



Morphology of the Town of Motihari: Issues, Challenges and Future Prospects

Dr Nutan Kumari

Assistant professor

Head, Department of Geography

D.B.K.N. College, Narhan, Samastipur

(L.N. Mithila University, Darbhanga)

Abstract

This paper analyses the morphology of Motihari, the district headquarters of East Champaran, Bihar. It explores the physical, historical, and socio-economic factors that have shaped the town's spatial form, identifies critical urban issues such as congestion, encroachment, and environmental degradation, and proposes sustainable morphological interventions. The study combines both primary and secondary data, GIS-based mapping and field observations to produce existing and proposed urban structure. The results reveal that Motihari's urban core around Motijheel Lake has expanded in a concentric yet unplanned manner toward the north-west and south-east fringes, producing spatial inequality and ecological pressure. Future morphological improvement depends on reclaiming public spaces, protecting the lake, improving drainage, and establishing a clear growth boundary.

Keywords: Urban morphology, land use, sustainable planning, flood risk, fringe development

1. Introduction

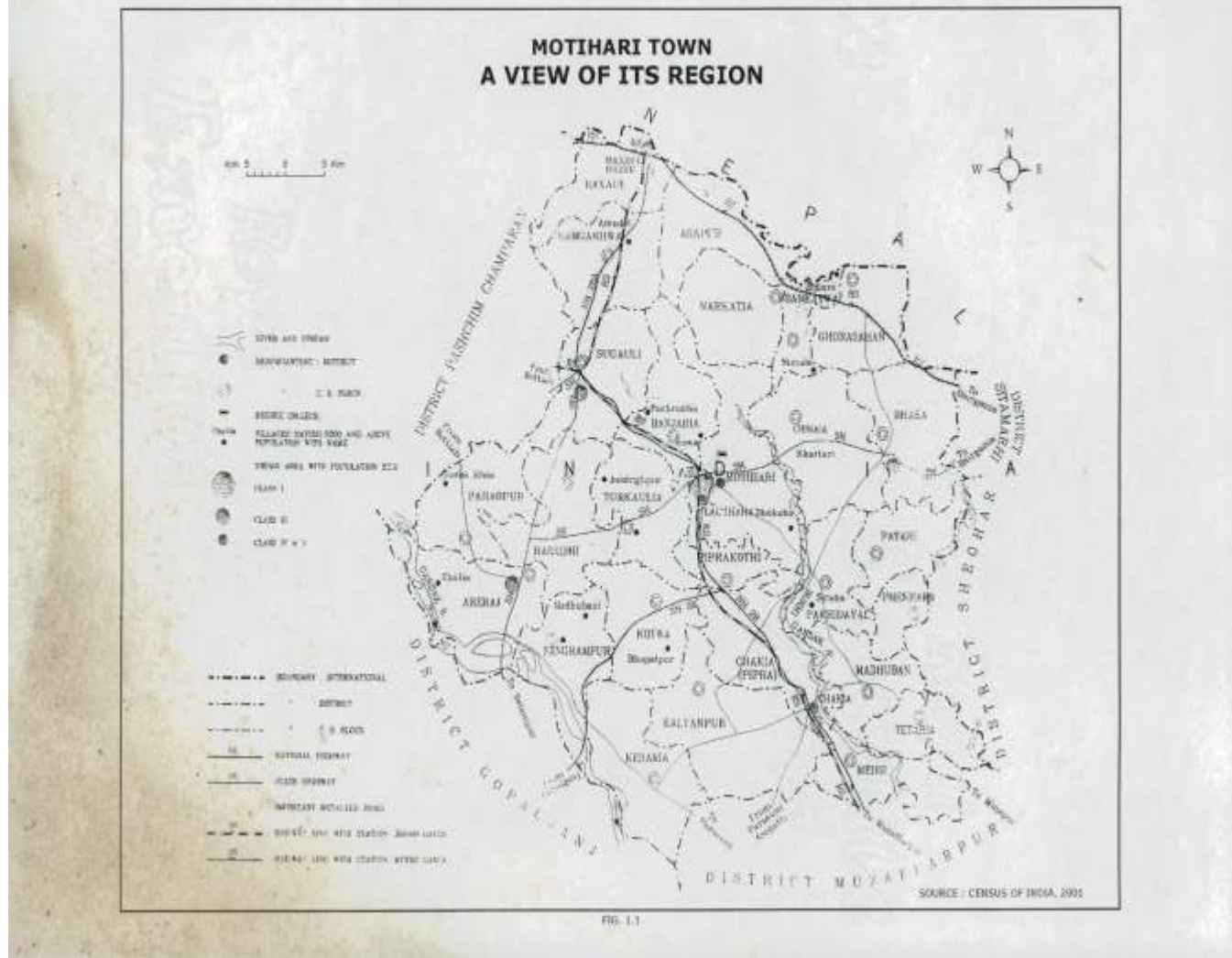
Urban morphology the study of a city's form and structure offers insight into the dynamics of small and medium Indian towns that are often overlooked in metropolitan-centred planning. Motihari, situated at approximately 26.65° N and 84.92° E, serves as an ideal case because it represents a transitional settlement between rural agrarian landscapes and emerging urban economies in north Bihar. The town has historical significance as the site of Mahatma Gandhi's first Satyagraha during the Indigo movement (1917) and now functions as an administrative, commercial, and educational centre. In recent decades Motihari has experienced rapid population growth, vehicular congestion, and physical expansion without coherent planning. The morphology of the town is strongly influenced by its hydro-geomorphological context. The Motijheel Lake divides the urban core, while the Burhi Gandak River and its tributaries impose flood risks. As informal settlements and commercial strips expand along highways, the traditional morphology of narrow bazaars and colonial-era institutions is transforming.

