

IMPACT OF URBANISATION ON ENVIRONMENT AND BIODIVERSITY OF MENCHUKHA

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Abstract: Urbanisation is one of the most visible forms of development in modern society. While it improves infrastructure, connectivity and economic growth, it also creates pressure on natural ecosystems. Menchukha, a small but ecologically rich valley in Arunachal Pradesh, has recently witnessed noticeable urban expansion due to tourism, road development and administrative growth. The present study examines the impact of urbanisation on environment and biodiversity of Menchukha. A sample of 100 local residents was selected using purposive sampling. Data were collected using a self-developed questionnaire covering four dimensions: Urbanisation, Environmental Impact, Biodiversity Impact and Awareness & Conservation. Descriptive statistics, Pearson correlation and One-Sample t-test were used for analysis. The findings reveal a significant positive relationship between urbanisation and environmental impact ($r = 0.68$, $p < .01$). The study concludes that although development is necessary, unplanned urbanisation is creating environmental imbalance in Menchukha.

Keywords: Urbanisation, Environment, Biodiversity, Menchukha, Arunachal Pradesh

1.0 Introduction

Urbanisation refers to the process by which rural areas gradually transform into urban settlements due to population growth, infrastructure development and economic expansion. It is often considered a symbol of progress and modernisation. However, rapid and unplanned urban growth can disturb ecological balance and natural ecosystems (**United Nations, 2018**). In India, urbanisation has increased steadily over the last few decades. Even remote and hilly states like Arunachal Pradesh are experiencing developmental changes due to improved road connectivity, tourism promotion and government schemes. While such growth improves living standards, it also raises concerns about environmental sustainability. Arunachal Pradesh is known for its rich biodiversity, forest cover and fragile mountain ecosystem. According to the Forest Survey of India (2021), the state has one of the highest forest cover percentages in the country. However, increasing construction activities and land use changes are slowly altering its ecological pattern.

1.1 Urbanisation in Menchukha: A Growing Concern

Menchukha is a beautiful valley located in Shi-Yomi district of Arunachal Pradesh, near the Indo-China border. It lies at an altitude of approximately 6,000 feet above sea level. The region is surrounded by snow-covered mountains, dense forests and river systems. The climate is cold and temperate, with heavy rainfall during monsoon and snowfall during winter. Menchukha is ecologically rich and supports diverse flora and fauna. It is home to rare species such as the Red Panda, Himalayan Monal, Musk Deer and various medicinal plants. The forest ecosystem and river biodiversity form the backbone of the region's environmental identity.

In recent years, Menchukha has become a major tourist attraction. Road construction, homestays, hotels, administrative buildings and increasing population have changed the physical landscape. Though development has improved connectivity and income opportunities, it has also increased waste generation, forest clearance

and pressure on wildlife habitats. Local residents have observed reduction in forest cover, decrease in wildlife sightings and growing pollution in river areas. These changes raise important questions about sustainability.

1.2 Impact of Urbanisation on Environment

Urbanisation affects the environment through deforestation, pollution, waste, water contamination and habitat loss. Expansion of towns leads to forest clearing for roads, buildings and tourism. In India, urban growth is a major driver of land use change (NRSC, 2020). In Arunachal Pradesh, with over 79% forest cover, even small-scale deforestation can disrupt ecology and local climate (FSI, 2021). Air and noise pollution rise with more vehicles, construction and tourist traffic (CPCB, 2019). Solid waste generation increases, often dumped near rivers or open areas, harming soil and water (Sharma & Shaw, 2013). Construction and wastewater discharge further degrade water quality and cause soil erosion in fragile hill ecosystems (MoEFCC, 2018). Habitat fragmentation reduces wildlife movement and increases human–wildlife conflict. Species like the Red Panda and Himalayan Monal are vulnerable to these changes (McKinney, 2006). Thus, while urbanisation improves connectivity and economy, it poses serious environmental risks in hill regions, requiring sustainable planning and strict regulation.

1.3 Need of the study

Urbanisation in India has accelerated over the last few decades, leading to significant changes in land use, biodiversity and environmental quality (Nagendra, 2013; Seto, Güneralp, & Hutyra, 2012). Studies conducted in various regions of the country have highlighted the adverse effects of urban expansion on forest cover, habitat fragmentation and ecosystem services (Borah, Taram, & Kanu, 2026; Menia, 2025; Nagendra, Sudhira, & Katti, 2013). In particular, the North-Eastern hill regions, including Arunachal Pradesh, are ecologically sensitive, with forest cover exceeding 79% of the geographical area (Forest Survey of India [FSI], 2021). However, despite the rich biodiversity, these areas have received limited empirical research on the perceptions of local communities regarding urban growth and its environmental and biodiversity impacts.

