decibel is the standard unit for measurement of sound. Usually 80 db is the level at which sound becomes physically painful. And can be termed as noise. Humans, animals, plants and even inert objects like buildings and bridges have been victims of the increasing noise pollution caused in the world. Be it human or machine-created, noise disrupts the activity and balance of life. While traffic dons the cap of being the largest noise maker throughout the world, there are many others that add to it, making our globe susceptible to its effects. The effect of noise pollution is multi-faceted and interrelated. In the following lines, we have provided some of the causes and effects of noise pollution.

CAUSES

Traffic noise is the main source of noise pollution caused in urban areas. With the ever-increasing number of vehicles on road, the sound caused by the cars and exhaust system of autos, trucks, buses and motorcycles is the chief reason for noise pollution.

People living beside railway stations put up with a lot of noise from locomotive engines, horns and whistles and switching and shunting operation in rail yards. This is one of the major sources of noise pollution. Though not a prime reason, industrial noise adds to the noise pollution. Machinery, motors and compressors used in the industries create a lot of noise which adds to the already detrimental state of noise pollution. Plumbing, boilers, generators, air conditioners and fans create a lot of noise in the buildings and add to the prevailing noise pollution. Household equipments, such as vacuum cleaners, mixers and some kitchen appliances are noisemakers of the house. Though they do not cause too much of problem, their effect cannot be neglected.

EFFECTS

Deafness, temporary or permanent, is one of the most prevalent effects of noise pollution. Mechanics, locomotive drivers, telephone operators etc all have their hearing impairment.

Fatigue caused is another effect of noise. Due to lack of concentration, people need to devote more time to complete their task, which leads to tiredness and fatigue.

Noise pollution acts as a stress invigorator, increasing the stress levels among people.

Sometimes, being surrounded by too much of noise, people can be victims of certain diseases like blood pressure, mental illness, etc. Noise pollution indirectly affects the vegetation. Plants require cool & peaceful environment to grow. Noise pollution causes poor quality of crops. Animals are susceptible to noise pollution as well. It damages the nervous system of the animals. Noise indirectly weakens the edifice of buildings, bridges and monuments. It creates waves, which can be very dangerous and harmful and put the building in

WATER POLLUTION

Water pollution happens when toxic substances enter water bodies such as lakes, rivers, oceans and so on, getting dissolved in them, lying suspended in the water or depositing on the bed. This degrades the quality of water.
Not only does this spell disaster for aquatic ecosystems, the pollutants also seep through and reach the groundwater, which might end up in our households as contaminated water we use in o Pollutants can be of varying kinds: organic, inorganic, radioactive and so on. In fact, the list of possible water contaminants is just too vast to be listed here're daily activities, including drinking.

CAUSES

There are several causes of water pollution –

1. organic
2. inorganic as well
3. municipal
4. industrial
5. agriculture

The causes of water pollution may be due to direct and indirect contaminant sources. The former are effluent outputs from refineries, factories, waste treatment plants. Fluids of differing qualities are emitted to the urban water supplies. However, still pollutants can be found in the water bodies. Contaminants can also be divided into inorganic, organic, acid/base and radioactive. The major sources of water pollution are as described below.

Discharge of contaminated and/or heated water that has been used for industrial purposes. The surface runoff from farms, construction sites or other impervious surfaces. The improper disposal of solid wastes like littering on a localized scale. Addition of excessive nutrients by runoff containing detergents or fertilizers called as eutrophication. The geology of aquifers where groundwater is abstracted. Maltreated sewage discharged in a wrong manner. Slash and burn farming practice is a component in shifting cultivation agricultural systems. Radioactive substances from nuclear power plants and industrial, medical and scientific use are also contribute. Uranium and thorium mining and refining are some of the examples. Heat is a leading cause as it results in the death of several aquatic organisms. A discharge of cooling water by factories and power plants lowers the temperature of the water bodies. Oil pollution is very harmful for coastal wildlife. Oil spreads on huge areas to form oil slicks.

EFFECTS

1) The food chain is damaged. When toxins are in the water, the toxins travel from the water the animals drink to humans when the animals' meat is eaten.

2) Diseases can spread via polluted water. Infectious diseases such as typhoid and cholera can be contracted from drinking contaminated water. This is called microbial water pollution. The human heart and kidneys can be adversely affected if polluted water is consumed regularly.

3) Acid rain contains sulphate particles, which can harm fish or plant life in lakes and rivers.

4) Pollutants in the water will alter the overall chemistry of the water, causing changes in acidity, temperature and conductivity. These factors all have an effect on the marine life.

5) Altered water temperatures (due to human actions) can kill the marine life and affect the delicate ecological balance in bodies of water, especially lakes and rivers.

LAND POLLLUTION

Land pollution the action of environmental contamination with man-made waste on land. Americans generate five pounds of solid waste every day, furthermore creating one ton of solid waste each year. In an average day in the United States, people throw out 200,000 tons of edible food and throw 1 million bushels of litter out of their automobiles. The main human contributor to pollution are landfills. Approximately half of our trash is disposed in landfills. Only 2% of our waste is actually recycled.

CAUSES

Increase in urbanization. More constructions means increase in demand for raw materials like timber. This leads to the exploitation and destruction of forests. There is more demand for water.

Domestic waste. Every single day, tons and tons of domestic waste is dumped ranging from huge pieces of rubbish such as unused refrigerator to fish bones. If all these wastes are not disposed of properly, the damage they can do to the environment and humankind can be devastating.

Agricultural activities. Besides domestic waste, pesticides and herbicides used by farmers to increase crop yields also pollute the land when they are washed into the soil.

Industrial activities. Industrial activities also are a contributing factor to land pollution. For example, in open cast mining, huge holes are dug in the ground and these form dangerously deep mining pools. Heaps of mining waste are left behind and these waste often contain several poisonous substances that will contaminate the soil.

EFFECTS

1. exterminates wildlife 2. acid rain kills trees and other plants.

3. vegetation that provides food and shelter is destroyed.It can seriously disrupt the balance of nature, and, in extreme cases, can cause human fatalities.

5. pesticides can damage crops, kill vegetation, and poison birds, animals, and fish. Most pesticides kill or damage life forms other than those intended. For example, pesticides used in an effort to control or destroy undesirable vegetation and insects often destroy birds and small animals. Some life forms develop immunity to pesticides used to destroy them.

POLLUTION IN KOLKATA

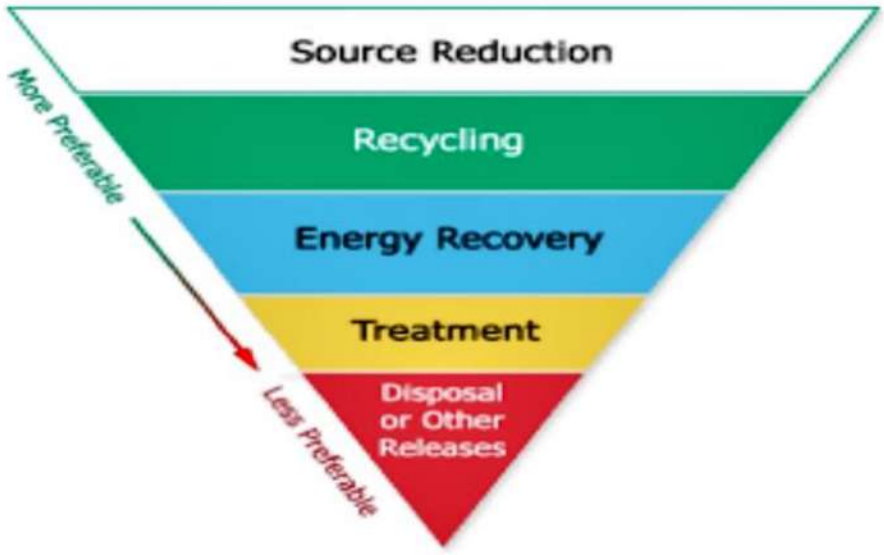
Kolkata is the most polluted city of India. There are a number of reasons for pollution in Kolkata. We, in Kolkata have the highest number of asthma patients and heart patients than anywhere else in the country. More than 18 persons per one lakh people in Kolkata fall victim to lung cancer every year, compared to the next highest 13 per one lakh in Delhi. Roadside hawkers, shop owners, traffic policemen, auto-rickshaw drivers, rickshaw pullers and others who spend long hours on the road are the most vulnerable to these diseases. Environmentalists feel that nearly 80 per cent of the buses and trucks and nearly half of the taxis and auto-rickshaws will have to be pulled off the roads to clean the city's air, which is not an easy task to accomplish. We need immediate introduction of CNG or LPG-driven buses, strict monitoring of auto-rickshaws which run on adulterated fuel and withdrawal of old buses belching toxic fumes.

CONCLUSION

POLLUTION PREVENTION leads to environmental sustainability. Once pollution prevention practices are implemented throughout the industrial process, a business will be well on its way to achieving environmental sustainability. Sustainability, as defined by the Brundtland Commission in 1987, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." While cost savings and regulatory drivers are important, environmental sustainability represents a higher goal—one that should be strived for because it's the right thing to do.

The benefits of pollution prevention and environmental sustainability not only include cost savings and regulatory compliance, but also improved working conditions for employees, competitive advantages with environmental-sway clients and consumers, and improved community and regulator relations.

In the United States, the Pollution Prevention Act (which became law in 1990—similar acts are in law in many other countries) required the Environmental Protection Agency must establish a source reduction program and to focus industry, government, and public attention on reducing the amount of pollution through cost-effective changes in production, operation, and raw materials use.



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AECC ENVS PROJECT

Topic – 'Global Warming – The Impending Danger'

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Finally, I would like to thank my parents and friends who helped me with their valuable suggestions.

