ForumIAS

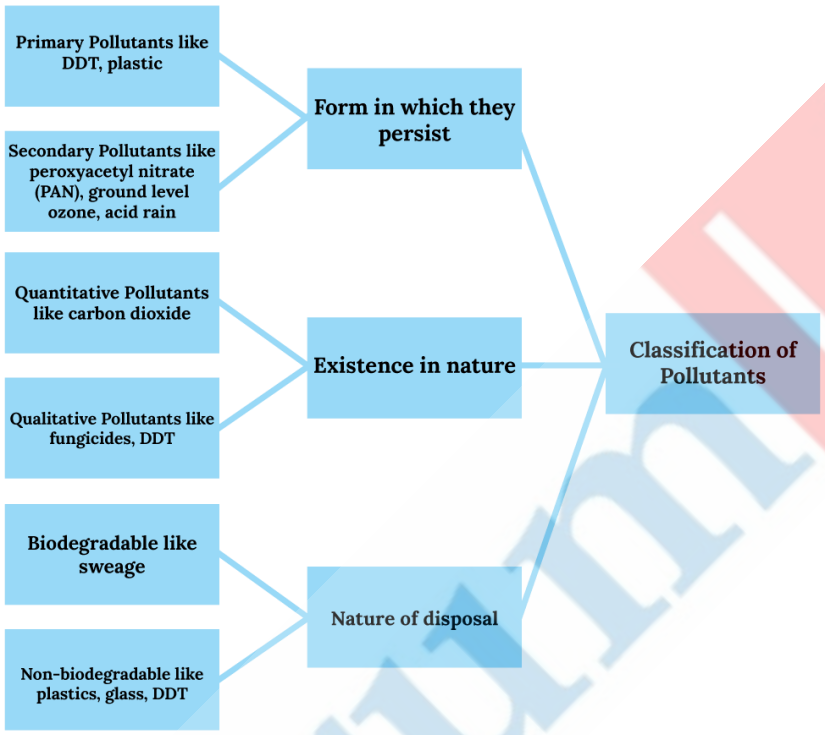
CHAPTER 2

ENVIRONMENTAL CHALLENGES

Pollution is the introduction of harmful materials into the environment. These harmful materials are called pollutants.

2.1 ENVIRONMENTAL POLLUTION

Pollutants are elements, molecules and particles involved in pollution.



1. **Primary pollutants** are emitted directly from the source.
2. **Secondary pollutants** are not emitted directly but form when primary pollutants react.
3. **Quantitative pollutants** are those occurring in nature and become pollutants when their concentration cross a threshold.
4. **Qualitative Pollutants** are substances which are not normally present in the environment and are added by human beings and are pollutants by nature.

2.1.1 Air Pollution

Some of the major air pollutants include Carbon Monoxide (CO), Carbon Dioxide (CO_2), Chlorofluorocarbons (CFC), Lead, ground-level Ozone, Suspended particulate matter, Sulphur Dioxide and Smog (a combination of fog and smoke).

Vehicles and industries are the main sources of ground-level ozone. Ground-level ozone further contributes to **photochemical smog** when nitrogen oxides (from vehicular emissions, industries) react with volatile organic compounds (from paints, inks etc.) in the presence of sunlight.

Sources of **indoor air pollution** are formaldehyde (from carpets, particle boards and insulation foam), Radon (gas emitted naturally from the soil), Volatile organic compounds (from perfumes, hair sprays, furniture polish etc.) and asbestos among others.

CPCB has been executing **National Air Quality Monitoring Programme** to determine the ambient air quality status and trends and ascertain the compliance of National Ambient Air Quality Standards (NAAQS).

NAAQS includes the following pollutants (CO_2 is not included):

1. Sulphur dioxide (SO_2)	Carbon Monoxide (CO)
2. Nitrogen dioxide (NO_2)	Arsenic
3. PM10	Nickel
4. PM2.5	Benzene
5. Ozone	Ammonia
6. Lead	Benzopyrene

National Air Quality Index (AQI) has six categories of air quality, namely Good, Satisfactory, Moderately Polluted, Poor, Very Poor and Severe with a distinct colour scheme. AQI considers the following pollutants (CO_2 not included):

PM10	CO
PM2.5	O_3
NO_2	NH_3
SO_2	Lead

National Clean Air Program (NCAP) is being implemented by MoEFCC. It is a pollution control initiative to cut the concentration of particles (PM10 and PM2.5) by 20-30% by 2024. It will have 2017 as the base year and 2019 as the first year. NCAP will be implemented in 102 non-attainment cities and is not legally binding.