Objectives

1. To describe and analyse the morphological evolution and structure of Motihari.
2. To identify and assess the major issues and challenges affecting its physical form.
3. To propose sustainable strategies for future morphological development.

Significance

Understanding Motihari's urban morphology helps planners address the spatial problems of small towns in flood-prone Bihar, where unregulated growth threatens ecological stability and quality of life.



2. Methodology

The study adopted a comprehensive and practical approach to understand the urban development and morphological characteristics of Motihari. The research relied primarily on two types of data: primary and secondary. Primary data were collected through field surveys, on-site visits, and analysis of Google Earth imagery. This included photographic documentation and detailed observations of the town's main markets, residential colonies, Motijheel Lake, and peripheral settlements, recording their spatial arrangement, land use, and physical conditions.

Secondary data were drawn from the Census of India (2011), the Bihar District Gazetteer for historical and geographic information, published research articles, local news portals, and municipal ward maps. Additionally, cartographic data from GIS portals and open-source

mapping platforms were utilized to digitize and analyze built-up areas, land use patterns, and morphological zones accurately.

GIS was used to delineate the town's core, intermediate, and fringe zones, visually representing spatial distribution and density patterns. A SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) was also conducted to identify the town's potential and key challenges.

Moreover, a comparative interpretation technique was applied, comparing historical maps with contemporary spatial data. This approach allowed for the identification of morphological transformations, growth patterns, and emerging urban issues.

Finally, the collected data and analytical insights were integrated to develop a conceptual model for sustainable morphological improvement, highlighting strategies for balanced growth, environmental preservation, and inclusive urban development. This methodology ensures that the town's historical context, hydro-geomorphology, and socio-economic dynamics are all considered in planning its future spatial structure.

3. Study Area Profile: Motihari Town

Motihari is the headquarters of East Champaran District in north Bihar, approximately 150 km north of Patna and 40 km south of the Indo-Nepal border. The municipal area covers about 14 km² with a population of roughly 125 000 (2011 Census), yielding a density exceeding 9 000 persons/km².