Most prior studies have focused on quantitative measures of forest loss, land use change or pollution levels (Seto et al., 2012; Bhatta, 2010) or on the ecological impacts of urbanisation from a macro perspective (McKinney, 2006; Mol & Spaargaren, 2000). While these studies provide important insights into environmental degradation, they rarely examine community awareness, attitudes and perceptions, which are crucial for designing participatory conservation and sustainable urban planning policies (Sharma & Shaw, 2013; Tiwari & Kweera, 2024).

Furthermore, research on hill towns in North-East India, particularly Menchukha in Arunachal Pradesh, remains sparse. While studies have documented forest cover trends and urbanisation patterns in the region (FSI, 2021; Borah et al., 2026), there is a lack of comprehensive investigation into how local residents perceive urbanisation, environmental change and biodiversity loss and the extent to which they are aware of conservation measures. Understanding local perceptions is essential, because residents play a critical role in maintaining ecological balance and implementing sustainable practices, especially in regions with high tourism and infrastructure development pressures (CPCB, 2019; World Health Organization [WHO], 2021).

Therefore, the present study addresses this research gap by focusing on Menchukha as a transitional hill settlement, investigating urbanisation trends, environmental and biodiversity impacts and community awareness regarding conservation. This approach not only fills a geographical and contextual void in existing research but also provides evidence-based insights for policy-making and sustainable urban planning in fragile ecosystems (Nagendra, 2013; FSI, 2021; Sharma & Shaw, 2013).

1.4 Objectives of the Study

1. To examine the relationship between urbanisation and environmental impact in Menchukha.
2. To assess the level of urbanisation in Menchukha is significantly high.

3. To examine environmental impact due to urbanisation.
4. To analyse whether biodiversity impact due to urbanisation is statistically significant.

1.4 Hypotheses of the study

1. H₀₁: There is no significant relationship between urbanisation and environmental impact in Menchukha.
2. H₀₂: The mean perception score of urbanisations is equal to the neutral value (3.0).
3. H₀₃: The mean perception of environmental impact is equal to the neutral value (3.0).
4. H₀₄: The mean perception of biodiversity impact is equal to the neutral value (3.0).

1.5 Research Methodology

The present study adopted a descriptive survey research design to explore the perceptions of local residents regarding urbanisation and its environmental and biodiversity impacts in Menchukha. A survey design was considered suitable as it allows the collection of information from a large population to describe trends, relationships and patterns in data (Best & Kahn, 2017).

1.5.1 Population and Sample

The population for the study consisted of all the residents of Menchukha, a small hill town experiencing gradual urban growth due to tourism and infrastructure development. A sample of 100 respondents was selected using purposive sampling, ensuring that participants were adults aware of local urbanization and environmental issues. Purposive sampling is appropriate when the researcher intends to select respondents who can provide relevant and reliable information (Creswell & Creswell, 2018).

1.5.2 Data and Sources of Data

For the present study, primary data were collected from local residents of Menchukha in Shi-Yomi district of Arunachal Pradesh using a self-developed structured questionnaire based on a five-point Likert scale. A total of 100 respondents were selected through purposive sampling, ensuring that participants were aware of local urbanisation and environmental changes. Data were collected through field visits and direct interaction with respondents. In addition to primary data, relevant secondary information on forest cover, environmental conditions and biodiversity was obtained from reports of the Forest Survey of India, the Central Pollution Control Board, government publications and related research studies.

1.5.3 Statistical Tools Used

The collected data were analysed using mean and standard deviation to determine the level of respondents' perceptions, Pearson correlation to examine the relationship between urbanisation and environmental impact, and a one-sample t-test to test whether the mean scores differed significantly from the neutral value (3.0).

1.6 Results and Discussion

The present study examined the perceptions of local residents in Menchukha regarding urbanisation and its effects on the environment and biodiversity. Data collected from 100 respondents were analysed using mean and standard deviation, Pearson correlation and one-sample t-test to understand the level of urbanisation, environmental and biodiversity impacts and community awareness regarding conservation.

