



Balalatha's



# CSB IAS ACADEMY

The Road Map to Mussoorie...

MAINS IMPACT– 2025 – 01/11/2024

## AIR POLLUTION IN INDIA

### SYLLABUS:

GS 3 > Environment & Ecology > Pollution > Air pollution

### REFERENCE NEWS:

- With the **withdrawal of the southwest monsoon and the onset of winter**, the air quality in Delhi has recently started to deteriorate significantly. The city and its adjoining areas have consistently recorded **particulate matter (PM 2.5) levels exceeding 300**, categorizing as 'very poor' air quality. Forecasts suggest that this situation could worsen in the coming days. It has become an established pattern that this decline in air quality coincides with the **burning of farm stubble**, primarily from Punjab.

### STATISTICS:

- According to the **World Air Quality Report 2023** released by the Swiss organisation **IQAir**, India is ranked as the **third most polluted country globally**.
- The report highlights that **83 of the top 100 most polluted cities** in the world are located in India, with **Begusarai in Bihar** identified as the most polluted metropolitan area. It notes that the average annual **PM2.5 concentration in India is 54.4 micrograms per cubic meter**, which is **more than 10 times** the guideline set by the World Health Organization.
- In the **Environmental Performance Index 2022**, India is at **179th rank in the air quality indicator**.
- Air pollution caused an estimated **1.6 million deaths in 2019 in India**: the highest in the world, according to the report by the Lancet Commission on Pollution and Health.
- Air pollution **shortens the average Indian life by roughly 3.4 years**, according to a study by the **Indian Institute of Tropical Meteorology**.

**MAJOR CAUSES OF AIR POLLUTION IN INDIA:**

- **Agricultural activities:**
  - **Use of insecticides, pesticides and fertilizers** in agricultural activities **release ammonia** which is a major air pollutant.
  - **Crop residue burning:** Large-scale burning of crop residues from paddy crop in October-November and then wheat in April in Punjab, Haryana and western Uttar Pradesh contributes significantly to the air pollution in the Delhi NCR Region every year.
  - Crop fires **also led to higher levels of surface ozone**
- **High dependence on coal for power:**
  - Share of coal in power generation in India continue to be around 80%.
  - Coal power plants with poor technology and efficiency continue to be the major source of pollutants like CO and oxides of nitrogen and sulfur.
- **Fuel adulteration:**
  - Adulteration of gasoline and diesel with lower-priced fuels is common in India, hence beating the purpose of fixing fuel standards.
  - Some adulterants increase emissions of harmful pollutants from vehicles, worsening urban air pollution
- **Mining operations:**
  - During the process of mining, dust and chemicals are released in the air causing massive air pollution.
- **Pollution from transportation sector:**
  - Transportation sources account for approximately a third of PM pollution in India, and a somewhat higher proportion of nitrogen oxides
  - **India's vehicle fleet is growing rapidly** as it increased from about **10 million in 2007 to over 21 million in 2016.**
- **Industrial pollution:**
  - As per TERI's inventory **industrial sector contributes 36%** of total PM2.5 emissions. This includes pollution due to burning of fossil fuels, chemical solvents by tanning industries, releasing untreated waste into the environment, improper disposal of radioactive material.

- **High levels of poverty:**
  - Dependence on **fuelwood and kerosene** for the purpose of lighting and cooking leads to a high level of pollutants being released in the rural and urban periphery. **Overexploitation of resources** like forests, grazing lands and mindless deforestation reduces the natural capacity to absorb pollutants.
- **Climate change:**
  - Elevated air pollution levels is also a result of climate change events, such as sandstorms and wildfires,
- **Administrative issues:**
  - **Poor governance:**
  - While agencies like CPCB and SPCBs continue to be under-resourced and understaffed, the multiplicity of the state authorities at the ground level leads to poor coordination, lax enforcement of rules and lack of accountability as seen in Delhi.
  - Absence of environmental governance continues to be a major challenge.
- **Poor enforcement of rules:**
- The Air (Prevention and Control of Pollution) Act was passed in 1981 to regulate air pollution but **has failed to reduce pollution because of poor enforcement of the rules.**
- **Unplanned urbanization:**
  - Rapid growth of urban areas has led to the proliferation of slums and poor public transport has increased the burden of personal vehicles on the road.
  - Landfills used for waste management also release pollutants in the air.
- **Poor access to technology:**
  - India's industrial landscape continues to be dominated by MSMEs which lack access to cleaner technologies. Agricultural waste burning is also the result of poor access to farm technologies.
- **Cultural reasons:**
  - Fire crackers are part of festivals such as Diwali. Stringent regulations during Diwali has been difficult due to people's reluctance.