3.1 Physical Setting - The town lies on a gently sloping alluvial plain of the Burhi Gandak basin. The central natural feature is **Motijheel Lake**, a large ox-bow shaped water body created by fluvial action. The lake divides the settlement into eastern and western

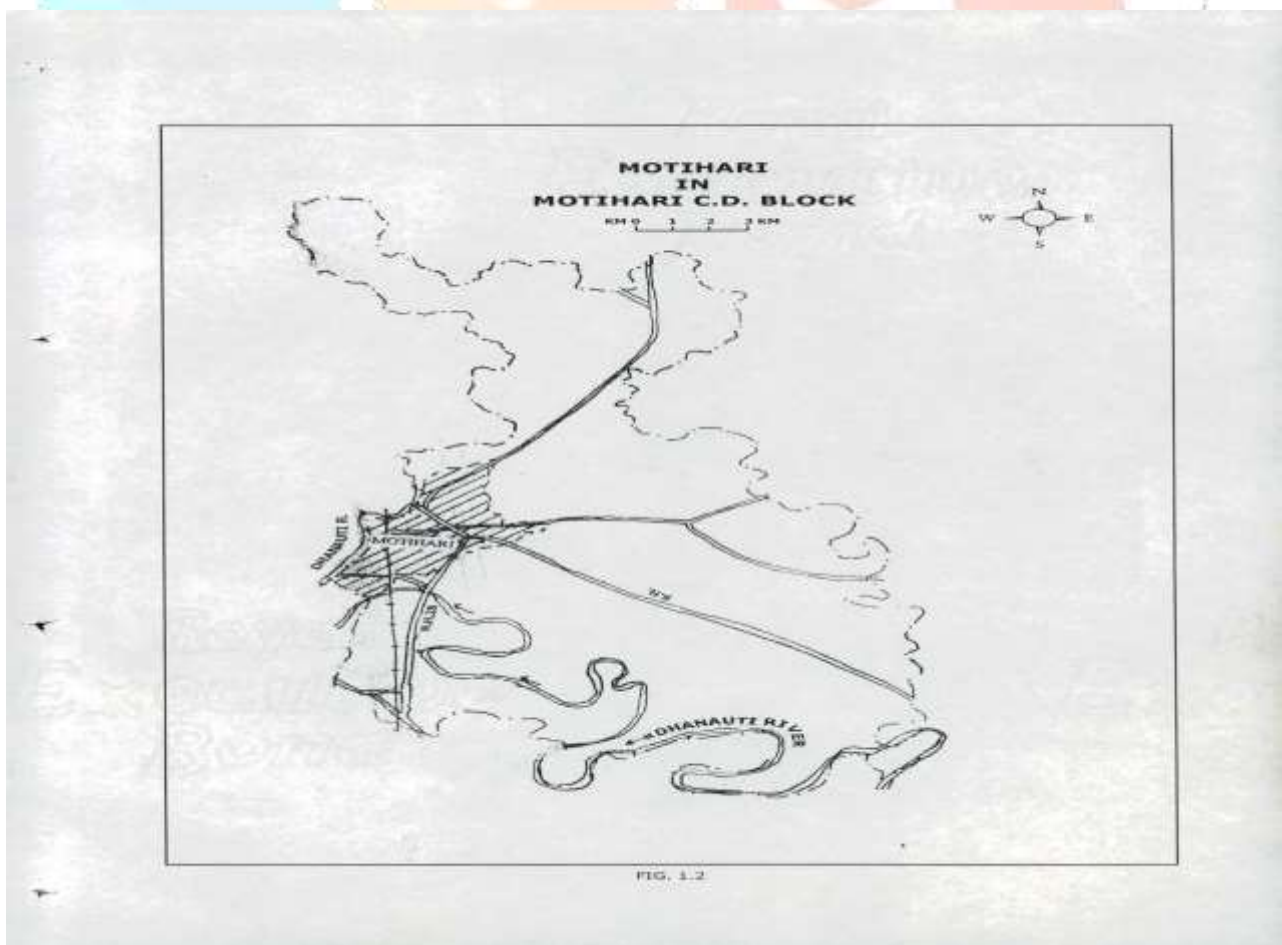


Figure: 2 Motihari C.D. Block
Source:- Census of India, 2011

halves and influences micro-climate, drainage, and land values. The climate is humid subtropical with mean annual rainfall around 1 300 mm.

3.2 Socio-Economic Context

Motihari functions as a service-oriented economy: administrative offices, educational institutions (Dr Rajendra Prasad Central Agricultural University nearby), small-scale industries, and local trade. Its market attracts rural populations from surrounding blocks, intensifying urban congestion. Informal economic activities line the major approach roads NH-28A and SH-54 creating a linear expansion.