Objective 1: To examine the relationship between urbanisation and environmental impact in Menchukha.

H₀₁: There is no significant relationship between urbanisation and environmental impact in Menchukha.

Table 1 Mean and Standard Deviation of Urbanisation, Environmental and Biodiversity Dimensions (N = 100)

Dimension	M	SD	Level of Perception
Urbanisation	3.79	1.06	Moderate to High Growth
Environmental Impact	3.82	1.08	Moderate to High Impact
Biodiversity Impact	3.82	1.04	Moderate to High Impact
Awareness & Conservation	3.75	0.98	Moderate Awareness

Note. Scores are based on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

The results indicate that the mean scores of all dimensions are above the neutral value of 3, showing that respondents generally agree that urbanisation is increasing in Menchukha. They also perceive that this growth is affecting the environment and biodiversity. Respondents appear to have some awareness of conservation practices. In simple Indian English, the people notice that the town is growing and with it, there are more environmental problems, changes in forests and impacts on wildlife.

Objective 2: To assess whether the level of urbanisation in Menchukha is significantly high.

H₀₂: The mean perception score of urbanisations is equal to the neutral value (3.0).

Table 2 Correlation between Urbanisation and Environmental Impact (N = 100)

Variable	Urbanisation	Environmental Impact
Urbanisation	—	
Environmental Impact	.68**	—

Note. p < .01 (two-tailed).

Table 2 shows a **strong positive correlation** between urbanisation and environmental impact (**r = .68, p < .01**). This indicates that as urban growth in Menchukha increases, environmental problems such as pollution, waste accumulation, soil erosion and habitat disturbance also rise. The null hypothesis (H₀₁), which stated that urbanisation and environmental impact are not related, is **rejected**. In simple terms, residents perceive that the expansion of the town is directly affecting natural ecosystems and wildlife, confirming that urbanisation and environmental degradation are closely linked.

Objective 3: To examine whether environmental impact due to urbanisation is statistically significant.

H₀₃: The mean perception of environmental impact is equal to the neutral value (3.0).

Table No3: One-Sample t-test for Urbanisation, Environmental and Biodiversity Dimensions

Dimension	t	p	Interpretation
Urbanisation	7.45	< .001	H ₀₂ rejected
Environmental Impact	7.59	< .001	H ₀₃ rejected
Biodiversity Impact	7.88	< .001	H ₀₄ rejected

The One-Sample t-test results show that the mean scores for **urbanisation** ($M = 3.79, t = 7.45, p < .001$), **environmental impact** ($M = 3.82, t = 7.59, p < .001$) and **biodiversity impact** ($M = 3.82, t = 7.88, p < .001$) are all significantly above the neutral value of 3. This indicates that respondents strongly agree that urbanisation is occurring in Menchukha and that it is having noticeable effects on the environment and biodiversity. The high score for urbanisation suggests that residents perceive visible growth in roads, infrastructure, population and tourism activities. Similarly, the elevated scores for environmental and biodiversity impacts show that people are aware of pollution, soil erosion, waste accumulation and threats to wildlife and plant species, including habitat loss and fragmentation. Overall, these results **reject the null hypotheses (H_{02}, H_{03}, H_{04})**, confirming that urban growth is perceived as significant and is clearly affecting both the ecological balance and biodiversity of the region. In simple terms, the residents feel that the town is expanding and this expansion is visibly harming nature and wildlife.

Objective 4: To analyse whether biodiversity impact due to urbanisation is statistically significant.

Table 4: Descriptive Statistics for Awareness and Conservation (N = 100)

Dimension	N	M	SD
Awareness & Conservation	100	3.75	0.98

Note. Scores are based on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

Interpretation

As shown in Table 4, the residents of Menchukha reported a mean score of **3.75 (SD = 0.98)** for Awareness and Conservation, indicating a moderate level of awareness regarding environmental protection and biodiversity conservation. The mean suggests that most respondents recognize the importance of preserving forests, rivers and wildlife and are aware of practices such as proper waste disposal, forest protection and promoting sustainable tourism. The standard deviation indicates some variability in responses, reflecting that while many residents have a good understanding of conservation issues, a subset of the community may still lack full awareness or active participation in conservation practices. Overall, these findings suggest that although the community shows general concern for the environment, there is a need for structured awareness programs, educational campaigns and participatory initiatives to translate awareness into practical conservation actions. In other words, residents understand that nature and wildlife need protection, but increased community involvement and targeted programs could further strengthen sustainable environmental practices in Menchukha.

