

# Mother Earth

Quarterly e-Magazine

Environment and Disaster Management Department

Ramakrishna Mission Vivekananda Educational and Research Institute

Narendrapur Campus, Kolkata: 700103

Volume-1, Number-2, June-August 2023



**World Environment Day 2023**  
**Beating Plastic Pollution**



## CONTENT

1. 50 Years of World Environment Day-Dr. P G Dhar Chakrabarti	3
2. ABC of Plastics and Biodegradable Plastics-Dr. Sudipta Tripathi	4
3. Human-Agriculture-Environment Interactions for a Sustainable World- Dr. Sumanta Das	6
4. Bioclimatic Aspects of Rural Low-cost Dwellings-Dr. Mahadev Bera	8
5. Global Environment and Disaster Updates	10
6. Departmental Updates	12
7. Application of GPS in Disaster Management-Sunayana Ray	13
8. Circular Economy Solutions for Sustainable Plastic Waste Management Future-Diksha Kar	14
9. Climate Resilient Technologies for Sustainable India-Sourav Halder	15
10. Beating Plastic Pollution Small Behavioral Changes Can Make Big Difference-Nirupama Singha	17
11. কোলকাতায় বায়ুদূষণ নিয়ন্ত্রণের উপায়-সৌমিক রায় চৌধুরী	19
12. From Trash to Treasure: Innovative Solutions for Waste Disposal Challenges-Anamika Sarkar	22
13. Replacement of Traditional Plastics-Anushka Saha	24
14. Adverse Effects of Plastics on Soil and Crops-Bibhas Ghosh	25
15. Plastic Pandemic: The Silent Threat to Human Health-Abhisek Kar	27
16. Snow Leopard Conservation in the Face of Climate Change and Biodiversity Loss in India-Diya Roy	29
17. Arsenic Contamination and Salinity in Sundarbans-V Rohit Kumar	31
18. Plastic Pollution: A Threat to the Himalayas-Sayani Ghosh	32
19. Unveiling Nexus of Human, Animal, Plant, and Soil Health: One Health Concept-Chetana Tunga	34
20. Environmental Research on Paleoecology-Pinanki Das	35
21. Beating the Climate: Building the Resilient Agriculture-Pritthish Rauth	37
22. Heatwaves are destroying the Indian Economy-Jubaraj Roy	38
23. Plastic Zones Surrounding Railways-Kaberi Saha	39
24. Net Zero Emission-Kasturi Datta	41
25. The Green Wall of India-Anindya Haty	43
26. Why West Bengal Did Not See Any Significant Environmental Movements-Arkadip Mondal	44
27. Plastic Pollution in Seas and Oceans-Bhagyasree Chatterjee	45
28. Climate, Salinity and Health: Triple Whammy of Sundarbans Women-Nidrothita Modak	47
29. Three Developments of 1973 that Brought Environment into the Policy Landscape of India-Rasmoni Karak	48
30. Whither East Kolkata Wetlands-Sonia Paul	50
31. The Devastating Impact of Oil Spills on Aquatic Ecosystems-Arundhatii Aich	51
32. Cleaning Ganga: Challenges and Opportunity-Banashree Chakroborty	53
Our contributors	55

### Editorial Board

#### Faculty:

Dr. P G Dhar Chakrabarti, Dr. Sudipta Tripathi, Dr. Sumanta Das, Dr. Mahadev Bera

#### Alumini:

Asmita Basu, Diksha Kar

#### Students:

Abhisek Kar, V Rohit Kumar, Soumik Roy Chowdhury, Bhagyasree Chatterjee, Rasmoni Karak,  
Pinanki Das, Anindya Haty, Arundhatii Aich

## 50 Years of World Environment Day

**Dr P G Dhar Chakrabarti**

Swami Vivekananda Chair Professor on Environment and Disaster Management

The decision to mark 5 June as the World Environment Day was taken at the first global conference on environment, known as the United Nations Conference on the Human Environment, hosted by Sweden in its capital of Stockholm from 5-16 June 1972.

One year later, on 5 June 1973, the first World Environment Day (WED) was celebrated by the member countries of the United Nations and its members all over the world. Therefore, 2023 mark the 50<sup>th</sup> year of the celebration of the World Environment Day.

Each year there is a 'designated theme' for the celebration and a 'host city' that organises the main function under the auspices of the United Nations. The city of Geneva in Switzerland hosted the first WED on the theme "Only One Earth", which was repeated in WED 2022, hosted by Stockholm, also to mark the fiftieth anniversary the first global conference on environment in 1972.

The themes of WED included a wide range of issues on environment, such as 'Water: Vital Resource for Life'; 'Ozone Layer Environmental Concern; Lands Loss and Soil Degradation'; 'Ground Water; Toxic Chemicals in Human Food Chains'; 'Managing and Disposing Hazardous Waste: Acid Rain and Energy'; 'Desert, Desertification: Don't Desert Drylands'; 'Youth: Population and the Environment'; 'A Tree for Peace'; 'Global Warming; Global Warning'; 'Poverty and the Environment – Breaking the Vicious Circle'; 'Environment Millennium – Time to Act'; Zero Tolerance for the Illegal Wildlife trade'; 'Only One Earth, Care and Share'; 'For Life on Earth – Save Our Seas'; 'Give Earth a Chance' etc.

Sylhet, Bangladesh had the distinction of hosting WED for the maximum number of 6 times. New Delhi hosted the event twice – in 2011 on the theme, 'Forests: Nature at Your Service' and in 2018 on the theme 'Beat Plastic Pollution', which is repeated as the theme of WED 2023, being hosted by Côte d'Ivoire, the capital city of the west African country of Ivory Coast.

Plastic pollution is a global problem. Approximately 7.5 out of the 9.8 billion tonnes of plastic produced during 1950-2022 became plastic waste, ending up in landfills or dumped in rivers, seas and oceans, with very adverse consequences on the environment.

Most plastic items never fully disappear - they just break down into smaller and smaller pieces, and infiltrate into our biotic and abiotic environment. The microplastics can enter into the human body through inhalation and absorption, and accumulate in organs. Microplastics have been found in our lungs, livers, spleens and kidneys, leading to many life threatening diseases. A study recently detected microplastics even in the placentas of newborn babies.

India notified the Plastic Waste Management Rules in 2016 and amended the Rule in 2021, prohibiting 20 identified single-use plastic (SUP) items by 2022, but the task still remains daunting and complex as livelihood of millions of people are involved in the manufacturing and use of SUP. The problem cannot be resolved easily till we have alternate, low-cost, adequate and sustainable materials to replace non-recyclable plastics. The problem has to be addressed through a multi-faceted approach involving industry, technology, law, governance and awareness generation among people.

An overarching international agreement on beating the plastic pollution is currently being negotiated under the auspices of the United Nations Environment Programme and it may expected it may not be too far when the mankind will find a solution to the vexed problem they have themselves created for the Mother Earth over the decades.



# ABC of Plastics and Biodegradable Plastics

**Dr. Sudipta Tripathi**

Assistant Professor, EDM, RKMVERI, Narendrapur Campus

Plastic pollution and its impacts are a very common topic of discussion now-a-days. While plastics have beneficial uses in medical science and scientific laboratories, the problem of plastic pollution in our environment poses significant challenges due to their non-biodegradable nature. So, this has led to ongoing debates regarding harmfulness and usefulness of plastics.

Now, we need to address some basic questions related to plastics to gain a better understanding about the nature and impacts of plastic.

## What is plastic? How plastics are being produced? Why plastics are harmful?

Plastics are made from non-renewable resources, specifically petroleum-based products. The production of plastics involves a cracking process where hydrocarbons are heated. With the help of a catalyst, larger molecules are broken down into smaller ones, which then serve as the building blocks for various types of plastics. This transformation converts components of natural gas or crude oil, like ethylene, propylene, butane, and styrene, into monomers used in plastic manufacturing.

The monomers are chemically bonded together to form chains known as polymers. These polymers can be created by combining different monomers, resulting in **plastic resins** with distinct properties, characteristics, and degradability. The fundamental composition of most polymers includes carbon and hydrogen. However, certain types of plastics, such as polyvinyl chloride, contain chlorine, nylon contains nitrogen, Teflon contains fluoride, while polyester and polycarbonate include oxygen in their molecular structure.

The polymerization process in plastics can potentially have harmful effects. Several of the monomers used in plastic production are known to be carcinogenic, mutagenic, and disruptive to the normal functions of the endocrine system in the human body. It's important to note that polymerization is not a flawless process, and as a result, there may be traces of toxic monomers present in plastics that can migrate and pose health hazards.

Polymers serve as the fundamental building materials for all plastics, but their functions would be limited without the use of additives. These additives play various roles, such as providing colorants for coloured plastics, formatting agents for Styrofoam or thermocol, and plasticizers for flexibility, commonly found in teethers and toys. However, additives have a weaker bond with polymers, causing them to leach out and contribute to environmental issues.

There are various types of plastics, including low-density polyethylene (LDPE), high-density polyethylene (HDPE), polyvinyl chloride (PVC), polycarbonate (PC), polystyrene (PS), polyurethane (PU), polypropylene (PP), and polyethylene terephthalate (PET).

The primary issue with plastic usage is its extremely slow natural degradation rate. Once used, plastic persists for an extended period, leading to various environmental problems. Over time, plastic may break down into microplastics, which pose even greater harm to our environment.

Plastic is primarily composed of carbon-containing compounds, which could potentially serve as a food source for microorganisms. However, the form of carbon present in plastic is generally not readily usable by microorganisms, but nothing is impossible in nature. Researchers may discover microbes in the near future that are capable of degrading plastic, offering a potential solution to the problem of plastic pollution.

Biodegradable plastics are a new approach in the plastic industry.

### What are biodegradable plastics?

Biodegradable plastic is capable of breaking down or disintegrating when disposed of in landfills or exposed to sunlight. This type of plastic is created by adding additives like Ecolyte and corn-starch, which facilitate the degradation process. Additionally, additives such as Poly ( $\beta$ -Hydroxybutyrate) can be utilized to produce biodegradable plastic.

Use of biodegradable plastics may have some advantage and disadvantages.

The use of biodegradable plastics can potentially help to reduce litter accumulation in the environment due to their biodegradability. However, there is a concern that it may encourage a "license to litter" mentality, leading to further issues. It's important to note that biodegradable plastics cannot be recycled, which again presents a new major concern.

However, at present, as plastic are toxic to nature and human so it is important to take appropriate measures to minimize plastic pollution. This can be achieved by following '**5 R**' concept (**refuse, reduce, reuse, repurpose, recycle**).

By refusing unnecessary plastic items, reducing plastic consumption, reusing plastic products, repurposing them for alternative uses, and promoting recycling, we can collectively work to save our mother earth.



# Human-Agriculture-Environment Interactions for a Sustainable World

**Dr. Sumanta Das**

Assistant Professor, Environment and Disaster Management, RKMVERI, Narendrapur

Feeding a growing global population while minimizing environmental consequences and protecting natural resources for future generations is a significant challenge for the agriculture sector today. Solutions to these problems may involve historical, national, socio-political, and socio-economic conditions and a high level of scientific and technological innovations. Significant advancements in science and technology should require facilitating the intensification of agriculture. While the intensification of agricultural production and its technogenic feature led to significant growth of food production in Western Europe and the United States, it could not solve all the world's food problems. Hundreds of millions of starving people remain in many countries in Asia, Africa, and Latin America, but these countries are not able to use the European-American model of agricultural intensification due to a lack of energy resources.

The environment can be significantly impacted by agriculture. Agriculture can have both negative and positive environmental effects. Positive effects include trapping greenhouse gases in crops and soils or reducing flood risks by using specific farming techniques and negative effects might include pollution and the deterioration of land, water, and air. Agriculture is fundamentally distinct from the processes that take place in natural ecosystems, even though it utilizes natural resources including land, water, plants, animals, natural fuels, and energy sources. With both beneficial and detrimental effects on the environment, anthropogenic influence on agriculture and the environment is increasing. As a result, sustainable management is necessary to ensure that agriculture is both ecologically and economically efficient, which fully depends on the state of the environment. The Organisation for Economic Co-operation and Development (OECD) keeps track of the interactions between agriculture and the environment, identifies effective agricultural policies to mitigate negative environmental effects while enhancing positive ones, and offers suggestions to improve policy coherence for sustainable agricultural practices reducing environmental impacts.

There have been some positive indications in recent years that the agriculture sectors of the majority of the world's nations can overcome their environmental issues. Farmers have improved their use of nutrients, pesticides, energy, and water, utilizing fewer of these inputs per unit of land. This is especially true in many different countries. Additionally, farmers have made good strides in implementing more environmentally friendly practices, such as conservation tillage, enhanced manure storage, and soil nutrient analysis.

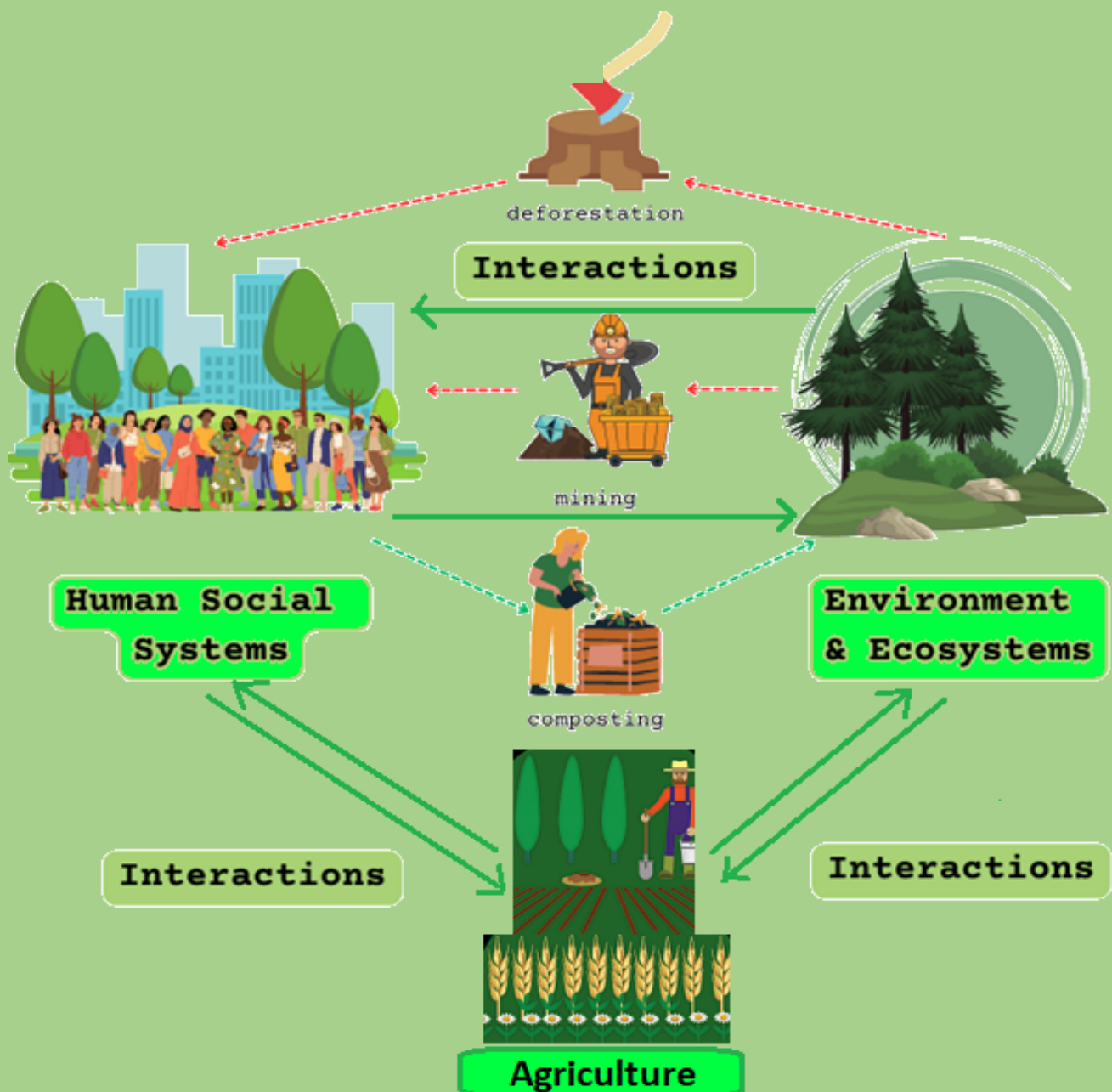
Despite these improvements, much remains to be done and policymakers have an important role to play. The nitrogen balance is increasing in several countries, bird populations on farmland continue to decline, and industry's share of water use and pollution remains high compared to other uses. More efforts and cooperation between farmers, decision-makers, and the agro-environmental chain are needed to solve these long-standing issues.

In addition, the twin policy challenge of ensuring global food security for a growing population while improving environmental performance will require raising the environmental and resource productivity of agriculture, enhancing land management practices, minimizing pollution discharges, curtailing damage to biodiversity, and strengthening policies that avoid the use of production and input subsidies which tend to harm the environment.

To help countries improve agricultural and environmental sustainability, the United Nations has prepared recommendations on how to develop cost-effective agri-environmental policies, how to manage agricultural

water problems, how to respond to the challenges of climate change, and how to preserve biodiversity. And managing ecosystem services associated with agriculture. Scientists around the world are developing strategies to provide insight into the potential environmental impacts of agricultural cultivation. In addition, decision-makers make policy by identifying possible policies and exploring how to achieve the goals of sustainable development and productivity growth together.

The differences in ecological conditions and general preferences of agriculture between different countries indicate that it is unlikely to have a particular solution to deal with agricultural impacts on the environment and its linkage to human interference. Nevertheless, policymakers must have a deep understanding and the ability to measure policy-outcome linkages to assess and achieve better agri-environmental outcomes in a cost-effective way to make a sustainable world.



# Bioclimatic Aspects of Rural Low-cost Dwellings

**Dr. Mahadev Bera**

Teaching and Research Assistant, Environment and Disaster Management, RKMVERI

Rural India prevails with a high predominance of low-cost dwellings. Low-cost rural dwellings (mud houses and huts) carry environmental concerns, including CO<sub>2</sub> and other GHGs emissions from conventional burning fuels, congested room structures, and cattle sheds. A major bottleneck of the rural areas is the poor indoor environmental quality due to different anthropogenic activities in the indoor and outdoor environment i.e. combustion of the fuel for cooking purposes, poor sanitation, and unplanned building infrastructure. Undoubtedly, building design and building environments have significant implications on the comprehensiveness of sustainability. That is, the building design process must address energy demand, building form, construction, materials, operation, and maintenance. The bioclimatic design aims at maximizing the quality of the built environment and minimizing or eliminating negative impacts on the natural environment.