Figure: 3 Base Map of Motihari town and its Region

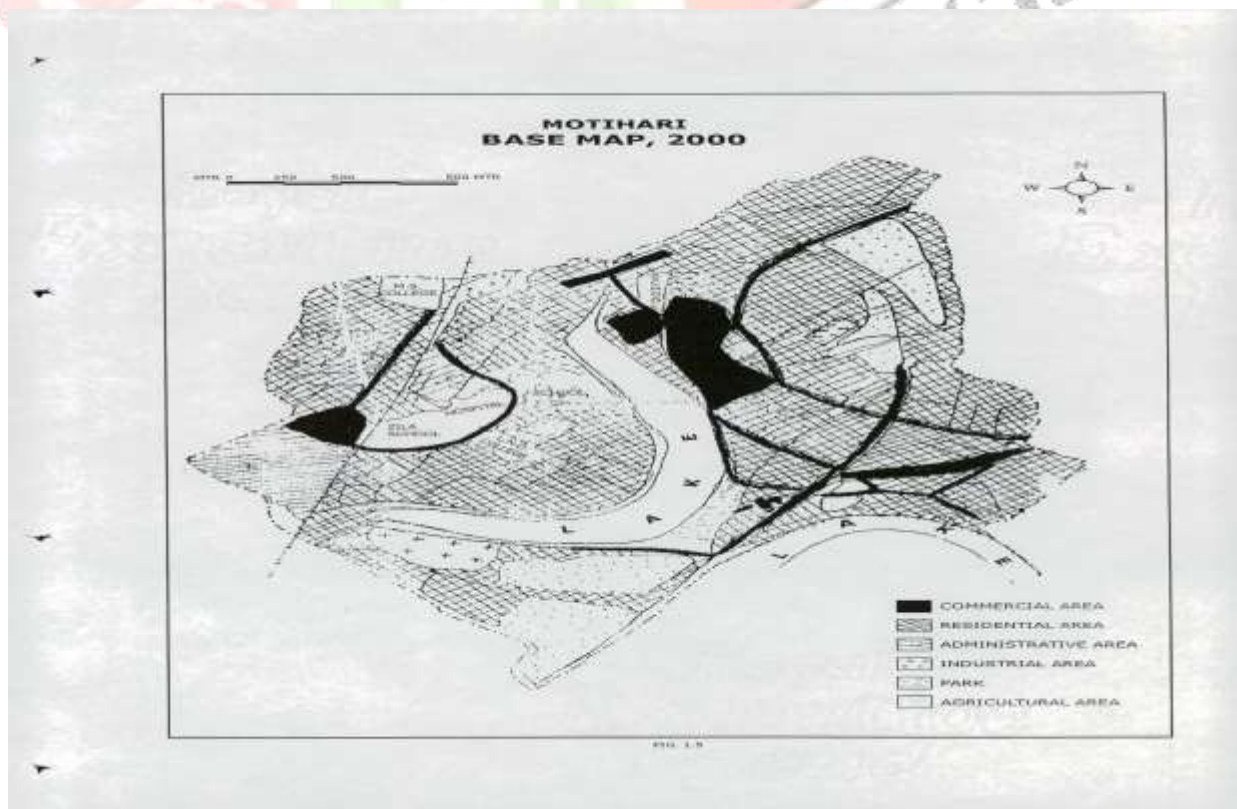


Figure: 4 Morphology of Motihari town in 2010

3.3 Historical Evolution

Originally a colonial district headquarters (1860s), the town grew around administrative precincts near the railway station. Post-independence, growth followed concentric rings outward from the core. Recent decades show ribbon-type development along roads toward Chhatauni and Raxaul, forming unplanned fringe zones.

4. Urban Morphology of Motihari

4.1 Overall Structure

Motihari's spatial form can be described as **concentric-cum-linear**. The earliest core developed around Motijheel Lake and the collectorate; later growth radiated along transport corridors. The railway station and bazaar define the inner commercial ring, while residential neighbourhoods extend outward in irregular clusters.