CONTENTS

INTRODUCTION

Many researchers, engineers and environmentalists are expressing deep concerns about changes in the overall climate of the planet. Fossil fuels are being continuously used to produce electricity. The burning of these fuels produces gases like carbon dioxide, methane and nitrous oxides which lead to global warming. Deforestation is also leading to warmer temperatures. The hazard of global warming is continuously causing major damage to the Earth's environment. Most people are still unaware of global warming and do not consider it to be a big problem in years to come. What most people do not understand is that global warming is currently happening, and we are already experiencing some of its withering effects. It is and will severely affect ecosystems and disturb ecological balance. Because of the treacherous effects of global warming, some solutions must be devised. The project introduces global warming, elaborates its causes and hazards and presents some solutions to solve this hot issue. Above all, alternative energy sources (solar, wind, hydro, geothermal, bio mass) need to be seriously pursued. Finding and using renewable sources of energy is one of the methods to combat the ever increasing global warming effectively.

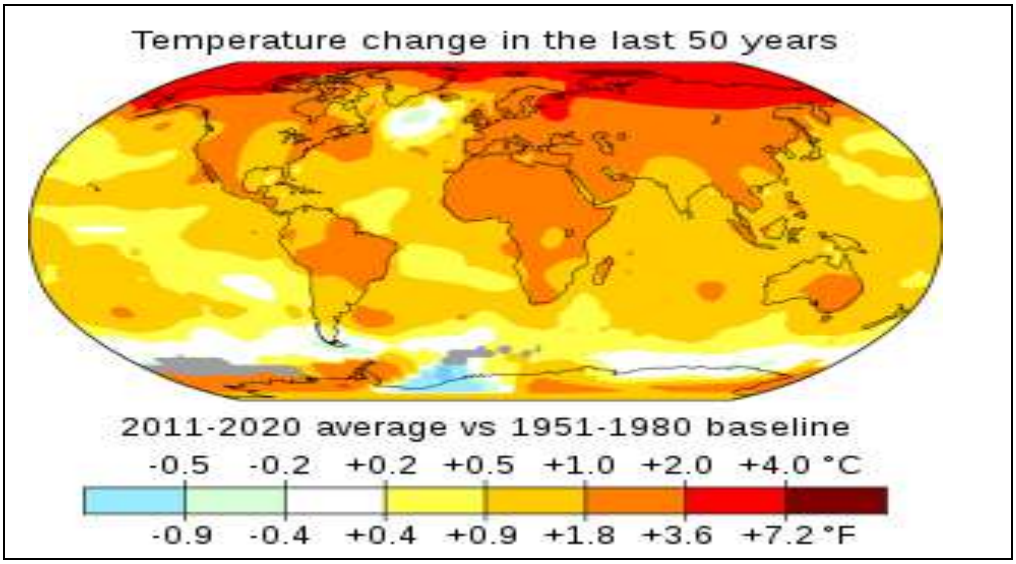
The continuous rise in temperature of the planet is really upsetting. The root cause for this is global warming.

WHAT IS GLOBAL WARMING ?

Global warming is a gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, CFCs, and other pollutants.

Since the Industrial Revolution, the global annual temperature has increased in total by a little more than 1 degree Celsius, or about 2 degrees Fahrenheit. Between 1880—the year that accurate recordkeeping began—and 1980, it rose on average by 0.07 degrees Celsius (0.13 degrees Fahrenheit) every 10 years. Since 1981, however, the rate of increase has more than doubled: For the last 40 years, we've seen the global annual temperature rise by 0.18 degrees Celsius, or 0.32 degrees Fahrenheit, per decade.

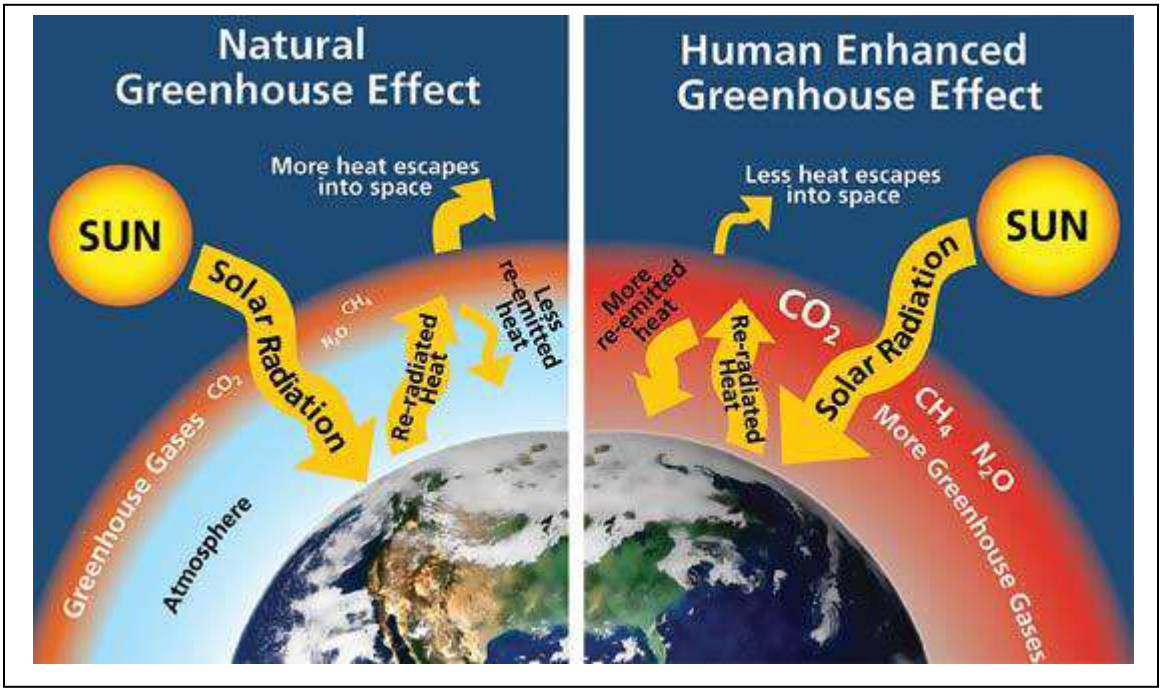
Now climate scientists have concluded that we must limit global warming to 1.5 degrees Celsius by 2040 if we are to avoid a future in which everyday life around the world is marked by its worst, most devastating effects: the extreme droughts, wildfires, floods, tropical storms, and other disasters that we refer to collectively as climate change. These effects are felt by all people in one way or another but are experienced most acutely by the underprivileged, the economically marginalized, and people of color, for whom climate change is often a key driver of poverty, displacement, hunger, and social unrest.



Temperature change in the last 50 years .

WHAT CAUSES GLOBAL WARMING ?

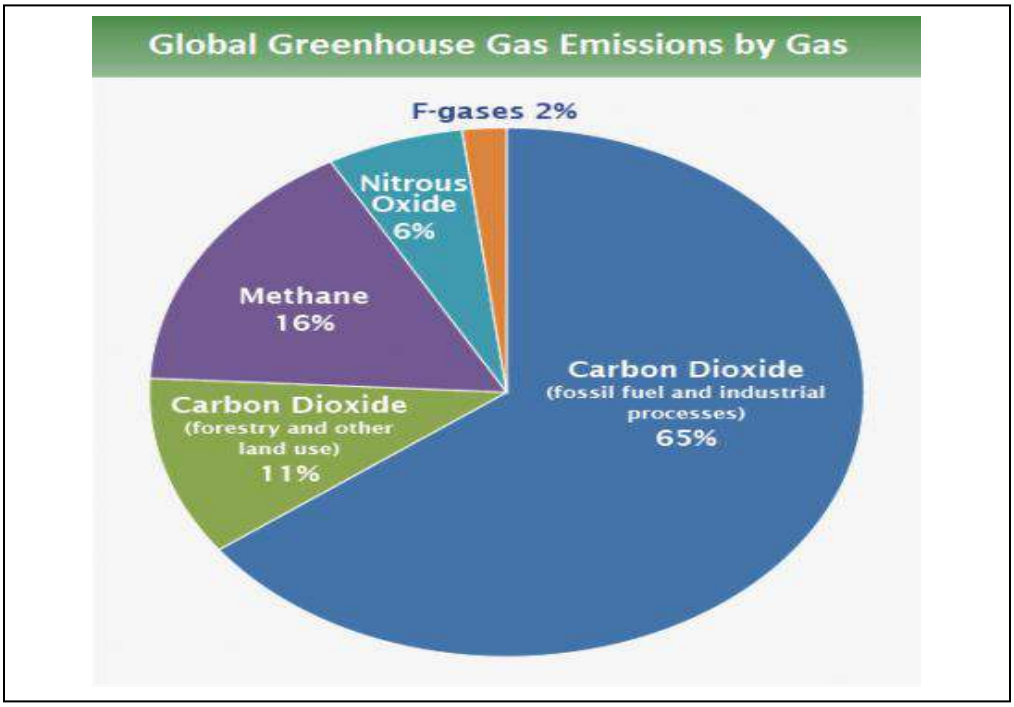
Global warming occurs when carbon dioxide (CO_2) and other air pollutants collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. Normally this radiation would escape into space, but these pollutants, trap the heat and cause the planet to get hotter. These heat-trapping pollutants—specifically carbon dioxide, methane, nitrous oxide, water vapor, and synthetic fluorinated gases—are known as greenhouse gases, and their impact is called **the greenhouse effect** .



Though natural cycles and fluctuations have caused the earth's climate to change several times over the last 800,000 years, our current era of global warming is directly attributable to human activity—specifically to our burning of fossil fuels which results in the greenhouse effect.

MAJOR GREENHOUSE GASES AND THEIR SOURCES

Carbon Dioxide (CO_2): Carbon dioxide is the primary greenhouse gas, responsible for about three-quarters of emissions. It can linger in the atmosphere for thousands of years. In 2018, carbon dioxide levels reached 411 parts per million at Hawaii's Mauna Loa Atmospheric Baseline Observatory, the highest monthly average ever recorded. Carbon dioxide emissions mainly come from burning organic materials: coal, oil, gas, wood, and solid waste.