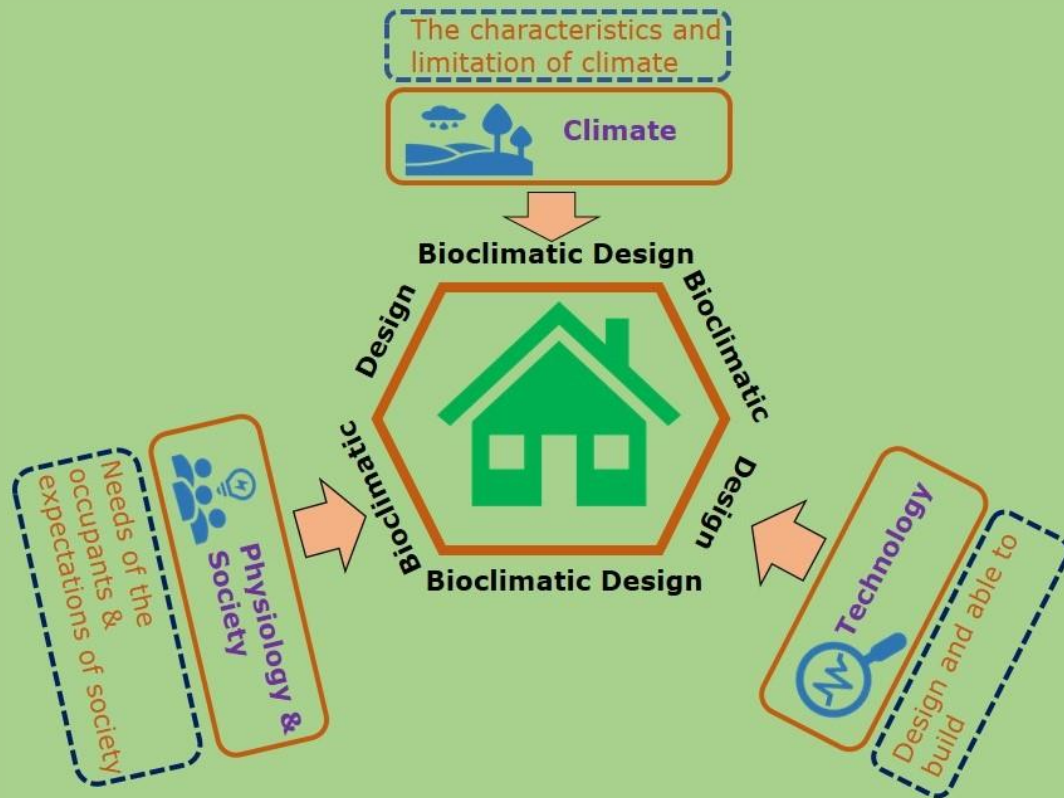
The application of bioclimatic aspects can improve human health, comfort, and safety, and enhance the energy efficiency of the built environment. The bioclimatic aspects consider the sustainability of dwellings concerning (a) eco-friendliness, that is, minimization of impact on the environment as well as non-renewable resources, (b) human-friendliness that addresses human health, comfort, and wellbeing; and (c) energy-friendliness associates with minimum energy consumption and maximum energy efficiency.

Bioclimatic Aspects	Description
<b>Eco-friendly:</b>	This is the aspect of minimizing the impact on the environment as well as non-renewable resources. The eco-friendly aspects of bioclimate are public transportation, ecological footprint, walking distance from market and school, use of surface water, rainwater harvesting facilities, local building materials use, etc.
<b>Human-friendly:</b>	The human-friendly aspects address the attention to human health and safety and increase human comfort. Human comfort is not just a matter of physical and environmental conditions but also the intermediaries such as architectural features, space design, physiological and demographical indicators, and safety features embedded in the design of the buildings.
<b>Energy-friendly:</b>	This aspect is associated with maximum energy efficiency in the buildings and is also influenced by building arrangement and layout, natural ventilation, landscape pattern, ecological footprint (watershed, plantation), use of solar energy and low-wattage electronic aids, and building materials. The bioclimatic approach adopts the passive building design to create comfortable conditions for occupants. The primary strategies include site design, landscape elements, building orientation, sun-shading windows, and façade design.

Bioclimatic design is a way of designing buildings based on the local climate, to ensure thermal comfort, energy efficiency, and improve indoor environmental quality using environmental resources. In the context of the bioclimatic design parameters under consideration in the rural building design include (a) site and



location,(b) building design, (c) energy efficiency, (d) health and safety, (e) building materials, (f) water use, (g) innovation.



**Diagram:** Components of bioclimatic design



**Picture:** Low-cost Rural Dwellings

# Global Environment and Disaster Updates

(April – June 2023)

Five weeks intervening Mother Earth Day on 23 April and World Environment Day on 5 June 2023 witnessed a number of natural and manmade disasters. A number of global events on environment and disaster management also took place during these weeks. A brief summary of these disasters and events are given in this update.

## Stampede in Yemen

In terms of casualty the most severe was the stampede inside a school in Sanaa in South Yemen in which at least 85 were killed and more than 322 injured during charity distribution event on 24 April following Eid al-Fitr. Hundreds of people in the war ravaged and poverty-hit country had gathered to receive handouts. More than eight years of civil war in Yemen has unleashed what the United Nations describes as one of the world's worst humanitarian tragedies in recent history.

## Heat waves in India

India is passing through another scorching summer, similar to last year's devastating heatwave, which caused widespread human suffering and affected workplaces, informal workers, landless laborers, marginalized communities, agriculture, and the overall economy. 13 individuals died of heatstroke after being exposed to the open sun for hours at a government-sponsored event in the Indian state of Maharashtra. According to a 2021 assessment by the United Nations Intergovernmental Panel on Climate Change (IPCC), India is predicted to be among the countries most hit by the effects of the climate crisis, with more severe heatwaves lasting longer and occurring more frequently across the country.

## Wild fire in Russia

At least 21 people perished in wildfires in Russia's Ural highlands in Siberia on May 10. Russia has witnessed a lot of forest fires in recent years, which experts attribute to arid summers and high temperatures. The majority of those killed were elderly persons who were unable to leave their houses. Over 5,000 structures have burnt down and a state of emergency was declared in the province.

## Bird Flu in United Kingdom

Bird Flu of extremely contagious H5N1 variety during May 2023 caused the largest and most rapid loss of birds in decades in UK. Black-headed gulls, which typically begin nesting during the month have reportedly been severely impacted due to this outbreak. 10% of the 2,000 breeding pairs of black-headed gulls in Yorkshire's largest black-headed gull colony at North Cave Wetlands nature reserve have perished, according to conservationists from the Wildlife Trust, who claimed they had "never seen mortality this high before."

## Floods in Italy

Floods in northern Emilia-Romagna region of Italy that caused 23 rivers to burst their banks and 280 landslides to envelop 41 cities and towns claimed 13 lives on 18 May and displaced 20,000 people. This is the worst flood in the last 100 years. Earlier Emilia-Romagna and other northern Italian regions were plagued by a drought that dried up the terrain. Simultaneous and unprecedented drought and flood in the same area and in the same season is being widely interpreted as an irreversible impact of climate change.

## Earthquake in Yunnan

A 6.4-magnitude earthquake struck Yunnan province in southwestern China late on May 22, killing three people and injured 28. The quake hit at a depth of 8 km (5 miles) and was followed by aftershocks, according to data from China Earthquake Networks Center. China TV quoted authorities as saying the collapse of some roads along with landslides had cut some transportation lines, disrupting electricity, telephones and internet. An emergency was declared and rescue operations were launched in Dali, a city of 134,000 people in Yunnan province about 24 km from the epicentre of the earthquake.

### **Typhoon Mawar in Guam**

Category 4 typhoon Mawar with gusts as high as 225km/h. hurled through the Pacific Islands of Guam on May 24, bringing heavy rain, tree-shredding winds, and a storm surge that smashed through the island's coral reefs. As the storm's eye moved over the island, the center and northern regions were drenched with 60cm of rain.

### **Angola flood**

The death toll from a torrential rainstorm that hit Angola's capital, Luanda during the last days of April rose to 24, with more than 2,000 homes flooded, according to officials. At least four bridges were destroyed by the floods in the Angolan capital. Rubble was scattered along Luanda's streets as residents took stock of the damage caused, wading through water-drenched patches of land. Several houses had caved-in roofs and broken-down brick walls.

### **Floods in Quebec**

Intense rainfall on 2 May caused the Rivière du Gouffre in Quebec in Canada to break its banks, flooding roads and damaging bridges. Around 1,000 residents in areas of the Baie Saint-Paul community have been left isolated as a result. The Mayor of Baie Saint-Paul, Michaël Pilote, declared a state of emergency and asked residents to stay home. Accommodation centres have been opened to house those displaced. Schools have been closed in the area. Quebec 2 firefighters were reportedly swept away by the flooding river on 01 May 2023.

### **G-20 Working Group on DRR**

G20 under India's Presidency created a Working Group on Disaster Risk Reduction (DRR). This will bring together representatives from the G20 countries to discuss five main issues identified by the Indian Presidency. These are: (a) improving global coverage of Early Warning Systems for all hydro-meteorological disasters; (b) increasing commitment towards making critical infrastructure systems disaster resilient; (c) developing disaster risk financing strategies, such as risk insurance, catastrophe bonds etc.; (d) cost-effective and time-efficient systems of disaster response; and (e) ecosystem based approaches to reduce disaster risks and resilience in communities. DRR Working Group had its meeting in Mumbai during 23-25 May 2023.

### **Meeting of the COPs of BRS**

Joint back to back meetings of the Conference of Parties of Basel, Rotterdam and Stockholm (BRS) Conventions, held during 1-12 May in Geneva, took several decisions, including on strengthening efforts to combat illegal trafficking and trade of hazardous chemicals and wastes. Parties to the Stockholm Convention were unable to advance work on establishing a compliance mechanism, with several developing countries emphasizing the need for funding for implementation as a precondition to any future agreements to establish such a mechanism. Consensus on e-waste amendments reached by parties to the Basel Convention is significant, given e-waste is the fastest-growing waste stream in the world, with only 17% recycled or recovered in 2019.

### **Midterm Review of Sendai Framework**

The world is experiencing a growing number of disasters, many compounded by climate change, putting millions of lives and every social and economic gain in danger. The High-Level Meeting on the Midterm Review of the Sendai Framework for Disaster Risk Reduction 2015-2030 gathered leaders and decision makers under the theme "Working Together to Reduce Risk for a Resilient Future" on 18 to 19 May 2023 at the UN Headquarters in New York. The meeting adopted a political declaration to accelerate implementation of the Sendai Framework

### **INC Meeting on International Agreement on Plastic Pollution**

The second meeting of the Intergovernmental Negotiating Committee (INC) to develop an international legally binding instrument on plastic pollution, including in the marine environment took place in Paris on 29 July-2 June. As per the mandate of UN Environment Assembly the process of negotiations shall be completed by the end of 2024 to create a global legally binding plastics treaty, based on a comprehensive approach that addresses the full life cycle of plastic.

## Departmental Updates

(May-June, 2023)

**M.Sc. admission:** Notification for admission to the M.Sc. programme (academic session: 2023-25) in Environment and Disaster Management has been published on the University website.

**Ph.D. admission:** Notification for admission to the Ph.D. programme on Environment and Disaster Management has been published.

### Proposed field visit:

- M.Sc. Second Semester students of Environment and Disaster Management will visit IMD, Regional Station, Alipore within first fortnight of June.
- M.Sc. Second Semester students of Environment and Disaster Management will visit to The National Cyclone Risk Mitigation Project (NCRMP) sites at Basanti Block, South 24 Parganas within second fortnight of June.

**Cultural Activities:** Our Students have participated in the celebration of Rabindra Jayanti at RKMVERI, Narendrapur Campus on 11<sup>th</sup> May.

**Internship cum dissertation work:** M.Sc. fourth semester students of Environment and Disaster Management are going to successfully complete their internship cum dissertation work at different Central and State Government Institutes and NGOs of International repute within second fortnight of June. These institute include ICAR, NIRD&PR, IIRS, IMD, AIDMI, WBPCB, GoWB.

**New faculty:** Dr. Sumanta Das has joined in the department as Assistant Professor.

**New Para-academics:** Dr. Mahadev Bera has joined the department as Teaching and Research Assistant.

**Dr P G Dhar Chakrabarti** delivered a talk on the ‘Humanitarian System of India’ at the South Asia release of the triennial global report on State of Humanitarian Systems 2023 at India International Centre New Delhi on 24 April 2023.

**Dr P G Dhar Chakrabarti** spoke on ‘Challenges of Developing Indicators on Leaving No One Behind for the ClimBer Project Countries’ at the online consultation meeting of the International Water Management Institute, Colombo on 19 May 2023.

**Dr. Sudipta Tripathi** delivered an invited talk on “Sustainable Organic Agriculture” at Joygopalpur Gram Vikash Kendra, Basanti, Sundarban on 14<sup>th</sup> May, 2023.

**Sunayana Ray**, ex-student of our department, has qualified for UGC-NET (LS) in Environmental Science conducted by the National Testing Agencies (NTA).

**Dr. Sumanta Das** will deliver an invited talk on “AI and Remote Sensing in Digital Agriculture” in the University of Twente, The Netherlands on 9<sup>th</sup> June 2023.

**Dr. Mahadev Bera:** One of his research articles has been accepted for publication in the International Journal of Environment and Climate Change.

**New Instrument in EDM Lab:** Atomic Absorption Spectrophotometer, Automatic Nitrogen Analyser, UV-Vis Spectrophotometer, Flame Photometer were installed.



# Application of GPS in Disaster Management

Sunayana Ray

Global Positioning System (GPS) is a satellite based global navigation system owned by US government and operated by US Space Force which currently consist of 28-30 navigation satellites in space (24 active and 4-5 spares or backups). These satellites are at an altitude around 20,000 km above the mean sea level which orbit the earth twice in a day and constantly broadcast signals to the earth. This system provides precise location of any point on earth surface using the 3D trilateration technique. The approach of real time or near real time positioning has made this technology an important tool in the field of Disaster Management.



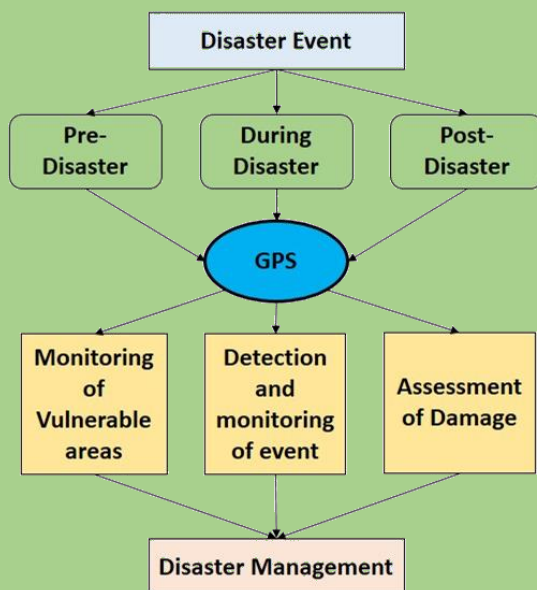
**Picture:** Constellation of satellite for GPS

## 1. GPS in Forest fire management

GPS mounted on aircraft are used to accurately detect the fire location very quickly which reduce the response time. In the post disaster activity GPS play an important role. The damage area can be precisely calculated and mapped with both hand-held or aircraft equipped GPS.

## 2. GPS in Landslide monitoring

The static survey technique is generally used to monitor the displacement of land in landslide prone areas. This technique can measure the movement of the active part of landslide based on different seasons. This monitoring is necessary for predicting the landslide behaviour and forecasting the high risk zone.



**Picture:** GPS in Disaster Management

in every stage of disaster events pre-disaster, during-disaster and post-disaster. GPS cover the full earth surface area and it is freely available to all the users which made it a suitable satellite based navigation and positioning system for the disaster management as it can be assessed every section of the earth.

## 3. GPS in Earthquake monitoring

GPS is a very powerful tool in monitoring earthquakes because it can provide centimetre level accuracy. The pre and post- earthquake measurement of land displacement generate data for the study and analysis of displacement pattern. GPS based positioning has been used by the scientist to study the movement of crustal plates since 1980. Deformation survey is also performed to find the cracks or deforms in buildings structures in post- earthquake situations.

## 4. GPS in Flood management

The first and foremost application of GPS during flood situation is emergency tracking of safe routes for evacuation. Apart from this flood map zoning, identifying relief and rehabilitation camps location are very useful application of GPS in Flood disasters.

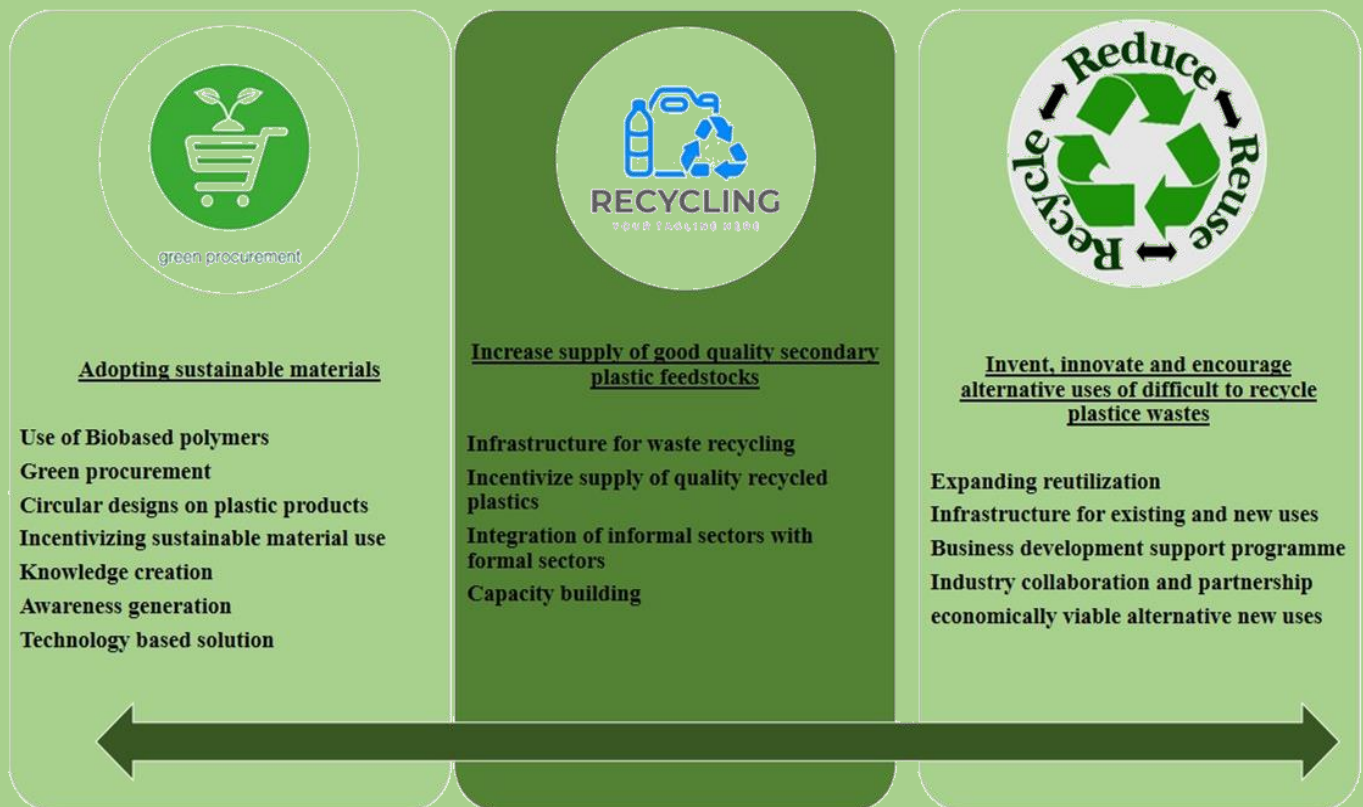
GPS irrespective of time and weather condition can be used

# Circular Economy Solutions for Sustainable Plastic Waste Management Future

**Diksha Kar**

The concept of circular economy (CE) encourages a closed-loop production cycle where waste is reduced or transformed to be used for the subsequent production cycle as an alternative to the current linear production life cycle. The goal of the circular economy is to ensure that resources are used within the economy for as long as possible. Reducing the consumption of raw materials, waste production, emissions, and energy can help achieve this. Currently, the circular economy's largest sector is the waste and recycling sector.