4.2 Land Use Pattern

- **Residential (approx. 45 %)** – Dense mixed housing in the old core, newer colonies such as Chhatauni Extension in the periphery.
- **Commercial (20 %)** – Markets near the station road, Raxaul Road, and Gandhi Chowk.
- **Institutional (15 %)** – Schools, hospitals, and government offices.
- **Open/Green (10 %)** – Mostly around Motijheel Lake and small playgrounds.
- **Industrial/Transport (10 %)** – Workshops, sawmills, and the railway yard.

4.3 Transportation Network

Motihari is connected via NH-28A to Bettiah and Muzaffarpur, and by broad-gauge rail to Raxaul and Patna. Within the town, narrow roads and encroachments cause severe congestion. Lack of a ring road concentrates all traffic through the core. Public transport is dominated by auto-rickshaws and e-rickshaws, producing high noise and air pollution.

4.4 Natural Morphology

Motijheel Lake is both an aesthetic and functional landmark serving drainage and recreation but rampant encroachment has reduced its water spread from 60 ha to about 40 ha (Telegraph India, 2023). Peripheral wetlands are being filled for housing, disturbing hydrological balance. The Burhi Gandak's seasonal floods frequently inundate low-lying wards (e.g., Ward 10 and 11).

4.5 Morphological Zones

Zone	Description	Characteristics
Core Zone	Around Motijheel, Gandhi Chowk, Station Road	High density, mixed use, narrow streets
Intermediate Zone	Suburbs such as Chhatauni, Rajendranagar	Residential colonies, partial infrastructure
Fringe Zone	Northern and eastern periphery	Unplanned sprawl, poor drainage, informal housing

4.6 Spatial Growth Trends

Comparison of 2001 and 2023 satellite images reveals that built-up area has doubled, expanding mainly northwest toward Piprakothi and southeast toward Raxaul Road. The pattern is fragmented; agricultural land pockets survive amid residential sprawl. The town lacks hierarchical open spaces or systematic street grids.

5. Issues and Challenges

5.1 Encroachment and Mobility

Encroachment is the dominant morphological problem. Shopkeepers extend structures onto pavements, forcing pedestrians onto roads. According to *The Telegraph* (2023), illegal grilles and kiosks occupy almost 40 % of footpaths along Station Road. Absence of parking zones worsens congestion, and the narrow colonial street layout offers little scope for widening. The morphological consequence is continuous “ribbon congestion,” disrupting the legibility of the urban core.

5.2 Drainage and Flooding

Choked drains and silted channels produce chronic waterlogging every monsoon. In 2017, *India Today* reported inundation up to 0.5 m in low-lying wards. The blocked natural link between Motijheel and Burhi Gandak aggravates flooding, transforming the lake from a buffer into a hazard. Morphologically, this causes deterioration of road surfaces and accelerates slum formation on marginal land.

5.3 Environmental Degradation

Encroachment and solid-waste dumping have severely polluted Motijheel Lake; eutrophication and weed growth reduce oxygen levels. Illegal construction has narrowed storm-water outlets. The absence of green belts means high surface temperatures in summer. Loss of open space not only threatens ecology but also alters the visual character of the town.

5.4 Socio-Economic Inequality

Peripheral settlements, particularly those of the Musahar community (Mooknayak, 2020), lack sanitation, paved streets, and reliable electricity. Fringe morphology reveals socio-spatial segregation: elite colonies on higher ground, informal clusters on flood-prone lowlands. Such inequality produces a dual city formal and informal without connective tissue.

5.5 Governance and Planning Deficits

The Motihari Municipal Council has limited technical staff and outdated cadastral maps. No statutory master plan exists; decisions are ad hoc. Eviction drives against encroachments are short-lived due to political pressure. Consequently, morphological control is absent, and the town expands reactively rather than strategically.

6. Future Prospects and Planning Strategies

6.1 Strengths and Opportunities

Motihari's strengths include its administrative importance, educational institutions, and proximity to tourist circuits (Gandhi Museum, Kesariya Stupa). Motijheel Lake and surrounding green areas offer scope for waterfront development. The proposed extension of piped natural gas and better connectivity to Patna (ToI, 2025) open prospects for planned growth.

