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Assessing the Environmental Impact of Urbanisation in Bhagalpur City, Bihar

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Abstract
Urbanisation involves the growth of population and industrial activities in cities, often fuelled by migration from rural areas. In India, rapid and unplanned urban expansion has led to severe environmental problems such as air and noise pollution, water contamination, land encroachment, and poor waste management. Bhagalpur City, a growing urban centre in Bihar, is facing similar challenges. This study assesses the impact of urbanisation on air and water quality, rising population, and increasing vehicle density. Based on secondary data from government reports and pollution control boards, the study reveals that unregulated urban growth in Bhagalpur is harming environmental health and reducing the quality of life. Issues like traffic congestion, unmanaged slums, and inefficient waste disposal are major concerns. To ensure sustainable development, coordinated efforts between government agencies and local citizens are essential, focusing on planned urban development and improved environmental infrastructure.

Keywords*:* Urbanisation, Waste Management, Pollution, Resources, Environment.

1. Introduction

Urbanisation is a major force transforming modern societies, especially in developing countries like India. It involves population growth and industrial expansion in urban areas, primarily driven by rural-to-urban migration in search of better opportunities. While urbanisation brings benefits like improved access to services and economic development, unplanned growth leads to serious challenges.

In India, rapid and poorly managed urbanisation has resulted in environmental and social issues such as air and noise pollution, water contamination, land encroachment, slum proliferation, and poor waste management. These issues threaten ecological balance and public health, especially among the poor.

Bhagalpur, the third-largest city in Bihar after Patna and Gaya, is a telling example of the complex dynamics of urbanisation. Strategically situated, Bhagalpur has emerged as a key centre for tourism, trade, and industry. Over the past decade, the city has experienced significant urban growth, driven by rising population and increased migration. However, this expansion has occurred largely in an unplanned manner, leading to urban sprawl and environmental degradation. The city now faces critical challenges, including the growth of slum areas, traffic congestion, deteriorating air and water quality, rising noise levels, and ineffective waste disposal systems, highlighting the urgent need for sustainable urban planning and environmental management.

2. STUDY AREA

Bhagalpur City, located in eastern Bihar, is situated approximately 220 km east of Patna and 410 km northwest of Kolkata, at 25°15′N latitude and 87°00′E longitude. Situated on the southern alluvial plains of the Ganga River, the Ganga bounds it to the north, the Champa River to the west, and a railway line to the southwest. Covering 26 km² with 51 wards, Bhagalpur City falls under Jagdishpur sub-district and serves as the district and divisional headquarters. Rich in cultural heritage as part of the ancient Anga region, the city is well connected by NH-80 and State Highways 19 and 25, ensuring strong road and rail connectivity.