Methane (CH_4): The main component of natural gas, methane is released from landfills, natural gas and petroleum industries, and agriculture (especially from the digestive systems of grazing animals). A molecule of methane doesn't stay in the atmosphere as long as a molecule of carbon dioxide—about 12 years—but it is at least 84 times more potent over two decades. It accounts for about 16 percent of all greenhouse gas emissions.

Nitrous Oxide (N_2O) : Nitrous oxide occupies a relatively small share of global greenhouse gas emissions—about six percent—but it is 264 times more powerful than carbon dioxide over 20 years, and its lifetime in the atmosphere exceeds a century, according to the IPCC. Agriculture and livestock, including fertilizer, manure, and burning of agricultural residues, along with burning fuel, are the biggest sources of nitrous oxide emissions.

Industrial gases: Fluorinated gases such as hydrofluorocarbons, perfluorocarbons, chlorofluorocarbons, sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) have heat-trapping potential thousands of times greater than CO_2 and stay in the atmosphere for hundreds to thousands of years. Accounting for about 2 percent of all emissions, they're used as refrigerants, solvents, and in manufacturing, sometimes occurring as byproducts.

IMPACT OF GLOBAL WARMING

ENVIRONMENTAL EFFECTS : The environmental effects of climate change are broad and far-reaching, affecting oceans, ice, and weather. Changes may occur gradually or rapidly. Evidence for these effects comes from studying climate change in the past, from modeling, and from modern observations.

> Melting of Glaciers : The melting of glaciers will create a plethora of problems for humankind and the animals living on the earth. Due to increased global warming, the level of the sea will rise which will lead to flooding and this will, in turn, create havoc in human life. Apart from raising the sea levels, it will also endanger several species of animals and thus will hamper the balance of the ecosystem.

> Hurricanes And Cyclones Will Become Stronger and More Intense : The intensity, frequency and duration, as well as the frequency of the strongest (Category 4 and 5) hurricanes and cyclones, have all increased since the early 1980s. Associated storm intensity and rainfall rates are projected to increase as the climate continues to warm. We have all seen the devastating effects of cyclones like 'Yaash' and 'Amphan' on our state .

Images from various parts of Kolkata – clicked a day after Amphan hit the city in 2020.

>Frequent Wildfires : Increasing heat, changing rain and snow patterns, shifts in plant communities, and other **climate**-related changes have vastly increased the likelihood that **fires** will start more **often** and burn more intensely and widely than they have in the past.

A wildfire burns between the towns of Orbost and Lakes Entrance in east Gipplsland on 2 January 2020 in Australia.

> Rise in Droughts and Agricultural Effects : While it may be flooding in coastal areas, severe drought will be happening elsewhere in the world.The risk of **drought** is expected to **grow** due to reduced precipitation and higher temperatures caused by climate change. **Drought's** far-reaching impacts can ripple through communities, regions, watersheds, economies and ecosystems. As the global temperature will increase, plants will find it harder to survive and will die. Plants are the major source of food for human beings and as a result food shortage may occur. The shortage of food may lead to war and conflicts in some countries.

> Longer /Shorter seasons : Are you a lover of winter? Maybe summer is your favorite season. Whatever weather and climate you enjoy, it could be happening sooner and shorter, or later and longer. Global warming affects show seasons are occurring 10 days sooner than it has in the past. While it may be nice to go from snow pants to shorts sooner, this could cause flooding from reservoirs filling too soon, and droughts were there's not enough precipitation to provide adequate nourishment for crops.

IMPACT ON HUMAN BEINGS

The **effects of Global Warming on humans** are far reaching and include effects on health, environment, displacement and migration, security, society, human settlement, energy, and transport. Climate change has brought about possibly irreversible alterations to Earth's geological, biological, and ecological systems. These changes have led to the emergence of large-scale environmental hazards to human health; such as extreme weather, ozone depletion, increased danger of wildfires, loss of biodiversity, stresses to food-producing systems, and the global spread of infectious diseases.] In addition, climatic changes were estimated to cause over 150,000 deaths annually in 2002, with the World Health Organization estimating this number will increase to 250,000 deaths annually between 2030 and 2050.

A growing body of research explores the many impacts of climate change on human health, food supply, economic growth, migration, security, societal change, and public goods, such as drinking water. The consequences of these changes are most likely detrimental in the long term. For example, Bangladesh has experienced an increase in climate-sensitive diseases; such as malaria, dengue fever, childhood diarrhea, and pneumonia, among vulnerable communities. Numerous studies suggest that the net current and future impacts of climate change on human society will continue being overwhelmingly negative.

Most adverse effects of climate change are experienced by poor and low-income communities around the world, who have much higher levels of vulnerability to environmental determinants of health, wealth and other factors.

A cartoon from the future if we don't change the path we are on.

EFFECTIVE MEASURES TAKEN BY THE GOVERNMENT

As a populous, tropical developing country, India faces a bigger challenge in coping with the consequences of Climate Change than most other countries. Climate Change is a global phenomenon but with local consequences. There are both external and domestic dimensions to India's Climate Change policy which has been articulated through two key documents. One is the **National Action Plan on Climate Change(NAPCC)** adopted on June 30, 2008. The other is India's **Intended Nationally Determined Commitments(INDC)** submitted to the UN Framework Convention on Climate Change(UNFCCC) in October 2, 2015. The NAPCC has an essentially domestic focus. The INDC is a statement of intent on Climate Change action announced in the run up to the Paris Climate Change summit held in December the same year.

The NAPCC incorporates India's vision of ecologically sustainable development and steps to be taken to implement it. This need for inter-related policy and coordinated action has been recognized, only several years later, in the adoption by the UN of the 17 Sustainable Development Goal (SDG). The National Missions are on Solar Energy, Enhancing Energy Efficiency, creating a Sustainable Urban Habitat, Conserving Water, Sustaining the fragile Himalayan Eco-system, creating a Green India through expanded forests, making Agriculture Sustainable and creating a Strategic Knowledge Platform for serving all the National Missions.

Prime Minister Modi has been one of the world leaders who has taken a keen interest in Climate Change issues. Under his leadership India decided to adopt a more pro-active, ambitious and forward looking approach in the run-up to the Paris Climate summit. This is reflected in the country's INDC. It links India's commitment to ecologically sustainable economic development with its age old civilizational values of respecting Nature, incorporating a sense of inter-generational equity and common humanity.

SUGGESTIONS

The hazards caused by global warming are tremendous. Excessive use of fossil fuels such as coal, natural gas and oil play a part in it too. The usage of fossil fuels should be discontinued immediately. The most significant solution to put an end to this disaster is the use of alternative energy sources. They include wind, solar, bio mass, geothermal and hydro. The most noteworthy point in using these sources is their clean nature. They do not produce any sort of pollution or toxic gases that can lead to global warming. They are environmentally friendly and pose no threat to ecological balance. However, their high installation and setup costs may drive energy companies away from them at first but in the long run they are surely beneficial for everyone. Most importantly, fossil fuels will deplete one day and sooner or later, we have to turn to renewable energy sources for energy production

A likely solution to reduce harmful emissions is to cut the usage of vehicles which produce them. This has not been met with much success as many people refuse to cut down their practice of using cars. No doubt, some people have started to use bicycles and public transport, whereas some other prefer to walk but these numbers are relatively small. Use of public transport such as buses, rails, etc. is better than using personal cars. But in some countries, the facility of public transportation is so bad that people don't feel comfortable to travel in them. The government should make cleaner sources of public transport and innovative ones, so people feel interested to travel in them. No one would be willing to go on dirty buses; therefore, the government should look after public transports.

The government should look around in its country and find out industries and companies that emit a large amount of carbon dioxide and other greenhouse gases. The government should either ban such industries or ask them to lower their greenhouse gas emissions. The government should plan awareness events more often for the public so that people know how dangerous carbon and greenhouse gases are. The government should suggest to people what they can do to save the Earth. It should emphasize to stop habits that emit greenhouse gases and cause global warming.

CONCLUSION

The scientific and environmental community is on the same page regarding the bitter reality of global warming and the involvement of human factor in it. The project discussed here has only dented the surface of what is a very intricate line of scientific and engineering exploration. Global warming is a big hazard and appropriate measures must be taken to tackle this serious problem. This problem will not only cause trouble to the human beings but also to animals and plants. Melting of polar ice caps will lead to floods which can cause mayhem everywhere. Rise of sea levels will devastate agricultural and fishing activities. To embark upon these problems, some remedial steps must be timely taken which include but are not limited to the use of renewable sources of energy and stopping deforestation. Innovative solutions must be brought forward to end this hazard once and forever.

The earth we want v/s the earth we will get if we don't change.

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HOUNOURS SUBJECT-ECONOMICS
SUBJECT FOR TUTORIAL-AECC ENVS
TOPIC FOR TUTORIAL-CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURE
BATCH2020-2023

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What is Climate?

- Climate is defined as an area's long-term weather patterns. The simplest way to describe climate is to look at average temperature and precipitation over time. Other useful elements for describing climate include the type and the timing of precipitation, amount of sunshine, average wind speeds and directions, number of days above freezing, weather extremes, and local geography.