CPCB, a statutory body under the Water (Prevention and Control of Pollution) Act, 1974 will execute the nationwide program. Further, CPCB is also entrusted with powers under the Air (Prevention and Control of Pollution) Act, 1981.

Pointers for prelims:

1. NITI Aayog has launched a 15-point action plan, '**Breathe India**' for combating air pollution in ten most polluted cities in India.
2. NITI Aayog and the International Transport Forum (ITF) of OCED jointly launched the '**Decarbonizing Transport in Emerging Economies (DTEE)**' project in India. The ambitious five-year project will help India develop a pathway towards a low-carbon transport system.
3. **Clean Air-India** is a collaborative project between Get in The Ring (a platform for start-ups by the government of Netherlands), Start-up India and INDUS forum (an online matchmaking platform of Indian and Dutch businesses).
4. **Environment Pollution (Prevention and Control) Authority**:
    a. It was constituted under Environment (Protection) Act, 1986 (but it is not a statutory body).
    b. It was empowered by the Supreme Court to enforce the **Graded Response Action Plan (GRAP)**. GRAP specifies actions required to control particulate matter (PM) emissions from various pollution sources and is being implemented in the Delhi-NCR region only.
5. Steps taken to control **Delhi Air Pollution**:
    a. Delhi became the first city running on **BS VI fuels**. Bharat Stage Emission Standards (BS) are based on European norms. BS VI fuels contain 10 ppm Sulphur compared to 50 ppm in BS IV. Also, harmful NOx emissions from diesel cars can be brought down by nearly 70%. Due to the above advantages, a direct jump from BS IV to BS VI was made, thus skipping BS V norms.
    b. Delhi is scheduled to run **Hydrogen-CNG (H-CNG)** fueled buses to curb emissions. H-CNG is a blend of Hydrogen and CNG, the ideal concentration of Hydrogen being 18%. The use of H-CNG can curb carbon monoxide (CO) emissions by 70%.
6. To curb **stubble burning**, a significant contributor to air pollution in North India, following steps have been taken:
    a. **Torrefaction**, a Swedish technology that can convert rice stubble into 'bio-coal', is being tested by India.

   b. **Happy Seeder machine** has been developed by Punjab Agricultural University (PAU) for in-situ management of paddy stubble.
   c. **Pusa decomposer**, a microbial spray that can cause decomposition of the harvested stubble, has been developed by Indian Agriculture Research Institute (IARI).
7. CSIR-NEERI has developed **green crackers**, namely- Safe Water Releaser (SWAS), Safe Thermite Cracker (STAR) and Safe Minimal Aluminum (SAFAL) using Potassium Nitrate (KNO_3) as oxidant.
8. **System of Air Quality and Weather Forecasting and Research (SAFAR)** is a national initiative introduced by the Ministry of Earth Sciences (MoES). It measures the air quality of a metropolitan city by measuring the overall pollution level as well as location-specific air quality of the city. The system has been indigenously developed by the Indian Institute of Tropical Meteorology (IITM), Pune.
9. **Taj Trapezium Zone** is a defined area of 10,400 sq km around the Taj Mahal to protect the monument from pollution. It is an 'eco-sensitive area' covering three world heritage sites, namely Taj Mahal, Agra fort and Fatehpur Sikri. It is spread over Uttar Pradesh and Rajasthan.
10. **Lichens** serve as a good indicator of air pollution.