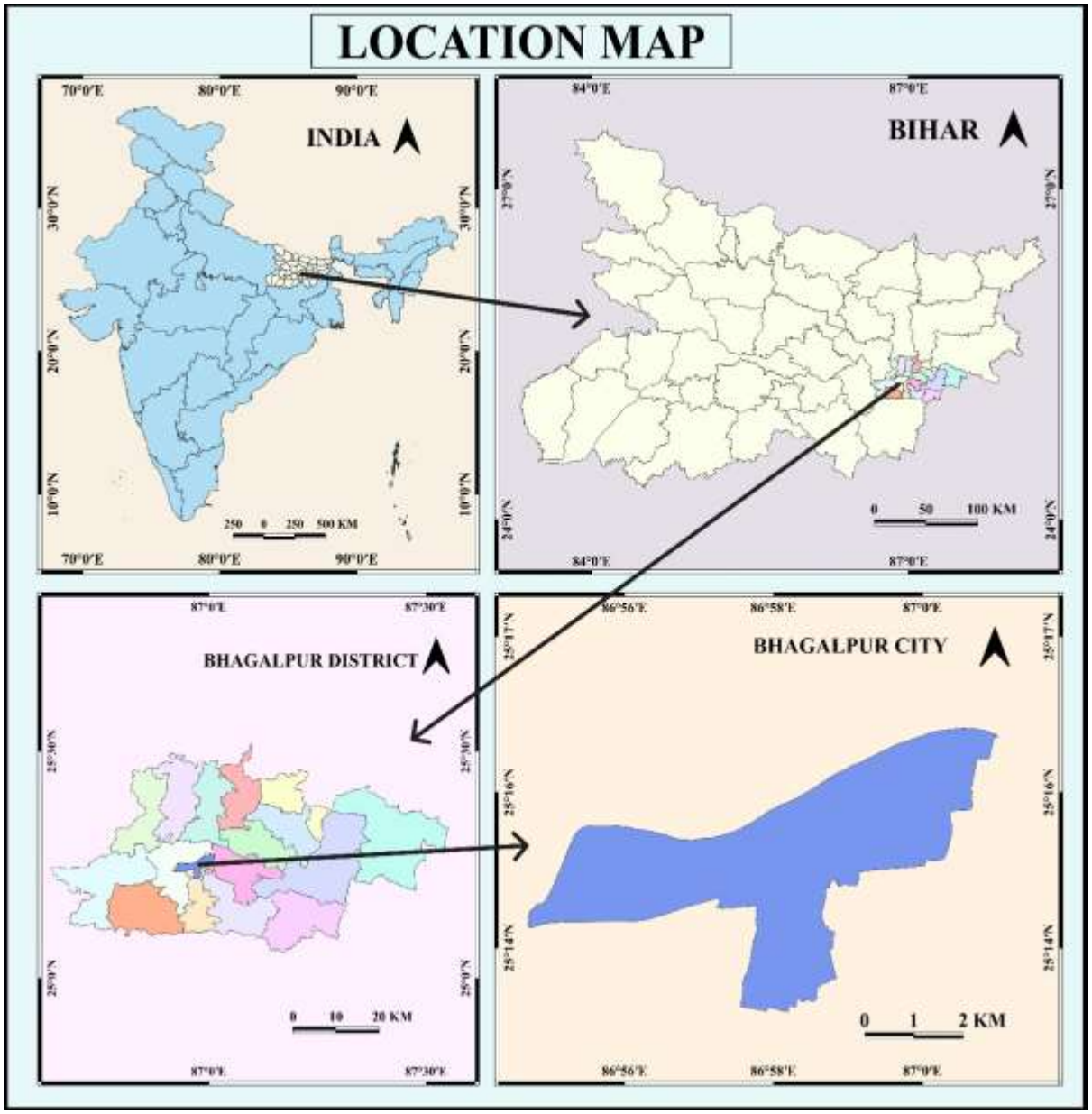

Figure 1: Location Map of Study Area

3. Literature Review

Urbanisation has emerged as a critical driver of environmental change, with numerous studies highlighting its diverse impacts on air quality, land use, ecosystems, and overall sustainability. The following literature

offers insights into the environmental implications of rapid urban growth across different Indian and South Asian contexts.

Newman and Kenworthy (1999) observed that increased reliance on automobiles in urban areas contributes to deteriorating air quality and global climate change. **Beatley (2000)** introduced the concept of **green urbanism**, advocating for the harmonious integration of urban development with natural ecosystems. **Landry and Wood (2003)** explored how urban cultures can foster innovative environmental solutions, emphasising the role of arts and creativity in promoting sustainability. **Brown et al. (2009)** emphasise the importance of sustainable urban water management and the role of integrated practices in addressing urban water challenges.

Foster and Kumar (2011) highlighted that high population density in cities leads to increased greenhouse gas emissions and energy consumption, affecting environmental sustainability.

Chen et al. (2012) noted that urban waste management challenges often result in significant land and water pollution, especially in rapidly growing urban centres. **Yadav et al. (2012)** assessed air quality in Jhansi City and found elevated levels of particulate matter in urban areas, indicating severe air pollution compared to rural zones. **Rydin et al. (2012)** concluded that urban health is strongly influenced by air quality, access to green spaces, and urban design. **Dora et al. (2015)** emphasised that sustainable urban planning can improve both environmental conditions and public health outcomes. **Yadav (2016)** analysed the impact of urbanisation on forest areas in Guwahati, reporting increased forest degradation and recommending carbon reduction for eco-city transformation. **Ramaiah and Avtar (2019)** examined the role of green spaces in Indian cities, highlighting implementation challenges and suggesting ecological restoration and wastewater reuse to support sustainable urbanisation. **Aslam et al. (2021)** investigated wetland loss in North Bihar due to urbanisation, population growth, and agricultural expansion, noting threats to biodiversity and livelihoods. **Quadir (2022)** analysed the environmental transformation of the Ganga Basin, linking it to unplanned urban expansion and industrial activities. **Jaysawal and Saha (2023)** provided a broader overview of urbanisation in India, showing its impact on river basins, particularly the Ganga, in terms of altered hydrology and water quality. **Kahkasha (2025)** studied environmental degradation in Rudrapur, Udham Singh Nagar, following industrialisation since 2003, and recommended sustainable development strategies. **Tiwari et al. (2025)** reviewed the effects of urbanisation on river management in Kanpur, emphasising the need for balanced planning to achieve sustainability goals for India by 2047.