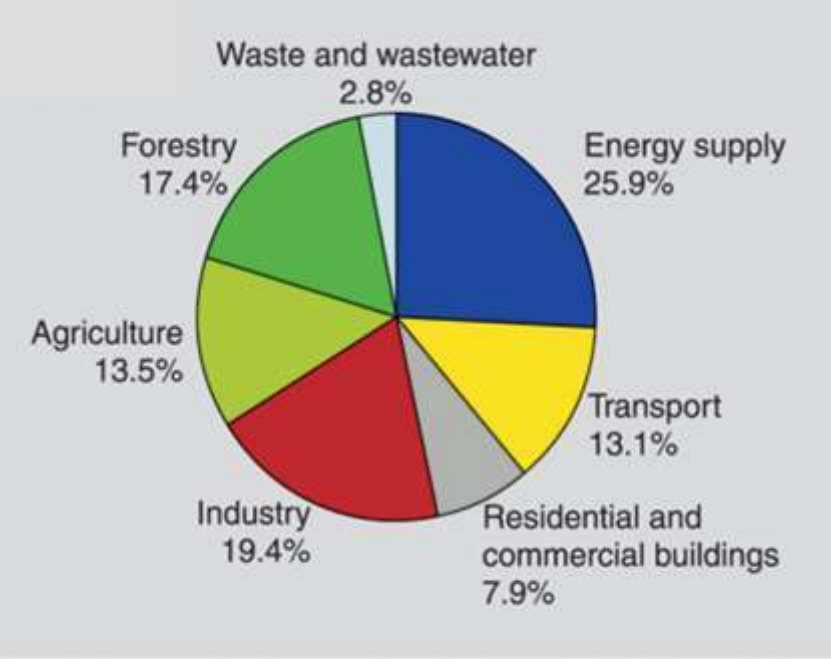
Global Climate Change

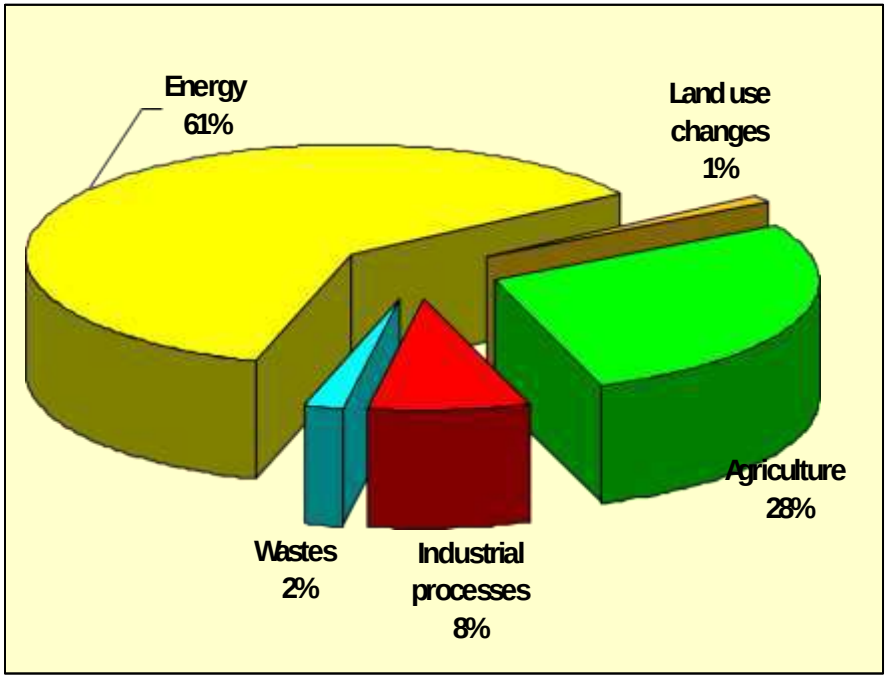
- Identifiable change in the climate of Earth as a whole that lasts for an extended period of time (decades or longer)
  - When due to natural processes, it is usually referred to as global climate variability
  - Usually refers to changes forced by human activities that change the atmosphere

Some Effects of Climate Change

- An average increase in Earth's temperature during the last century
- Melting of polar ice—polar bears and other animals are drowning
- Migrating birds are forced to change their time and place of migration
- Melting of glaciers will lead to higher sea level, which will cause floods and put many low-elevation regions at risk of disappearing under water
- Longer summers can disrupt animal habitation
- New and widespread diseases because of warm climate
- Damaged crops due to sudden climate change and floods
- Average precipitation increase around the world
- Droughts, heat waves, extreme winters and storms.

Contribution of different sectors to climate change.





In world

In india

Climate change impact on villages

- Villages are adversely affected by climate change, it not only affects the life of farmers but it also affects the agriculture. Climate change affects agriculture in a number of ways, including through changes in average temperatures, rainfall, and climate extremes changes in pests and diseases; changes in atmospheric carbon dioxide and ground-level ozone concentrations; changes in the nutritional quality of some foods

EFFECT OF CLIMATE CHANGE ON AGRICULTURE

•Climate change may have beneficial as well as detrimental consequences for agriculture.

•A warming climate and decreasing soil moisture can also result in increasing need for irrigation.

•Benefits to agriculture might be offset by an increased likelihood of heat waves, drought, severe thunderstorms and tornadoes.

•With the virtually certain likelihood of warmer and more frequent hot days and nights, there are projected to be increased insect outbreaks impacting agriculture, forestry and ecosystems. (IPCC)

INDIA AND AGRICULTURE

- Population : 1.14 Billion
- GDP from Agriculture : 18.6 % (2005)
  (Source: Map of India.com)
- Area under Agriculture : 37.8% (124.14 mha)
  (Source: npcm team)
- Population dependent on Agriculture : 66%
  (Source: EconomyWatch.com)
- Average farm size: : 1 to5 ha

How does agriculture influence climate change?

- **The primary sources of greenhouse gases in agriculture are the production of nitrogen based fertilizers; the combustion of fossil fuels such as coal, gasoline, diesel fuel and natural gas; and waste management. One of the biggest problems in industrialized agriculture is the massive overuse of fertilizers. More than 50 percent of all fertilizer applied to the soil ends up in the atmosphere or in local waterways.**

- **The second biggest direct emitter in agriculture is animals. When digesting fodder, animals produce and emit large amounts of methane; a potent greenhouse gas.**

Agriculture's role in mitigating climate change

There are several adaptation measures that the agricultural sector can undertake to cope with future climate change.

These include:

– Changing planting dates;

– Planting different varieties or crop species;

– Development and promotion of alternative crops;

– Developing new drought and heat-resistant varieties;

– Improved crop residue and weed management;

– More use of water harvesting techniques,

– Better pest and disease control for crops;

– Implementing new or improving existing irrigation systems

(Reducing water leakage, soil moisture conservation - mulching)

Reducing use of fertilisers: By applying only the amount of fertiliser that the crop needs, precisely and at the right time, a tremendous amount of greenhouse gas releases can be prevented.

Protecting the soil: By increasing the carbon content through a variety of measures such as cover crops, agricultural soils can be turned into carbon sinks and can greatly reduce agriculture's contribution to climate change.

Land restoration and land use changes: Modifications to grazing practices, such as implementing rotational grazing and seasonal use of rangelands. Converting marginal cropland to trees or grass maximizes carbon storage.

WHAT ARE THE IMPLICATIONS OF THESE PREDICTIONS?

- Changes in yield of certain crops can affect imports/exports, depending on the crop (this is particularly relevant for cash crops).

- Because impacts vary significantly according to whether crops are rain fed or irrigated, water policy will need to consider the implications for water demand of agricultural change due to climate change.

- Policy-makers will also need to consider adaptive measures to cope with changing agricultural patterns. Measures may include the introduction of the use of alternative crops, changes to cropping patterns, and promotion of water conservation and irrigation techniques.

Conclusions

- Climate change is a reality
- Indian agriculture is likely to suffer losses due to heat, erratic weather, and decreased irrigation availability
- Adaptation strategies can help minimize negative impacts
- These need research, funding, and policy support
- Costs of adaptation and mitigation are unknown but likely to be high; costs of inaction could be even higher

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AECC ENVS PROJECT

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PROJECT TOPIC :

WATER POLLUTION

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INTRODUCTION:

Water Pollution has become a global crisis. The perennial threat of the water crisis is exacerbating because of uncontrolled and unbalanced development of the allied sectors such as industries and agriculture. According to the reports of NITI Aayog, 21 major Indian cities, including Delhi will completely run out of groundwater. Water pollution need to be controlled immediately or else the existence of the human-kind as will as the entire flora and fauna of the earth will be uncertain.

CAUSES:

There are many causes of water pollution. Below, we will focus on seven of the major ways that water can become polluted.

1. Industrial Waste

Industries and 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. When industrial waste is not treated properly (or worse, not treated at all), it can very easily pollute the freshwater systems that it comes into contact with.

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 unsafe for human consumption, they can also cause the temperature in freshwater systems to change, making them dangerous for many water dwelling organisms.

2. Marine Dumping

The process of marine dumping 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.

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 Leaks and Spills

The age-old phrase "like water and oil" is used when describing two things that do not mix easily or at all. 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.

5. Agriculture

In order to protect their crops from bacteria and insects, farmers often use chemicals and pesticides. When these substances seep into the groundwater, they can harm animals, plants and humans. Additionally, when it rains, the chemicals mix with rainwater, which then flows into rivers and streams that filter into the ocean, causing further water pollution.

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 help 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.

EFFECTS:

When discussing the issues that can arise due to water pollution, there are three major areas to consider:

- **Health:** According to the United Nations, every year there are more deaths caused by polluted water than all types of violence combined, including war. Waste from humans and animals that contaminates water carries bacteria and viruses that cause the spread of diseases such as typhoid, cholera and giardia.

- **Environment:** All the species in an ecosystem rely on each other in order to survive. Outside substances, such as pollutants found in wastewater, can disrupt the complicated relationships between species that an ecosystem needs in order to thrive.

- **Economy:** Polluted water can have many negative effects on the economy. It directly impacts sectors such as commercial fishing, recreational businesses, tourism and even property values, all of which rely heavily on clean water. Polluted drinking water can also cause treatment costs to rise, which in turn makes the cost of drinking water rise as well.

PREVENTION:

There are numerous ways that each of us can help reduce water pollution. Here are a few ways by which we can prevent water pollution on a personal level:

1. **Don’t flush trash.** Being mindful not to flush non-degradable products, such as plastic, down your toilet is one small but great way to stop contributing to the problem and start becoming part of the solution.

2. **Pick up after your pets.** Waste from animals is full of bacteria, and if not disposed of properly, that bacteria can find its way into the water supply through storm drains and runoff. The recommended disposal method is to use a bag made from recycled plastic to throw it in the trash.

3. **Maintain your car.** Antifreeze, oil, coolant and other chemicals can leak out of your car if it’s not properly cared for. Then, rainwater washes those chemicals into the groundwater supply. Regular maintenance can reduce the amount of pollutants emitted by your car, and it enhances the vehicle’s performance as well.