Fly Ash is produced whenever combustion of solid materials takes place. Its composition includes Aluminum silicate, Silicon dioxide and Calcium oxide. Fly Ash has a number of advantages like:

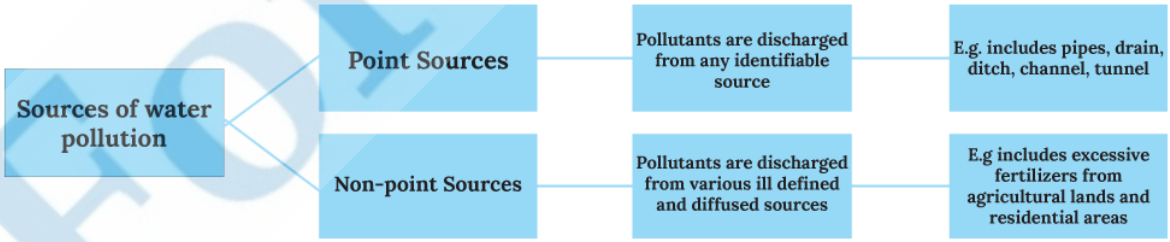
1. Fly Ash bricks are lightweight and have high strength.
2. Fly Ash can be used in the reclamation of wastelands, filling up abandoned mines.
3. Fly Ash can increase crop yield.

Notification on Fly Ash Utilization in 2016 had the following features:

1. Mandatory to use Fly Ash-based products in all construction projects, road embankments and low-lying filling works within 300 km of thermal power stations.
2. Cost of transportation of Fly Ash to be borne entirely by TPS up to 100 km and equally shared between user and TPS for more than 100 km and up to 300 km.
3. Mandatory use of Fly Ash-based products in all government schemes like MGNREGA etc.
4. Target 100% Fly Ash utilization by 2017.

2.1.2 Water Pollution

Addition of certain substance to water which degrades the quality of water so that it becomes unfit for use is Water Pollution.



Oil Spill is one of the most dangerous of all water pollutants. Oil floats on the water surface and poses the threat of swift-spreading fire. It also decreases the oxygen level in the water. Oil spills can be cleared with the help of 'bregoli' (a by-product of paper industry resembling saw dust), **oilzapper** and micro-organisms.

Basic Concepts:

1. **Biological Oxygen Demand (BOD)** and **Chemical Oxygen Demand (COD)**
   a. BOD represents how much dissolved oxygen is required by bacteria to break down organic matter in water.

   b. COD represents the measure of oxygen equivalent of the requirement of oxidation of total organic matter (both biodegradable and non-biodegradable) present in water.

COD value is always higher than BOD values. Polluted as well as warm waters increase the BOD and COD values.

2. Diseases caused due to polluted waters
   a. Itai-Itai disease is caused by Cadmium contamination.
   b. Minamata disease is caused by Mercury contamination.
   c. Blue baby syndrome is caused by Nitrate poisoning.
   d. Black foot disease is caused by exposure to Arsenic.

Pointers for prelims:

1. **Central Water Commission** released a recent report titled 'Status of trace and toxic metals in Indian rivers 2018.'
   a. The report highlighted that 42 rivers in India have at least two toxic heavy metals in quantities beyond the permissible limit.
2. **Composite Water Management Index** was released by NITI Aayog to assess and improve the performance of states/UTs in the efficient management of water resources. As per the report-
   a. 600 million people in India face high to extreme water stress in the country.
   b. 75% of the households in the country do not have drinking water on their premises.
   c. 84% of rural households do not have piped water access.
   d. Per capita annual availability of water has decreased.
   e. 14 out of 24 states scored below 50% on water management and have been classified as "low performer".
3. Uranium contamination of groundwater has increased due to overexploitation of groundwater and excessive use of nitrogenous fertilizers. **Bureau of Indian Standards** prescribes drinking water specifications. However, no such limit has been provided for uranium.
   a. Arsenic contamination of groundwater has also increased in states along the Ganga-Brahmaputra-Meghna (GBM) river basin; Uttar Pradesh, Bihar, Jharkhand, West Bengal and Assam.
5. **National Hydrology Project** is a central sector scheme launched to store and analyze hydro-meteorological data.
   a. **National Water Informatics Centre** is a component of the National Hydrology Project.
6. **Jal Shakti Abhiyan** is a time-bound campaign for water conservation and water security with a mission mode approach. The focus of the campaign is on water-stressed districts and blocks.
7. **Jal Jeevan Mission** aims at providing Functional Household Tap Connection (FHTC) to every rural household by 2024.
   a. Fund sharing pattern is 90:10 for Himalayan and North-eastern states, 50:50 for other states and 100% for UTs.
   b. It follows a community driven approach.
8. **Atal Bhujal Yojana** has been launched by Ministry of Jal Shakti.
   a. It is a Central Sector Scheme to improve groundwater management through community participation.
   b. It covers seven states- Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.
   c. It is being implemented (starting 2020) over a period of 5 years with 50% support from the World Bank.

