

Urban Aerosol Pollution

Mains: GS III - Environmental Pollution and Degradation

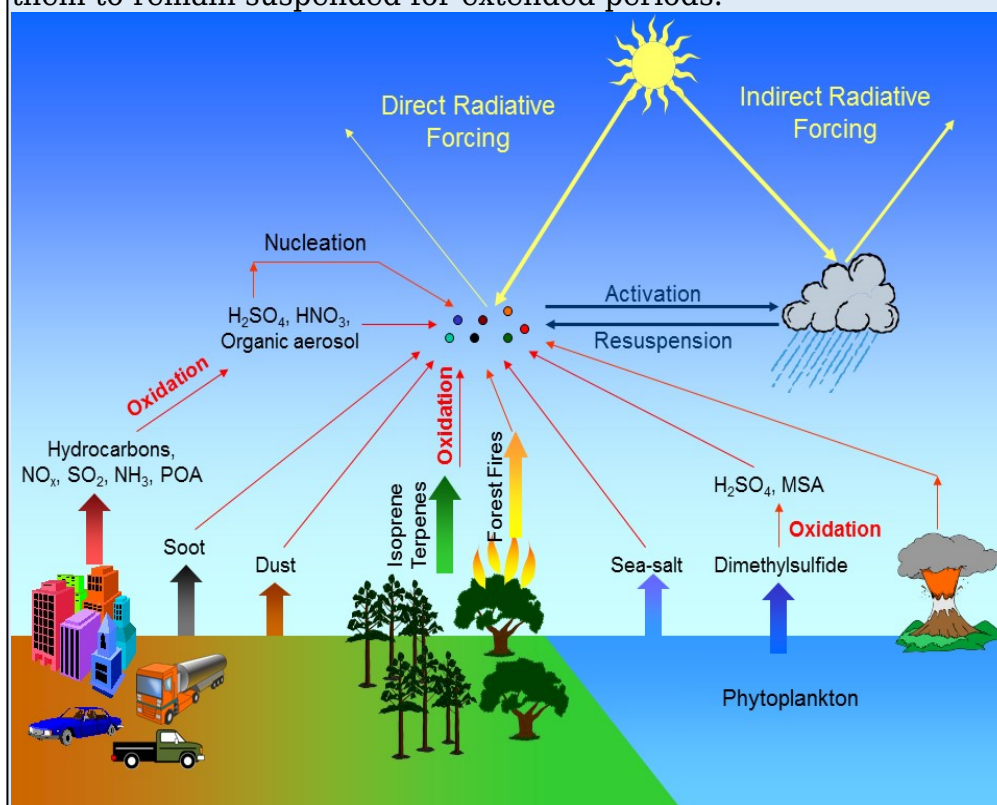
Why in the news?

A recent study on aerosols levels of 141 cities in India from 2003 to 2020 by IIT at Bhubaneswar, has shed new light on urban aerosol pollution patterns across India, revealing a north-south divide in how pollution domes form over cities.

What is urban aerosol pollution?

Aerosols

- It is a suspension of fine solid particles or liquid droplets in a gas, most commonly in air.
- **Sources**
 - Natural cause - Volcanoes
 - Anthropogenic cause - Burning fossil fuels.
- **Size** - They are typically small, with diameters *often less than 1 micrometre*, allowing them to remain suspended for extended periods.



- **Role** - They play a role in atmospheric processes, influencing air quality, weather, and climate.

- **Urban aerosol pollution** - It refers to the presence of *small, solid, or liquid particles*

suspended in the atmosphere within cities.

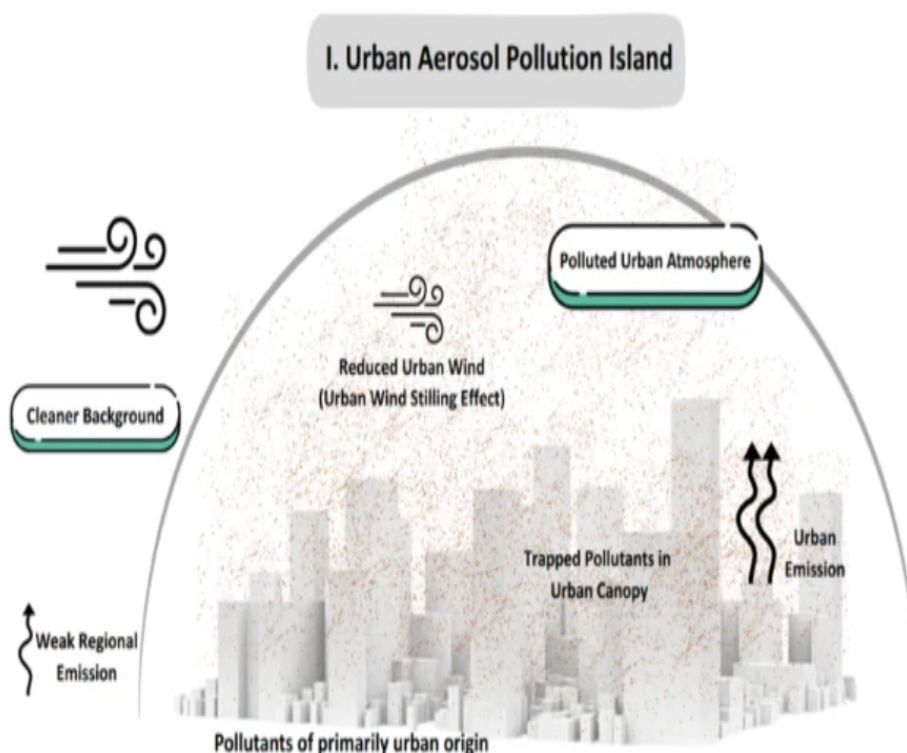
- **Two types**

- Urban aerosol pollution island
- Urban aerosol clean island

- **Urban aerosol Pollution Island** - It refers to the cities that show higher aerosol levels than the surrounding areas.
- It occurs, whenever less transport of aerosol or pollution is happening irrespective of the season.
- The aerosol levels were not uniformly higher in the surrounding areas compared with the city.
- **Urban aerosol clean island** - It refers to the cities that show relatively lower aerosol levels compared with the surrounding areas.