6.2 Morphological Redevelopment

1. **Lakefront Rejuvenation:** Remove encroachments, dredge sediments, and develop a pedestrian promenade with controlled commercial zones.
2. **Road Reorganization:** Introduce a semi-ring road linking NH-28A and SH-54 to divert through traffic.
3. **Public Spaces:** Create pocket parks and open squares to restore urban permeability.

4. **Building Regulations:** Impose height and setback controls around Motijheel to preserve skyline.

6.3 Drainage and Flood Management

- Desilt and reconnect the Motijheel outflow to Burhi Gandak.
- Construct retention ponds in the south-eastern periphery.
- Adopt permeable paving in redevelopment areas. These measures will reshape the morphological relationship between built-up and water bodies.

6.4 Inclusive Development

Integrate peripheral informal settlements by providing infrastructure and tenure security. Low-cost housing should be developed on raised plinths in planned clusters rather than dispersed shanties. Community-based planning will reduce the physical divide between the formal and informal city.

6.5 Economic Revitalisation

Promote heritage and eco-tourism around Gandhi-related sites and the lakefront. Support small-scale carpentry and craft clusters through dedicated workspaces outside flood-risk zones. The resulting morphology will combine preservation of cultural identity with sustainable economic growth.

6.6 Conceptual Model

The proposed morphological model envisions a **polycentric pattern** a revitalized core around Motijheel Lake, supported by sub-centres at Chhatauni and Piprakothi. A continuous green corridor will integrate the lake, drainage channels, and open spaces, enhancing resilience. Planned densification within the core and controlled expansion at the periphery will balance efficiency and sustainability.

7. Conclusion

Motihari's morphology reflects the tensions between heritage and modernity, water and land, plan and spontaneity. The concentric-linear structure formed by historical growth has degenerated into an unregulated sprawl. Major challenges encroachment, flooding, congestion, and governance weaknesses threaten the town's environmental and spatial balance.

Future prospects depend on adopting a **morphology sensitive planning approach** that respects natural features, manages growth boundaries, and promotes inclusive urbanism. Reviving Motijheel Lake as a civic heart, implementing flood-resilient infrastructure, and strengthening municipal capacity can transform Motihari into a sustainable model for small-town Bihar.

References

1. Ahmad, E. (2019). *Urban geography of India* (5th ed.). Concept Publishing.
2. Banerjee, S., & Mahapatra, A. K. (2020). GIS-based urban growth analysis of North Bihar towns. *Spatial Information Research*, 28(4), 567–579. <https://doi.org/10.1007/s41324-020-00302-1>
3. Bhatta, B. (2010). *Analysis of urban growth and sprawl from remote sensing data*. Springer.

4. Census of India. (2011). *District Census Handbook: East Champaran (Motihari)*. Directorate of Census Operations, Bihar.
5. Chandna, R. C. (2021). *Geography of population: Concepts, determinants and patterns*. Kalyani Publishers.
6. Chaudhuri, B. (2017). Morphological evolution of small towns in the Gangetic plains. *Indian Journal of Regional Science*, 49(2), 25–38.
7. Department of Urban Development & Housing, Government of Bihar. (2023). *State urbanisation report: Bihar 2023*. <https://urban.bih.nic.in>
8. Environmental Planning & Coordination Organisation (EPCO). (2019). *Urban flood risk management guidelines for small towns*. Government of India Press.
9. GISmaps.in. (2024). *Motihari Nagar Nigam Ward Map*. <https://www.gismaps.in>
10. India Today. (2017, August 18). *Floods hit Bihar's Motihari town; NH-28A submerged*. <https://www.indiatoday.in>
11. Jha, R., & Sinha, R. (2019). Flood hazard zonation and settlement morphology in the Burhi Gandak basin, Bihar. *Geomatics, Natural Hazards and Risk*, 10(1), 1580–1599.
12. Joshi, P. K., & Arora, M. K. (2018). Remote sensing and GIS applications in urban morphological studies. *Journal of the Indian Society of Remote Sensing*, 46(3), 361–372.
13. Kalia, R. (2016). *Urban design in post-independence India: A morphological perspective*. Oxford University Press.
14. Kumar, A., & Singh, P. (2022). Informal urban growth and governance challenges in small Bihar towns. *Economic and Political Weekly*, 57(14), 48–56.
15. Kumar, B. (2018). Urban morphology of Motihari town and environmental challenges. *Eurasia Journal of Social Sciences*, 8(12), 45–58. <https://euroasiapub.org>
16. Kumar, S., & Pandey, S. (2020). Flood vulnerability assessment of Motihari using remote sensing. *Journal of Water and Climate Change*, 11(3), 789–801.
17. MapsofIndia. (2024). *Motihari Map, Bihar*. <https://www.mapsofindia.com>
18. Mishra, M., & Roy, A. (2021). Morphological transformation of small Indian towns: Case studies from eastern plains. *Journal of Urban Management*, 10(2), 189–202.
19. Mooknayak. (2020, October 30). *Musahar community in Rulhi village of Motihari struggles with poverty and caste discrimination*. <https://en.themooknayak.com>
20. National Institute of Urban Affairs (NIUA). (2022). *Small and medium town development framework for Bihar*. Ministry of Housing and Urban Affairs.
21. National Remote Sensing Centre (NRSC). (2023). *Bihar land-use/land-cover atlas (LULC 1:50 000)*. ISRO.
22. Nath, S., & Sharma, R. (2018). Hydro-geomorphology and urban sprawl in the Indo-Gangetic plain. *Environment and Urbanization Asia*, 9(1), 79–95.