2.1.3 Noise Pollution

Noise pollution is generally defined as regular exposure to elevated sound levels, leading to adverse effects in humans or other living organisms. As per the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, whereas exposure for more than 8 hours to constant noise beyond 85 dB may be hazardous.

Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area declared as such by a competent authority.

2.1.4 Radioactive Pollution

Radioactivity is a phenomenon of spontaneous emission of proton (α), electrons (β), gamma rays due to disintegration of atomic nuclei of some elements. Natural sources include cosmic rays from space and terrestrial radiations from radio-nuclides present in the earth's crust such as radium-224, uranium-238 etc. Man-made sources include nuclear power plants, uranium mining and radiation therapy.

2.1.5 E-Waste

E-waste is electronic products that are unwanted, not working, and nearing or at the end of their "useful life." Computers, televisions, VCRs, stereos, copiers, and fax machines are everyday electronic products.

E-waste and its Source		
Sl. No	**Particulars**	**Source**
1	Lead	Glass panels in computer monitors, solder in printed circuit board
2	Cadmium	Semiconductor chips, IR detectors, cathode-ray tubes
3	Mercury	Thermostats, sensors, relay, switches, lamps, flat panel displays and electric and electronic equipment
4	Hexavalent Chromium	PVC (Dioxin is released when PVC is burned)

Pointers for prelims:

1. **1st E-waste clinic** has been set up in Bhopal, Madhya Pradesh.
2. As per **Global E-Waste Monitor**, India ranks 5th among e-waste producing countries.

2.1.6 Plastic Pollution

Plastic pollution is the accumulation of plastic objects and particles (e.g., plastic bottles, bags and microbeads) in the Earth's environment that adversely affects wildlife, wildlife habitat, and humans. Plastics that act as pollutants are categorized into micro-, meso-, or macro debris, based on size. Some of the major sources of plastic pollution are:

Single-use plastic: Disposable plastics that are commonly used for plastic packaging and include items intended to be used only once before they are thrown away or recycled.

Microbeads: Plastic pieces or fibre, which is very small, generally measuring less than 1 mm. They are present in a variety of products, from cosmetics to synthetic clothing to plastic bags and bottles and are carcinogenic in nature.

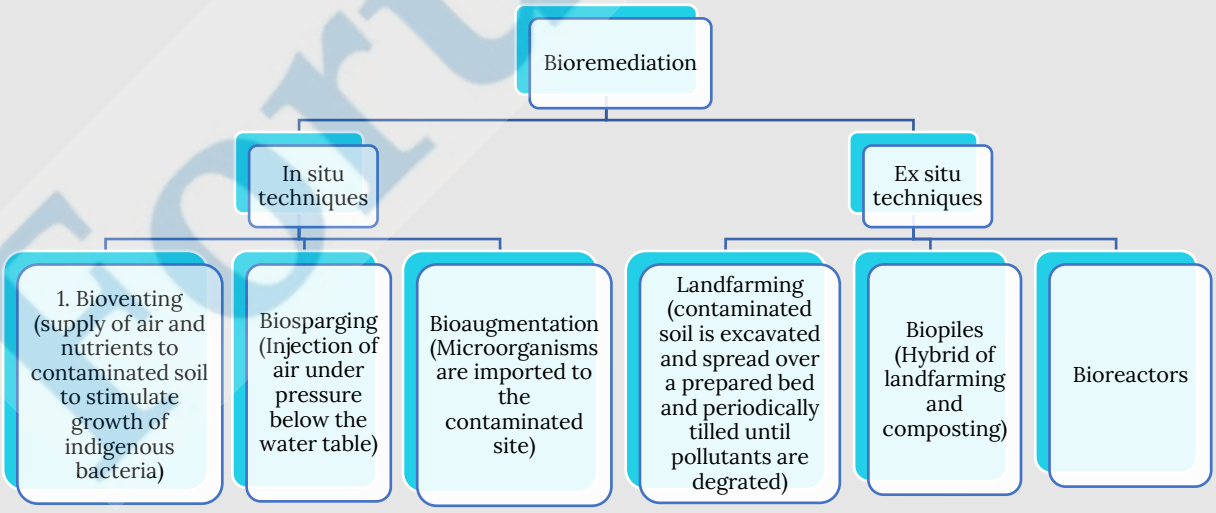
Pointers for prelims:

1. **Plasticrust** is a thin coating on plastic that's growing on rocks at the seashore.
2. Global steps to counter plastic pollution:
    a. UNEP had declared '**Beat Plastic Pollution**' as the theme for World Environment Day 2018.
    b. UN Environment launched **#CleanSeas campaign** with the target of ending marine plastic pollution.
    c. **Honolulu Strategy** is a comprehensive and global effort to reduce the ecological, human health and economic impacts of marine debris.
3. **Alliance to End Plastic Waste** was recently founded as a non-profit organization that includes companies across the globe. From India, Reliance Industries is a part of this alliance.
4. **Ocean Cleanup** is a non-profit organization that is developing advanced technologies to rid the world's ocean of plastics.
    a. It is directed at cleaning the 'Great Pacific Garbage Patch (GPGP)', a zone between Hawaii and California.
5. **Blue Flag beach standards** were established by the Copenhagen-based Foundation for Environmental Education in 1985 in France. It is an environmental award for beaches and sustainable tourism.
    a. Chandrabhaga beach of Odisha was the first in Asia to get Blue Flag certification.
    b. Further, **Society for Integrated Coastal Management (SICOM)**, established under the aegis of MoEFCC, is developing 12 beaches in India for a 'Blue Flag' certification. SICOM is also implementing the World Bank assisted Integrated Coastal Zone Management (ICZM) project.

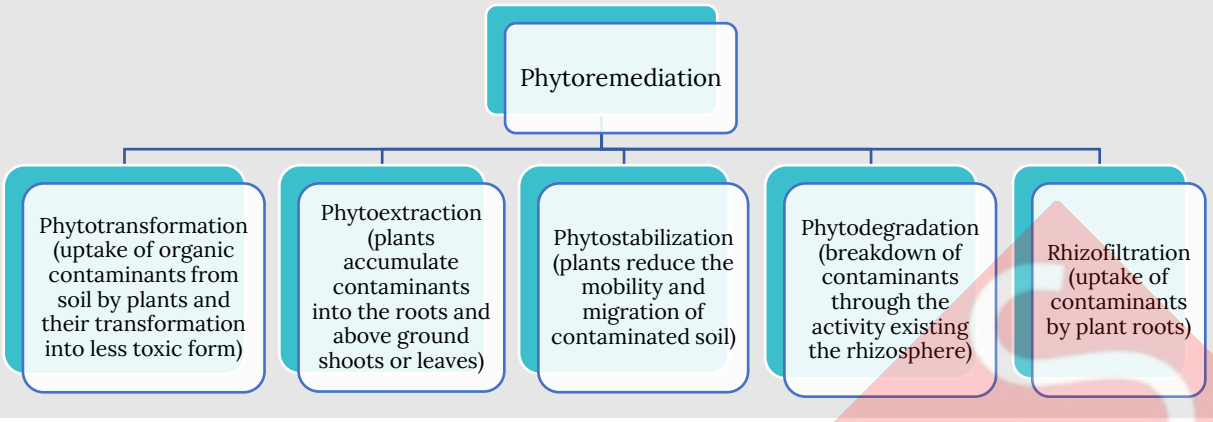
2.1.7 Soil Pollution

It is a build-up of persistent toxic compounds, chemicals, salts, radioactive materials or disease-causing agents in the soil that have adverse effects on plant growth, human and animal health.

Bioremediation is the use of microorganisms like fungi and bacteria to degrade the environmental contaminants. Mycoremediation is a form of bioremediation which uses fungi to decontaminate the area.



Phytoremediation is the use of plants to remove contaminants from soil and water.



Advantages of bioremediation:

1. Complete destruction of target pollutants is possible.
2. It is environmentally friendly.

However, disadvantage is that bioremediation is limited to those compounds that are biodegradable and it takes a longer time than other treatment processes.

