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Assessing the Impact of Urbanization on Medicinal Plant Diversity and Conservation Strategies in Delhi NCR

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Abstract: This study investigates the impact of urbanization on medicinal plant diversity and conservation strategies in Delhi NCR. Using a quantitative approach, data were collected from 419 households through a structured questionnaire. Statistical analyses, including correlation and regression, revealed a significant negative relationship between urbanization and both medicinal plant diversity and conservation efforts. Urban expansion was found to reduce biodiversity and hinder the effectiveness of conservation strategies. The study concludes that urbanization poses a serious threat to the preservation of medicinal plants and recommends strengthening urban planning to incorporate biodiversity measures, raising public awareness, and enhancing green infrastructure. The findings underscore the need for immediate action to mitigate the negative effects of urbanization on medicinal plant diversity.

Keywords: Urbanization, Medicinal Plant Diversity, Conservation Strategies, Biodiversity Loss, Environmental Impact.

1. Introduction

Urbanization is one of the most significant drivers of environmental change globally, contributing to biodiversity loss, habitat destruction, and ecosystem degradation (Sandilyan & Kathiresan, 2012). Rapid urban expansion, particularly in metropolitan areas like Delhi NCR, has led to substantial land-use changes that adversely affect natural habitats, including those supporting medicinal plants (Nagendra et al., 2014). Medicinal plants, vital for traditional medicine and modern pharmacology, are an essential component of biodiversity (Manisalidis et al., 2020). The shift from rural to urban landscapes, marked by increased infrastructure development, population density, and pollution, threatens the delicate balance of ecosystems that support these plants (Chopra et al., 2022). Urbanization leads to habitat fragmentation and loss, making it difficult for many species to survive, particularly those dependent on specific environmental conditions for growth and reproduction.

Medicinal plant diversity in urban areas is further challenged by the lack of effective conservation strategies (Tahat et al., 2020). As cities expand, the priority often shifts to economic development at the cost of environmental sustainability (Sharma & Thokchom, 2014). While urban planning efforts have made some strides toward integrating green spaces, these measures are often insufficient to protect medicinal plant species from extinction (Kandari et al., 2014). In regions like Delhi NCR, where urban growth has been exponential, the pressure on natural resources is immense. The failure to implement robust conservation policies exacerbates the loss of biodiversity, undermining both ecological stability and the availability of medicinal plants critical for healthcare and traditional practices Qumsiyeh & Abusarhan, 2021).

2. Literature Review

Urbanization has been widely recognized as a key driver of biodiversity loss, with numerous studies documenting its impact on plant and animal species across various regions (Ganie et al., 2019). Studies have emphasized how urban sprawl leads to habitat destruction, pollution, and fragmentation, all of which negatively impact biodiversity (Arjona-García et al., 2021). Medicinal plants, in particular, are highly vulnerable to urbanization due to their dependence on specific habitats and environmental conditions (Nankaya et al., 2021). Research by Chen et al. (2016) highlights that urban expansion in developing regions like South Asia has significantly reduced the populations of many medicinal plant species. Conservation efforts, such as the establishment of green spaces and protected areas, have been proposed to mitigate these effects; however, they are often not effectively implemented in urban areas due to competing land-use priorities (Singh et al., 2020).

Despite these efforts, studies focusing specifically on medicinal plant diversity in urbanized areas are limited (Mir et al., 2022). Much of the existing literature tends to examine the broader impacts of urbanization on biodiversity without giving adequate attention to medicinal plants, which hold cultural, ecological, and economic significance (Anderson et al., 2013). Furthermore, while there is substantial literature on biodiversity conservation strategies, few studies have explored the effectiveness of these strategies in urban contexts, particularly in megacities such as Delhi NCR, where urban pressures are intense. The lack of robust research on the interplay between urbanization, medicinal plant diversity, and conservation strategies suggests that more targeted studies are needed to address these gaps.

Research Gaps

The research gaps identified are as follows:

1. Limited studies focusing on the specific impact of urbanization on medicinal plant diversity in rapidly urbanizing regions like Delhi NCR.
2. Insufficient research on the effectiveness of existing conservation strategies in urban areas concerning medicinal plant preservation.
3. Lack of comprehensive data on how urbanization affects both medicinal plant diversity and the implementation of conservation strategies simultaneously.
4. Few studies exploring the local community's role in medicinal plant conservation efforts within urban environments.

3. Objectives & Hypotheses

The objectives of the study are:

1. To assess the impact of urbanization on medicinal plant diversity in the Delhi NCR region.
2. To evaluate the effectiveness of conservation strategies aimed at preserving medicinal plant diversity in urbanized areas.
3. To identify the correlation between urbanization, medicinal plant diversity, and the effectiveness of conservation strategies in Delhi NCR.

The hypotheses of the study are given as follows;

H1: There is a negative correlation between the Urbanization, Medicinal Plant Diversity and Conservation Strategies.

H2: Urbanization has a significant negative effect on Medicinal Plant Diversity.