4. Objectives

These are the primary objectives of the study:

- To examine the trends and patterns of urbanisation in Bhagalpur City.
- To assess the impact of urbanisation on air quality.
- To study the impact of urbanisation on water quality.
- To suggest sustainable urban planning measures for mitigating negative environmental impacts and promoting eco-friendly development in Bhagalpur city.

5. Data Source and Methodology

This study is primarily based on the analysis of secondary data, collected and reviewed from a range of credible sources. Key references include Census of India reports, the District Census Handbook

(Bhagalpur), the Bihar State Census Report, the Municipal Solid Waste (MSW) Management Report for Bhagalpur, and official documents. Additionally, relevant books, academic journals, and government websites were consulted to support contextual understanding and analytical depth. To process and analyse the data, Microsoft Excel was used for compiling statistical information, creating tables, and generating basic charts to visualise data. QGIS was employed for map-making.

6. Result and Discussion

1) Urbanisation Trends in Bhagalpur City

The population data from 1901 to 2011, as shown in Table 1, reveals a clear pattern of urbanisation in Bhagalpur City, marked by long-term growth, though with some fluctuations. This population trend is a critical indicator of the city's urban expansion and socio-economic transformation.

- **Early 20th Century (1901–1931): Slow or Negative Growth:**

Between 1901 and 1921, Bhagalpur city experienced a slight population decline, marked by negative growth rates of -1.9% in 1911 and -7.4% in 1921. This downward trend can be attributed to several challenges prevalent during the colonial era, such as inadequate infrastructure, frequent health crises, and outward migration due to limited economic opportunities. However, by 1931, the city witnessed a significant demographic turnaround with a positive growth rate of 21.7%. This marked the beginning of a phase of gradual urban consolidation, indicating improvements in living conditions and possibly enhanced administrative and economic stability that encouraged population retention and growth.

Table 1 Population Trends of Bhagalpur City (1901-2011)

Census Year	Population	Growth Rate (%)
1901	75,760	–
1911	74,349	-1.9
1921	68,878	-7.4
1931	83,847	21.7
1941	93,254	11.2
1951	1,14,530	22.8
1961	1,43,850	25.6
1971	1,72,202	19.7
1981	2,25,062	30.7
1991	2,53,225	12.51
2001	3,40,767	34.57
2011	4,00,146	17.4

Source: Urban Wetland /Water Bodies Management Guidelines, Vol. II (2021)

- **Mid-20th Century (1941–1971): Moderate Urban Growth:**

From 1941 to 1971, Bhagalpur city witnessed steady population growth, with rates ranging between 11.2% and 25.6%. This period corresponds to the post-independence era, reflecting the impact of early urban development initiatives undertaken after 1947. Modest improvements in administrative functioning, expansion of local trade, and gradual enhancement of infrastructure contributed to making the city more

habitable and economically viable. These developments encouraged population growth, marking a phase of consistent urban expansion and socio-economic stabilisation.

- **Late 20th Century (1981–2001): Rapid Urbanisation:**

The decades of 1981 and 2001 recorded notably high population growth rates in Bhagalpur, with 30.7% in 1981 and 34.57% in 2001. This surge can be linked to increased rural-to-urban migration, driven by the city's growing importance as a regional hub for trade, the silk industry, and education. The 1990s economic liberalisation further accelerated urban growth by opening new economic opportunities and attracting the workforce from surrounding rural areas. Additionally, the expansion of municipal boundaries and the proliferation of informal settlements contributed significantly to the population spike, reflecting both planned and unplanned urban expansion during this period.

- **Recent Trends (2001–2011): Slower but Continued Growth:**

In 2011, Bhagalpur's population growth rate declined to 17.4%, marking a noticeable slowdown compared to the sharp increases seen in the previous two decades. This deceleration likely reflects the limitations of the city's urban capacity, with increasing congestion, infrastructure stress, and the lack of adequately planned expansion becoming significant challenges. Despite the reduced growth rate, the city still witnessed an absolute increase of nearly 60,000 people within a decade, highlighting the continued momentum of urbanisation and the pressing need for sustainable urban planning to accommodate future growth.