23. Pandey, S. K., & Jaiswal, V. (2023). GIS-based analysis of urban land transformation in East Champaran. *Geo-Spatial Information Science*, 26(2), 215–228.
24. Patel, S., & Sharma, K. (2022). Inclusive planning strategies for flood-prone towns in Bihar. *Journal of Urban Planning and Development*, 148(4), 04022023.
25. Prasad, R. N. (2019). *Regional planning and development in Bihar*. Concept Publishing.
26. Rahman, A., & Agarwal, S. (2020). Assessment of urban heat islands in Motihari and Muzaffarpur using Landsat imagery. *Urban Climate*, 33, 100659.
27. Ranjan, R. (2021). *Ecological transformation of Motijheel Lake, Motihari: A case study*. Patna University Department of Geography (Unpublished dissertation).
28. Roy, A., & Chatterjee, S. (2019). Urban encroachment and morphology change in small Indian cities. *Habitat International*, 87, 48–59.
29. Saha, S., & Singh, R. B. (2018). *Urban ecology and sustainability in India*. Springer.
30. Saran, A. (2020). Participatory lake management for flood-resilient urban morphology. *Indian Journal of Environmental Planning*, 27(3), 71–84.
31. Sen, J., & Basu, M. (2021). Morphological resilience of water-based towns in northern India. *Town and Country Planning Review*, 92(1), 115–133.
32. Sharma, R., & Khan, N. (2020). Street encroachments and public-space deprivation in small towns. *Environment and Urbanization*, 32(2), 403–419.
33. Singh, R. B. (Ed.). (2018). *Urban development challenges, risks and resilience in Asian megacities*. Springer.
34. Singh, S. K., & Kumar, A. (2022). Drainage morphology and sustainability of lake-centred towns in Bihar. *Applied Water Science*, 12, 244.
35. Sinha, R., & Ghosh, S. (2019). Mapping flood-risk towns in the Ganga basin. *Natural Hazards*, 98(2), 887–905.
36. Srivastava, A. (2020). *Colonial heritage and morphological identity of district towns in Bihar*. Heritage India Press.
37. Surya, B. (2019). Morphological typologies and spatial structure in small South Asian towns. *Urban Morphology*, 23(1), 15–28.
38. The Telegraph India. (2023, July 14). *Encroachments spell traffic nightmare in Motihari*. <https://www.telegraphindia.com>
39. Times of India. (2025, February 3). *Motihari set to get piped natural gas within a year*. <https://timesofindia.indiatimes.com>
40. United Nations Human Settlements Programme (UN-Habitat). (2022). *Sustainable urban morphology guidelines for secondary cities in South Asia*. UN-Habitat Regional Office for Asia and the Pacific.