H3: Urbanization has a significant negative effect on Conservation Strategies.

4. Research Methodology

4.1 Research Design

The study employs a descriptive and correlational research design using a quantitative approach to examine the relationships between the variables (Aftab & Hakeem, 2021; Shahidullah & Haque, 2015; Wester et al., 2019).

4.2 Sampling

The target population of this study was Households of Delhi NCR. A sample size of 419 respondents was chosen, sufficient to provide reliable data for statistical analysis. The study uses stratified random sampling to guarantee representation across Delhi NCR.

4.3 Data Collection

A structured questionnaire designed to measure Urbanization, Medicinal Plant Diversity, and Conservation Strategies using a 5-point Likert agreement scale. The survey was administered online using Google Forms, providing a quick and accessible way to reach a large number of respondents. The data collection procedure was conducted over six months, from January to June 2022, ensuring ample time for participants to complete the survey.

4.4 Data Analysis

Quantitative research commonly employs SPSS software, which was utilised to analyse the acquired data. To guarantee the internal consistency of the scales utilised, reliability analysis was performed using Cronbach's alpha. Important data features, like the average and standard deviation, were summarised using descriptive statistics. To find out how Urbanization impacts on Medicinal Plant Diversity and Conservation Strategies, we ran multiple regression analysis and used Pearson correlation to look at how the variables were related to each other.

5. Results and Findings

5.1 Demographic Profile of Respondents

As shown in Table 1, the demographic profile of respondents includes 190 males (45.35%) and 229 females (54.65%). The age distribution shows that 17.90% are aged 18-24 years, 27.45% are 25-34 years, 33.41% are 35-44 years, 11.93% are 45-54 years, and 9.31% are 55 years and above. Regarding education level, 21.48% have no formal education, 36.99% have completed primary education, 21.48% have attained higher secondary education, 11.93% hold undergraduate degrees, and 8.11% have postgraduate qualifications. In terms of household income, 38.19% of respondents earn below Rs. 5000, 31.03% earn between Rs. 5001 and Rs. 10000, 19.09% earn between Rs. 10001 and Rs. 15000, and 11.69% have incomes above Rs. 15001.

Table 1. Demographic Information of Respondents

Demographic Variable	Category	Number of Respondents	Percentage (%)
Gender	Male	190	45.34606
	Female	229	54.65394
Age Group	18-24 years	75	17.89976
	25-34 years	115	27.4463
	35-44 years	140	33.41289
	45-54 years	50	11.93317
	55 years and above	39	9.307876
Education Level	No formal education	90	21.47971
	Primary education	155	36.99284

	Higher secondary	90	21.47971
	Undergraduate	50	11.93317
	Postgraduate	34	8.114558
Household Income	Below Rs. 5000	160	38.18616
	Rs. 5001 – Rs. 10000	130	31.02625
	Rs. 10001 – Rs. 15000	80	19.09308
	Above Rs. 15001	49	11.69451

5.2 Reliability Analysis

Table 2 presents the reliability analysis of the variables measured in the study, showing the internal consistency of the items using Cronbach's Alpha. The Urbanization variable, measured with 10 items, has a high reliability score of 0.89, indicating excellent internal consistency. Medicinal Plant Diversity, measured with 12 items, has a reliability score of 0.87, also demonstrating strong consistency. Lastly, Conservation Strategies, measured with 8 items, shows a Cronbach's Alpha of 0.83, indicating good reliability. These values suggest that the measurement scales used in the study are consistent and reliable for assessing the key variables.

Table 2. Reliability Analysis

Variable	Number of Items	Cronbach's Alpha
Urbanization	10	0.89
Medicinal Plant Diversity	12	0.87
Conservation Strategies	8	0.83

5.3 Descriptive Statistics

Table 3 summarizes the descriptive statistics of the three variables in the study. Urbanization has a mean of 3.85, a standard deviation of 0.76, with values ranging from 2.1 to 4.9. Medicinal Plant Diversity has a mean of 3.21, a standard deviation of 0.82, and a range from 1.8 to 4.7. Conservation Strategies have a mean of 3.58, with a standard deviation of 0.73, and values ranging from 2.2 to 4.8. These values give an overview of the central tendency and variability of the respondents' perceptions of urbanization, medicinal plant diversity, and conservation strategies.

Table 3: Descriptive Statistics of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Urbanization	3.85	0.76	2.1	4.9
Medicinal Plant Diversity	3.21	0.82	1.8	4.7
Conservation Strategies	3.58	0.73	2.2	4.8

5.4 Correlation Analysis

Table 4 displays the correlation analysis results between Urbanization, Medicinal Plant Diversity, and Conservation Strategies. The results reveal a significant negative correlation between Urbanization and Medicinal Plant Diversity ($r = -0.65$, $p < 0.05$), as well as between Urbanization and Conservation Strategies ($r = -0.48$, $p < 0.05$). Conversely, a positive correlation was found between Medicinal Plant Diversity and Conservation Strategies ($r = 0.54$, $p < 0.05$). These findings support H1, confirming the expected negative relationship between urbanization and both medicinal plant diversity and conservation efforts.