### WHY DELHI SUFFERS THE MOST?



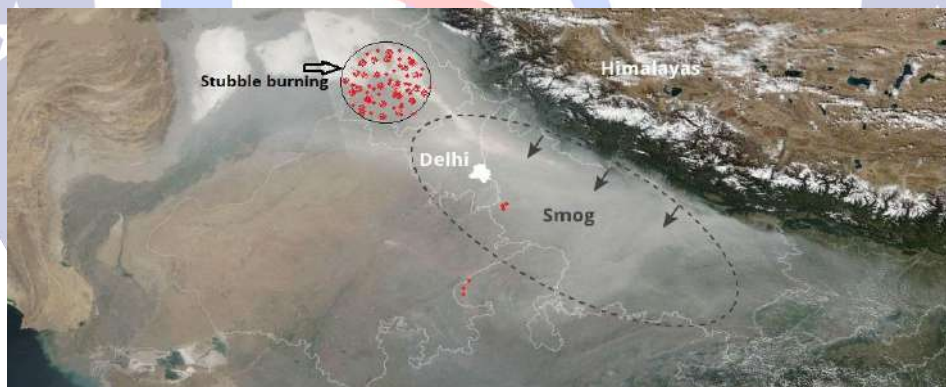
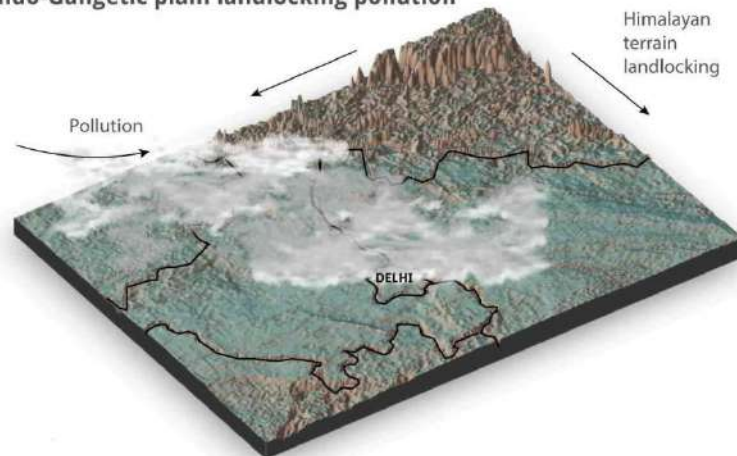
- **Geographical Disadvantage (Landlocked Region):** Delhi's landlocked position **without any moderating effect from seas or oceans** makes it particularly vulnerable to pollution accumulation. The slow-moving winds from the northwest during the crop burning season are **trapped by the Himalayas** to the north, as described in geographical studies from the Indian Institute of Tropical Meteorology, Pune.

- **Stubble Burning:**

Stubble burning in Punjab and Haryana majorly contributes to PM2.5 pollution in Delhi. A 2023 study by Climate Trends indicates that up to 35% of PM2.5 levels

during peak burning periods can be attributed to this source. The geographical positioning worsens the impact, as pollutants are transported by prevailing winds.

Indo-Gangetic plain landlocking pollution



- **Vehicular Emissions:** The high density of vehicles in Delhi contributes significantly to air pollution, with emissions accounting for **about 18% of PM2.5 levels**. This data is supported by findings from the Indian Institute of Tropical Meteorology (IITM), Pune.
- **Industrial Pollution:** Industries in and around Delhi, including power plants and manufacturing units, release pollutants from burning coal and diesel. The lack of effective pollution control measures exacerbates this issue, as noted by the Central Pollution Control Board (CPCB).