These are just a few ways to start the process of combatting water pollution, and they are contained to the actions you carry out in your home. There are bigger issues that need to be addressed, though, and that’s where leaders come in, like:

1. Preventing the industries from dumping their waste into the rivers lakes and oceans.
2. Preventing oil spills into the ocean as much as possible.
3. Generating public awareness.
4. Generating awareness among the farmers about the effects of excessive use of inorganic fertilizers on the soil and water pollution.

CONCLUSION:

Water is the most important element for the survival of life. The past decade has witnessed a remarkable shift in government policy from emphasis on water pollution control to water pollution prevention in order to tackle the environmental problem posed by the industry and other factors. The Namami Ganga Programme is example of such an initiative. Now the responsibility lies with the industry, equipment manufacturers, academic and consultancy organisations, national and international organisations as well as on the citizens to work in line with the government to prevent water pollution and create a healthy and competitive atmosphere for everyone as well as for the future generations.

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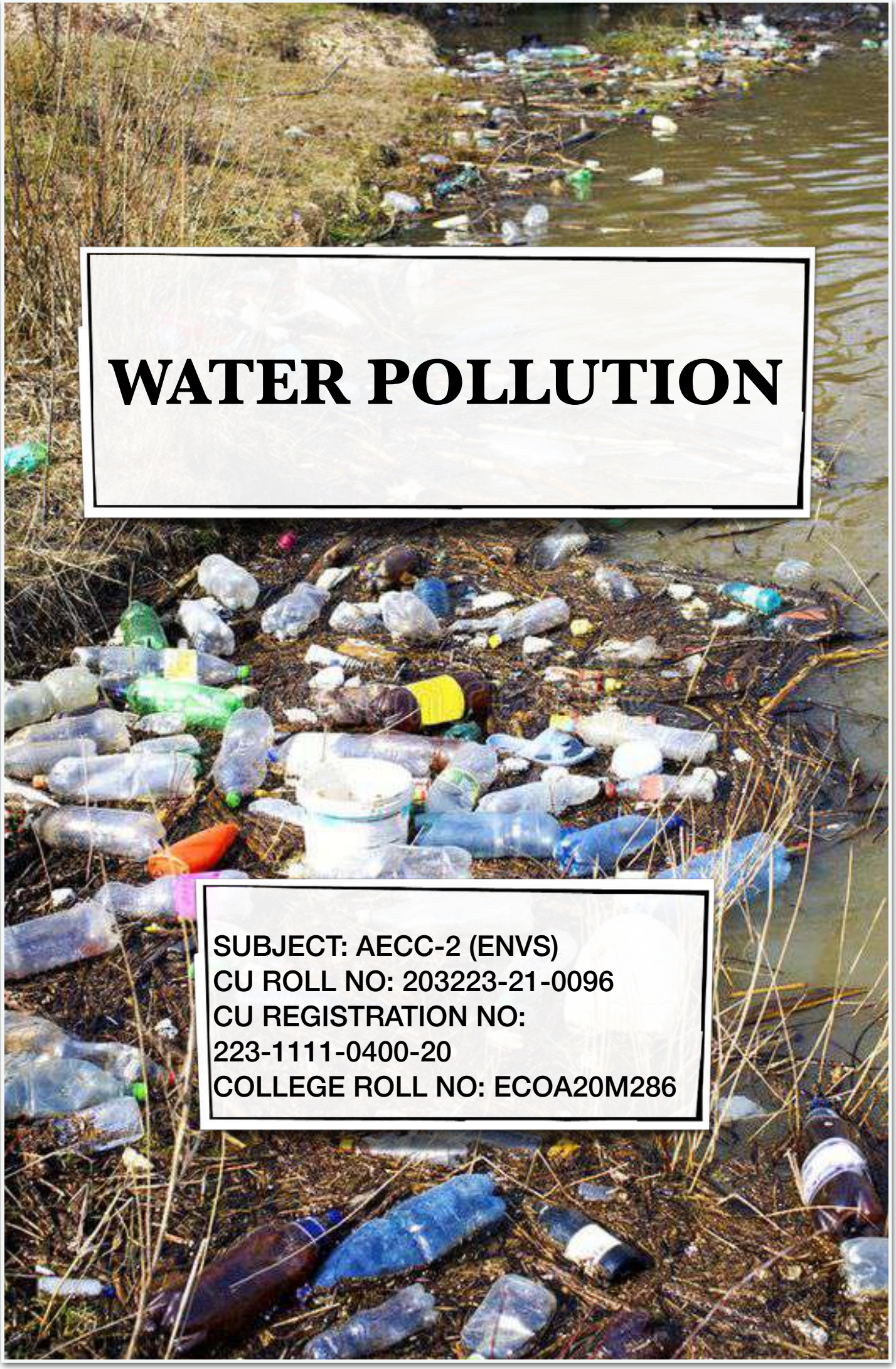
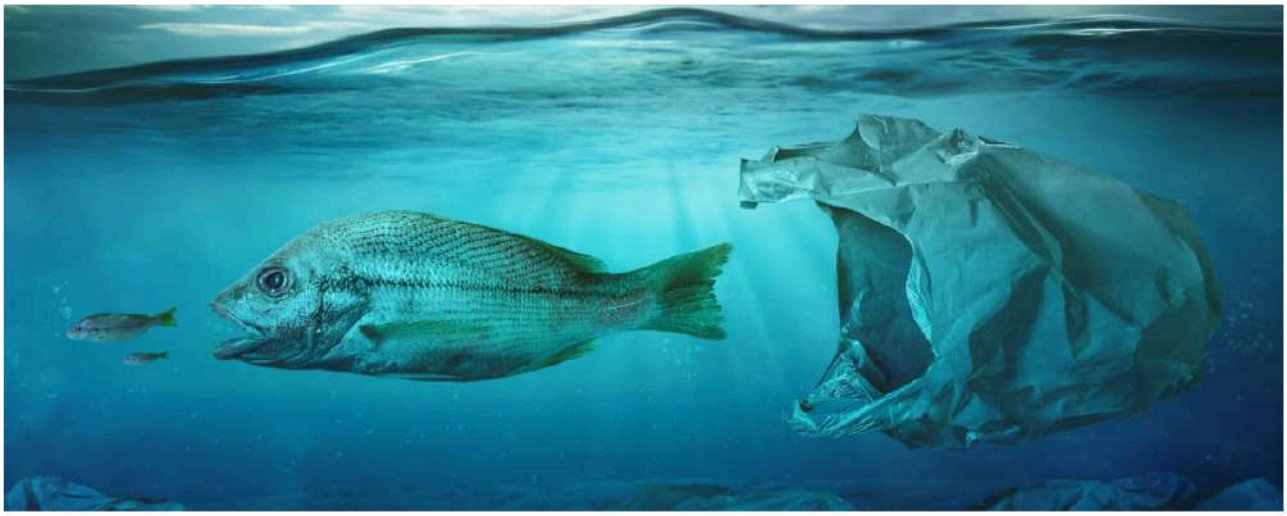


WATER POLLUTION

SUBJECT: AECC-2 (ENVS)
CU ROLL NO: 203223-21-0096
CU REGISTRATION NO:
223-1111-0400-20
COLLEGE ROLL NO: ECOA20M286

CONTENTS



Water Pollution

Water pollution can be defined as the presence of toxic chemicals and biological agents in groundwater that exceed what is naturally found in the water and may pose a threat to human health and the environment. Additionally, water pollution may consist of chemicals introduced into the water bodies as a result of various human activities. Any amount of those chemicals pollutes the water, regardless of the harm they may pose to human health and the environment.

Many of the chlorinated solvents commonly used in industry (such as PCE, TCE, 1,1,1-TCA) are examples of chemicals polluting our waters exclusively due to human activities. Another example is MTBE (methyl-tert-butyl-ether), a gasoline oxygenate that is currently banned in the U.S. and many countries. The chemicals or biological agents causing water pollution are referred to as water pollutants.

What are the causes of Water Pollution?

1. **Industrial waste**: Industries and industrial sites 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 these cases, industrial waste is dumped into nearby freshwater systems. This waste 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 unsafe for human consumption, they can also cause the temperature in freshwater systems to change, making them dangerous for many water dwelling organisms.

2. **Sewage and waste water**: 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.
3. **Oil leaks and spills**: 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.

4. **Agriculture**: In order to protect their crops from bacteria and insects, farmers often use chemicals and pesticides. When these substances seep into the groundwater, they can harm animals, plants and humans. Additionally, when it rains, the chemicals mix with rainwater, which then flows into rivers and streams that filter into the ocean, causing further water pollution.
5. **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.

6. **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.

What impact does water pollution have on the ecosystem?

1. **Diseases**: Not just the aquatic life, even when the humans end up drinking polluted water, they make themselves vulnerable to various life-threatening illnesses like hepatitis, cholera, typhoid, and many other water-borne diseases.
2. **Ruination of the ecosystem**: Our ecosystem is extremely fragile. Even a simple change can lead the ecosystem to react and impact the environment. If the water system is unchecked in a particular locality, then the whole ecosystem of that particular area may collapse.
3. **Eutrophication**: The chemicals available in the water body promote the growth of algae. These algae end up forming a thick layer over the ponds and lakes. The bacteria present in the water tend to feed on algae, causing the amount of oxygen in the water to decrease, thus impacting the aquatic life of the entire water body.

4. **Adverse impact on the food chain**: If the aquatic life tends to accommodate as per the polluted water, it is highly possible that the marine species may have toxins and pollutants in their body. When humans tend to feed on fishes, shellfishes, or other aquatic species, they end up consuming the toxins and pollutants too.

How to tackle with Water Pollution to protect our Environment?

1. **Wastewater treatment**: The most effective way to reduce water pollution is by treating some of the water before it is

reintroduced into the waterways. This is a highly effective solution because wastewater treatment facilities are able to remove nearly all pollutants in wastewater via a chemical, physical, or biological process. Sewage will be taken through several chambers of the facility to slowly reduce its toxicity levels.