2.1.8 General pointers

Waste Minimization Circles (WMC) helps small and medium industrial clusters in waste minimization in their industrial wastes. This is assisted by World Bank with the help of MoEFCC. The project is being implemented with the assistance of National Productivity Council.

Acid rain is the rainfall that has been acidified. It is formed when oxides of sulphur and nitrogen react with moisture in the atmosphere. Impact of acid rain includes:

1. Microbial species in the soil shift from bacteria-bound to fungi-bound as most fungi favor an acidic environment.
2. It causes leaching of nutrients from the soil, making it infertile.
3. It leads to discoloration, loss of foliar mass, prodigious production of lichens and premature senescence (aging) in vegetation.

MoEFCC has categorized industrial sectors into **White, Green, Orange and Red industries** based on the pollution index. White industries are practically non-polluting and do not require environmental consent. No red category of industries shall normally be permitted in the ecologically fragile/protected area.

2.2 ENVIRONMENTAL ISSUES

2.2.1 Sand Mining in India

Sand is a minor mineral defined under the Mines and Minerals (Development and Regulation) Act, 1957.

Consequences of sand mining are:

1. It can change the course of river.
2. Pollution as well as depletion of groundwater tables.
3. Destruction of habitat of microorganisms.
4. Saline water ingress into freshwater may happen.

MoEFCC has released the **Enforcement & Monitoring Guidelines for Sand Mining (EMGSM-2020)**. Its major points include:

1. District Survey Reports (DSR) are to be prepared to identify and define mining and no mining zones.
2. All districts to prepare a comprehensive mining plan for the district.
3. Abandoned stream channels to be preferred rather than active channels.
4. Suggested use of technology for checking illegal mining.
5. Annual audit of each mining lease to be carried out.
6. State government should develop an online portal for the sale and purchase of sand and riverbed material.
7. State government should constitute a District Level Task Force (DLTF) under the chairmanship of Collector.

2.2.2 Other issues

'**Colony Collapse Disorder**' is an abnormal phenomenon that occurs when the majority of worker bees in a honey bee colony disappear, leaving behind a queen, plenty of food, and a few nurse bees to care for the remaining immature bees. Pesticides like neonicotinoids and other factors like global warming, metal pollution, stress, habitat loss and malnutrition are responsible for this disorder.

Locust attacks have struck parts of Rajasthan and Gujarat, causing heavy damage to standing crops. Locusts are a group of short-horned grasshoppers that migrate up to 150 km in a day and migrate rapidly. Locusts are voracious feeders, eating up to their body weight daily. Four species of locusts are found in India, out of which desert locust is the most destructive pest.

While there are three breeding seasons: winter breeding, spring breeding and summer breeding, India has only summer breeding season. Unusual weather patterns exacerbated by climate change have created ideal conditions for insect numbers to surge.

Palm oil forms 33% of the world's vegetable oil production mix. Indonesia and Malaysia contribute almost 87% of the production of palm oil, while India and China account for 34% of the imports. Palm oil production leads to deforestation of tropical forests in order to make rooms for plantations. Indiscriminate falling of trees has destroyed the habitats of **Orangutans** living in the tropical forests of Indonesia and Malaysia.

Roundtable on Sustainable Oil (RPSO) was established in 2004 to promote the production of sustainable palm oil. Around 14% of palm oil globally is certified by RPSO.

In India, **nitrogen emissions** grew at 69% from 2001 to 2011 and have replaced methane as the second-largest Greenhouse Gas (GHG) from Indian agriculture. Agricultural soils contribute to over 70% of Nitrous oxide (N_2O) emissions, followed by waste water (12%) and residential/commercial activities (6%). Further, India is globally the biggest source of ammonia emissions. Cattles are a major source of ammonia.

International Nitrogen Initiative (INI) is an international program set up in 2003 under the sponsorship of Scientific Committee on Problems of the Environment (SCOPE) and International Geosphere-Biosphere Program (IGBP) to optimize nitrogen's beneficial role in sustainable food production.

Pet Coke, also known as "bottom of the barrel" fuel, is a solid carbon-rich material derived from oil refining. It emits 11% more Green House Gases (GHGs) than coal. Recently, government has banned the import of pet coke as a fuel. It is now only allowed for cement, lime kiln, calcium carbide and gasification industries when used as a feedstock or in the manufacturing process on actual user condition.