India generates around 3.5 MT plastic wastes per year out of which only 30% is get recycled through different waste management practices such as: recycling, landfilling, incineration etc. But the society requires a resource-efficient circular economy for plastics that minimizes wasteful use of plastics, produces plastics from renewable sources, which is powered by renewable energy, reuses and recycles plastics without leakage to the environment, and generates no or minuscule waste or emissions. The circular economy can help in the plastic waste management in the following ways:



**Picture:** Role of Circular Economy for Plastic Waste Management in India

# Climate Resilient Technologies for Sustainable India

Sourav Halder

“We do not inherit the Earth from our ancestors; we borrow it from our children”

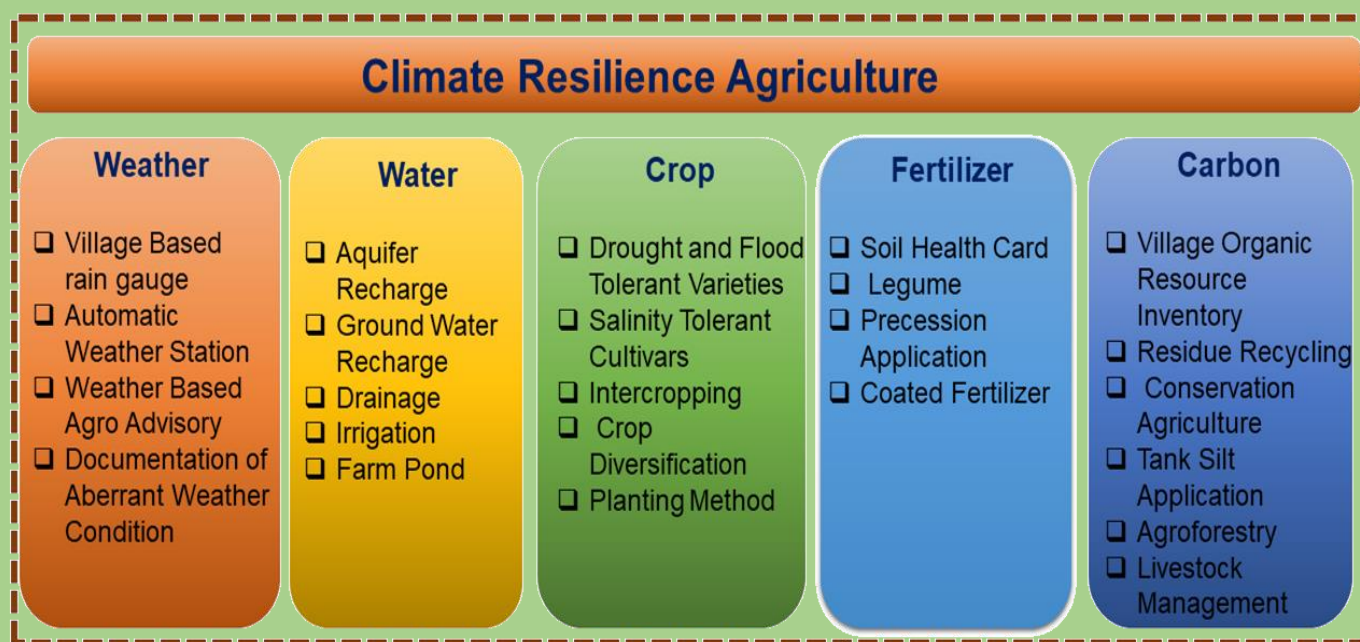
— David Brower

This soul-stirring thought reveals the reality of climate change and its brutal effects on the environment. “Climate change” is a major threat that the global community faces at present but it is unpredictability makes sustenance of life more challenging. It is evident that frequent cyclones, floods, and drought that manifest altogether the drastic changes unleashed on the face of the earth. The effects of climate change are multi-dimensional, it calls for the enforcement of alternative technologies to resist the impact in all aspects of life, agriculture, energy, lifestyle, food, and so on.

## Agriculture:

India is vulnerable to climate change because of the dependence of its huge population on agriculture and relatively weak coping mechanisms. Climate resilient agriculture (CRA) encompasses the incorporation of adaptation and resilient practices in agriculture which increases the capacity of the system to respond to various climate-related disturbances.

To address the issue related to climate variability and to enhance the adaptive capacity of communities, extensive farmer participatory demonstrations of location-specific climate resilient technologies were initiated on the fields in each vulnerable district of the country as part of the National Initiative on Climate Resilient Agriculture. To develop climate-resilient agriculture, we must focus on the following techniques.

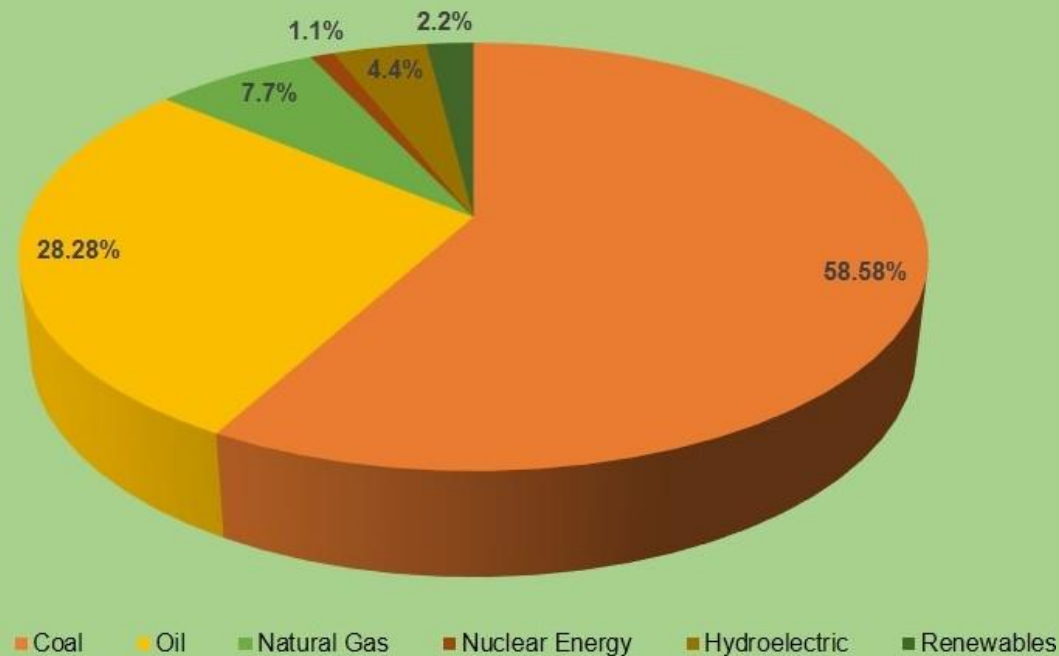


**Picture:** Components of climate-smart Agriculture

## Power:

The major bulk of energy in India is derived from coal and gas-based thermal power plant. However, the dependence on coal which is the largest contributor of greenhouse gas CO<sub>2</sub> can be reduced through alternative technologies. In recent years, the interest in using Biomass as an energy source has increased and

it represents approximately 14% of the world's final energy consumption. India has a potential of 16,881 MW. India has an estimated hydroelectric power potential of about 15,000 MW. The Ministry of New and Renewable Energy supports SHP project development throughout the country. India is endowed with a vast solar energy potential about 5000 trillion kwh over year energy. Other renewable energy sources are Geothermal, Ocean thermal energy which saves harm to the environment. India will meet 50 percent of its energy needs from renewable energy by 2030.



**Picture:** India's energy mix

### Infrastructure:

Concrete a major component in construction has a lower albedo, i.e., they absorb a very high percentage of incoming radiation. So, using heat-reflecting materials would be a way forward. Roads and terraces can be painted white to reflect the sunlight and avoid weather extremes.

### Health Sector:

Global warming has created an upward swing in warm and moist environments, which is favorable for the reproduction of various vector diseases like mosquitoes, rats, and cockroaches. Clustered Regulatory Interspaced Short Palindromic Repeats of genetic information (CRISPR) is an interesting scientific innovation that edits the gene in vector mosquitoes and uses it to eradicate a particular species from an area.

### Desirable Approach:

The IPCC has mandated sustainable development, mitigation, and adaptation as the climate challenge resilience pathway.

- At the social level, Self Help Groups and community participation and adaptation to changes for a greener environment can bring positive results.
- At the national level levelling up of the National Mission for Green India and the National Action Plan on Climate Change will cater towards enhanced energy efficiency.



# **Beating Plastic Pollution**

## **Small Behavioral Changes Can Make Big Difference**

**Nirupama Singha**

“Every plastic bottle we refuse, every plastic bag we replace, is a step towards a cleaner and healthier planet”

United Nations Environment Programme



Plastic pollution has now become a pressing issue of global environmental concern. The presence and abundance of plastic waste is everywhere - from the lakes, rivers and oceans to mountains, coasts and soils, and where not. Plastic pollution poses many threats to the ecosystem, as it is persistent and penetrating, durable and non-bio-degradable. Over time it breaks down to microplastic which then further gets mixed with air, water, and soil, impacting adversely on plant, animal and human health. Plastic is one of the gravest threats to the idea sustainability which is driving development agendas around the world.

Ironically, use of plastic is increasing globally in every country across all sectors, and has become a part and parcel of our daily life even though we all know it very well that plastics have poisonous effects on our body and on the body of our Mother Earth. In India, the average annual usage of plastic has sharply increased from just one kilogram per person in 1990 to 15 kilograms in 2021.

Government of India has notified a complete ban on single use plastic that is less than 120 microns, but this is followed more in violations. It will be practically impossible to enforce the ban unless people themselves decide refuse to accept plastics, replace plastics with environment friendly materials and facilitate the recycling of the plastics by segregating these from bio-degradable household wastes. In this regard small behavioral changes in our daily life can make a very big difference. Some of these changes may be suggested as follows:

- **Saying no to plastic cups, straws, and glasses:** Opt for reusable cups and glasses. Carrying jute or cloth bags while going to grocery or vegetable shopping or a container or a big pouch will replace plastics and reduce plastic waste.
- **Reduce plastic consumption:** Opt for alternatives to single-use plastics whenever possible. Choose products with minimal or no plastic packaging and prioritize reusable options.
- **Recycling and disposal of plastics properly:** Follow proper recycling guidelines and dispose of plastic waste in designated bins. Encourage and support local recycling initiatives.
- **Promote reuse and refill systems:** Encourage the use of refillable water bottles, coffee cups, and shopping bags. Support businesses and organizations that provide refill stations for personal care and cleaning products.
- **Support plastic alternatives:** Promote the use of sustainable materials like glass, metal, paper, or biodegradable/compostable plastics. Advocate for policies that encourage the development and adoption of plastic alternatives.
- **Raise awareness and educate:** Spread awareness about the environmental impact of plastic pollution through campaigns, social media, and educational programs. Educate individuals and communities about proper waste management and the importance of reducing plastic waste.
- **Encourage responsible production:** Support companies that adopt sustainable and eco-friendly practices, and encourage industries to reduce the use of unnecessary plastic packaging.
- **Advocate for policy changes:** Support legislation and policies aimed at reducing plastic pollution, such as bans or restrictions on single-use plastics, extended producer responsibility, and improved waste management systems.
- **Clean-up and restoration efforts:** Participate in community clean-up events to remove plastic waste from natural environments. Support initiatives that focus on restoring and protecting ecosystems affected by plastic pollution.

By making small changes in our daily lives and working together, we can make a significant positive impact on the health of our planet. And we must remember that isolated actions of a few individuals are not enough; collective action is crucial for effectively reducing plastic pollution. Beating the plastic pollution must therefore be a mass movement.





# কোলকাতায় বায়ুদূষণ নিয়ন্ত্রণের উপায়

## সৌমিক রায় চৌধুরী

আমাদের সকলের প্রিয় শহর কোলকাতাকে বলা হয় "City of Joy"। দুর্ভাগ্যের বিষয় হলো আমাদের এই আনন্দের শহর ক্রমে দুঃখের শহরে পরিণত হচ্ছে। এর জন্য দায়ী বায়ু দূষণ। কলকাতাকে এখন নিঃসন্দেহে "City of Pollution" বলা যেতেই পারে। কোলকাতায় বায়ু দূষণের অন্যতম কারণ হলো বাতাসে PM 2.5 এর উপস্থিতি। পরিসংখ্যান বলছে State of Global Air report, ২০২২ অনুসারে, PM 2.5 দূষণের পরিপ্রেক্ষিতে বিশ্বের ১০৩টি জনবহুল শহরের মধ্যে দিল্লির পরে দ্বিতীয় সবচেয়ে দূষিত শহর হিসেবে কোলকাতার নাম ছিল। কোলকাতার বাতাসে বার্ষিক গড় PM 2.5 এর মাত্রা ৮৪৮g/m<sup>3</sup> যা WHO এর নিরাপদ মাত্রার থেকে ১৭ গুণ বেশি। কোলকাতায় প্রতি ১ লাখ মানুষের মধ্যে ৯৯ জন মানুষ প্রতিবছর PM 2.5 এর জন্য মারা যায়। মার্কিন গবেষণা সংস্থা - Health Effects Institute এর সর্বশেষ প্রতিবেদনে বলা হয়েছে যে PM 2.5 এর প্রভাবে ২০১১-১৯ সালের মধ্যে কলকাতায় প্রায় ১.৮৫ লক্ষ মানুষের অকাল মৃত্যু ঘটেছে। ২০১৯ সালে করা WBPCB এবং



C40  
CITIES

CSIR - NEERI এর যৌথ সমীক্ষা থেকে জানা যাচ্ছে যে কোলকাতার বাতাসে PM 2.5 এর অন্যতম প্রধান উৎস হলো রাস্তার ধুলো ২৪% ও গাড়ির ধোঁয়া ২৪%। এছাড়া অপরিকল্পিত বাড়িঘর নির্মাণ, কয়লার উনুনের ব্যবহার PM 2.5 এর অন্যতম উৎস। C40-এর একটি নতুন গবেষণা প্রতিবেদন অনুসারে, ২০১৯ সালে সারা বিশ্বে ৬১টি মেগাসিটির মধ্যে কোলকাতায় কয়লা-চালিত তাপবিদ্যুৎ কেন্দ্রের দূষণের কারণে সর্বাধিক সংখ্যক মানুষের অকাল মৃত্যু ঘটেছে। রিপোর্ট অনুযায়ী, ২০৩০ সালের মধ্যে কলকাতায় আরও ১০,০০০ জন মানুষের অকাল মৃত্যু হতে পারে। এই প্রেক্ষাপটে কেন্দ্রীয় সরকার বায়ু দূষণ নিয়ন্ত্রণ করার জন্য কলকাতা বা KMC কে Clean Air Program এর অধীনে ২০১৯ সালে ৫৩৯ কোটি টাকা দেয়। দুর্ভাগ্যের কথা হলো KMC আজ অর্ধি এই টাকার অধিকাংশ খরচই করতে পারেনি।

এই প্রতিবেদনে আমরা আলোচনা করবো কোলকাতার বায়ু দূষণ কী করে কম করা যায়। PM 2.5 এর অন্যতম উৎস হলো গাড়ির ধোঁয়া। জীবাশ্ম জ্বালানিতে চলা গাড়ি যতো কম চলবে ধোঁয়া ততো কম বেরোবে। তাই গাড়ির ধোঁয়ার থেকে বাঁচার শ্রেষ্ঠ উপায় হলো বেশিমাাত্রায় গণপরিবহন এবং সাইকেল ব্যবহার করা ও শহরের মধ্যে মানুষের হাঁটার রাস্তার ব্যবস্থা করা। জীবাশ্ম জ্বালানির বদলে বৈদ্যুতিক গাড়ির ব্যবহার বাড়ালে বায়ু দূষণ আরো কমবে। কোলকাতা ২০১৯ সালে green mobility এর জন্য C40 অ্যাওয়ার্ড পেলেও বর্তমানে কলকাতায় গণপরিবহনের অবস্থা খুব খারাপ। ভারতের একমাত্র ট্রাম ব্যবস্থা যেটি কোলকাতার সর্বপ্রথম বৈদ্যুতিক গণপরিবহন সেটি আজ মৃতপ্রায়। রাতের শহরে পর্যাপ্ত পরিবহন ব্যবস্থা নেই। FAME 1 এবং 2 প্রকল্পের অধীনে বিদ্যুৎ চালিত বাস কলকাতায় আসলেও সেটা প্রয়োজনের তুলনায় সামান্য। ২০১৯ সাল অর্ধি শহরে ৮০টি বৈদ্যুতিক বাস রাস্তায় নামানো হয়েছে। এর ফলে বছরে ৬২৬০ টন CO<sub>2</sub> নিষ্কাশন কম



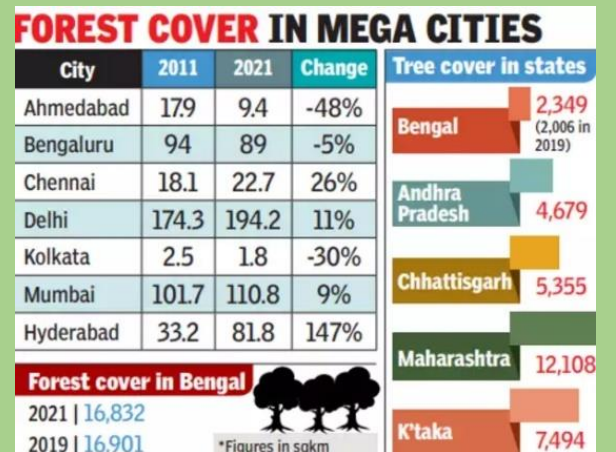
হবে। সরকার TATA Motors এর সাথে যৌথ উদ্যোগে ২০২৩ সালের মধ্যে ১১৮০টি বৈদ্যুতিক বাস রাস্তায় নামানোর পরিকল্পনা করেছে। হাঁটা এবং সাইকেল অন্যতম গুরুত্বপূর্ণ non-motorized transport। কিন্তু কোলকাতায় মানুষের হাঁটার রাস্তার অভাবের পাশাপাশি কোলকাতার অনেক রাস্তায় সাইকেল চালানো নিষিদ্ধ। নিউ টাউনে আলাদা "সাইকেল বে" বানানো হয়েছে সম্প্রতি। কোলকাতায় বাস, ট্রাম, ট্রেন, মেট্রো, ভেসেল এর সমন্বয়ে একটি integrated public transport system গড়ে তোলা যায় তাহলে কলকাতায় বায়ু দূষণের পরিমাণ অনেকটা কমানো যাবে। এছাড়া বায়ু দূষণ কমানোর উদ্দেশ্যে কোলকাতায় ২০০৮ সাল থেকে ১৫ বছর বয়সের অধিক বাণিজ্যিক কাজে ব্যবহৃত গাড়ি এবং বর্তমানে ২০ বছর বয়সের অধিক ব্যক্তিগত গাড়ি চলাচল নিষিদ্ধ করা হয়েছে। সম্প্রতি কোলকাতায় BS6 এর নীচের নতুন গাড়ির রেজিস্ট্রেশন নিষিদ্ধ করা হয়েছে। BS6 ইঞ্জিন ব্যবহারের ফলে গাড়ির ধোঁয়া থেকে নির্গত NO2 পরিমাণ ৬০mg/km এবং Particulate Matter এর পরিমাণ ৪.৫mg/km এর কম হবে। কোলকাতায় বায়ু দূষণের অন্যতম আরেক কারণ হলো কোলকাতা এবং তার আশেপাশে অবস্থিত ৭০০০ কারখানা। এগুলোর অধিকাংশ বসতি এলাকায় অবস্থিত হওয়ায় মানুষের শরীর স্বাস্থ্য এর ওপর