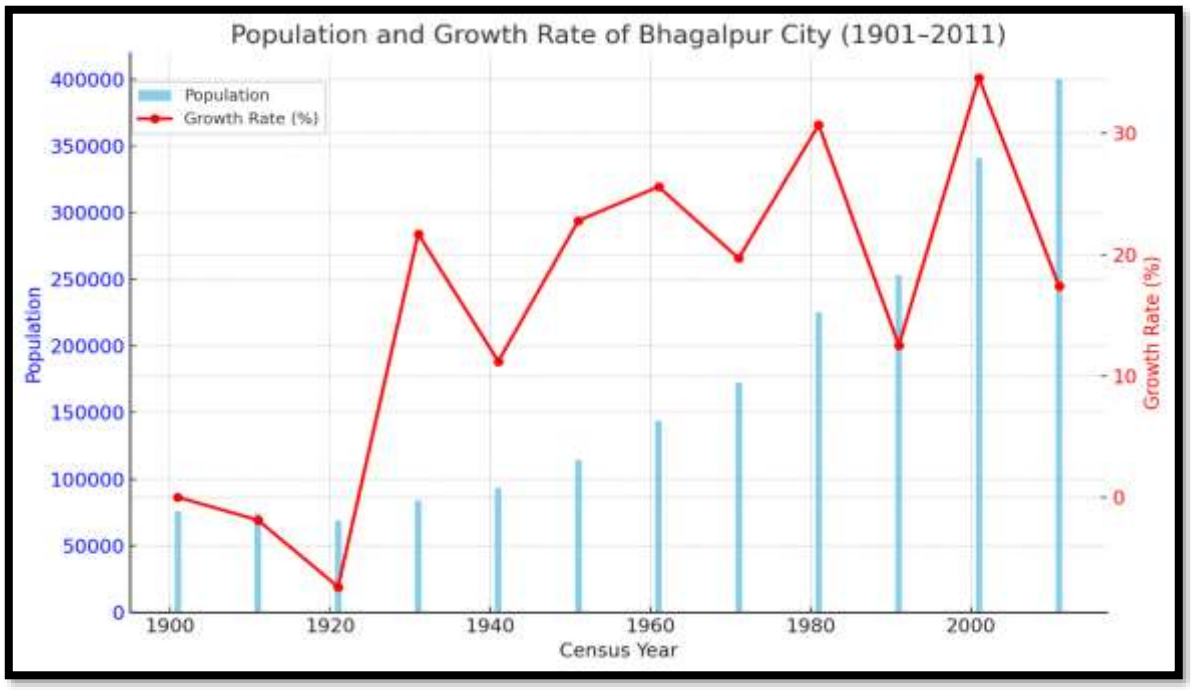

Figure 2: Population & Growth Rate of Bhagalpur City (1901-2011)

2. Environmental Impact Analysis

Urbanisation in Bhagalpur city has brought about significant transformations in its natural and built environment. While development has accelerated infrastructure growth and economic activities, it has also led to a range of environmental challenges. This section analyses the key areas of ecological concern emerging from rapid urban development, with a focus on air pollution, water quality degradation.

- **Air Pollution**

Rapid urbanisation in Bhagalpur city has contributed significantly to deteriorating air quality, particularly due to the increasing volume of vehicular traffic and the expansion of small-scale industries. The urban core, including areas such as Tilkamanjhi, Station Chowk, and Nathnagar, now faces frequent traffic congestion, resulting in higher emissions of air pollutants, including PM **2.5**, PM**10**, NO_2, and CO_2.

The growth in private vehicle ownership, particularly two-wheelers and three-wheelers, combined with inadequate public transportation, has led to continuous vehicular movement throughout the day. Diesel-powered generators and brick kilns located on the outskirts of the city exacerbate air quality issues during peak production seasons. According to the Bihar State Pollution Control Board, air quality monitoring data shows elevated pollutant levels, particularly during the winter months when atmospheric inversion traps pollutants closer to the surface. Urban expansion has also led to a reduction in green cover, which previously acted as a natural sink for airborne pollutants. The loss of tree belts along roadways and the encroachment on open spaces further exacerbate air pollution problems. The Bhagalpur Transport Department reports that vehicular density has increased sharply in the past two decades, especially with the rise in commercial and freight traffic linked to wholesale markets and inter-district connectivity. These trends indicate a clear correlation between urban expansion, transportation stress, and declining air quality, highlighting the need for integrated urban transport planning, vehicle emission control, and green infrastructure development.