1.7 Major Findings

- I. **Urbanisation in Menchukha:** The mean score for urbanisation was $M = 3.79, SD = 1.06$, which is significantly above the neutral value of 3 ($t = 7.45, p < .001$). This indicates that residents perceive moderate to high urban growth, including the expansion of roads, infrastructure and tourism facilities.
- II. **Environmental Impact:** The mean score for environmental impact was $M = 3.82, SD = 1.08$, also significantly above neutral ($t = 7.59, p < .001$). Residents notice moderate to high environmental degradation, including pollution, soil erosion, waste accumulation and disturbances to local rivers and forests.
- III. **Biodiversity Impact:** Biodiversity impact had a mean of $M = 3.82, SD = 1.04$, significantly above neutral ($t = 7.88, p < .001$). This shows that residents perceive moderate to high threats to local flora and fauna, including habitat disturbance, fragmentation and risks to species such as Red Panda and Himalayan Monal.
- IV. **Correlation between Urbanisation and Environmental Impact:** Pearson correlation revealed $r = .68, p < .01$, indicating a strong positive relationship. This means that as urbanisation increases, environmental problems also increase, confirming that urban growth and environmental degradation are closely linked.
- V. **Awareness and Conservation:** The mean score for awareness and conservation was $M = 3.75, SD = 0.98$, indicating moderate awareness among residents. Although people are somewhat conscious of

conservation practices, there is a need to strengthen awareness programs to mitigate environmental and biodiversity impacts.

VI. Overall Implication: The findings clearly indicate that urbanisation in Menchukha is significantly affecting the natural environment and biodiversity. Without proper planning, regulation and community engagement, ecological balance may be disturbed, emphasizing the need for sustainable urban development, strict environmental monitoring and participatory conservation initiatives.

1.8 Suggestions and Implications

Based on the findings of this study, several suggestions and policy implications emerge:

- I. Sustainable Urban Planning:** Urban growth in Menchukha should be guided by eco-sensitive urban planning. Local authorities should adopt zoning regulations, limit unplanned construction near forest areas and ensure roads, tourism and infrastructure development do not disturb natural ecosystems.
- II. Forest and Biodiversity Protection:** Strict regulation is required for forest land diversion and habitat disturbance. Protected areas and wildlife corridors should be maintained to prevent fragmentation of habitats, especially for species like the Red Panda and Himalayan Monal.
- III. Waste Management Systems:** The study shows a rise in environmental degradation due to waste accumulation. Local councils should implement regular waste collection, segregation and recycling programs, especially in tourist areas, to reduce pollution and safeguard soil and water quality.
- IV. Community Awareness and Participation:** Although residents show moderate awareness of conservation, community engagement programs are essential. Educational campaigns, eco-tourism awareness workshops and participation in tree plantation or clean-up drives can increase environmental consciousness.
- V. Policy Integration:** Urbanisation and environmental protection should be integrated in district-level development plans. Policies must balance economic development with ecological sustainability, ensuring long-term benefits for both humans and wildlife.

1.9 Discussion

The findings of this study indicate that urbanisation in Menchukha is perceived as significantly increasing, with associated environmental degradation and biodiversity impacts. Residents report moderate to high awareness of conservation, but there is variability in participation and engagement. The strong correlation ($r = .68$) between urbanisation and environmental impact confirms that growth in infrastructure, tourism and population is closely linked to ecological pressures, consistent with previous research in Himalayan and North-East Indian hill regions (Nagendra, 2013; Seto et al., 2012; McKinney, 2006). The results align with Ecological Modernisation Theory, which suggests that development without proper regulation increases environmental stress (Mol & Spaargaren, 2000) and with Habitat Fragmentation Theory, which explains how urban expansion reduces habitat connectivity and threatens biodiversity (McKinney, 2006). These findings underscore the need for sustainable urban planning, strict environmental regulation and active community involvement to balance development with ecological preservation.

1.10 Conclusion

The study clearly demonstrates that urbanisation in Menchukha is significantly affecting the environment and biodiversity. Residents perceive moderate to high growth in infrastructure, roads and tourism, accompanied by environmental degradation, waste accumulation, soil erosion and habitat disturbance. Biodiversity impacts, such as threats to local species, are evident and while residents show moderate awareness, there is a need for stronger community engagement.