সরাসরি প্রভাব ফেলে। উদাহরণ - হুগলি নদীর দুপাশে কারখানা, কসবা ইন্ডাস্ট্রিয়াল এস্টেট, ট্যাংরা ট্যানারি, কোলকাতা লেদার কমপ্লেক্স ইত্যাদি। কঠোর বিধিনিষেধ আরোপ করা যাতে দূষিত ধোঁয়া কম নির্গত হয়, জনবসতিপূর্ণ অঞ্চলে কারখানা স্থাপন না করা, বেআইনি কারখানা তুলে দেওয়া, গণ সচেতনতা ইত্যাদির মধ্যে দিয়ে কলকাতার বায়ু দূষণ কম করা যেতে পারে। জীবাশ্ম জ্বালানি থেকে বিদ্যুৎ উৎপাদন করা হলে সেটি বায়ু দূষণ ঘটায়। মূল কোলকাতায় কোনো বিদ্যুৎ উৎপাদন কেন্দ্র না থাকলেও কোলকাতার আশেপাশে ৩টি এরকম কেন্দ্র আছে - গার্ডেনরিচ, বজবজ, কোলাঘাট। এগুলো থেকে নির্গত দূষিত বাতাস শহর কলকাতার মানুষের স্বাস্থ্যের ওপর ক্ষতিকারক প্রভাব ফেলে।

কোলকাতার যা বিদ্যুতের চাহিদা তাতে এই বিদ্যুৎকেন্দ্রগুলো বন্ধ করা সম্ভব না কিন্তু অপ্রচলিত শক্তির ব্যবহারের মধ্যে দিয়ে এই বিদ্যুৎ উৎপাদন কম করা যেতে পারে। কোলকাতা কর্তৃক রেখার কাছে অবস্থিত হওয়ায় সারা বছর পর্যাপ্ত সূর্যের আলো পাওয়া যায় যা সৌরবিদ্যুৎ উৎপাদনের অনুকূল। যদিও বর্তমানে কোলকাতায় সৌরবিদ্যুতের ব্যবহার সীমিত। KMC নিজেদের উদ্যোগে কোলকাতার বড়ো বড়ো পার্কের আলো জ্বালাতে বিদ্যুতের পরিবর্তে সোলার প্যানেল ব্যবহার করছে। এরফলে KMC বার্ষিক বিদ্যুৎ খরচ ও অনেক কমে গেছে। উদাহরণস্বরূপ বলা যায় ৪০ লাখ টাকা দিয়ে ৫০টি সোলার লাইটপোস্ট লাগানোর ফলে দেশপ্রিয় পার্কের বার্ষিক মাসিক বিদ্যুতের খরচ ৮০% কমে গেছে এবং এরফলে ৩৬ হাজার টাকা সাশ্রয় হচ্ছে প্রতি মাসে। এছাড়া KMC ভবিষ্যতে বস্তি এলাকায় সোলার প্যানেল বসানোর পরিকল্পনা করছে।

আমরা সবাই জানি কোনো এলাকায় যতো বেশি গাছপালা থাকে সেই এলাকায় বায়ু দূষণ ততো কম হয়। কোনো জায়গায় কমপক্ষে ৩৩% বনভূমি থাকা উচিত। সেইদিক থেকে দেখতে গেলে কোলকাতা খুব একটা ভালো জায়গায় নেই। একসময় ভারতের সমস্ত শহরের মধ্যে বনভূমির দিক থেকে কোলকাতা দ্বিতীয় স্থানে ছিল। কিন্তু কলকাতায় বনভূমির পরিমাণ গত ১০ বছরে ৩০% হ্রাস পেয়েছে। কোলকাতার আয়তন ১৮৬.৫০ বর্গকিমি। ২০১১ সালে কলকাতায় বনভূমির পরিমাণ ছিল ২.৫০ বর্গকিমি - মোট আয়তনের মাত্র ১.৩৪%। ২০২১ সালে সেই বনভূমির পরিমাণ কমে দাড়িয়েছে মাত্র ১.৮০ বর্গকিমি - কোলকাতার মোট আয়তনের ১% এর ও কম। পরিকল্পনামূলক residential



complex, shopping mall, entertainment zone, flyover নির্মাণ এর প্রধান কারণ। কোলকাতার ফুসফুস ময়দানের অবস্থা দিন দিন খারাপের দিকে যাচ্ছে। পাশাপাশি রবীন্দ্র সরোবর, সুভাষ সরোবর এবং সল্টলেক সেন্ট্রাল পার্ক - কোলকাতার



তিনটি প্রধান Urban park এর সবুজের পরিমাণ ক্রমে কমে আসছে। বায়ু দূষণ নিয়ন্ত্রণ করতে চাইলে বড়ো বড়ো গাছপালা লাগানো এবং সেগুলোর পরিচর্যা করা ছাড়া আর কোনো বিকল্প নেই।

কলকাতায় বায়ু দূষণ এর আরো অন্যতম দুটো ছোটো কিন্তু গুরুত্বপূর্ণ কারণ হলো যেখানে সেখানে আবর্জনা ফেলা এবং পড়ানো ও কাঠ কয়লার উননের ব্যবহার। পূর্ব ভারতের বৃহত্তম শহর কোলকাতার সমস্ত আবর্জনা দীর্ঘদিন ধরে ধাপায় ফেলা হচ্ছে। কোলকাতায় প্রতিদিন ৪০০০ টন কঠিন বর্জ্য উৎপাদিত হয়। যেটা ধাপায় রোজ জমা হতে হতে পাহাড়ের আকার ধারণ করেছে। এই বর্জ্য থেকে বিষাক্ত গ্যাস যেমন মিথেন বেরোয় যেটা মানুষের স্বাস্থ্য এর পক্ষে ক্ষতিকর। KMC বর্তমানে ধাপায় solid waste management এর মাধ্যমে আবর্জনা থেকে biogas উৎপাদনের চেষ্টা করছে কিন্তু তা প্রয়োজনের তুলনায় অনেকটা কম। পাশাপাশি দীর্ঘদিন ধরে এই আবর্জনা পুনর্ব্যবহার করে বিভিন্ন জিনিস তৈরি করা হচ্ছে, চাষের উপযোগী সার বানানো হচ্ছে। শুনতে অবাক লাগলেও কোলকাতার মতো শহরে কয়লার উনন বায়ু দূষণের অন্যতম কারণ। এখন ও কোলকাতার কিছু বাড়িতে রান্নার কাজে কাঠ কয়লা ব্যবহার করা হলেও প্রধানত রাস্তার ওপর ইঞ্জির দোকান, ছোটখাটো খাবার স্টল এবং বড়ো বড়ো রেস্টুরেন্টে রান্নার কাজে কাঠ কয়লার ব্যবহার এই ক্ষেত্রে দূষণে প্রধান ভূমিকা গ্রহণ করে। NEERI এর সমীক্ষা অনুযায়ী কোলকাতায় PM 2.5 এর অন্যতম প্রধান উৎস - ৩০% হলো এই কাঠ কয়লা পড়ানো। FAO এর রিপোর্ট অনুযায়ী কোলকাতায় মোট ৩০ হাজার ভেড়র আছে যারা কয়লা ব্যবহার করে। যা নিয়ে KMC বা পশ্চিমবঙ্গ সরকার এখনও কোনো পদক্ষেপ নেয়নি।

প্রথমেই উল্লেখ করেছিলাম যে কোলকাতায় PM 2.5 এর অন্যতম প্রধান উৎস হলো রাস্তার ধুলো। এটির প্রতিকারের উপায় হিসেবে KMC আরো ২০টি water sprinklers গাড়ি অর্ডার করেছে যাতে রাস্তাঘাট জল ছিটিয়ে পরিষ্কার রাখা যায়।

পরিশেষে বলা যায় কোলকাতা বায়ু দূষণ নিয়ন্ত্রণে এতদিনেও কোনো শক্তিশালী পদক্ষেপ নিতে পারেনি। এর পাশাপাশি জনগণ সতর্ক না হলে শুধু সরকারের পক্ষে বায়ু দূষণ নিয়ন্ত্রণ করা সম্ভব না।

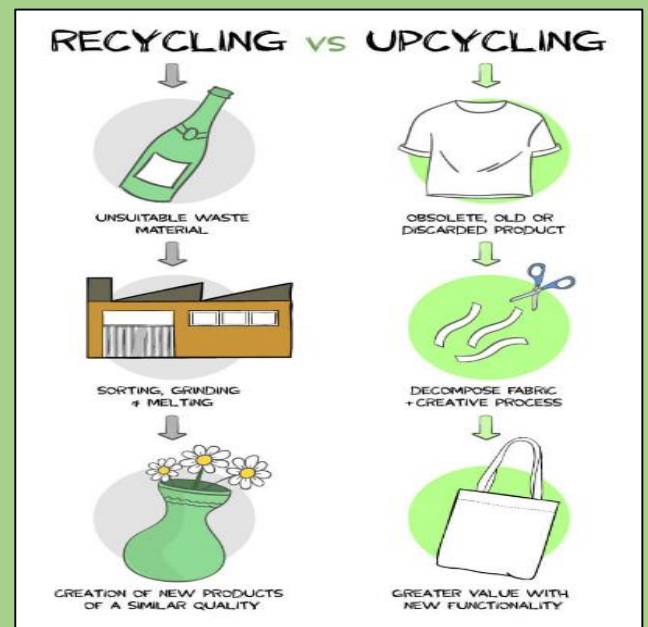


# From Trash to Treasure: Innovative Solutions for Waste Disposal Challenges

Anamika Sarkar

In today's world, waste disposal has become an increasingly critical challenge, threatening the health of our planet. However, amid this growing concern, innovative solutions are emerging to transform trash into treasure, paving the way for a more sustainable future. Let's explore some ground-breaking ideas that have the potential to revolutionize waste management.

- **Recycling:** One of the most promising approaches to tackling waste disposal challenges is through recycling. Recycling involves collecting, sorting, and processing discarded materials to produce new products. By diverting waste from landfills, recycling reduces the burden on the environment and conserves valuable resources. From plastic bottles to paper and electronics, recycling initiatives are gaining momentum worldwide, promoting environmental sustainability and raising awareness about responsible consumption.
- **Resource Recovery:** It is another key concept in waste management. Instead of considering waste as a problem to be disposed of, resource recovery views it as an opportunity. This approach focuses on extracting valuable materials from waste streams and reintroducing them into the production cycle. By doing this we can minimize waste, conserve resources, and reduce our reliance on virgin materials.
- **Circular Economy:** The idea of a circular economy underpins many innovative waste disposal solutions. In a circular economy, products and materials are designed to be reused, repaired, or recycled. This shift away from the linear "take-make-dispose" model promotes sustainable consumption patterns and reduces waste generation. Companies are increasingly adopting circular design principles, creating products that are durable, modular, and easy to disassemble, thereby facilitating resource recovery and minimizing waste.
- **Upcycling:** It is another exciting trend in waste management. Unlike recycling, which breaks down materials to create new ones, upcycling involves transforming waste materials into higher-value products without losing their original quality or functionality. From turning old tires into fashionable accessories to repurposing glass bottles into decorative items, upcycling not only reduces waste but also encourages creativity and innovation.
- **Waste to Energy Conversion:** Another innovative solution is waste-to-energy conversion technology, which converts waste into electricity, heat, or fuel. This technology can help to reduce the amount of waste sent to landfills, while also producing a valuable energy source. Some waste-to-energy technologies include incineration, gasification, and anaerobic digestion. In Sweden, for example, waste-to-energy facilities generate enough electricity to power over 250,000 homes.

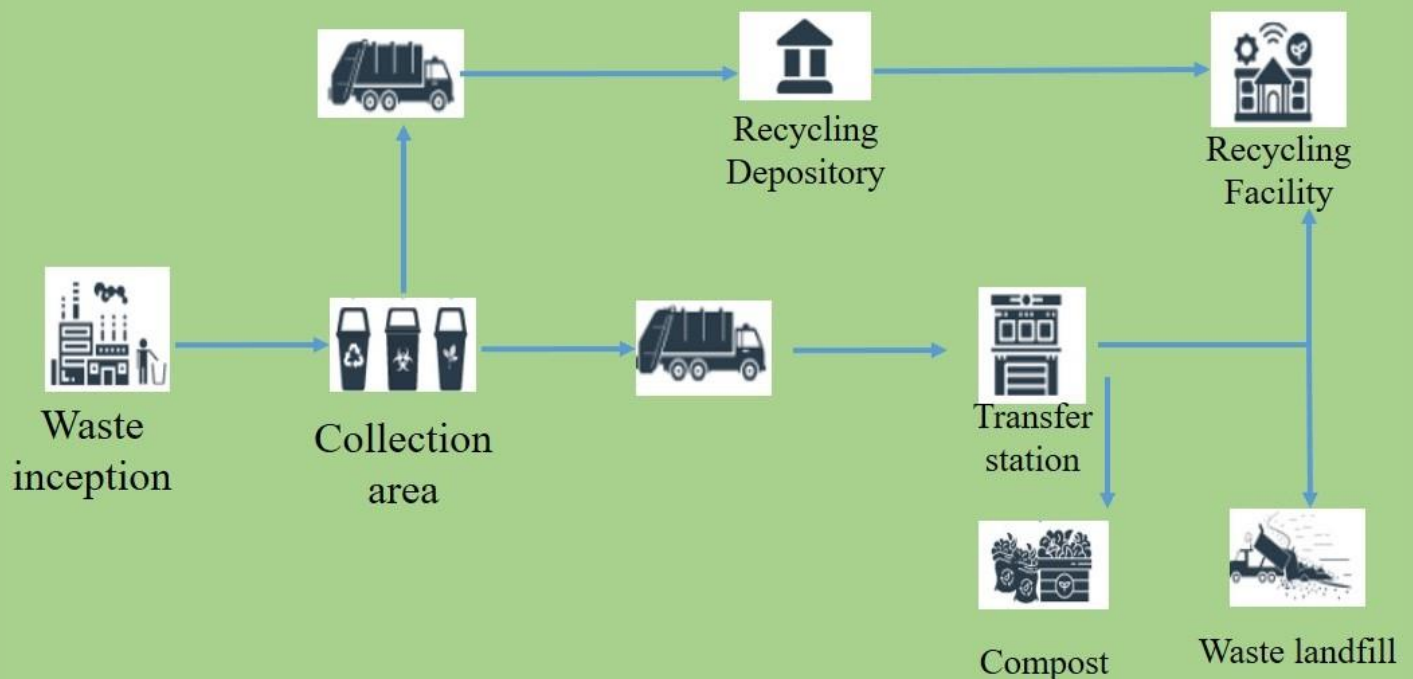




- **Composting:** It is a natural process of decomposing organic waste, and is gaining popularity as an effective waste disposal solution. By diverting food scraps, and yard waste from landfills, converting them into nutrient-rich compost, and soil amendment, we can enhance soil fertility, reduce greenhouse gas emissions, and minimize the need for chemical fertilizers. Composting can be practiced on a small scale in individual households or on a larger scale in community composting facilities, fostering a sense of environmental stewardship and community engagement.
- **Technological advancements:** It plays a pivotal role in revolutionizing waste management practices. Smart waste bins that optimize collection routes and artificial intelligence-powered sorting systems that automate recycling processes are examples of how technology is enabling more efficient and effective waste disposal methods. Sensor-based technologies can monitor waste levels, helping authorities optimize waste collection schedules and reduce unnecessary trips. Furthermore, block-chain technology is being explored to create transparent and traceable supply chains, promoting accountability and encouraging responsible waste management practices.

Addressing waste disposal challenges requires a multifaceted approach that combines individual actions, government policies, and technological innovations. Also, Education and awareness campaigns can help to promote sustainable waste management practices, while policies and regulations can encourage the adoption of innovative solutions. Embracing these solutions not only promotes environmental sustainability but also fosters a more conscientious and responsible society.

## Waste Management Life Cycle



# Replacement of Traditional Plastics

Anushka Saha

Replacing traditional plastics with eco-friendly materials is an important step towards reducing negative environmental impact and promoting sustainability. Traditional plastics are primarily made from polymers through the polymerization of fossil-fuel-based raw materials. Traditional plastics are composed of various materials such as polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), and polyethylene terephthalate (PET). The production, use, and disposal of these materials have a significant impact on the environment, including depletion of resources, emissions of greenhouse gases, harm to ecosystems, and environmental pollution. While it is challenging to eliminate traditional plastics, some alternatives and approaches can help reduce their usage and replace them with eco-friendly materials.

**Paper and Cardboard:** Paper and cardboard are widely recognized as eco-friendly alternatives to plastic. By using recycled paper and cardboard, we can reduce our reliance on plastic while promoting a circular economy. To produce it needs less energy compared to plastics. Recycling paper and cardboard can help create a closed-loop system where they are reused, minimizing the need for virgin materials.

**Glass:** Glass is a timeless material that has been used for centuries. It is 100% recyclable without any loss in quality, making it a sustainable choice. Glass containers, bottles, and jars are popular alternatives to plastic packaging, particularly for food and beverages. With its inert nature, glass ensures no leaching of harmful chemicals and provides a visually appealing and durable option for long-term use.

**Metal:** Metal, especially aluminium, and stainless steel, offers excellent durability and recyclability, making it an ideal replacement for plastic. Metal containers, bottles, and cans are commonly used for storing food, beverages, and personal care products. Not only can metals be recycled repeatedly without degradation, but the recycling process also requires less energy compared to producing new metal from raw materials.

**Biodegradable and Compostable Plastics:** Biodegradable and compostable plastics are designed to break down naturally through biological processes. These materials, derived from plant-based sources like corn starch or cellulose, offer an eco-friendly alternative for single-use applications. Biodegradable plastics degrade into harmless substances, while compostable plastics transform into nutrient-rich compost under specific conditions. Proper disposal and composting infrastructure are essential to realize the full potential of these materials.

**Natural Fibers and Bio-composites:** Natural fibers, such as hemp, flax, or sisal, can be used to create bio-composites as replacements for plastic. Bio-composites combine natural fibers with biodegradable polymers to create strong and lightweight materials. These materials find applications in sectors like automotive, construction, and consumer goods. By utilizing renewable and biodegradable resources, bio-composites offer a more sustainable alternative to conventional plastics.

**Bio-based Polymers:** Bio-based polymers are derived from renewable resources, such as corn, sugarcane, or algae. They possess similar properties to traditional plastics, making them suitable replacements in various applications. Bio-based polymers reduce the dependence on fossil fuels, lower carbon emissions, and promote a more sustainable supply chain. Such as bagasse, the fibrous residue that remains after sugarcane stalks are crushed to extract their juice.

**Edible Packaging:** Edible packaging made from materials like seaweed or proteins provides an innovative solution. These materials can be consumed or safely decomposed, reducing waste and minimizing environmental impact.

By embracing these alternatives, we can reduce plastic waste, conserve resources, and minimize the environmental impact associated with plastic production and disposal. However, the successful transition requires collaborative efforts from the community and governments to develop infrastructure, and promote awareness.