Table 2: Annual Trends of Air Pollution in Bhagalpur City (2020 to 2024)

Parameters	2020	2021	2022	2023	2024
PM 2.5 ($\mu g/m^3$)	106	47	83	84	59
PM 10 ($\mu g/m^3$)	106	81	156	160	108
CO (ppb)	-	-	313	904	632
NO_2 (ppb)	8	11	21	15	8
O_3 (ppb)	14	19	13	12	15
SO_2 (ppb)	4	4	3	5	6

Sources: www.aqi.in/in/dashboard/india/bihar/bhagalpur

The air quality data over the last five years, as shown in Table 2, reveal fluctuating trends in major pollutants, indicating intermittent improvements and worsening of air quality depending on seasonal and anthropogenic factors:

1. PM2.5 (Particulate Matter ≤2.5 µg/m³)

PM2.5 levels in Bhagalpur have shown concerning fluctuations in recent years, indicating persistent air quality challenges. In 2020, the concentration reached an alarming 106 µg/m³, far exceeding the CPCB's safe limit of 40 µg/m³, reflecting severely polluted air. A significant drop was observed in 2021, with levels falling to 47 µg/m³, likely due to the nationwide COVID-19 lockdowns that curtailed vehicular and industrial activity. However, the improvement was short-lived, as PM2.5 levels surged again to 83 µg/m³ in 2022 and 84 µg/m³ in 2023, driven by the resurgence of vehicular emissions, construction activities, and unregulated urban expansion. Although a moderate improvement was recorded in 2024, with levels

decreasing to 59 µg/m³, air quality remains well above the safe threshold, underscoring the urgent need for sustained and comprehensive pollution control measures.

2. PM10 (Particulate Matter ≤10 µg/m³)

PM10 levels in Bhagalpur have consistently remained above the permissible limits, indicating ongoing air quality concerns. The concentrations peaked in 2022 at 156 µg/m³ and further increased to 160 µg/m³ in 2023, highlighting the impact of rising road dust, unregulated construction activities, and industrial emissions. Although there was a reduction in 2024, with PM10 levels dropping to 108 µg/m³, the figure still exceeds the CPCB's prescribed safe limit of 100 µg/m³. This trend underscores the need for stringent dust control measures, better regulation of construction practices, and enhanced monitoring of industrial emissions to curb particulate pollution in the city.

3. CO (Carbon Monoxide in ppb)

Carbon monoxide (CO) levels in Bhagalpur experienced a significant spike in 2023, reaching 904 ppb, which is indicative of increased vehicular emissions and inadequate traffic management. Although a decline was observed in 2024, with levels reducing to 632 ppb, this only marks a partial improvement and still warrants continuous monitoring. The persistently high CO concentrations highlight the need for stricter emission controls, promotion of cleaner fuels, and improved traffic flow strategies to ensure healthier air quality in the city.

4. NO_2 (Nitrogen Dioxide in ppb)

Nitrogen dioxide (NO_2) levels in Bhagalpur showed a rising trend from 8 ppb in 2020 to 21 ppb in 2022, indicating an increase in combustion-related activities such as vehicle emissions and industrial processes. However, this upward trajectory was followed by a decline to 15 ppb in 2023 and a further drop to 8 ppb in 2024, returning to the 2020 baseline. This reduction suggests that pollution control interventions such as stricter emission norms, improved fuel quality, and regulatory enforcement may have played a role in curbing NO_2 levels, reflecting a positive shift towards cleaner urban air.

5. O_3 (Ozone in ppb)

Ozone levels in Bhagalpur have remained relatively stable and within acceptable limits over recent years, fluctuating between 12 and 19 ppb. The highest concentration was recorded in 2021 at 19 ppb, but levels have remained steady and within the permissible range since then. This stability indicates that ground-level ozone pollution has not yet become a major environmental concern for the city, likely due to controlled precursor emissions and favourable atmospheric conditions. However, continued monitoring is essential to ensure levels remain within safe limits as urbanisation and vehicular activity increase.

6. SO_2 (Sulphur Dioxide in ppb)

Sulphur dioxide (SO_2) levels in Bhagalpur have remained consistently low, ranging between 3 and 6 ppb, which is well within the CPCB's safe limit. This indicates minimal contribution from large-scale sulphur-emitting sources such as heavy industry or coal-based power plants. However, slight increases observed in 2023 and 2024 could be attributed to localised activities like biomass burning and emissions from small-scale industrial units. While the overall levels are not alarming, continued vigilance is necessary to prevent any future escalation linked to unregulated combustion sources.