The findings highlight the importance of integrating environmental regulation with urban development, implementing eco-friendly infrastructure and promoting conservation awareness programs. If timely measures are not taken, the ecological richness of Menchukha may decline, affecting both human livelihood and wildlife sustainability. This study provides evidence-based insights for policymakers, urban planners and local communities to ensure balanced growth and ecological preservation in fragile hill regions.

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References

- [1] Bhatta, B. (2010). *Analysis of urban growth and sprawl from remote sensing data*. Springer.
- [2] Borah, D., Taram, M., Kanu, B., & Mili, C. (2026). Urban expansion threatens forest biodiversity on private lands in Nirjuli, Arunachal Pradesh, Northeast India. *Discover Forests*, 2(1). <https://doi.org/10.1007/s44415-026-00069-w>
- [3] Census of India. (2011). *Provisional population totals: Urbanisation data*. Office of the Registrar General & Census Commissioner, India. <https://censusindia.gov.in>
- [4] Central Pollution Control Board. (2019). *Air quality assessment and pollution sources in Indian towns*. Government of India. <https://cpcb.nic.in>
- [5] Fahrig, L. (2003). Effects of habitat fragmentation on biodiversity. *Annual Review of Ecology, Evolution, and Systematics*, 34, 487–515. <https://doi.org/10.1146/annurev.ecolsys.34.011802.132419>
- [6] Forest and Environment Department, Government of Arunachal Pradesh. (2021). *Forest cover statistics for Arunachal Pradesh*. Government of Arunachal Pradesh. <https://arunachalforests.gov.in>
- [7] Forest Survey of India. (2021). *India state of forest report 2021*. Ministry of Environment, Forest and Climate Change, Government of India. <https://fsi.nic.in/isfr-2021/chapter-2.pdf>
- [8] Forman, R. T. T. (2000). *Urban ecology: Science of cities*. Cambridge University Press.
- [9] India State of Forest Report. (2021). *Forest cover by state and forest category*. Forest Survey of India. https://en.wikipedia.org/wiki/Forest_cover_by_state_in_India
- [10] McKinney, M. L. (2006). Urbanisation as a major cause of biotic homogenisation. *Biological Conservation*, 127(3), 247–260. <https://doi.org/10.1016/j.biocon.2005.09.005>
- [11] Menia, N. (2025). Reduced green space in Itanagar-Naharlagun of Northeast India: A preliminary investigation. *Journal of South Asian Research*, 3(1), 103–114. <https://www.arfjournals.com/jsar/issue/405>
- [12] Ministry of Environment, Forest and Climate Change. (2019). *Biodiversity and climate change*. Government of India. <https://moef.gov.in>
- [13] Mol, A. P. J., & Spaargaren, G. (2000). Ecological modernisation theory in debate: A review. *Environmental Politics*, 9(1), 17–49. <https://doi.org/10.1080/09644010008414512>
- [14] Nagendra, H. (2013). *Urbanisation, biodiversity and ecosystem services in India*. Springer.

- [15] Nagendra, H., Sudhira, H. S., & Katti, M. (2013). Sub-regional assessment of India: Effects of urbanization on land use, biodiversity and ecosystem services. In *Urbanization, biodiversity and ecosystem services* (pp. 65–74). Springer. https://doi.org/10.1007/978-94-007-7088-1_6
- [16] Scolozzi, R., & Geneletti, D. (2012). Urban green infrastructure in environmental planning. *Landscape and Urban Planning*, 104(1), 1–8. <https://doi.org/10.1016/j.landurbplan.2011.10.015>
- [17] Seto, K. C., Güneralp, B., & Hutyra, L. R. (2012). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences*, 109(40), 16083–16088. <https://doi.org/10.1073/pnas.1211658109>
- [18] Sharma, R. K., & Shaw, T. (2013). Impact of tourism and waste on hill ecosystems: Examples from North-East India. *Journal of Environmental Studies*.
- [19] Tiwari, P. C., & Kweera, M. (2024). Urban expansion and forest loss in Himalayan biodiversity hotspots (summary report). Mongabay India. <https://india.mongabay.com/2024/09/urban-explosion-land-use-changes-driving-forest-loss-in-himalayas-western-ghats/>
- [20] World Health Organization. (2021). *Air pollution and health: Global update*. WHO Press. <https://www.who.int/publications/i/item/9789240034228>

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