# Adverse Effects of Plastics on Soil and Crops

Bibhas Ghosh

Plastic has become an integral part of our daily lives due to its convenience and versatility. However, the extensive use and improper disposal of plastic have led to severe environmental consequences, including its detrimental effects on soil and crops. The persistence and non-biodegradability of plastic pose a significant threat to agricultural ecosystems, soil fertility, and ultimately, food security.

## Soil Contamination:

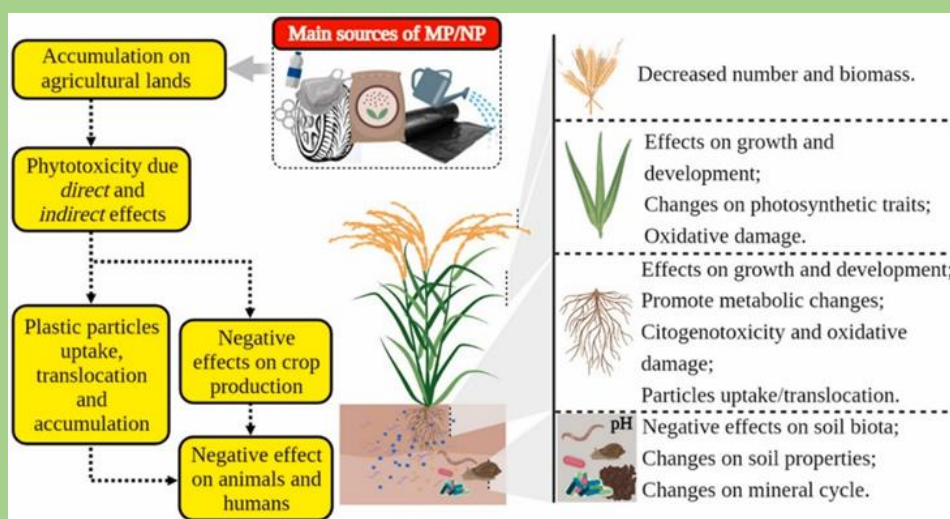
Plastic pollution contributes to soil contamination, primarily through the deposition of microplastics. Microplastics, small plastic particles less than 5mm in size, can accumulate in agricultural soils due to improper waste management, agricultural plastic residues, and the breakdown of larger plastic items. These particles are nearly indestructible and their presence in the soil disrupts natural processes, affecting the soil structure, nutrient cycling, and the soil's ability to support plant growth. Microplastics also act as carriers for toxic chemicals, such as pesticides and heavy metals, which further exacerbate soil contamination.

## Soil Degradation:

Plastic wastes have adverse effects on soil structure and composition, leading to soil degradation. The accumulation of plastics reduces the soil's porosity, inhibiting water infiltration and air circulation. Consequently, the soil becomes compacted, limiting root penetration and nutrient uptake by plants. Plastic debris also prevents the growth of beneficial soil microorganisms, which are crucial for nutrient cycling, organic matter decomposition, and maintaining soil fertility. As a result, soil degradation reduces crop productivity and overall agricultural sustainability.

## Chemical Leaching:

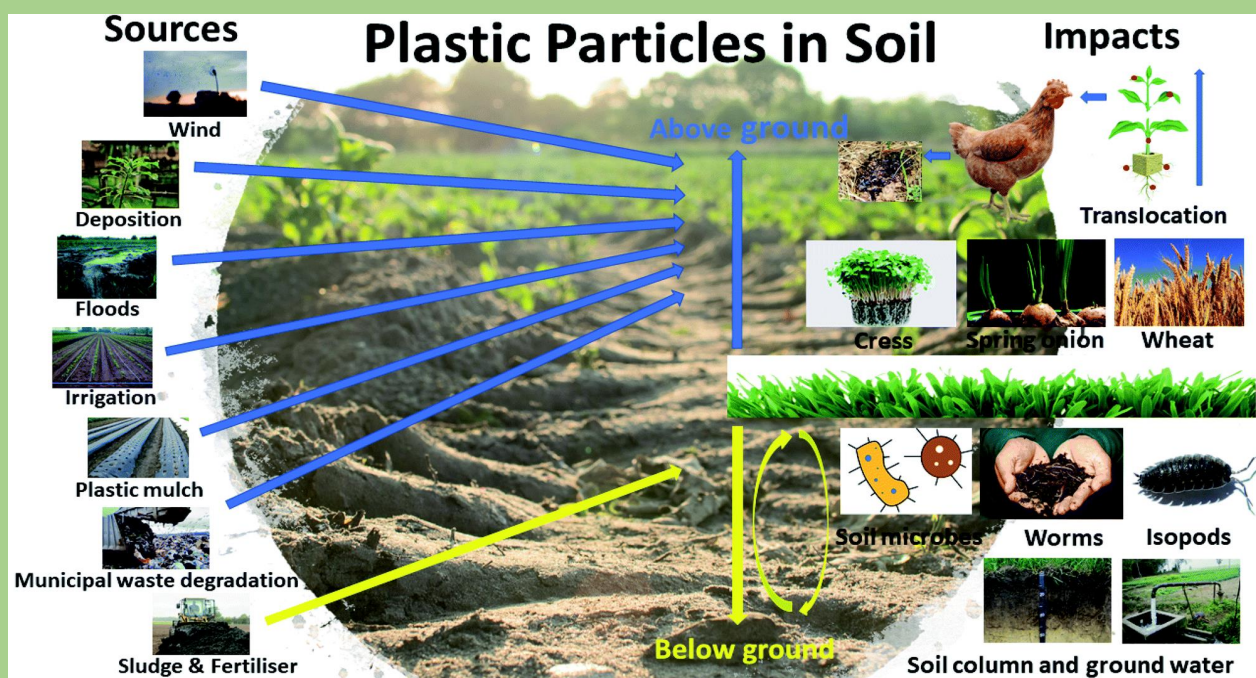
Plastic materials, particularly those used in agriculture, often contain additives and chemicals that can leach into the soil. Phthalates, bisphenol A (BPA), and other plasticizers are known to migrate from plastic waste and contaminate the surrounding soil. Plastic debris can act as a reservoir for persistent organic pollutants (POPs), which are toxic chemicals that resist degradation and persist in the environment for long periods. POPs, including polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), can adsorb onto the surface of plastic particles and enter the soil when plastics degrade. Once in the soil, these pollutants can accumulate, posing risks to soil-dwelling organisms, plants, and subsequent consumers in the food chain. Exposure to POPs has been associated with various health issues, including reproductive



disorders and carcinogenesis.

### Waterlogging and Drainage Issues:

Improperly discarded or abandoned plastic materials can impede water drainage and lead to waterlogging in agricultural fields. Plastic waste can accumulate in drainage systems, causing blockages and hindering the proper flow of water. Excessive water retention due to plastic barriers or debris can result in waterlogged conditions, depriving crops of oxygen and negatively affecting their root health. Waterlogged soils can lead to root rot, nutrient deficiencies, and increased vulnerability to diseases, ultimately impacting crop productivity.



### Crop Contamination:

Plastic pollution poses a direct threat to crop quality and productivity. Plastics, when left in the field or inadvertently incorporated into the soil, can contaminate crops during growth. Plastic residues can become entangled in plants, impeding their development and causing physical damage. Moreover, the absorption of toxic chemicals from plastic particles can result in the accumulation of harmful substances in plant tissues.

Plastic waste acts as a sink for heavy metals present in the environment, such as lead, cadmium, and mercury. When plastics degrade, these metals can be released into the soil, posing significant risks to both the environment and human health. Heavy metals accumulate in the soil over time, making it unfit for cultivation.

To mitigate these adverse impacts of plastics on soil and crops, it is essential to reduce plastic consumption, promote recycling and waste management practices, and develop sustainable alternatives. By addressing the harmful effects of plastic on soil and crops, we can safeguard the environment, preserve soil fertility, and ensure the sustainability of our agricultural systems for future generations.

# Plastic Pandemic: The Silent Threat to Human Health

Abhisek Kar

The global issue of plastic pollution has garnered significant attention in recent years. From disrupting ecosystems to contaminating food chains, the ubiquity of plastics in our environment poses a silent threat to human health. Though the COVID-19 pandemic has overshadowed the plastic pandemic, it is crucial to recognize the potential health risks associated with plastic exposure and implement sustainable solutions to mitigate this growing problem.

## ❖ The Ubiquity of Microplastics:

### Microplastics in the Environment

Microplastics, tiny plastic particles ranging from microscopic to 5 millimeters long, have become increasingly prevalent in our environment. These particles can originate from various sources, including the breakdown of larger plastic items, wear from synthetic rubber tires, and plastic fibers released when washing polyester or nylon clothes.

The term "microplastics" was coined in 2004 by Richard Thompson, a professor of marine biology at Plymouth University, who discovered the presence of these particles on beaches and within marine creatures. Since then, microplastics have been found in nearly every fish and aquatic animal tested, raising concerns about their potential impact on human health.

### Microplastics in the Human Body

In a groundbreaking study conducted by Austrian scientists Philipp Schwabl and Bettina Liebmann, microplastics were found in the stool samples of every participant, suggesting that more than half of the world's population might have plastic passing through their bodies. This alarming discovery has triggered a wave of concern and further research into the potential risks of ingesting microplastics.

While the health effects of ingesting microplastics remain uncertain, the presence of these particles within our bodies raises red flags. As plastics are known to contain harmful chemicals and additives, it is crucial to investigate the potential risks associated with plastic exposure and implement measures to reduce our plastic footprint.

## ❖ Chemicals in Plastic: The Endocrine Disruptors:

### Bisphenols and Phthalates

Various chemicals found in plastics, such as Bisphenol A (BPA), other bisphenols, phthalates, and styrene, have been linked to serious health effects. These chemicals can seep from packaging into food and then into the human body, causing a range of health problems. BPA and phthalates are known as endocrine disruptors due to their ability to interfere with the hormone system. These chemicals can affect brain and organ development in children, and fertility, and even increase the risk of cardiovascular problems.

### The Effects of Endocrine Disruptors

Endocrine disruptors such as BPA and phthalates can have wide-ranging effects on human health. Bisphenols have been linked to reproductive issues, brain development problems, immune system disruption, obesity, and increased cancer risk, particularly for cancers influenced by the endocrine system,



such as mammary and prostate cancer. Prenatal exposure to phthalates has been associated with lower testosterone levels in male offspring, while styrene exposure has been linked to nervous system dysfunction, hearing loss, cancer, and more. Despite concerns about the health effects of these chemicals, many industries continue to use BPA and its structurally similar replacements, such as Bisphenol S and Bisphenol F. As a result, products labeled as "BPA-free" may still pose health risks due to the presence of these alternative chemicals.

## ❖ Policy and Governance: The Key to Mitigating the Plastic Pandemic:

### International Treaties and Protocols

A cohesive, international approach to addressing plastic pollution is essential to effectively mitigate the plastic pandemic. While several cities and nations have implemented plastic bans or restrictions, these measures are often limited in scope and do not address the broader issue of plastic waste management. To tackle the plastic pandemic on a global scale, nations must collaborate and develop international treaties and protocols that focus on sustainable waste management practices, including upcycling technologies and the promotion of a circular economy.

### The 4R Principle: Removal, Responsibility, Reduction, and Revival

A comprehensive strategy to address the plastic pandemic involves the implementation of the 4R principle: removal, responsibility, reduction, and revival. This approach encompasses the need for technological advancements in plastic waste removal, government and industry responsibility in managing waste, global efforts to reduce plastic consumption, and the promotion of upcycling technologies to revive waste materials into valuable products. By adopting the 4R principle, humanity can progress toward a near-zero plastic world that prioritizes environmental health and sustainability.

The plastic pandemic poses a silent threat to human health and the environment, with microplastics and harmful chemicals found in plastics raising serious concerns about their potential health effects. As the world continues to grapple with the ongoing COVID-19 pandemic, it is crucial to address the plastic pandemic simultaneously, implementing sustainable solutions to manage and reduce plastic waste. By embracing upcycling technologies, policy changes, and a shift towards a circular economy, humanity can mitigate the global plastic footprint and pave the way for a sustainable and healthy future.





# Snow Leopard Conservation in the Face of Climate Change and Biodiversity Loss in India

Diya Roy

## Linnaeus's Hierarchy of Snow Leopard

**Kingdom**– Animalia

**Phylum** – Chordata

**Class** – Mammalia

**Order** – Carnivora

**Family** – Felidae

**Genus**– Panthera

**Species** – *unica*

(According to J.Z. Young)

The scientific name of the Snow leopard – ***Panthera unica***. The snow leopard is a species of big cat that belongs to the Panthera genus and family of Felidae. The Himalayan ranges of Central and South Asia are the species' natural habitat. The IUCN Red List classifies it as vulnerable species. According to The World Wildlife Federation (WWF), India estimates that there are only 450–500 snow leopards present in India. The western Himalayan nations of Uttarakhand, Himachal Pradesh, Ladakh, Sikkim, and Arunachal Pradesh are home to this animal, and it is also known as the "Grey Ghost." The snow leopard is the state animal of Himachal Pradesh.

Snow leopards are adapted to live in harsh and rugged environments of mountainous regions, usually at elevations of 3000-4500m.



**Picture:** Snow leopard or common name "ounce"



**Picture:** Snow leopards in their natural habitat

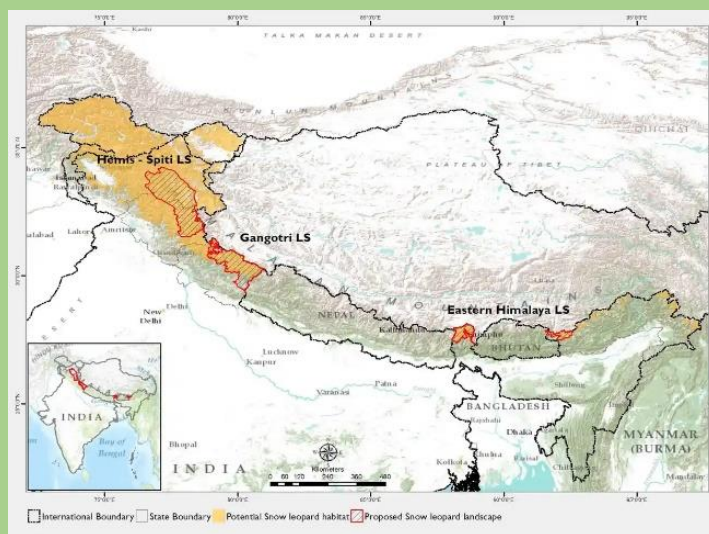
Where they prey on animals like ibex, Himalayan tahr, marmot, pika, hares, and small rodents. The snow leopard preferred rough, broken terrain like cliffs, rocky outcrops, and ravines. They can move through and stay adaptable in their rocky, steep terrain because of their small forelimbs and long hind legs.

The habitats of snow leopards are undergoing severe changes due to climate change with temperatures rising faster at higher altitudes than at lower elevations. Climate change has also led to an increase in extreme weather events such as heavy rainfall,

landslides, and floods which can cause significant damage to snow leopard habitat and prey. Habitat loss including deforestation, mining, road construction, and human settlements in high-altitude regions is a significant factor contributing to the vulnerability of snow leopards in India. Retaliatory killings by local communities, resulting inhuman-animal conflict, further endanger the snow leopard population.

In India, poaching is a danger to snow leopards. Targeted for their beautiful fur and other body parts that are extremely valuable in the illegal wildlife trade. Their skin, bones, and other body parts are valued highly on the black market and utilized in traditional Asian medicine. Despite national and international regulations against poaching, the demand for snow leopard products continues to drive illegal hunting.

To assess the vulnerability of snow leopard habitats to climate change and biodiversity loss in India, several initiatives have been taken. The Indian government has implemented Project snow leopard the government of India's flagship program launched in 2009 by the Ministry of Environment, Forests and Climate Change, which aims to conserve the snow leopard and its habitat.



**Picture:** Map showing snow leopard habitat and proposed landscapes for conservation

Under this project, several protected areas have been established to safeguard the snow leopard's habitat, such as the Hemis National Park (Himachal Pradesh), the Nanda Devi Biosphere Reserve, the Kibber Wildlife Sanctuary (Himachal Pradesh), and Ulley Valley (Ladakh). India is a significant host to around 10% of the global snow leopard population, distributed across five Himalayan states. However, their habitat only covers 5% of the available global range. India has implemented various conservation initiatives to safeguard the snow leopard and its habitat, including active participation in the Global Snow Leopard and Ecosystem Protection (GSLEP) Programme. The country has designated three large landscapes for conservation and introduced the Himal Sanrakshak community volunteer program.

The First National Protocol on Snow Leopard Population Assessment has facilitated population monitoring, while the SECURE Himalaya project, funded by the Global Environment Facility (GEF) and United Nations Development Programme (UNDP). Additionally, conservation breeding efforts are underway at the Padmaja Naidu Himalayan Zoological Park in Darjeeling, West Bengal.

Despite the aforementioned project programs, snow leopard conservation in India has faced challenges in terms of effectiveness. The habitats of snow leopards in India are increasingly threatened by climate change and biodiversity loss. Continuous monitoring is essential to address these dangers and conservation measures must be put together to mitigate those effects.

# Arsenic Contamination and Salinity in the Sundarbans

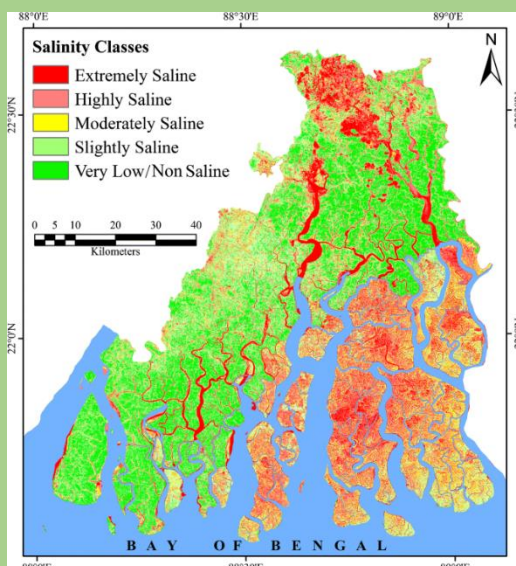
V Rohit Kumar

Sundarbans is the largest mangrove forest-covered delta formed at the confluence of the Ganga, Brahmaputra, and Meghna rivers. It's a disaster-prone region that is facing the brunt of climate change and various disasters from time to time. Here, people are dependent on agriculture and aquaculture activities for their livelihoods. The population in this region has often faced adversities such as depletion of freshwater resources severely affecting the health of inhabitants in the Sundarbans. Due to the heavy siltation of the local river systems, freshwater resources from the local ravines have been salinized. At the same time, salinity levels also increased due to fluctuation in pre and post-monsoon rainfall, frequent cyclones, and capillary movement of salinized groundwater have severely hampered the availability of safe drinking water. Salinization of surface water bodies forced the population to depend upon the utilization of groundwater. The aquifers of the region retain toxic levels of arsenic which are lifted for various needs such as drinking purposes and irrigation of the agricultural fields. Ultimately, it enters the human body, and bioaccumulation of arsenic takes place. The compound effect of consuming arsenic-contaminated drinking water and food has resulted in severe health issues among the local population in the delta. During and post disasters, people greatly suffer due to an acute crisis of safe drinking water and the degradation of health.