- Construction Dust:** Construction activities contribute to PM10 and PM2.5 levels, with this source becoming particularly problematic in dry conditions. Local government reports highlight the contribution of construction dust to overall pollution levels.
- Meteorological Factors:** Reduced wind speeds and temperature inversions during the winter trap pollutants close to the ground. Meteorological data from the Indian Meteorological Department (IMD) support these observations.
- Transboundary Pollution:** Pollutants from neighboring states significantly affect Delhi's air quality. This emphasizes the need for cooperative regional efforts, as discussed in various inter-state environmental forums.
- Environmental Degradation:** The degradation of the Aravalli Range reduces atmospheric moisture and rainy days, contributing to increased dust. Studies from environmental research institutes highlight the impact of green cover loss on local climate and air quality.
- High Population Density :** Delhi's population density leads to increased construction, pollution, and waste burning. Urban planning reports from the Delhi Development Authority (DDA) provide insights into how urban sprawl contributes to air pollution.
- Proximity to Polluting Sources:** The proximity to thermal power plants and the prevalence of firecrackers during Diwali are significant pollution sources. Reports from the CPCB detail the impact of these sources during festival times.



#### **INITIATIVES:**

##### **Legislative Framework:**

- The Air (Prevention and Control of Pollution) Act, 1981:** Establishes mechanisms for controlling air pollution and sets up Central and State Pollution Control Boards.

- **The Environment (Protection) Act, 1986:** Acts as an umbrella legislation coordinating central and state authorities related to environmental protection, including air quality.
- **Dust Mitigation Plan:** Implemented under the Environment Protection Act to control dust pollution.

**Schemes/Programs:**

- **National Clean Air Programme (NCAP):** Aims to reduce PM2.5 and PM10 levels by 20%-30% from 2017 levels by 2024 through enhancing monitoring networks and building a national-level emission inventory.
- **National Air Quality Index (AQI):** Provides daily air quality updates with health advisories based on pollution levels.
- **Graded Response Action Plan:** Specifies actions for different air pollution levels in Delhi and NCR.
- **National Ambient Air Quality Standards (NAAQS):** Sets permissible limits for PM2.5 and PM10, aligned with stricter WHO guidelines.

**Vehicular Pollution Control:**

- **Bharat Stage Emission Standards (BSES):** Regulations to reduce emissions from vehicles, with a significant reduction in pollutants with the introduction of BS VI standards.
- **FAME India Scheme:** Promotes the adoption of electric and hybrid vehicles to reduce vehicular emissions.
- **Promotion of Public Transport:** Enhancements in public transport systems like rapid transit and implementation of traffic management schemes like the odd-even policy.

**Indoor and Industrial Pollution Control:**

- **Pradhan Mantri Ujjwala Yojana:** Provides LPG connections to reduce indoor air pollution from biomass burning.
- **Industrial Standards:** The Central Pollution Control Board (CPCB) enforces limits on industrial emissions and banned the use of polluting fuels like pet coke and furnace oil in several states.

**WAY FORWARD:**

- **Enhance Indoor Air Quality Initiatives:** Expand efforts beyond providing clean cooking fuels, incorporate continuous awareness programs on clean cooking benefits, and improve ventilation in rural kitchens.
- **Strengthen Public Transport Systems:** Integrate public transport services to ensure reliability, comfort, and comprehensive coverage, including last-mile connectivity, without incurring additional costs.
- **Improve Waste Management:** Prevent open burning of municipal and industrial waste by building stronger institutional capacities for enforcement and ensuring legal compliance.
- **Promote Renewable Energy:** Overcome intermittency issues with smart grid technologies and incentivize decentralized power production, such as biogas, rooftop solar, and electric vehicles.
- **Agricultural Waste Management:** Address crop burning by providing financial incentives and technology (like happy seeder machines and bio-decomposers), and develop markets for crop residues to encourage sustainable disposal methods.
- **Enhanced Inter-State Coordination:** Reform administrative and legal frameworks to improve coordination for managing transboundary pollution sources like stubble burning.

**BEST PRACTICES:**

- **Beijing's air quality management system:**
  - Beijing implemented a series of measures focused on **energy infrastructure optimization, coal-fired pollution control, and vehicle emission controls**
  - In the five years from 2013 to 2017, **fine particulate pollution (PM2.5) in Beijing fell by 35% and sulphur dioxide dropped by 83%.**
- **Airshed Management Overview**
  - **Concept Similarity:** Airshed management involves treating a geographic region as a unified area where pollutants disperse, similar to the concept of a watershed.
  - **Stakeholder Inclusion:** Includes the public, industry, and local governments as key stakeholders.