2. **Plastic waste reduction**: Plastics are commonly washed into the ocean and other bodies of water, which serves to degrade the quality of the water. It's believed that around 9-12 million tons of plastic reach the ocean every year, which is a number that needs to be reduced substantially to make sure that the quality of ocean water doesn't worsen even more. To help reduce the amount of plastic waste that gets cycled into the environment, we must avoid using plastics whenever possible. It is necessary to seek alternatives for plastic bottles, plastic utensils, and straws. Whenever we use plastic, we must make sure that we recycle.

3. **Water Conservation**: To keep water clean and pure in a manner that will protect the environment, it's important that we focus on water conservation whenever possible. There are many ways to conserve water on a daily basis. Whenever we're shaving or brushing our teeth, it's recommended that we keep the water turned off. We must use only that much amount of water that is required to water our plants in the garden. Water is a scarce resource, which is why it's important that we try to lessen our water usage when we can.

4. **Septic tanks**: Septic tanks are useful pieces of equipment that are able to treat sewage by efficiently separating the liquids from the solids. These tanks will use various biological processes to properly degrade the solid substances before the liquids flow directly into a land drainage system. Septic tanks limit water pollution by effectively getting rid of the pollution that is already in the water.

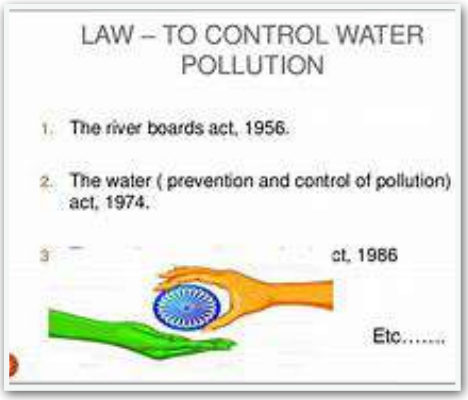
5. **Stormwater Management**: Another effective solution for protecting the environment and reducing the amount of water pollution is to manage stormwater whenever possible. When stormwater flows along sidewalks, streets, and lawns, it picks up harmful pollutants that are then pushed into storm drains, streams, and rivers. Stormwater can be treated and managed through a variety of different processes, which include everything from sand filtration and electrocoagulation to reverse osmosis and advanced oxidation.

6. **Green Agriculture**: The agricultural sector uses 70 percent of the surface water supplied around the earth for everything from livestock production to farming. Unfortunately, agriculture is the primary cause of water pollution. Whenever it rains, the pesticides and fertilisers wash away with the stormwater, which takes viruses and bacteria into the waterways. To foster the use of green agriculture , we must consider planting trees (**Afforestation**) and other plants nearby water bodies, which will keep chemicals from being washed away when it rains. We should also avoid using pesticides that contain harmful chemicals.

7. **Denitrification**: Denitrification is a simple ecological process that's designed to convert nitrates directly into nitrogen gas, which helps to prevent nitrate from being taken into the soil and contaminating the groundwater. When too much nitrate reaches groundwater, the nitrogen content of the water becomes far too high, which causes algae and phytoplankton to

grow at an accelerated rate causing eutrophication.

What are the laws existing in India to prevent and control Water Pollution?



1. **Water Prevention and Control of Pollution Act, 1974**: The prime object of this Act is to provide for the prevention of water pollution and cater to the maintenance of the water bodies and carry out activities to promote restoration of water. With the objective of giving practical implementation to this Act, the Central Pollution Control Board and the State Pollution Control Board have been established by the central and state authorities.The Central Pollution Control Board is to promote the cleanliness of streams and wells in different areas of the state.The Central Pollution Control Board has the power to advise the central government on various matters, which are concerned with the prevention and control of pollution of water. Under the Act mentioned above, the board has the power to encourage and conduct research and investigation with a view of promoting, the prevention of contamination of water in a significant manner.
2. **Orissa River Pollution Act, 1953**: This Act was formulated with the view of regulating the disposal of waste and effluents into the river by the factories and enable maintenance of the streams and water bodies. With the intention of giving this Act a practical implementation, the state of Orissa had established a board to govern the provisions of the Act above. This Act gives the board the competency to represent the inhabitants of a particular locality.
3. **The Water Prevention and Control of Pollution Cess Act, 2003**: According to Section 2 of this Act, industries include any operation or process or sewage or disposal treatment or any industrial

effluent. Section 3 of this Act provides an exemption to industries from levying cess on those industries, which consume water below the specified limit. Water gets polluted through the toxic or non-biodegradable substances when the processing of these materials is being done in any industry, and such industries are required to pay cess under this law.

4. **The River Boards Act, 1956**: This act aimed at the establishment of rivers and the regulation of interstate water disputes.The interest of the public is considered to be the prime concern of this Act. The Act gives the power to the State Government to establish Boards by issuing a special notification.The object of this Act is to resolve and regulate the inter-state water disputes. Article 262 of the Constitution of India gives the power to the Union to establish and adjudicate the inter-state water disputes prevailing in the country. Through this Act, awards and tribunals were being formulated to regulate the interstate dispute prevailing in a particular country.
5. **Damodar Valley Corporation Prevention of Water Pollution Act, 1948**: The Damodar Valley has been among the most flourished river basins which the country has witnessed since time immemorial. With the view of keeping a check on the functioning of this valley, Damodar Valley Corporation was established. During the monsoon season, 80 percent of the waste comprising of waste from mines and industries is discharged into this river. With the coming up of this Cooperation, the agricultural sector had undergone a change. The agricultural area decreased from 59 percent in 1925 to just 10 percent in 1984. The mining industry had become the need of the hour during that period. The discharge of effluents from these mines was made into this river. This results in the pollution of water.
6. **Right to Clean Water, A Fundamental Right**: The Indian Judiciary has initiated a positive step, with the view of controlling pollution of water. Under the Indian Constitution, the judiciary has given a liberal interpretation to Article 21 of the Constitution of India and included the right to clean water and environment under the ambit of Article 21, Article 48, Article 51(g) of the Constitution of India. Various judicial decisions throughout the history of Fundamental Rights have paved a way to the broad concept of Right to Life. The judiciary had propounded that the Right to Clean water comes under the ambit of the right to life and hence the scope of Article 21, Article 48 and Article 51(g) can include the right to clean water.

CONCLUSION

Water plays a noticeable role in the sustenance of life on earth. Present day practices have often disregarded the old practices of saving water leading to undesired results in the form of increasing water pollution.

Through this project, I became aware of the paramount value of water since clearly, the problems associated with water pollution have the capabilities to disrupt life on our planet to a great extent.

I also understood the causes and effects of water pollution which sadly is mainly due to human activities.

Another aspect is that the solutions that can be undertaken by us to solve this major crisis of water contamination from a grass-root level.

It is high time to change our habits that degrade the water because if we don't and follow the same way till now, one day maybe our sons woke up and they won't have water to drink.

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my teachers of Economics Department for their able guidance and support in completing my project.
I would also like to extend my gratitude to our honourable Principal Ma'am and Vice-Principal Sir for giving me the golden opportunity to do this wonderful project on the topic,
"Water Pollution"
Last but not the least, I would like to thank my parents and friends who helped me a lot in finishing this project within the limited time.

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DEPARTMENT: ECONOMICS

AECC ENVS TUTORIAL

PROJECT TOPIC – GANGA RIVER POLLUTION: A CASE STUDY

BATCH: 2020-23

ACKNOWLEDGEMENT

I would like to thank my subject teachers of AECC ENVS and our department HOD for providing me with adequate study materials for this topic and encouraging me to do this project systematically. I would also like to thank my parents and batch mates, because without their timely help and guidance, it was impossible for me to opt and work on this project.

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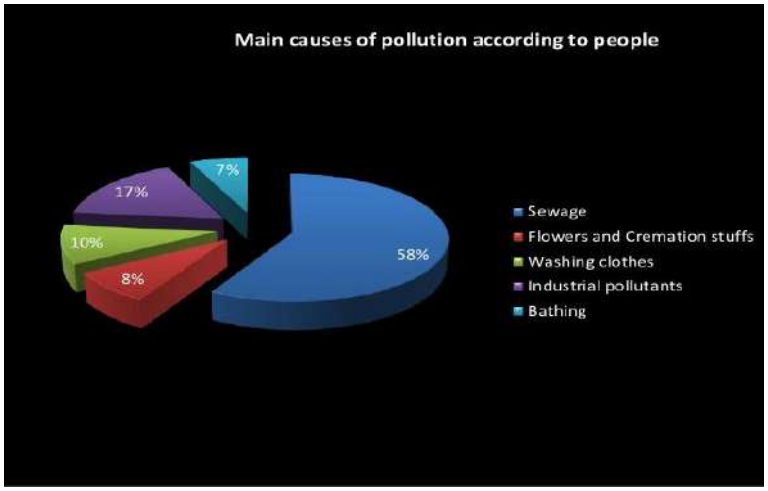
INTRODUCTION

Water Pollution has become a global crisis. The perennial threat of the water crisis is exacerbating because of uncontrolled and unbalanced development of the allied sectors such as industries and agriculture. According to the reports of NITI Aayog, 21 major Indian cities, including Delhi will completely run out of groundwater. 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.

← Water pollution caused in rivers by sewage

Pollution in river Ganga →

REASONS FOR POLLUTION IN RIVER GANGA:



Main Causes of pollution of Ganga in Varanasi

1. Industries

There are 4600 industries in Uttarakhand out of which 298 are seriously polluting industries. There are many industries which have not taken permission from the Uttarakhand pollution control board for their operations and they started their operation based on the advisory of the government in which the government exempted certain classes of industries from taking permission. The sewage treatment and advanced technology for the treatment of the wastes are not used despite government strict regulations.

↑ Industrial pollutants causing river pollution in Ganga ↑

2. Sewage

Sewage is an important source of pollution and contributes 75% to the pollution caused by all sources of pollution. Urban development of different sizes contributes to sewage pollution in the river. The considerable efforts by the Ganga Action Plan are not able to improve the situation.