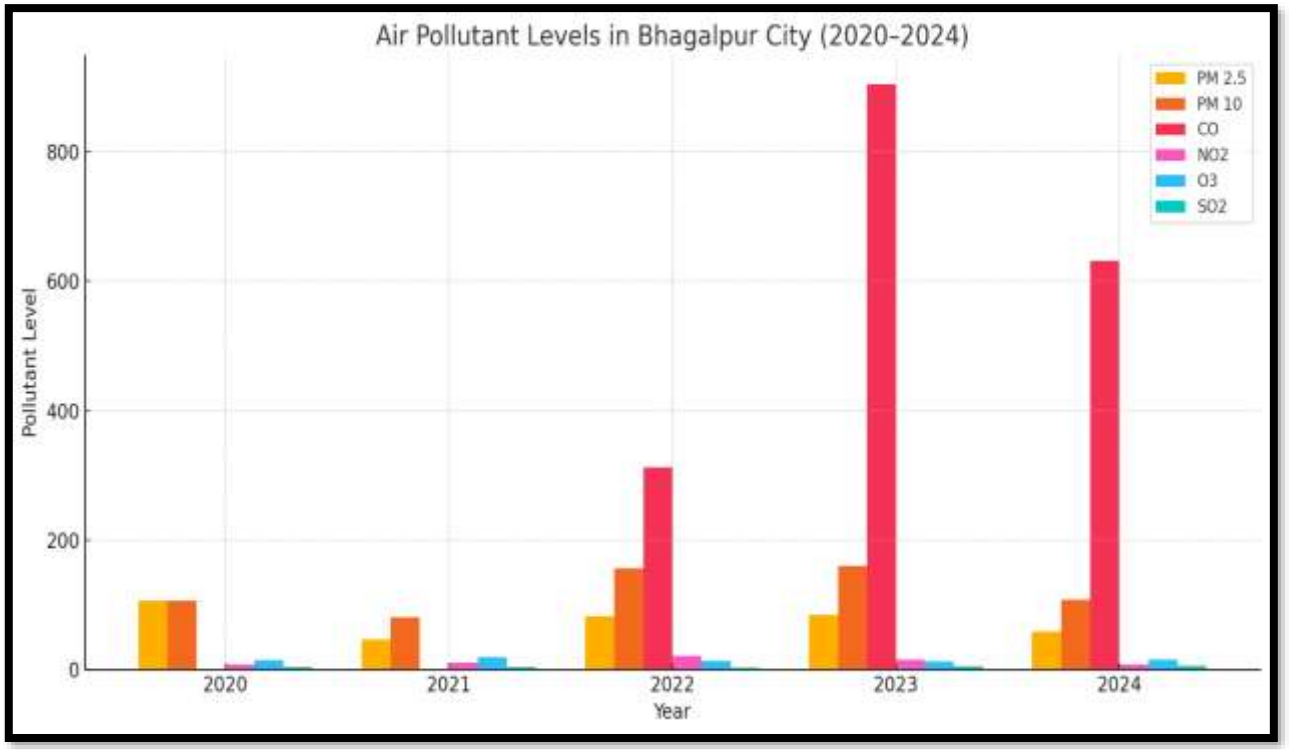

Figure 3: Air Pollutant Levels in Bhagalpur City (2020- 2024)

- **Water Pollution**

Rapid urbanisation in Bhagalpur City has led to the widespread degradation of its water bodies. Unregulated sewage discharge, solid waste dumping, and encroachments have severely polluted ponds, wetlands, and drainage systems. Once vital for groundwater recharge, biodiversity, and local livelihoods, these water bodies now face declining ecological health and rising public health risks.

Major Causes of Water Pollution in Bhagalpur City

- **Unregulated Waste Disposal**

A significant portion of domestic sewage and greywater in Bhagalpur is discharged into open drains without treatment, eventually contaminating local ponds and the Ganga River. Key water bodies such as Kachahari Pond, Adampur Talab, and nearby riverfront areas are severely impacted due to the lack of operational sewage treatment plants (STPs).

- **Solid Waste Dumping**

Daily municipal waste, including plastic, biomedical, and organic matter, is often dumped near Bhagalpur's water bodies, leading to the clogging of natural drainage channels and the release of harmful toxins into aquatic ecosystems.

- **Encroachments and Slum Settlements**

Unauthorised constructions near ponds in Bhagalpur have significantly disrupted natural catchment areas, reduced water recharge and altered drainage patterns. Additionally, residents of nearby slum settlements often depend on these ponds for their daily needs, resulting in faecal contamination and increased nutrient loading, which further degrades water quality and poses serious public health risks.

- **Cultural and Religious Practices**

Ritual immersions during festivals like Chhath Puja and idol immersions, often conducted without proper environmental safeguards, contribute to the accumulation of pollutants such as plaster of Paris, chemical dyes, and heavy metals in pond sediments. These practices not only degrade water quality but also disrupt aquatic life and accelerate the deterioration of already stressed water bodies in Bhagalpur.

- **Agricultural and Urban Runoff**

Runoff from surrounding areas carries pesticides, detergents, and fertilisers into Bhagalpur's ponds, accelerating the process of eutrophication. This nutrient overload leads to excessive algal growth, reduced oxygen levels, and the degradation of aquatic habitats, further threatening the ecological balance and water quality of these vital water bodies.