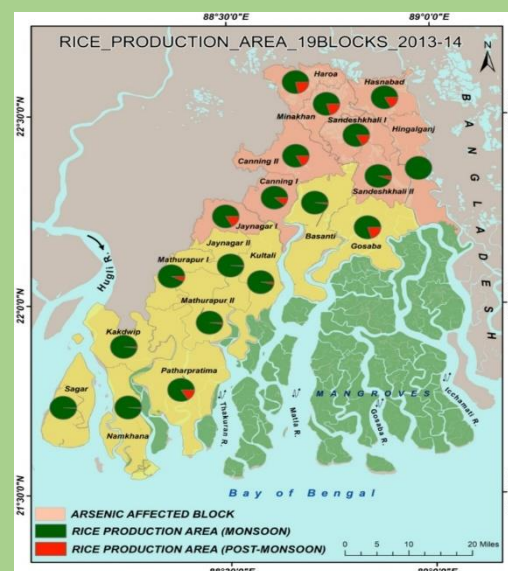
“In the early to mid-2010s, 1.9 billion people, or 27% of the global population, lived in potentially severely water-scarce areas. In 2050, this number will increase to 2.7 to 3.2 billion people”. (United Nations, 2020)

## Solutions to the water crisis are as follows –

- **Rainwater harvesting:** Saving precious rainwater by various techniques will curtail the adverse impacts of the prevailing water crisis and pave a path toward a sustainable solution. It can be used for various domestic purposes.
- **Groundwater recharge:** Recharging the aquifers which contain contamination-free and standard quality water will also be proven as a sustainable solution to the water crisis at the local level and help in maintaining the water table.



**Picture:** Map depicting classified saline areas in Sundarbans



**Picture:** Map depicting arsenic-affected areas in Sundarbans



# Plastic Pollution: A Threat to the Himalayas

Sayani Ghosh

Plastic pollution is a global environmental issue that affects various ecosystems, including the Himalayas. While the Himalayas are known for their stunning natural beauty and rich biodiversity, they are not immune to the impacts of plastic pollution.

Recent research works showed microplastic deposition and accumulation in the Himalayan Mountains and adjoining ecosystems, rivers, and streams. Fine particles of microplastic originating from different anthropogenic sources can travel long distances, even altitudinally upwards through atmospheric transport can pollute remote locations of the Himalayas. Microplastic can be trapped in the snow of glaciers for a long time and can be released into freshwater rivers by snow melting. Microplastic pollution in Himalayan Rivers such as Ganga, Indus, Brahmaputra, Alakananda, and Kosi have been researched in both the upper and lower catchments.



**Sources of Plastic Pollution:** Plastic waste in the Himalayas primarily originates from tourism activities, trekking expeditions, and local settlements. Tourists and trekkers often bring plastic water bottles, food packaging, and other single-use items that end up as litter. Local communities also contribute to plastic pollution through improper waste management and disposal practices.

**Picture:** Nepal's Sagarmatha National Park, where Everest is located, each climber generates around 8kg of trash, most of which gets left on the mountain.  
Photo: GRID-Arendal/Jason Sheldrake

**Environmental Impact:** Plastic pollution has severe consequences for the fragile ecosystems of the Himalayas. Plastic waste, if not managed properly, can contaminate water bodies, degrade soil quality, and harm wildlife. The Himalayan region is home to numerous endangered species like the snow leopard and Himalayan musk deer, which can be affected by ingestion or entanglement in plastic debris.

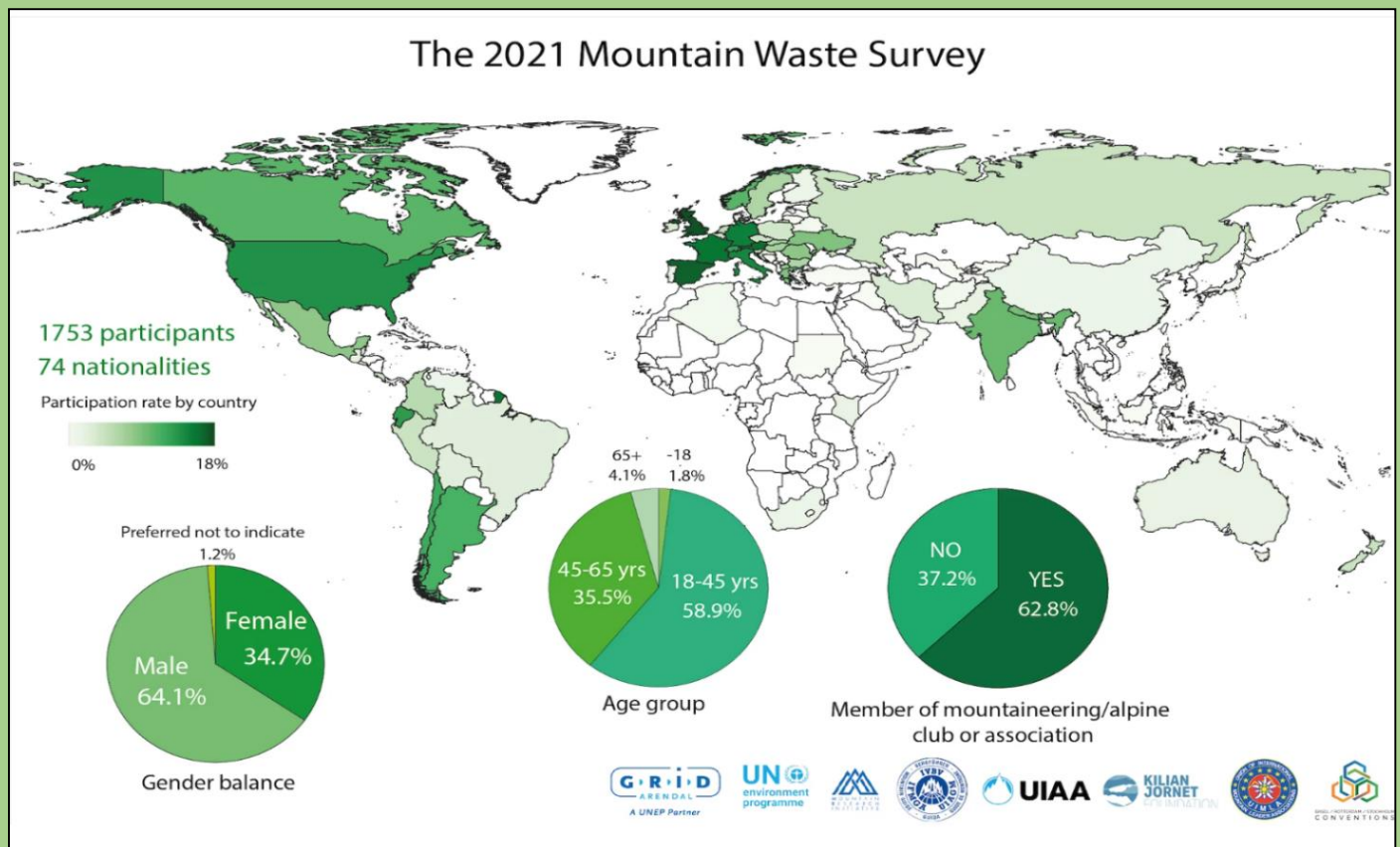
**Mountaineering Waste:** Mountaineering expeditions, particularly on popular peaks like Mount Everest, have been associated with significant amounts of waste, including plastic. Climbers use plastic equipment, food packaging, and oxygen cylinders, and due to logistical challenges, much of this waste is left behind on the mountains.

**Awareness and Initiatives:** Recognizing the problem, several organizations, local communities, and authorities have initiated efforts to combat plastic pollution in the Himalayas. These include awareness campaigns, waste management programs, and the promotion of eco-friendly practices among tourists, trekkers, and local communities.

**Waste Management Infrastructure:** One of the key challenges in addressing plastic pollution in the Himalayas is the lack of proper waste management infrastructure in remote areas. Implementing effective waste collection, segregation, and recycling systems, especially in high-altitude regions, is essential to mitigate plastic pollution.



**Policy Interventions:** Governments and non-governmental organizations have a role to play in implementing policies and regulations to reduce plastic pollution. This may involve promoting alternatives to single-use plastics, incentivizing recycling, and enforcing stricter waste management practices.



### PWorld Map of Plastic Pollution surveyed by 1753 participants from 74 nationalities by UNEP

As per a report published in Hindustan Times, a total of 15000 volunteers from 200 organizations, picked up about 4 lakh pieces of plastic waste in a two-hour operation on May 26, 2018, across 12 Himalayan states (Sikkim, Assam, Manipur, Meghalaya, Tripura, Mizoram, Nagaland, Arunachal Pradesh, West Bengal, Uttarakhand, Himachal Pradesh, Jammu, and Kashmir). More than 2.50 lakh (62.67%) waste items comprised wrappers of chips, candies, chewing gums, and tobacco products and they also collected 36389 PET bottles and 12869 cartons of juices, milk, and other drinks.

It is important for all stakeholders, including governments, local communities, tourists, and individuals, to take collective responsibility and work towards reducing plastic pollution in the Himalayas. By adopting sustainable practices, raising awareness, and implementing effective waste management strategies, we can help protect this unique and precious ecosystem from the impacts of plastic pollution.

# Unveiling Nexus of Human, Animal, Plant, and Soil Health:

## One Health Concept

Chetana Tunga

### The Interconnected Ecosystem

The health of humans, animals, plants, and soil are all interconnected and dependent on each other. By recognizing and respecting this nexus, we can work towards a sustainable future where all elements of the ecosystem thrive. Centre for Disease Control and Prevention (CDC) recognizes that the health of people, animals, and the environment are interconnected and that the well-being of one is dependent on the others. Therefore, environmental health is a critical component of the One Health approach.

The One Health approach emphasizes the importance of understanding and addressing the environmental factors that affect the health of humans and animals. This requires collaboration between public health, veterinary, and environmental professionals to identify and mitigate environmental health risks. By working together, we can promote a healthy environment that supports the health and well-being of all living beings. Their focus is on zoonotic disease.

Validating the nexus between human, plant, animal, and soil health requires a multidisciplinary and collaborative approach. Here are some steps that can be taken to validate this nexus:

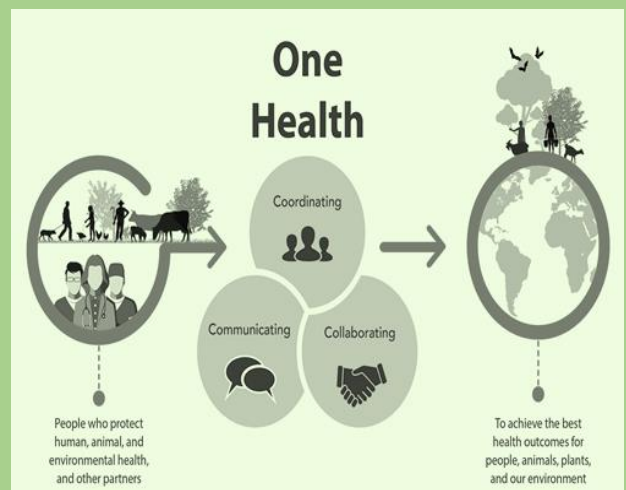
**Collect and analyse data:** To validate the nexus, we need to collect and analyse data from various sources, including human health records, animal health records, plant health records, and soil health monitoring data. This data should be analysed to identify any correlations between the health of these different systems.

**Use a One Health approach:** The One Health approach recognizes the interconnectedness of human, animal, and environmental health. By using a One Health approach, we can better understand the interactions between these different systems and validate the nexus between them.

**Collaborate with experts in different fields:** Validating the nexus between human, plant, animal, and soil health requires collaboration between experts in different fields, including public health, veterinary medicine, plant science, and soil science. Collaboration between these experts can lead to a better understanding of the links between these different systems.

**Communicate findings:** Once the nexus has been validated, it is important to communicate the findings to the public, policymakers, and other stakeholders. This can help raise awareness about the importance of environmental health and promote actions to protect and improve the health of humans, animals, plants, and soil.

**The success story of one health approach:** In the southwestern U.S. and Mexico, brown dog ticks can carry a germ that causes Rocky Mountain spotted fever in people and dogs. In Arizona, free-roaming dogs were spreading infected ticks. Many people got sick and some died from Rocky Mountain spotted fever. Public health and animal health officials used long-lasting tick collars on dogs, regular pesticide applications around homes, community education, and provided free spay and neuter clinics for dogs. Public health and animal health officials used long-lasting tick collars on dogs, regular pesticide applications around homes, community education, and provided free spay and neuter clinics for dogs.



# Environmental Research on Paleoecology

Pinanki Das

Paleoecology is the study of past ecosystems and their interactions with the environment. It plays an important role in environmental research by providing a historical perspective on how ecosystems have changed over time, and how they may respond to future environmental changes.

## Paleoecology as a valuable tool in environmental research:

- **Understanding long-term environmental changes:** By studying sediment cores, tree rings, fossils, and other sources of ancient environmental data, paleo-ecologists can reconstruct past climates, vegetation patterns, and other environmental variables. This information can help us understand how the environment has changed over the thousands or even millions of years, and how these changes have affected ecosystems.
- **Evaluating ecosystem resilience:** Paleoecology can help us understand how ecosystems have responded to past environmental changes, such as climate shifts, volcanic eruptions, or human impacts. By studying the responses of ecosystems to these events, researchers can evaluate their resilience and predict how they might respond to future environmental changes.
- **Informing conservation efforts:** Paleoecology can provide valuable information for conservation efforts by revealing how ecosystems have changed over time and which species have been most affected. By understanding how ecosystems have responded to past environmental changes, researchers can identify areas of high conservation value and develop strategies to protect them.
- **Testing ecological theories:** By comparing past and present ecosystems, paleo-ecologists can test ecological theories and hypotheses. For example, they can study how changes in temperature or precipitation have affected plant and animal communities, or how human activities have influenced the distribution and abundance of species.



## The emerging field of research:

1. **Paleoecological reconstructions of human impacts:** This field involves using paleoecological data to understand the history of human impacts on the environment, such as deforestation, agriculture, and urbanization. Researchers are using pollen records, charcoal analysis, and other techniques to reconstruct the history of human land use and its impact on ecosystems.
2. **Paleogenomics:** This field involves using DNA sequencing to reconstruct past ecosystems and understand how species have evolved. Researchers are using ancient DNA from fossils, sediments, and other sources to study the genetic diversity and evolutionary history of plants and animals.
3. **Paleoclimatology:** This field involves using paleoecological data to reconstruct past climate patterns, such as temperature, precipitation, and atmospheric carbon dioxide levels. Researchers are



using techniques such as stable isotope analysis and dendrochronology to reconstruct past climate patterns and understand how they have influenced ecosystems.

- 4. Paleoceanography:** This field involves using paleoecological data to reconstruct past oceanic conditions, such as temperature, salinity, and nutrient availability. Researchers are using techniques such as foraminifera analysis and sediment core studies to reconstruct past oceanic conditions and understand how they have influenced marine ecosystems.
- 5. Paleobiogeography:** This field involves using paleoecological data to understand how species have migrated and evolved. Researchers are using fossil records and molecular data to reconstruct past biogeographic patterns and understand how they have influenced modern biodiversity.

Overall, these emerging fields within paleoecology are helping us to better understand the complex interactions between the environment, climate, and ecosystems over time, and to inform conservation and management efforts for the future.

### Recent Discovery:

A recent study published in the journal *Science Advances* in 2021 used ancient DNA to reconstruct the history of bison populations in North America. The researchers collected DNA from bison fossils and compared it to modern bison DNA to trace the evolution and migration of bison populations over the past 10,000 years. The study found that bison populations were highly mobile, and they responded to changing climate conditions by migrating across the continent. The researchers also found evidence of anthropogenic impacts on bison populations, including the introduction of new genetic lineages and a decline in genetic diversity.



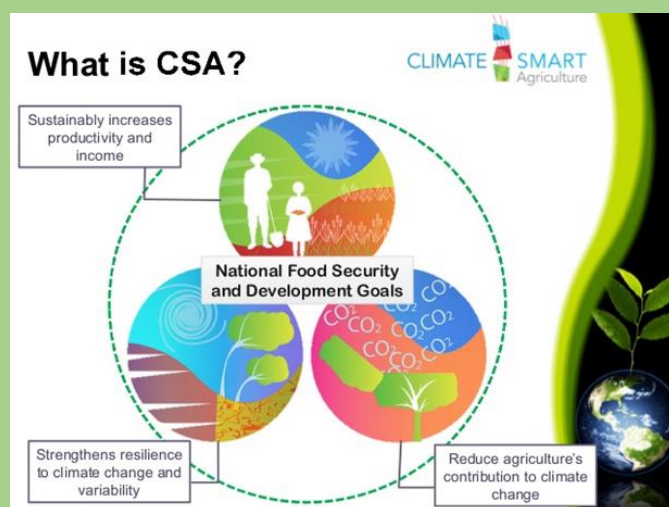


# Beating the Climate: Building the Resilient Agriculture

Pritthish Rauth

Agriculture is one of the most climate-sensitive sectors, with farmers facing numerous challenges, i.e., unpredictable weather patterns, droughts, floods, and soil degradation which are exacerbated by the increasing frequency and intensity of extreme weather events related with climate change. Therefore, building the resilience in agriculture is crucial nowadays to ensure food security and sustainability. One of the key strategies for building the resilience in agriculture is the promotion of Climate-Smart Agriculture (CSA). This concept was proposed by the Food and Agriculture Organisation of the United Nations (FAO) in 2010. The CSA aims to increase agricultural productivity, adapt to climate change, and mitigate greenhouse gas emissions and involves the use of climate-resilient crop varieties, efficient water management techniques, sustainable soil management practices, and agroforestry.

The development of climate-resilient crop varieties is cumbersome, as different crops/varieties respond differently to the changing climatic including precipitation and temperature variabilities, heat stress, droughts, and floods. Farmers can also adopt intercropping, crop rotation, and crop diversification to increase the resilience of their farms. These practices not only mitigate the risks which are associated with climate change but also improve soil fertility, pest and disease management, and overall farm productivity. Efficient water management is another critical aspect of resilient/climate-smart agriculture. Effective irrigation practices, rain water harvesting, mulching, and conservation tillage practices to conserve soil moisture and reduce water loss through evaporation should reduce in-season risks in crop production related to climatic variabilities and help improving resilience of agricultural farms.



Sustainable soil management practices are also essential in building the resilience of agriculture. Soil degradation (sodicity, salinity, etc.) is a significant constraint to crop production, globally and is predicted to be worsen with climate change. Farmers can adopt certain agronomic practices, such as conservation tillage, crop residue management, and integrated soil fertility management by using organic fertilizer in a balanced manner to improve soil health and productivity. Agroforestry is an integrated land-use system that combines trees with crops and/or livestock production. Agroforestry practices such as windbreaks, alley cropping, and silvi-pasture are effective in building the resilience in agriculture. Trees provide shade, reduce soil erosion, and improve soil fertility, while also offering multiple benefits such as timber, fodder, and fuel wood.

Building the resilience in agriculture also requires the adoption of climate-smart livestock production practices including improved animal nutrition, breeding for resilience, disease control, and better animal health management. Farmers can also use climate information and early warning systems to plan and manage their farms better. Climate forecasting helps farmers to take decisions on planting and harvesting schedules, crop selection, and water management.

In conclusion, building the resilience in agriculture is critical to ensuring food security and sustainability in the face of climate change. Additionally, the adoption of climate information and early warning systems and appropriate policies and institutional frameworks is essential. With the right investments and policies, agriculture can be transformed into a climate-resilient and sustainable sector that contributes to achieving the United Nations Sustainable Development Goals (SGD).

# Heatwaves are Destroying the Indian Economy

Jubaraj Roy

Can you imagine, sunlight can impoverish India? Yes, it's true. Nowadays India becomes the 5th largest economic country in the world. But one demon that eats away at our GDP every year is heat.