The report says that despite the failure of the Ganga Action Plan there is no disapproval on the part of the citizens as well as their representative living in urban areas on the banks of the river. The failure is on the part of the government agencies responsible for the effective implementation of the plan.

The urban citizens residing near the river show a lack of interest in the cleanliness of the river. The representatives of the urban areas are not receiving enough complaints from the citizens and as a result, they refrain from raising this issue to the higher authorities. Based on the analysis done by the independent authorities, the political parties show reluctance to increase the taxes because they may lose the support of their voters. The taxes will help the authorities to have financial validity. The Kanpur Nagar Nigam has to pay operation and management taxes to the Uttar Pradesh Jal Nigam for the operation and maintenance of the services in the Ganga Action Plan.

However, the Kanpur Nagar Nigam is unable to collect taxes from the users of the services of Ganga Action Plan to pay to the Uttar Pradesh Jal Nigam. So, the government directly transfers the money to the Uttar Pradesh Jal Nigam by cutting the share of the Kanpur Nagar Nigam.

3. Municipal Corporation

These are the following factors contributing to the waste in the river:

a. PLASTIC

Improper disposal of plastic waste causing contamination of water in Ganga

The use of plastic by people at large and its improper disposal ultimately reach in the river. Plastic pollution has been considered as one of the significant reasons for the pollution in the river. The government has failed in the implementation of Management and Sewage Waste Rules to curb the menace of plastic pollution.

The state should declare a complete ban on the use of plastic. The authorities pay no attention to the rampant use of plastics and the improper treatment of wastes before releasing them in the river. The pollution level of water has exponentially risen because of plastic wastes. The Tribunal while dealing with the matter of pollution on the ghats has banned the use of plastic in the vicinity of ghats.

However, the ban imposed by the tribunal has no effect on the ground level and the plastics are used rampantly. The plastic bags can be replaced by the jute bags which are nature friendly.

Pollution in Ghats of River Ganga due to religious practices

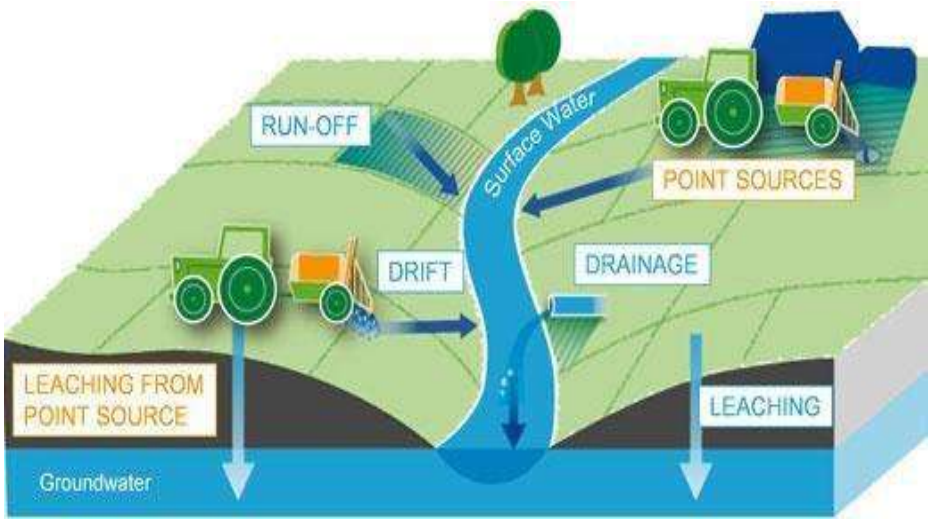
b.GHATS

The Ghats are also one of the major sources of pollution in the river. Ganga is one of the important parts of our Indian culture due to which different kinds of pujas and other religious tasks are performed on the ghats, and the materials used are disposed of in the river. The materials are non-decomposable, highly toxic and hence pollute the river.

4. Agriculture Waste

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 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 fertilisers wash away due to rain or other factors and pollute the river.

Harmful chemicals used in agriculture when washed through rain, leads to pollution of the river



EFFECTIVE MEASURES BY GOVERNMENT TO STOP THE POLLUTION

1. 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.

Volunteers of Ganga Action Plan

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 was spent on the Ganga action plans. The failure of such a big plan has led to economic pollution. 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.

2. Namami Ganga Programme

A flagship Namami Ganga Programme was launched under separate union Water Ministry created under river rejuvenation programme. The project aims to integrate Ganga conservation mission and it is in effect to clean and protect the river and gain socio-economic benefits by job creation, improved livelihoods and health benefits to the population that is dependent on the river.

The key achievements of the Namami Ganga projects are:

1. Creating sewage treatment capacity- 63 sewerage management project under implementation in the states of Uttarakhand, Uttar Pradesh, Bihar and West Bengal. 12 sewerage management projects launched in these projects.
2. Creating riverfront development: 28 riverfront development projects and 33 entry-level projects for construction, management and renovation of 182 ghats and 118 crematoria has been initiated.
3. River surface cleaning: The river surface cleaning is the collection of solid floating waste on the ghats and rivers.after collection, these wastes are pumped into the treatment stations.

Cleaning process of river Ganga using machines under Namami Ganga Plan

4. Public Awareness: Various activities such as seminars, workshops and conferences and numerous activities are organised to aware the public and increase the community transmission.
5. Industrial Effluent Monitoring: The Grossly Polluting Industries monitored on a regular basis. Industries are following the set standard of the environmental compliances are checked. The reports are sent directly to the central pollution control board without any involvement of intermediaries.

SUGGESTIONS

These are the following suggestion for making the existing machinery robust to expedite cleanliness process of the Ganga:

Development of a comprehensive and basic plan

We need to develop a plan by which we can reach the problem in a holistic way. The already devised plans involve many intermediaries wherein the transparency factor is cornered and only paper works are shown to the people at large.

The strategy should be formulated for different areas according to their demand. The people having apt knowledge of that area should be involved to know the actual problem of pollution in the river. A thorough check should be done and a customer-friendly platform should be formed wherein the views of every individual should be considered.

Measurement of the quality

The apt instruments are required to measure the quality of the water. We have many schemes for the cleanliness of the Ganga but the officials assigned the duty of measuring the quality of water either have authoritarian pressure or lack of knowledge to assess the quality of water. The quality of water should be measured by a recognised testing agency. Further, the research should be made to evolve better machinery for precision in quality measurement.

Getting the institutions right

The main task is to get the involved institution on the right path. The river cleaning task demands leadership, autonomy and proper management. The cities need to be amended. Ultimately they will be the custodians of the networks developed for the cleanliness process. Many cities have weak financial powers and their revenue generation is also weak so they should be given extra incentives. An awareness campaign should be launched in small cities where

people have no idea about the pollution of the river and how it affects the environment.

Engaging and mobilising all the stakeholders

The inhabitants of the river Ganga are people, elected representatives, and the religious leaders who consider the river as a pious and clean river. The mass awareness campaign can launch only when these people will be under sound financial conditions. So, if a portion is invested in these people, then it will help to develop their thinking on a large scale.

A similar situation has arisen in Australia where the government has invested 20% of the funds in creating mass awareness among the people for the cleanliness of the Murray river basin. It has shown a great impact on the productivity of the programmes implemented in Australia. So, when we promote all the stakeholders in one or the other way we can see a holistic development in the situation.

Rejuvenation requires equal attention to quality and quantity

The rejuvenation of rivers requires quality and quantity at the same time. The old adage of "solution to pollution is dilution" should be kept in mind while making any kind of plan.

The improvement of water quality in Ganga during the Kumbh Mela is the result of the release of water barrage of the water upstream. The water in the upper stream is used in the agriculture process by the respective states. So, if the water is released on a regular basis it will also help to improve the quality of the water and reduce the pollution level in the water.

CONCLUSION

Ganga is considered a pious river in the religious scriptures. The current situation demands holistic accountability from the authorities and people to make it clean. The global image is projected by the cleanliness of our rivers. The river Ganga is a part of our culture and it is our duty to maintain its sanctity. The government should formulate a more stringent policy to develop the quality of the water in the river. The environmental laws should be strictly followed and the violators should be punished.

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DEPARTMENT- ECONOMICS

AECC ENVS TUTORIAL

PROJECT TOPIC- GANGA RIVER POLLUTION

A CASE STUDY

BATCH: 2020-23

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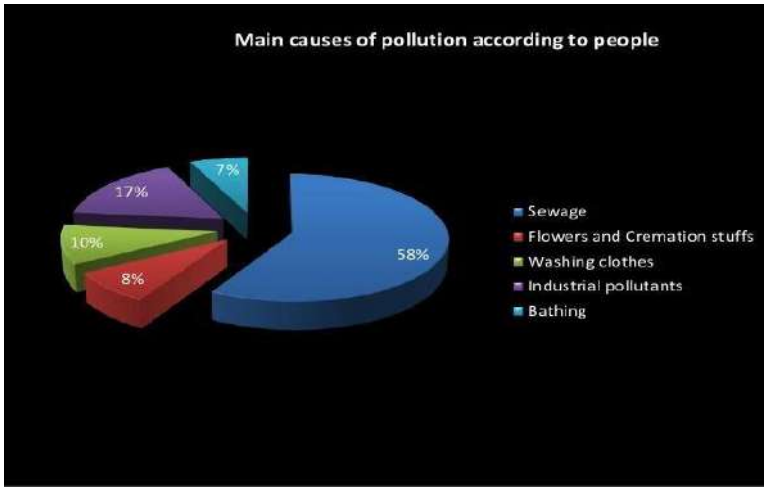

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Sewage is an important source of pollution and contributes 75% to the pollution caused by all sources of pollution. Urban development of different sizes contributes to sewage pollution in the river. The considerable efforts by the Ganga Action Plan are not able to improve the situation.

The report says that despite the failure of the Ganga Action Plan there is no disapproval on the part of the citizens as well as their representative living in urban areas on the banks of the river. The failure is on the part of the government agencies responsible for the effective implementation of the plan.