Ecological Assessment of Urban Water Bodies in Bhagalpur City

These are the 13 major urban water bodies based on three key parameters:

- **Catchment Impact**: Reflects the extent of urban pressure and construction within the immediate drainage basin.
- **Zone of Influence Impact**: Evaluates land-use encroachment and anthropogenic activities within 100 meters of the water body.
- **Ecosystem Service Score (0–20)**: Measures the ability of the water body to perform ecological services such as groundwater recharge, biodiversity support, flood mitigation, and social utility.

Table 3: Ecological Status and Ecosystem Service Scores of Major Urban Water Bodies

Water Body	Catchment Impact	Zone of Influence	Ecosystem Service Score (0–20)
Bhairava Pond	Medium	Low	18
Naya Tola Pond	Medium	Medium	12
University Pond	High	High	10
W9 Pond 1	High	Medium	18
W9 Pond 2	Medium	Medium	18
Nathnagar Pond	Medium	Medium	14
Dhobia Ghat Pond	Medium	Medium	14
Tanti Tola Pond	High	High	14
Shahjangi Peer Masjid Pond	Medium	Medium	17
Shahjangi Talaab (L)	Medium	Medium	12
Ragopur Talaab	Medium	High	13
Habibpur Talaab	High	Medium	13
Dighi Talaab	Low	Medium	18

Source: Urban Wetland /Water Bodies Management Guidelines, Vol. II (2021)

- **Key Observations and Interpretation**

High-Risk Water Bodies:

University Pond and Tanti Tola Pond in Bhagalpur are among the most critically endangered water bodies, suffering from severe encroachment and direct wastewater discharge. These pressures have resulted in alarmingly low ecosystem service scores of 10 and 14, respectively. Immediate restoration efforts are essential to prevent further ecological degradation and to revive their functional and cultural significance within the urban landscape.

Relatively Resilient Ponds:

Bhairava Pond, W9 Pond 1, and Dighi Talaab in Bhagalpur exhibit high ecological potential, each scoring 18 in ecosystem service evaluations. This is largely due to relatively well-protected catchment areas and minimal nearby encroachments. To preserve their ecological integrity and maintain urban ecosystem balance, these ponds should be prioritised for targeted conservation and sustainable management efforts.

Vulnerable Mid-Score Ponds:

Naya Tola, Shahjangi Talaab, and Ragopur Talaab are showing clear signs of ecosystem degradation, primarily due to increasing anthropogenic stress from nearby human activities. Encroachment, pollution, and unregulated land use around these ponds have compromised their ecological health, highlighting the urgent need for intervention and restoration measures to prevent further decline.

- **Environmental Implications**

The degradation of ponds and water bodies in Bhagalpur has led to several pressing challenges. Public health concerns have intensified, particularly in slum areas, with a rise in waterborne diseases such as diarrhoea, dysentery, and typhoid due to contaminated water sources. Simultaneously, there has been a noticeable decline in native fish and aquatic organisms, driven by toxic pollutants and reduced dissolved oxygen levels, indicating a loss of biodiversity. The disruption of vital ecosystem services, such as flood buffering and groundwater recharge, has further weakened the city's environmental resilience. Moreover, fishing communities and the urban poor, who depend on these ponds for daily sustenance and livelihood, now face growing vulnerabilities due to deteriorating water quality and ecosystem decline.

3. Recommendations for Sustainable Urban Planning

Given the intensifying air and water pollution challenges associated with Bhagalpur's rapid urbanisation, this section presents strategic urban planning interventions designed to curb environmental degradation, enhance public health, and advance sustainable and environmentally responsible urban growth.

3.1 Strategies to Mitigate Water Pollution:

To protect the Ganga and its tributaries from pollution, it is imperative to complete and operationalise all proposed Sewage Treatment Plants (STPs) under the Namami Gange Mission, ensuring that untreated domestic and industrial wastewater does not enter the river system. Equally important is the urgent need to upgrade ageing and leaking sewage infrastructure, particularly in congested and low-lying areas, where overflows and direct discharges into water bodies are common. Promoting household-level greywater treatment systems and incentivising eco-friendly drainage designs in residential and commercial developments can further reduce the burden on centralised systems. Strengthening monitoring and enforcement mechanisms is also essential to penalise illegal waste discharge into local ponds, rivers, and drains. Additionally, implementing strict buffer zone regulations to restrict construction near the Ganga

riverbank and other natural water bodies will help prevent encroachment and contamination, preserving the ecological integrity of these vital water resources.