According to the **World Bank**, "**India is experiencing higher temperatures every year. By 2030 over 160-200 million people across the country could be exposed to lethal heat waves annually.**" Heat waves are declared when the temperature becomes 5°C higher than a particular limit. As per the **Indian Meteorological Department**, it is more than 40°C for the plane, for the hilly area it's more than 35°C and for the coastal region, it's more than 37°C. India had the record highest heat wave conditions in the year 2022, with 280 heat wave days recorded in 16 states.

In India, approximately 75% of people are associated with labor-related work, those 75% of people contribute almost 1/3 of our GDP. According to **McKinsey Global Institute**, the productivity of every people reduces by 5-10% the heat waves. This shows a large-scale impact on our economy. It is approximately 4.5% of India's GDP, which means 126 dollars every year. For education, the purpose is allocated 3% of the total GDP of India. It is much more than that.



Let's see how heat waves affect different sectors. Agriculture is an outdoor sector. It's very much affected by the heat waves situation. In the year 2022 wheat production in India reduce 6.36% due to heat waves. According to **Indian Labour Organization (ILO)** until 2023 productivity of the Indian agriculture sector will be reduced by 9% by the heat waves.

Pharmaceutical, India is the largest exporter country of generic drugs in the world. But 20% of medical equipment is wasted due to heat waves because they are temperature sensitive. 25% of vaccines are wasted due to heat waves. The total economic loss in the pharmaceutical sector is 313 million US dollars every year in India.

Construction is one of the topmost employer sectors in India. But in this sector, most of the workers worked outdoors in the heat. Due to the heat waves work efficiency of workers has become low and the project gets delayed. According to the **ILO**, the construction sector is also projected to experience 9% lower productivity by 2030

The electricity sector, for reducing indoor heat with increasing heat waves requires more amount of energy. This energy comes from electricity. By 2050, 50% of electricity will be required for cooling purposes, in AC, fridges, fans, and other electronic gadgets. One of the main sources of electricity in India is the burning of coal, which generates high amounts of greenhouse gases

A common possible solution to heat waves is tree plantation. Indian government launched the Indian Cooling Action Plan in 2019 to reduce cooling demand by 20-25% by the year 2037-38.

# Plastic Zones Surrounding Railways

Kaberi Saha

## Use of plastic in our daily life:

In our daily life, the most commonly used plastic made-up material is Polythene Bags, which are used to carry household goods, groceries, etc. In addition, plastic is an essential raw material to build different items, such as water bottles, straws, etc., and is widely used in industries and domestic purposes. Undoubtedly, plastic is a useful material and associated with our day-to-day life and activities, however, it causes environmental degradation as it is nonrenewable. Although the plastics we use can be recycled, the amount of solid waste generated by plastic is a problem. Most of the plastic substances end up on landfill sites where it takes around 300 years to photodegrade. It breaks down into tiny toxic particles that contaminate the soil and water. Eventually, it adversely affects the land and marine ecosystems.



## Dumping of plastic wastes near railway tracks:

Plastic packaging is extensively used in Railways catering services, resulting in a significant quantity of plastic waste. The quantity of plastic waste generated per day at a major railway station in India is approximately 3500-4000 kg. Out of these total quantities, the value-added plastics (water and soft drink bottles) are about 20%. The per capita plastic waste generation is approximately 7.5 - 9.0 gm. The plastic wastes generated from sources like unauthorized vendors, passengers, and passing trains are improbable to quantify as all these factors are variable. However, the quantities generated from these sources are reflected in the total plastic waste generated from the collection yard. Given the problems posed due to the littering of plastic waste on railway stations and along the tracks due to the lack of proper facilities/systems, there is an urgent need for increased public awareness as people are responsible for the pollution caused by plastics. Keeping this in mind, a few recommendations have been made by the Indian government, which may assist in formulating future policies for plastic waste management. Furthermore, it is of utmost importance to upgrade the technology for plastic waste disposal. The virgin plastic products shall be labelled with the plastic identification code to help in sorting and segregating as per ISO 14535: 1998.





## Can we act as responsible citizens to make our environment sustainable?

Plastic waste management shall not be the sole responsibility of local government and developers, rather, it requires the involvement of all concerned stakeholders. Some key recommendations to be made that may help in formulating policy making, planning, and management of plastic waste at railway stations across the country. Those are:

- The entry of rag-pickers at railway stations shall be restricted.
- The plastic waste collection, segregation, and disposal shall be closely monitored by the competent authorities and should be done daily.
- A separate dustbin system should be adopted for biodegradable and nonbiodegradable waste.
- The plastic recycling industry is needed to upgrade the technology for better products.
- Massive public awareness programs with the help of NGOs shall help in war footing against littering, segregation, and disposal of plastic wastes near the railway track.
- There is a need to use biodegradable plastic bags in place of plastic bags. Thus, the use of plastic products can be reduced.
- An independent Waste Management Cell may look after the solid and plastic waste management on railway tracks.
- Currently, in 2019, the 'Indian Railways Catering and Tourism Development Corporation (IRCTC)' has implemented the practice of returning plastic drinking bottles, and all the vendors at railway stations have been asked to avoid plastic bags, as much as possible. The employees of railways are asked to spread awareness of reducing the use of plastic substances and using eco-friendly, biodegradable materials while serving meals and/or drinks. Moreover, the public should be aware of this and act as responsible travelers to make India a '**Plastic free Nation**'.



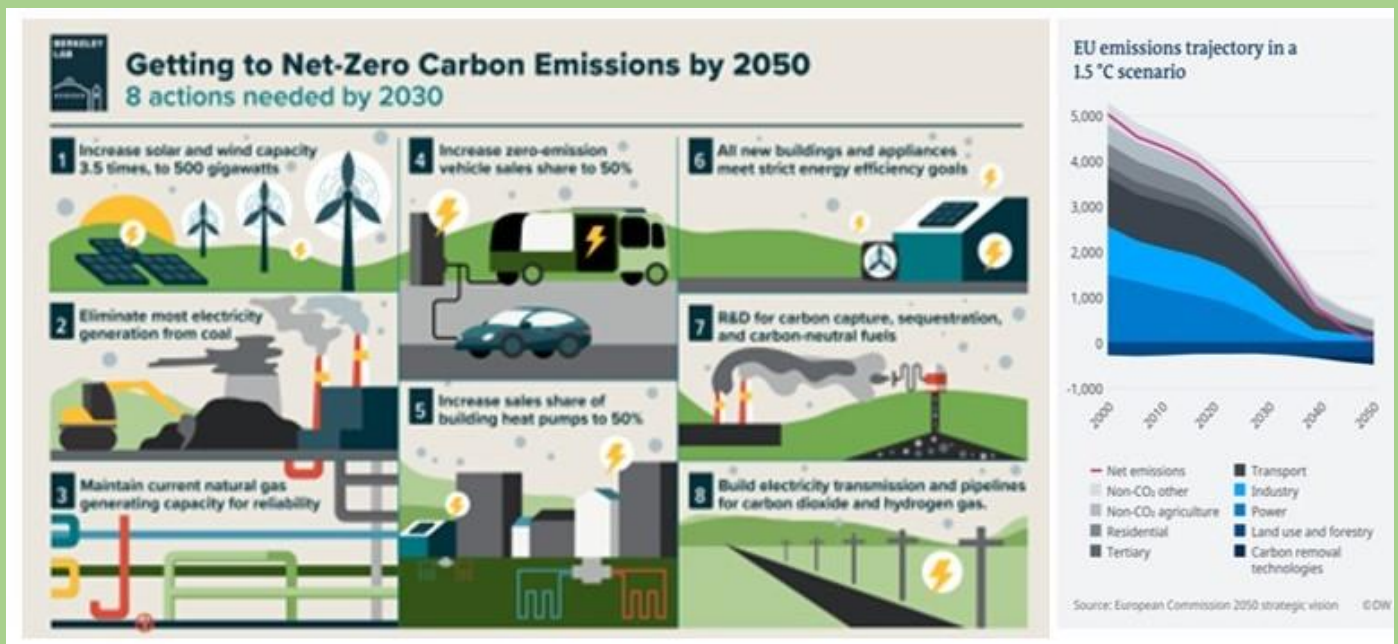
# Net Zero Emission

Kasturi Datta

Net zero, which is also referred to as carbon neutrality does not mean that a country would bring down its emission to zero. Rather, net-zero is a state in which a country's emissions are compensated by the absorption and removal of greenhouse gases from the atmosphere.

Net Zero means the amount of carbon being emitted (from industries, automobiles, etc.) is equals to the amount of carbon being sequestered (absorbed) by nature (like forest, wasteland). In simple terms, net zero means that greenhouse gas emissions pumped into the atmosphere by humans need to be balanced by the creation of new carbon sinks to absorb an equivalent amount.

Scientists reported that global emissions need to roughly halve by 2030 and reach net zero by 2050. Most nations have agreed to the 2050 deadline. China aims to achieve the goal by 2060.



Absorption of the emission can be increased by creating more carbon sinks such as forests. While the removal of gases from the atmosphere requires futuristic technologies such as carbon capture and storage. Likewise, it is even possible for a country to have a negative emission, if the absorption and removal exceed the actual emission. A good example is Bhutan, which is often described as carbon-negative because it absorbs more than it emits.

Global carbon neutrality by 2050 is the only way to achieve the Paris Agreement target of keeping the planet's temperature rise per annum below 2 degrees Celsius. This campaign has been ongoing for two years. Current policies and actions being taken to reduce emissions would not even be able to prevent 3-4 degrees centigrade rise by the turn of the century. The goal of carbon neutrality is only the latest formulation of

discussion going on for decades, on having a long-term goal. Long term targets ensure predictability and continuity in the policies and actions of the countries. But there has never been a consensus on what this goal should be.

Earlier, the discussion used to be on emission reduction targets, for 2050 or 2070 for rich and developed countries, whose unregulated emissions over several decades are mainly responsible for global warming and consequent climate change. Theoretically a country can become carbon neutral at its current level of emission or even by increasing its emission if it can absorb or remove more.

From the perspective of the 1<sup>st</sup> world countries, it is a big relief because now the burden is shared, by everyone and does not fall only on them. Canada, South Korea, Japan, and Germany have expressed their intention to commit themselves to a net zero future. Even China has promised to go net zero by 2060.

India's per capita CO<sub>2</sub> emissions at 1.8 tonnes per person in 2015 are around a ninth of those in the USA and around a third of the global average of 4.8 tonnes per person. India is the third largest emitter of CO<sub>2</sub> behind China and the USA. Therefore, there is global pressure on India to commit to net zero emissions by 2050. On one hand, a few argue that India should pledge to reduce its "net" emissions to zero by 2050, backed by a climate law. This will make India "hypercompetitive" attract investment and create jobs.

Several studies have shown that India is the only G-20 country whose climate actions are compliant with the Paris Agreement goal of keeping global temperatures from rising beyond 2 degrees centigrade. PM Shri Narendra Modi sets five targets for India's net-zero emissions by 2070 as below:





# The Green Wall of India

## Anindya Haty

The Thar Desert is a vast and arid region that spans across India and Pakistan. It is the world's 18<sup>th</sup> largest desert and 9<sup>th</sup> largest subtropical desert. It is home to a wide range of unique plant and animal species that have adapted to the harsh desert environment. However, in recent years, the Thar Desert has been experiencing a significant expansion due to climate change, overgrazing, and deforestation. The expansion of the desert has had a severe impact on the local communities and the environment. To combat desertification, a green wall has been proposed in the Thar Desert. The project covers the states of Haryana, Rajasthan, Gujarat, and Delhi.

Green walls have been widely used in urban areas to improve air quality, reduce the heat island effect, and provide aesthetic benefits. However, the use of green walls in arid regions such as the Thar Desert has not been explored until recently. The proposed green wall in the Thar Desert aims to combat desertification by preventing soil erosion, improve soil fertility, and increase the water-holding capacity of the soil and helps mitigate the climate change impacts on the environment and the local communities by reducing the amount of carbon dioxide in the atmosphere and improving air quality. Additionally, this will provide habitat for a range of wildlife species that are currently under threat due to habitat loss. In that way, the green wall will provide numerous environmental and socio-economic benefits by preserving the unique ecosystem of the Thar Desert.

It aims to create a 1400 km long and 5 km wide green wall starting from Porbandar to Panipat. The green wall in the Thar Desert will be created using a variety of plant species that are native to the region. The plant species that are being considered for the green wall include *Acacia Senegal*, *Prosopis Cineraria*, and *Tecomella Undulata*. These plant species have been selected based on their ability to survive in arid conditions, their drought tolerance, and their ability to improve soil fertility. The green wall will be designed to provide a barrier against desertification and soil erosion.



The green wall will be established along the periphery of the Thar Desert, in areas that are experiencing the highest rates of desertification. The green wall will be constructed using a range of techniques, including hydroponics, drip irrigation, and rainwater harvesting. The green wall will be designed to be self-sustaining, with the use of renewable energy sources, such as solar panels and wind turbines.

The green wall will have numerous benefits for the environment and the local communities. The green wall will provide opportunities for eco-tourism, which will generate income for local communities. Additionally, the green wall will provide employment opportunities for local people, particularly in the areas of plant propagation and management.

The implementation of the green wall in the Thar Desert will require a collaborative effort between the government, non-governmental organizations, and local communities. The project will need to be designed to be sustainable and adapted to the local conditions. The involvement of local communities in the management of the green wall will be crucial for its long-term success.

In conclusion, the establishment of a green wall in the Thar Desert is a crucial step in combating desertification and mitigating the impact of climate change on the environment and the local communities. The idea of creating a green wall is a part of the agenda of the conference COP14 of the United Nations Convention to Combat Desertification (UNCCD). However, the success of the green wall will depend on the effective implementation of the project and the involvement of local communities in its management. With proper planning and management, the green wall has the potential to transform the Thar Desert into a sustainable and thriving ecosystem.

# Why West Bengal Did Not See Any Significant Environmental Movements

Arkadip Mondal

It's baffling to think that state of West Bengal that contributed immensely in the fields of education, culture, economy, sports and above all our struggle for freedom did not see any significant environmental movement. Well, there can be no swift and to-the-point answer to this puzzle because multitudes of factors have played here.

Let's talk about the 1970-80s, when major environmental movements sprouted in different areas of the country, West Bengal, in particular, went through a torrid time. For instance, the Bangladesh freedom movement forced a population boom in the state, and general people were going through usual hardships. Daily news of land-related disputes among various sections of the population was compounded by the unhealthy political atmosphere during that period that organizing a significant environmental movement would seem trifling in the face of the then circumstances. After Left government took control of Bengal, they rolled out support for a few environmental projects like *-nadi o paribeshunniyon samiti*, but were not enough, as most of the people were aloof to these developments happening in the outskirts of the state. Regarding forest resources, Govt maintained capital control on them and prevented the commercialization of forest in the initial years, but the tribal people living in forest areas were not satisfied with the land provided by the Govt and did not have enough resources to voice their opinions publicly. In short, the political climate in West Bengal has historically been dominated by a few powerful political parties, which did neither prioritize environmental issues nor encourage independent civil society movement to grow.

Though elites in towns like Calcutta cheered for environmental movements happening around the country, like the Chipko movement or the Narmada Bachao Andolan most in the suburbs and the villages were too weary of igniting interest in this topic. Issues like poverty, unemployment, and political unrest took precedence over environmental concerns. This probably made it difficult for environmental movements to gain traction, as people focused more on addressing immediate social and economic problems than on long term environmental concerns.

However despite this relative lack of concerns for environmental issues in West Bengal there have been occasional bouts of civil society activism that triggered judicial interventions and prompted legislative and administrative action. One of such examples is the demands for conservation of East Kolkata Wetlands that crystallized into a Public Interest Litigation before the High Court of Kolkata which ordered measures for the protection and conservation of the wetlands. This facilitated the passage of a law and creation of East Kolkata Wetlands Management Authority. Even though the problems of encroachment and conservation have not been resolved fully, a legal and institutional framework has been created for addressing the issues.

There are so many environmental issues of West Bengal, such as deteriorating air quality of the urban areas, urban heat island effect in Kolkata, solid waste management, worsening conditions of the river Ganga, erosion of river banks, arsenic contamination of water and alarming saline water ingress into agricultural lands and sub-soil in the Sunderbans. All these require strong, united, independent and sustained voice of the communities and civil society to force public debate and policy interventions by government.



## Plastic Pollution in Seas and Oceans

**Bhagyasree Chatterjee**

The seas and oceans of our planet have long been recognized as vast and untamed, teeming with life and brimming with mystery. However, beneath the shimmering surface, plastic pollution is a widespread problem affecting the marine environment. It threatens ocean health and the ecosystem, food safety and quality, coastal tourism, and contributes to climate change. The relentless influx of plastic waste into the ocean and sea waters has reached an alarming level, necessitated immediate action and raised awareness of this pressing issue.

Plastic, with its durability and versatility, has undoubtedly revolutionized industries and aspects of our daily lives. Nevertheless, the same qualities that make it desirable, also make it an environmental menace. At least 14 million tons of plastic end up in the ocean every year. Plastic debris is currently the most abundant type of litter in the ocean, making up 80% of all marine debris found from surface waters to deep-sea sediments. This unfathomable amount of plastic is causing irreversible damage to marine life and ecosystems.

Marine animals, from majestic whales to delicate sea turtles, are falling victim to our plastic addiction. They mistake plastic debris for food or become entangled in it, leading to fatal consequences. Plastic pollution has been identified as the cause of death for countless seabirds and marine mammals, often due to ingestion or suffocation. The stomachs of deceased animals are frequently found filled with plastic waste, a grim testament to the pervasive nature of this problem. Plastic pollution also adversely affects marine ecosystems, such as coral reefs, leading to coral bleaching and eventual death. The intricate cycle of life that depends on coral reefs suffers a catastrophic collapse when these vibrant habitats disappear, endangering countless species and jeopardizing the livelihoods of coastal communities that rely on them.