The urban citizens residing near the river show a lack of interest in the cleanliness of the river. The representatives of the urban areas are not receiving enough complaints from the citizens and as a result, they refrain from raisingthis issue to the higher authorities. Based on the analysis done by the independent authorities, the political parties show reluctance to increase the taxes because they may lose the support of their voters. The taxes will help the authorities to have financial validity. The Kanpur Nagar Nigam has to pay operation and management taxes to the Uttar Pradesh Jal Nigam for the operation and maintenance of the services in the Ganga Action Plan.

However, the Kanpur Nagar Nigam is unable to collect taxes from the users of the services of Ganga Action Plan to pay to the Uttar Pradesh Jal Nigam. So, the government directly transfers the money to the Uttar Pradesh Jal Nigam

3.MUNICIPAL CORPORATION

These are the following factors contributing to the waste in the river:

a. PLASTIC

Improper disposal of plastic waste causing contamination of water in Ganga

The use of plastic by people at large and its improper disposal ultimately reach inthe river. Plastic pollution has been considered as one of the significant reasons for the pollution in the river. The government has failed in the implementation of Management and Sewage Waste Rules to curb the menace of plastic pollution.The state should declare a complete ban on the use of plastic. The authorities pay no attention to t he rampant use of plastics and the improper treatment of wastes before releasing them in theriver. The pollution level of water has exponentially risen because of plastic wastes. The Tribunal while dealing with the matter of pollution on the ghats has banned the use of plastic in the vicinity of ghats.

However, the ban imposed by the tribunal has no effect on the ground level and the plastics are used rampantly. The plastic bags can be replaced by the jute bags which are nature friendly.

Pollution in Ghats of River Ganga due toreligious practices

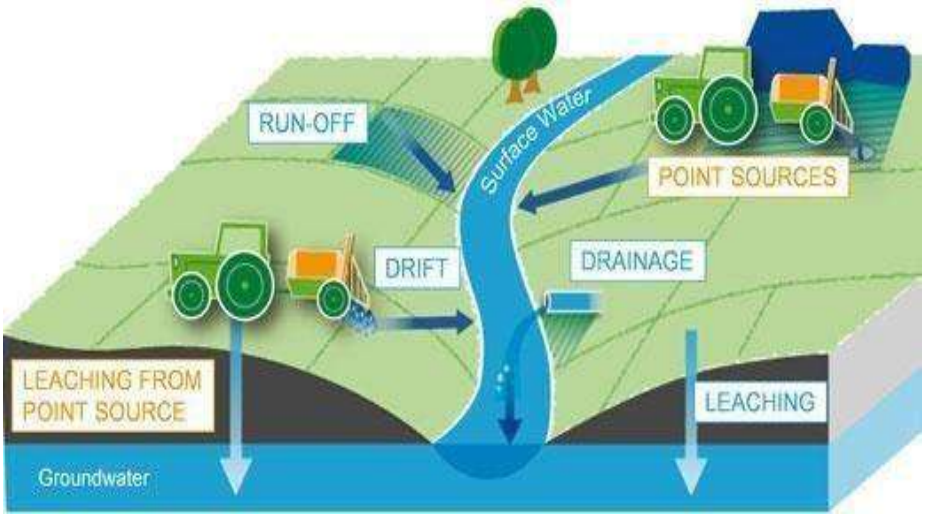
b.GHATS

The Ghats are also one of the major sources of pollution in the river. Ganga is one of the important parts of our Indian culture due to which different kinds of pujas and other religious tasks are performed on theghats, and the materials used are disposed of in the river.

4.AGRICULTURAL WASTE

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

Harmful chemicals used in agriculture when washed through rain, leads to pollution of the river



EFFECTIVE MEASURES BY GOVERNMENT TO STOP THE POLLUTION

1.GANGA ACTION PLANT

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. Thecentral 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.

Volunteers of Ganga Action Plan

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 was spent on the Ganga action plans. The failure of such a big plan has led to economic pollution. 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.

2.NAMAMI GANGE

A flagship Namami Ganga Programme was launched under separate union Water Ministry created under river rejuvenation programme. The project aims to integrate Ganga conservation mission and it is in effect to clean and protect the river and gain socio-economic benefits by job creation, improved livelihoods and health benefits to the population that is dependent on the river.

The key achievements of the Namami Ganga projects are:

1. Creating sewage treatment capacity- 63 sewerage management project under implementation in the states of Uttarakhand, Uttar Pradesh,Bihar and West Bengal. 12 sewerage management projects launched in these projects.
2. Creating riverfront development: 28 riverfront development projects and 33 entry-level projects for construction, management and renovation of 182 ghats and 118 crematoria has been initiated.
3. River surface cleaning: The river surface cleaning is the collection of solid floating waste on the ghats and rivers.after collection, these wastes are pumped into the treatment stations.

Cleaning process of river Ganga using machines under Namami Ganga Plan

4. Public Awareness: Various activities such as seminars, workshops and conferences and numerous activities are organised to aware the public and increase the community transmission.
5. Industrial Effluent Monitoring: The Grossly Polluting Industries monitored on a regular basis. Industries are following the set standard of the environmental compliances are checked. The reports are sent directly to the central pollution control board without any involvement of intermediaries.

SUGGESTIONS

These are the following suggestion for making the existing machinery robust to expedite cleanliness process of the Ganga:

Development of a comprehensive and basic plan

We need to develop a plan by which we can reach the problem in a holistic way. The already devised plans involve many intermediaries wherein the transparency factor is cornered and only paper works are shown to the people at large.

The strategy should be formulated for different areas according to their demand. The people having apt knowledge of that area should be involved to know the actual problem of pollution in the river. A thorough check should be done and a customer-friendly platform should be formed wherein the views of every individual should be considered.

Measurement of the quality

The apt instruments are required to measure the quality of the water. We have many schemes for the cleanliness of the Ganga but the officials assigned the duty of measuring the quality of water either have authoritarian pressure or lack of knowledge to assess the quality of water. The quality of water should be measured by a recognised testing agency. Further, the research should be made to evolve better machinery for precision in quality measurement.

Getting the institutions right

The main task is to get the involved institution on the right path. The river cleaning task demands leadership, autonomy and proper management. The cities need to be amended. Ultimately they will be the custodians of the networks developed for the cleanliness process. Many cities have weak financial powers and their revenue generation is also weak so they should be given extra incentives. An awareness campaign should be launched in small cities where

Engaging and mobilising all the stakeholders

The inhabitants of the river Ganga are people, elected representatives, and the religious leaders who consider the river as a pious and clean river. The mass awareness campaign can launch only when these people will be under sound financial conditions. So, if a portion is invested in these people, then it will help to develop their thinking on a large scale.

A similar situation has arisen in Australia where the government has invested 20% of the funds in creating mass awareness among the people for the cleanliness of the Murray river basin. It has shown a great impact on the productivity of the programmes implemented in Australia. So, when we promoteall the stakeholders in one or the other way we can see a holistic development inthe situation.

Rejuvenation requires equal attention to quality andquantity

The rejuvenation of rivers requires quality and quantity at the same time. Theold adage of "solution to pollution is dilution" should be kept in mind while making any kind of plan.

The improvement of water quality in Ganga during the Kumbh Mela is the result of the release of water barrage of the water upstream. The water in the upper stream is used in the agriculture process by the respective states. So, if the water is released on a regular basis it will also help to improve the quality of the water and reduce the pollution.

CONCLUSSION

Ganga is considered a pious river in the religious scriptures. The current situation demands holistic accountability from the authorities and people to make it clean. The global image is projected by the cleanliness of our rivers. The river Ganga is a part of our culture and it is our duty to maintain its sanctity. The government should formulate a more stringent policy to develop the quality of the water in the river. The environmental laws should be strictly followed and the violators should be punished.

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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:

- 1. Elimination of all forms of human exploitation and disturbance from the core and rationalization of such activities in the buffer.
- 2. 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.

- 3. Researching facts about habitat and wild animals and carefully monitoring changes in flora and fauna.

  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

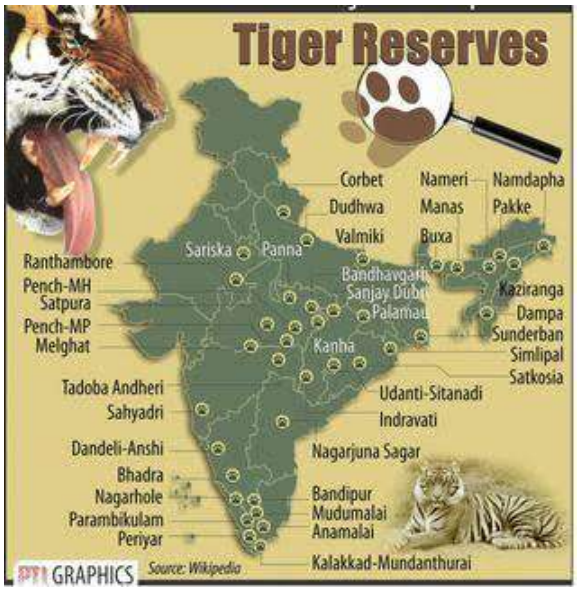
  Today the number of tiger reserves, which come under the 'Project tiger' of India, has increased to 27. For example:

  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



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.

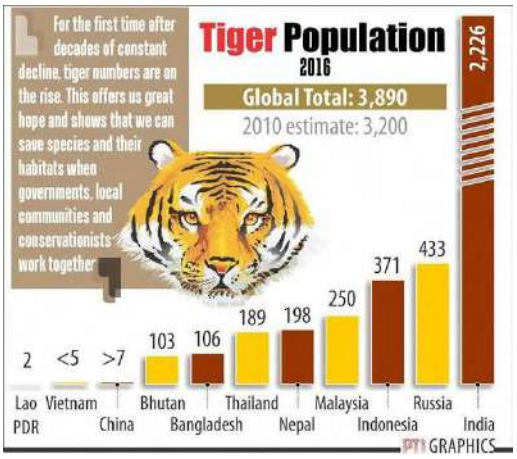
ACHIEVEMENTS OF PROJECT TIGER

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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