3.2 Strategies to Reduce Air Pollution:

To tackle rising air pollution in Bhagalpur, it is essential to promote green public transport options such as electric buses and e-rickshaws, particularly in densely populated and high-traffic areas, thereby reducing vehicular emissions. Complementing this, the development of non-motorised transport infrastructure, including dedicated cycling lanes and pedestrian-friendly zones in markets, school areas, and along the riverfront, can encourage sustainable mobility while easing traffic congestion. Establishing urban green buffers, such as tree belts along roads and parks in pollution-prone zones, will help absorb particulate matter and enhance ambient air quality. Moreover, introducing air pollution monitoring stations at key traffic intersections and industrial areas will enable the city to track trends and design evidence-based environmental policies. Simultaneously, promoting the use of clean cooking fuels like LPG in slums and peri-urban areas is crucial to mitigating indoor air pollution and improving public health outcomes, especially among vulnerable communities.

3.3 Integrated Awareness and Governance Measures:

Addressing environmental challenges in Bhagalpur requires active public engagement and technological integration. Launching city-level awareness campaigns focused on the environmental and health impacts of air and water pollution can foster informed citizen participation, especially when schools, Resident Welfare Associations (RWAs), and community groups are actively involved. To ensure localised monitoring and accountability, ward-level environmental monitoring committees should be established, with citizen representation to oversee the implementation and reporting of pollution control measures. Moreover, leveraging Smart City ICT tools can significantly enhance real-time pollution tracking, data visualisation, and the dissemination of public alerts during periods of poor air or water quality, thereby promoting a more informed and responsive urban environment.

3.4 Green Infrastructure and Urban Resilience:

To enhance Bhagalpur's climate resilience, integrating urban greening strategies is essential. Initiatives such as tree-lined roads, vertical gardens, rooftop gardens, and the development of urban forests can significantly mitigate the Urban Heat Island effect, improve air quality, and enhance the city's overall livability. In parallel, enforcing climate-resilient zoning regulations is crucial to restrict construction in flood-prone and ecologically sensitive areas, thereby reducing environmental degradation and disaster vulnerability. Additionally, establishing robust early warning systems and community-level disaster preparedness plans will equip residents to effectively respond to floods, heatwaves, and other climate-related urban risks, ensuring a safer and more sustainable urban future.

3.5 Smart and Participatory Urban Governance:

Strengthening e-governance platforms is crucial for promoting transparency, real-time grievance redressal, and data-driven decision-making under the vision of **Sushaasit Bhagalpur**. By leveraging digital tools, the city can enhance administrative efficiency and ensure more responsive governance. Alongside this, institutionalising citizen engagement mechanisms such as regular public consultations, ward-level committees, and active youth participation can foster inclusive and participatory urban planning. Furthermore, encouraging Public-Private Partnerships (PPP) is vital for mobilising resources and expertise to address key infrastructure challenges, especially in areas like solid waste management, sanitation, and the development of green mobility solutions, thereby supporting sustainable urban growth.

3.6 Inclusive Urban Development and Livelihood Support:

To foster inclusive and sustainable urban development in Bhagalpur, it is essential to upgrade infrastructure in slums and low-income settlements, ensuring access to clean water, sanitation, electricity, and education for all residents. Equally important is the need to regularise and support the informal economy, which sustains a large portion of the city's population. This can be achieved by creating designated vending zones, offering skill development programs, and extending social protection to street vendors and daily wage workers. Additionally, promoting Bhagalpur's renowned Tussar silk industry and local handicrafts can help build a resilient and sustainable urban economy by generating environmentally friendly livelihoods rooted in traditional skills and cultural heritage.

7. Conclusion

In conclusion, Bhagalpur stands at a crucial juncture where proactive and sustainable policy interventions can transform it into a model for eco-conscious urban development in eastern India. By addressing current pollution concerns and promoting green infrastructure, the city can secure a healthier, cleaner, and more resilient future for its growing population.

The rapid pace of urbanisation in Bhagalpur City has brought with it significant environmental challenges, particularly in the form of rising air and water pollution. These issues, if left unaddressed, threaten the ecological balance, public health, and overall quality of life for the city's residents. Effective waste management, promotion of clean mobility options such as CNG and electric vehicles, and investments in critical water infrastructure like the Ganga Water Lift Project are essential for ensuring a sustainable urban future.

Moreover, improving sanitation and housing conditions in slum areas, managing rural-urban migration through balanced regional development, and upgrading traffic infrastructure will collectively reduce the environmental burden on the city. The Bhagalpur Municipal Corporation (BMC), supported by state and central government schemes, including the Smart City Mission and Namami Gange, must adopt integrated and forward-looking urban planning practices that prioritise both environmental protection and inclusive development.

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