- **Purpose and Need:** Addresses air quality issues that result from the cumulative impact of various activities and emission sources, particularly exacerbated by geographical and meteorological conditions that restrict pollutant dispersion.
- **Successful Implementations:** Has been successfully applied in areas such as California, USA.
- **Potential Application:** Suggested for the Indo-Gangetic plain to develop new strategies for pollution reduction.

**PRACTICE QUESTION:**

**Q. Analyze the major factors contributing to air pollution in Delhi and suggest measures to mitigate these issues, with special reference to the airshed management approach. (10 marks, 150 words)**

**APPROACH:****Introduction :**

- Begin by describing how the end of the southwest monsoon leads to poor air quality in Delhi, worsened by stubble burning.

**Body :**

- Discuss major factors contributing to air pollution in Delhi significance of the guidelines
- Suggested measures with special reference to airshed management

**Conclusion :**

- Conclude with some government initiatives.

**MODEL ANSWER:**

With the withdrawal of the southwest monsoon, Delhi consistently experiences a severe decline in air quality, a recurring issue marked **by PM2.5 levels rising above 300, which signals a 'very poor' air quality status. This regular pattern is often exacerbated by stubble burning** from neighboring states like Punjab and highlights the complex interplay of factors contributing to the city's recurring air pollution crisis during this particular time each year.

**Major Factors Contributing to Air Pollution in Delhi**



1. **Stubble Burning:** A 2023 study by Climate Trends identifies that up to 35% of Delhi's PM2.5 levels during peak burning seasons are due to stubble burning in Punjab and Haryana. This seasonal activity significantly deteriorates air quality.
2. **Vehicular Emissions:** The Indian Institute of Tropical Meteorology (IITM) reports that vehicular emissions contribute about 18% to PM2.5 levels in Delhi, underlining the city's heavy reliance on road transport.
3. **Industrial Activities:** According to TERI's inventory, industrial activities contribute 36% of PM2.5 emissions in Delhi, from sectors including power plants and manufacturing units that often use outdated pollution control technology.
4. **Geographical Challenges:** Delhi's landlocked position exacerbates air pollution, with the Himalayas to the north trapping pollutants during periods of low wind in winter.
5. **Meteorological Conditions:** The Indian Meteorological Department (IMD) highlights that reduced wind speeds and temperature inversions are frequent in winter, significantly affecting pollutant dispersion.
6. **Transboundary Pollution:** Pollution does not respect borders, affecting Delhi from surrounding states. This necessitates regional cooperation for effective air quality management.

< May include diagrams and maps provided in the article.>

#### **Suggested Measures with Special Reference to Airshed Management**

1. **Adopt Airshed Management:** Airshed management treats a geographic region as a single entity, considering all pollution sources collectively rather than in isolation.

#### **Potential Benefits of Airshed Management**

**Unified Approach:** Facilitates coordinated actions across different administrative regions and sectors, leading to more effective pollution control.

#### **Successful Implementations:**

- **California, USA:** Has successfully implemented airshed management to significantly improve air quality by regulating emissions from various sources including vehicles and industry.
- **Beijing, China:** Implemented similar strategies which resulted in a 35% reduction in PM2.5 levels from 2013 to 2017 by targeting coal-fired pollution and vehicle emissions.

2. **Policy Enforcement:** Effective enforcement of the Air (Prevention and Control of Pollution) Act, 1981 and Environment Protection Act, 1986 is crucial. These should be rigorously applied to curb emissions from all sources.
3. **Enhance Public Transport:** Developing a robust, integrated public transport system can reduce dependency on personal vehicles, thus lowering vehicular emissions.
4. **Promote Clean Energy:** Promoting the adoption of renewable energy sources and electric vehicles through incentives can decrease reliance on fossil fuels.
5. **Community Engagement:** Involving communities in air quality management initiatives ensures better adherence to regulations and fosters sustainable practices.
6. **Strengthen Inter-State Coordination:** Enhanced collaboration between states is vital, especially in tackling widespread issues like stubble burning that affect air quality across state lines.

Delhi's To combat air pollution in Delhi, a combination of national policies like the **National Clean Air Programme and Bharat Stage VI standards**, alongside local initiatives such as the **Odd-Even scheme and Graded Response Action Plan (GRAP)**, are essential. These efforts, integrated through an airshed management framework, are key to significantly improving air quality and ensuring a sustainable, healthy future for Delhi.