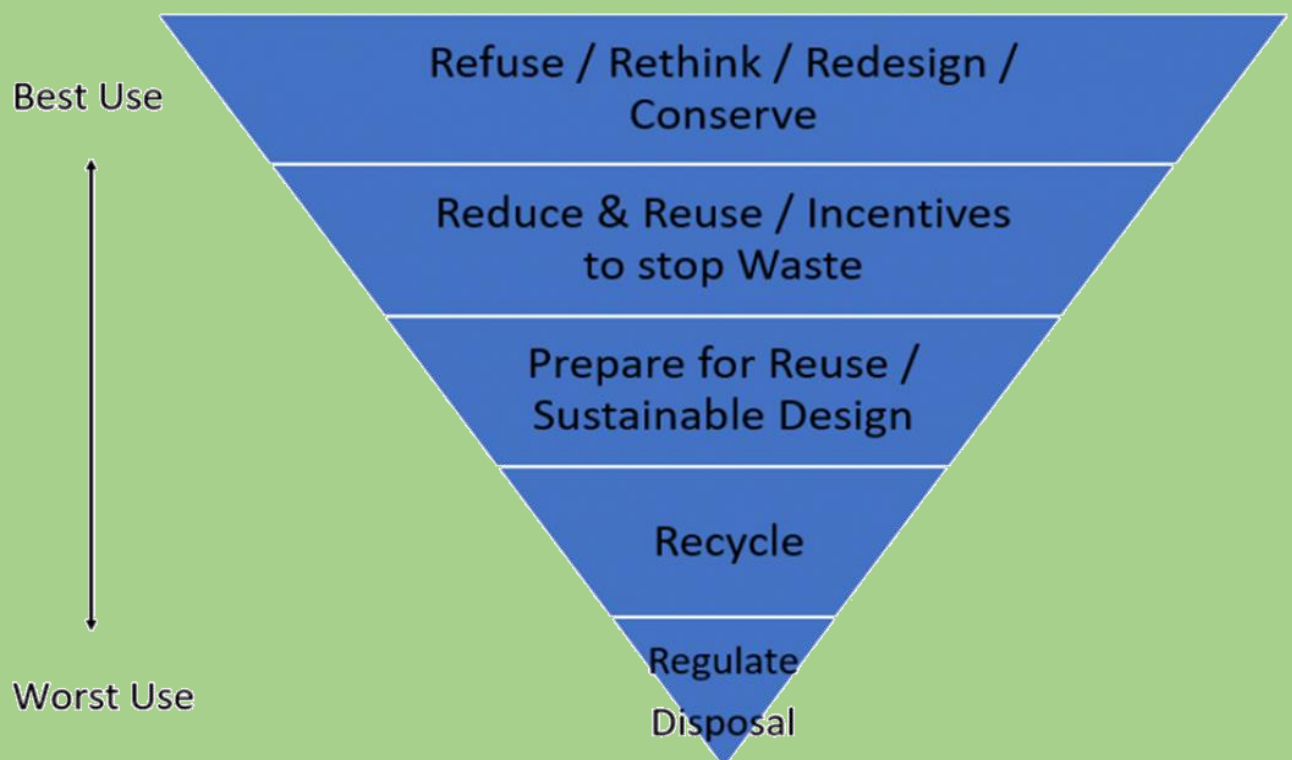


The impacts of plastic pollution extend beyond the visible casualties. Microplastics (fragments of plastic less than five millimetres) have infiltrated the marine food chain, posing a grave threat to both marine life and human health. As small marine organisms consume microplastics, they become concentrated in larger predators, ultimately making their way to our dinner plates. The long-term effects of ingesting these particles are still not fully understood, but research suggests potential adverse health consequences, including hormonal disruption and organ damage.

Addressing this issue requires a multifaceted approach. Interventions must be made at individual, local, national, and international levels. As individuals, we can reduce our plastic consumption by opting for reusable alternatives, recycling responsibly, and participating in beach clean-ups. Governments, non-governmental organizations (NGOs), and industries must prioritize sustainable alternatives to single-use plastics and implement strict waste management policies. International collaboration is crucial to address plastic pollution at its source, targeting the countries responsible for most of the plastic waste production and inadequate waste management practices. In addition, educational institutions should incorporate environmental awareness and plastic pollution programs into their curricula, nurturing a generation that understands the importance of protecting our marine environments and actively works towards sustainable solutions.

The challenges exist in protecting our marine environment from plastic pollution due to the lack of sanitary landfills, incineration facilities, recycling capacity and circular economy infrastructure, and proper management and disposal of waste systems. However, by taking necessary actions today, we can stem the tide of plastic pollution and restore the vitality of our seas and oceans for generations to come.

**“Let us join hands and strive for a cleaner, healthier planet, where plastic pollution becomes a distant memory rather than an enduring legacy”.**



The UN 2030 Agenda for Sustainable Development calls for action to ‘Conserve and sustainably use the oceans, seas and marine resources’.

# Climate, Salinity and Health: Triple Whammy of Sundarbans Women

**Nidrothita Modak**

*“The best thermometer to the progress of a nation is its women”*

- Swami Vivekananda

Sundarbans is a large mangrove forest delta located in the Bay of Bengal, extremely vulnerable to the adverse impacts of climate changes, devastating cyclones and storm surge. These events have caused intrusion of saline water into agricultural fields and into the sub-soil, simultaneously creating scarcity of pure drinking water and making the agriculture unviable in salty soil.

As their agriculture becomes unviable, most of the able bodied men of Sundarbans are forced to be climate refugees, migrating to various urban areas in search of employment, leaving behind the women, children and elders in the villages. This is having very adverse consequences on the conditions of women in the Sundarbans.

First, burden of work on women has increased many fold as they have not only to look after the children and the elders, they have also to earn their livelihood as remittances sent by the men folk are not regular and always uncertain. The women mostly meet their day-to-day expenses by catching and selling crabs, fishes. The women are exposed to the saline water daily as they remain in waist deep water for 4-6 hours per day for catching fishes.



Second, various recent studies and surveys have demonstrated that incidences of irregular menstrual cycle, recurring urinary tract infection and miscarriages have increased in recent years and are common problem amongst most of the women of Sundarbans village due to repeated infection from saline water.

Third, ponds and tube wells are still the primary source of water for daily use and most of such areas are also contaminated by saline water and these cause water borne diseases. Many of the women also suffer from back pain and spondylitis as they bring drinking water from far away of their villages. Beside many women are suffering from skin eczema and infected sores due to saline water.

These problems of Sundarbans women are increasing day by day leading to silent deaths of women in door. We can try to solve their problems through some steps like-

- Desalination of water through local level desalination plants
- Supply of potable drinking water twice daily from deep tube well or treatment plants
- Women oriented NGOs need to be more focused and sensitive about the health problems of women's as they are very shy to talk about their health problems.
- Free health checkup must be included to their nearer health centers.
- Govt. should provide them alternative livelihood opportunities like cottage industry etc instead of fishing so they can avoid their exposure to the saline water.

We have to protect and take care of the diligent women of Sunderbans as they are backbone of the life and economy of these deltaic communities on the edge and facing bravely the threats of climate change and disasters.

## Three Developments of 1973 that Brought Environment into the Policy Landscape of India

**Rasmoni Karak**

Protection for environment like air, water, soil, mountains, forests and rivers are at the core of the civilizational ethos of India. Surprisingly environmental issues did not appear much in the visions of the leaders of our freedom movement. Environment was hardly discussed during three yearlong debates in the Constituent Assembly; environment did not figure in the long list of 220 subjects in the Seventh Schedule of the Constitution of India that determines the legislative competence of the Parliament of India and the Legislative Assemblies of the States, nor is environment mentioned in any of the Directive Principles of State Policy.

As the problems of environment surfaced due to unsustainable development practices, the issues started gathering momentum till it occupied an important place in the public policy landscape of India. Three important developments of 1973 played significant role in this regard.

### Chipko Movement

The first was the Chipko Movement which started in March 1973 in a remote village Mandal in Uttarakhand when villagers spontaneously, and led mostly by women, hugged trees to prevent forest lumbermen from logging trees. This non-violent movement gradually spread to other villages and throughout the State under the leadership of Sunderlal Bahuguna assisted by Chandi Prasad Bhatt and Gauri Debi. The movement forced the government to ban felling of trees for fifteen years and eventually Forest Conservation Act was passed in 1980 to ban such felling altogether. The movement further raised basic questions related to ecology, equity and social justice, promoted lively debates, and sparked a series of similar protests throughout the country. Chipko activist protested against limestone mining in Doon Vally leading to eventual ban on quarrying in Tehri District.





## A Charter for the Land

In March 1973 the Economic and Political Weekly published a landmark article by B.B. Vohra that highlighted the economic and environmental importance of land and soil which is getting degraded due to unsustainable agricultural, grazing and other practices. Although 75% of the people still depend on land for livelihood, no programme had been initiated for the soil health and soil conservation. The green revolution during the sixties had helped country to achieve self-sufficiency in food grains, but still we are seriously short of providing high levels of nutrition to rural people. Excessive use of fertilizers without scientific assessment of quality of soil has reduced productivity of soil. Often nutrient-rich top soils have been eroded due to grazing, deforestation, floods and landslides. The article advocated a Charter for the Land which generated policy discourses that eventually led to various programmes and initiatives for soil conservation and soil health in the country.

## Project Tiger

In April 1973 another landmark project on Saving the Tiger was started. The population of tigers in different forests of India had declined rapidly due to unrestricted hunting during the colonial period, which continued unabated due to increasing encroachments into forest area, mining and other development projects and grazing in forests. Villagers often poisoned carnivores to protect cattle, which resulted in elimination of species, and tigers in particular.

Various national and international NGOs including the WWF and IUCN demanded a national law banning the hunting of tiger, leading to the enactment of the Wildlife (Protection) Act in 1972. Government further decided to demarcate some reserved forests as the tiger's habitat, and started removing human settlements from these areas, thus starting the project Save the Tiger in 1973.



## Golden Jubilee of the events

This year we are celebrating the golden jubilee of these events. All these three events created lasting impacts on the policies, programmes and projects on environment in India. While the Chipko Movement established the rights of forests in India, EPW article created awareness about the rights of land, and Project Tiger highlighted the rights of animals. We need similar and stronger movements to establish the rights of our rivers and water bodies, rights of air and similar other rights to make our environment free from pollution.

# Whither East Kolkata Wetlands

**Sonia Paul**

East Kolkata Wetlands is a unique peri-urban ecosystem located on the eastern margin of Kolkata city, covering 1250 hectares Kolkata and its adjoining twin districts of North 24 and South 24 Parganas. These wetlands have been historically formed by a natural shift of the Bidyadhari River, a tributary of the Ganga. It consists of salt marshes, and agricultural fields, sewage farms and setting ponds.

About 15000 metric tons paddy, 150 tons vegetables and more than 1000 tons of fish are produced from these wetlands, which meets the needs of food and nutrition of many people. The wetlands are a source of livelihood of many people in around Kolkata.

This natural ecosystem is a nestling place for a large number of migratory birds from faraway places, adding life and colour to the busy metropolis.

These wetlands further played very important role in the drainage system of the city. Since the topography of Kolkata has eastward slope, the river Ganga has not provided a natural system for draining out rainwater. It is the East Kolkata wetlands that have provided a natural cushion for absorbing the excess discharge and saved the city from floods.



Along with rainwater has flowed waste water which is naturally treated with the help of sunlight, oxygen and bacteria. This natural way of decontaminating waste water has earned the description of East Kolkata Wetland as the Kidney of Kolkata.

All these attributes no doubt make East Kolkata Wetlands as an invaluable ecological asset of the city Kolkata. It was very rightly notified as wetlands of international

importance under the Ramsar Convention on 19 August 2002.

## East Kolkata Wetlands under Threats

Unfortunately the East Kolkata Wetlands are under very severe threats. Unabated encroachments into the wetlands, unplanned urban development, continuous dumping of solid and liquid waste, and inappropriate measures for conservation and management of the wetlands have had very adverse impacts on the wetlands. These have not only shrunk in size, but the natural capacity of bio-cleansing of waste water has also been compromised, both contributing to the deteriorating quality of water in some areas.

This triggered civil society movement leading to a PIL in which High Court of West Bengal directed the Government to protect the wetlands and the Government enacted The East Kolkata Wetlands (Conservation and Management) Act and established the East Kolkata Wetlands Management Authority in 2006. Although EKWMA has taken many measures for conservation of the wetlands lot more needs to be done to ensure that this valuable ecological asset of Kolkata remains alive and does not wither away.



## The Devastating Impact of Oil Spills on Aquatic Ecosystems

Arundhatii Aich

An oil spill refers to the accidental or intentional release of liquid petroleum hydrocarbons, commonly known as oil, into the environment, particularly bodies of water such as oceans, rivers or lakes. It occurs when oil is discharged from ships, pipelines, storage facilities or offshore drilling rigs posing severe ecological, economic and social impacts.

### Exxon Valdez Oil Spill, 1989:

The Exxon Valdez oil spill, which occurred on March 24, 1989, was one of the most devastating environmental disasters in history. It occurred in Prince William Sound, Alaska, when the oil tanker Exxon Valdez, owned by Exxon Shipping Company, ran aground on Bligh Reef.

The spill resulted in the release of approximately 11 million gallons of crude oil in pristine water Prince William Sound. The oil contaminated over 13,000 miles of coastlines, including sensitive habitats such as beaches, marshes and rocky shores. The spill had immediate and long-term impacts on the environment, wildlife and local communities.





## The Deepwater Horizon Oil Spill, 2010:

The Deepwater Horizon oil spill, also known as the BP oil spill or Gulf of Mexico oil spill, was a catastrophic environmental disaster that occurred on April 20, 2010. It was the result of an explosion and subsequent sinking of the Deepwater Horizon offshore drilling rig operated by Transocean and leased by British Petroleum (BP). The rig was in the Macondo Prospect, approximately 40 miles off the coast of Louisiana, in the Gulf of Mexico.



The explosion and sinking of the Deepwater Horizon rig caused the release of an estimated 4.9 million barrels of crude oil into the Gulf of Mexico over a period of 87 days. The spill became the largest marine oil spill in history.

### Impacts:

Oil spills are not just a human tragedy, but an ecological one. When oil is spilled into the ocean, it creates a slick on the surface that blocks the sunlight from reaching marine plants and organisms. This causes the death of phytoplankton, which is the base of the marine food chain. Without phytoplankton, the entire ecosystem can collapse, leading to the loss of valuable commercial fisheries and recreational opportunities for humans.



The impact of oil spills on marine mammals is particularly devastating. When oil gets on their fur or feathers, it reduces their ability to regulate their body temperature, making them more vulnerable to hypothermia. Ingestion of oil can also lead to a range of health problems, including liver damage, reproductive failure, and even death.

In addition to the direct impact on marine life, oil spills can also have long-term effects on the environment. Oil can persist in the sediment and water column for years, continuing to harm organisms long after the initial spill has been cleaned up. This can lead to chronic exposure to toxic substances, leading to genetic mutations and other health problems.

Fortunately, there are steps that can be taken to prevent oil spills and minimize their impact when they do occur. Governments can enact regulations to require safer drilling practices and the use of double-hulled tankers to transport oil. Industry can invest in new technologies like remote sensing to detect spills before they become catastrophic. And we can all do our part to reduce our dependence on fossil fuels and support the development of renewable energy sources.

As we celebrate World Environment Day, it is important to reflect on the devastating impact of oil spills on aquatic ecosystems. Catastrophic events like the Exxon Valdez spill in 1989 and the Deepwater Horizon oil spill in 2010 have left a lasting mark on our oceans, reminding us of the fragility of our planet's ecosystems.

As we look to the future, the devastating impact of oil spills on aquatic ecosystems cannot be ignored. We must work together to protect our oceans and the creatures that call them home. Only by doing so can we ensure a healthy and sustainable future for generations to come.

# Cleaning Ganga: Challenges and Opportunity

Banashree Chakroborty

The Ganga River basin is considered one of the largest river basins in the world, covering approximately 26.3% of India's land area. It flows through multiple states including Uttarakhand, Bihar, West Bengal, Uttar Pradesh, Himachal Pradesh, Haryana, Punjab, Rajasthan, and Madhya Pradesh before finally reaching the Bay of Bengal. The river is primarily fed by two sources: the meltwater from glaciers in the Himalayas and its perennial flow, which is further supplemented by the monsoon rains. The Ganga River holds the distinction of having the largest freshwater resources in India. Its abundant water supply supports a vast fertile land, making it an essential lifeline for millions of people in the country. The river plays a crucial role in sustaining agriculture, providing drinking water, and supporting various industries along its course.



The Ganga River holds immense cultural and religious significance for the people of India, being considered the national river and revered as a holy site. However, the river has been severely polluted due to various factors, including rapid urbanization, untreated discharge of industrial and municipal waste directly into the river, and the construction of dams and barrages. The pollution of the Ganga River is a significant concern, as it impacts both human health and the environment. This pollution is detrimental to the aquatic life and ecosystems that depend on the river.



The religious practices and rituals associated with the Ganga River also contribute to its pollution. Activities such as flower offerings and the cremation of dead bodies on its banks are commonly performed. Additionally, a significant number of people bathe in the river every year, believing it will cleanse them of their sins. However, these practices, when not properly regulated, can lead to the accumulation of pollutants in the water.

Today, the Ganga River is widely known as one of the most polluted rivers in India, ranking as the fifth-most polluted. What is particularly startling is that before the 1970s, there was little to no discussion about the pollution affecting the Ganga. However, in recent years, the gravity of the situation has come to the forefront of public awareness. **Kannauj to Kanpur** stretch is identified as the most polluted section of the river.



## Measures implemented to clean the Ganga River:

- **Ganga Mahasabha** is an organization that is founded by Madan Mohan Malaviya in 1950.
- **Ganga action plan** was launched in June 1986 by the late Prime Minister of India Rajiv Gandhi to improve the water quality and to treat the domestic sewage to prevent waste and toxins.
- **National Ganga River Basin Authority** was established by the Central Government of India on February 20, 2009, under the Environmental Protection Act of 1986. In 2011, they received funding of around \$1 billion from the World Bank.
- **The 2010 Government clean-up campaign** focused mainly on addressing the issue of untreated municipal sewage and industrial runoff entering the 1560-mile river.
- **The Namami Ganga Program** is a development project dedicated to the pollution control, conservation, and rejuvenation of the Ganga River. With a budget allocation of 2,037 crore rupees, it covers 8 states in India and aims to achieve the ambitious mission of cleaning the Ganga.
- **Namami Ganga Mission-2** Following the success of the Namami Ganga Program, the Government of India allocated 22,500 crore rupees for Namami Ganga Mission-2.
- **Ganga Manthan** is a national conference organized by the National Mission for Clean Ganga. It took place on June 7th, 2014, in New Delhi and aimed to address the issues related to cleaning the Ganga River and explore potential solutions to resolve this problem.

## Cleaning the Ganga River has encountered various challenges:

- The Ganga basin receives approximately 12,000 million liters of sewage daily, yet the treatment capacity is only 4,000 million liters, indicating a significant shortfall in the proper treatment of sewage daily.
- In the Namami Ganga mission, a total of 20,601 crores was sanctioned for 193 projects, but only 4,254 crores were utilized for project implementation.
- Bihar, West Bengal, Uttarakhand, Jharkhand, and Uttar Pradesh are the five states along the mainstream of the river that contribute the most to its pollution.
- Distilleries, paper mills, and sugar mills located near the river release a significant amount of industrial pollution into the Ganga River.



Despite facing numerous challenges, the Indian government remains committed to the cleaning of the Ganga River due to its immense importance. The Ganga River is not only a vital source of fresh water but also supports the livelihoods of countless people. However, the cleaning process is still ongoing and not yet fully implemented. The Namami Ganga project stands as a significant achievement in this endeavor, and the government of India is working diligently to ensure the successful restoration and cleanliness of the river.



## Our Contributors

### Faculty



Dr. P G Dhar Chakrabarti



Dr. Sudipta Tripathi



Dr. Sumanta Das



Dr. Mahadev Bera

### Alumni



Sunayana Ray



Diksha Kar



Sourav Halder

### Students



Abhisek Kar  
Fourth Semester



V Rohit Kumar  
Fourth Semester



Soumik Roy Chowdhury  
Fourth Semester



Diya Roy  
Fourth Semester



Sayani Ghosh  
Fourth Semester



Nirupama Singha  
Fourth Semester



Anamika Sarkar  
Fourth Semester



Anuska Saha  
Fourth Semester



Bibhas Ghosh  
Fourth Semester



Jubaraj Roy  
Second Semester



Sonia Paul  
Second Semester



Pinanki Das  
Second Semester



Chetana Tunga  
Second Semester



Banashree  
Chakroborty  
Second Semester



Rasmoni Karak  
Second Semester



Kasturi Datta  
Second Semester



Anindya Haty  
Second Semester



Nidrothita Modak  
Second Semester



Arundhatii Aich  
Second Semester



Arkadip Mondal  
Second Semester



Bhagyasree Chatterjee  
Second Semester



Kaberi Saha  
Second Semester



Pritthish Rauth  
Second Semester