What is the level of urban aerosol pollution Island in India?

- **Regional variation** - 57% Cities in south and southeast India show higher aerosol levels inside the city compared to neighbouring parts.
- **Causes** - This occurs due to local pollution sources which dominates aerosol presence and lack any large external source of pollutants coming from elsewhere.
- It became distinct in many cities during no dust scenario.



- **Consequences** - This results in a typical “pollution dome” where urban areas are more polluted than their rural surroundings.

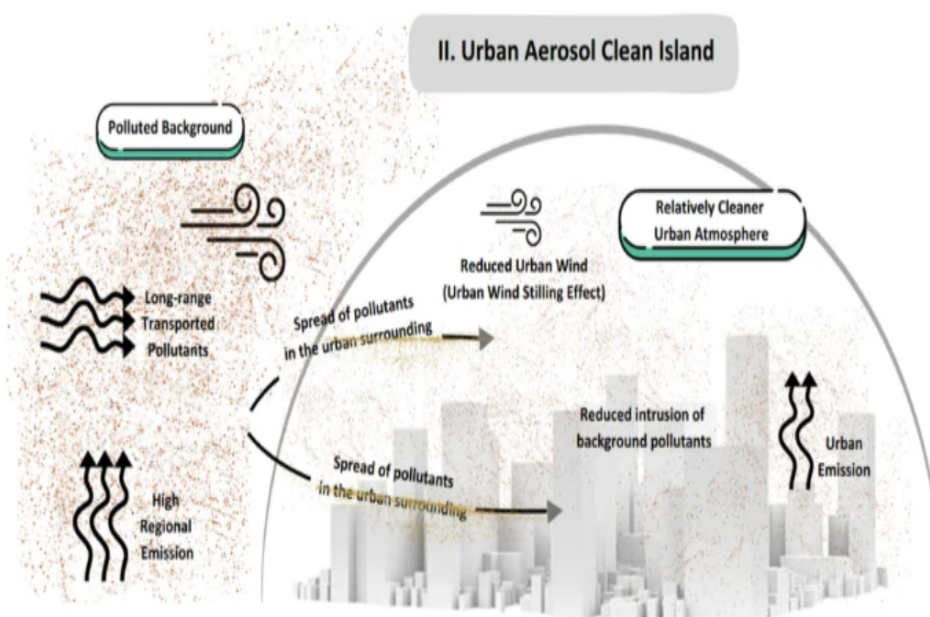
A pollution dome is a phenomenon where pollutants, such as smog and particulate

matter, become concentrated and trapped in the atmosphere usually above a city or industrial area, forming a dome-like layer of polluted air.

- **Higher level** - It is in the areas southwest of the city, which are located upstream of the dust flow.
- **Lower level** - It is in the northeast side of the city situated downstream of the dust flow that exhibited less aerosol levels which almost matched the levels seen in the city.
- It is a trail that continues downwind for some distance.

What is the level of urban aerosol clean Island in India?

- **Regional variation** - 43% of cities in northwest and northern Indo-Gangetic Plain display lower aerosol levels within city limits than in surrounding areas.
- North Indian cities, despite being blamed for poor air quality, are found to have no consistent pollution domes.
- **External aerosol source** - Aerosols from external sources such as dust from the Thar Desert and biomass burning contribute heavily to background pollution.
- It became pronounced in many cities in high dust case.



- Clean island effect is whenever the pollution transport from outside is enhanced.
- **Cities as barriers** - The infrastructures of the cities block aerosol entry and creating cleaner urban zones compared to their surroundings.
- This unexpected pattern is linked to a phenomenon known as urban wind stilling effect.

Wind Stilling Effect

- It refers to a *weakening of surface winds across highly urbanised cities* where the buildings and infrastructure reshape local climates, *creating zones of atmospheric stagnation*.
- These zones collectively lead to invisible barriers around the city in the upwind regions.
- They *partially block the entry of long-range aerosol* pollution, especially mineral dust from the nearby arid regions.
- This results in cities having relatively less aerosol loading than the surrounding areas.
- Global megacities such as *Shanghai, Atlanta and a few European cities* have urban aerosol clean islands.

- **Seasonal variation in India**

- **During monsoon** - Not studied due to non-availability of data due to clouds and rain.
- **Pre-monsoon** - Clearly observable.
- **Post-monsoon** - Normally disappears but seen again in winter due to dry conditions.

What lies ahead?

- Deeper scientific understanding could help to evolve an idea on how urban growth and emerging micro-climates influence air pollution and its spatial patterns.
- Creation of truly sustainable, climate-resilient cities will depend on our capability to understand and anticipate these multifaceted interactions as cities continue to grow.

Reference

[The Hindu| Urban Aerosol Pollution](#)



SHANKAR
IAS PARLIAMENT
Information is Empowering