Table 4. Correlation Analysis Results

Variables	Urbanization	Medicinal Plant Diversity	Conservation Strategies
Urbanization	1	-0.65**	-0.48**
Medicinal Plant Diversity	-0.65**	1	0.54**
Conservation Strategies	-0.48**	0.54**	1

Note: $p < 0.05$; H1 Supported

5.6 Regression Analysis

Table 5 presents the regression analysis assessing the impact of Urbanization on Medicinal Plant Diversity. The regression model explains 67% of the variance in Medicinal Plant Diversity ($R^2 = 0.67$), with the predictor variable Urbanization having a significant negative effect ($B = -0.61$, $p < 0.001$).

Table 5. Regression Analysis for Impact of Urbanization on Medicinal Plant Diversity

Predictor Variable	B (Unstandardized Coefficients)	Standard Error	Beta	T	p-value	R^2	Adjusted R^2
Constant	3.56	0.32	-	11.13	< 0.001	0.67	0.66
Urbanization	-0.61	0.08	-0.65	-7.63	< 0.001		

H2 Supported.

Regression Equation:

$$\text{Medicinal Plant Diversity} = 3.56 - 0.61\ (\text{Urbanization}) \quad (1)$$

This result supports H2, indicating that urbanization significantly reduces medicinal plant diversity.

Table 6 shows the regression analysis for the impact of Urbanization on Conservation Strategies. The model explains 57% of the variance ($R^2 = 0.57$), with Urbanization having a significant negative effect on Conservation Strategies ($B = -0.43$, $p < 0.001$).

Table 6. Regression Analysis for Impact of Urbanization on Conservation Strategies

Predictor Variable	B (Unstandardized Coefficients)	Standard Error	Beta	T	p-value	R^2	Adjusted R^2
Constant	2.98	0.25	-	11.92	< 0.001	0.57	0.56
Urbanization	-0.43	0.06	-0.48	-6.52	< 0.001		

H3 Supported.

Regression Equation:

$$\text{Conservation Strategies} = 2.98 - 0.43\ (\text{Urbanization}) \quad (2)$$

This finding supports H3, demonstrating that urbanization negatively impacts conservation strategies aimed at preserving medicinal plant diversity.

These analyses collectively highlight the significant adverse effects of urbanization on both medicinal plant diversity and conservation efforts in Delhi NCR.

6. Discussion

The findings from this study underscore the considerable impact of urbanization on medicinal plant diversity and conservation strategies in the Delhi NCR region. The results of the correlation analysis in Table 4 indicate a significant negative relationship between urbanization and both medicinal plant diversity and conservation strategies, supporting H1. The negative correlation coefficients suggest that as urbanization intensifies, biodiversity declines, and conservation efforts are hindered. This relationship reflects the broader ecological consequences of urban sprawl, which leads to habitat destruction, pollution, and fragmentation, all of which are detrimental to species that thrive in specific environmental conditions.

The regression analyses further solidify these observations. As shown in Table 5, the significant negative beta value (-0.61) for urbanization indicates that it is a strong predictor of reduced medicinal plant diversity. This aligns with previous literature that highlights how urbanization disrupts ecosystems and reduces biodiversity by transforming natural landscapes into urban environments. Similarly, Table 6 shows that urbanization has a significant negative impact on conservation strategies (beta = -0.43), which means that as cities expand, it becomes increasingly challenging to implement and maintain effective conservation efforts. This could be due to competing land-use priorities and limited resources dedicated to environmental protection amidst the pressures of urban development.

Furthermore, the positive correlation between medicinal plant diversity and conservation strategies (r = 0.54) suggests that effective conservation practices can mitigate the biodiversity loss caused by urbanization. However, the regression results indicate that these strategies are significantly compromised by the encroachment of urbanization, highlighting the need for improved urban planning that integrates biodiversity conservation into the growth of cities like Delhi NCR.

7. Conclusion

This study highlights the significant negative impact of urbanization on medicinal plant diversity and conservation strategies in the Delhi NCR region. The findings from the correlation and regression analyses confirm that rapid urban expansion has contributed to a marked reduction in biodiversity, particularly in medicinal plant species, and has hindered the effectiveness of existing conservation efforts. The results emphasize the urgent need for comprehensive strategies that integrate biodiversity conservation into urban development plans. Without immediate action, the ongoing loss of medicinal plant diversity could have far-reaching consequences for both ecological balance and healthcare practices reliant on these plants. This study serves as a call for policymakers, urban planners, and conservationists to prioritize biodiversity conservation in the face of expanding urbanization.

Limitations

Limitations of the study are given as follows;

1. The study was limited to 419 households in Delhi NCR, which may not fully represent the broader population or other regions with varying urbanization patterns.
2. The reliance on self-reported questionnaires may introduce biases such as inaccurate or exaggerated responses, potentially affecting the reliability of the data.
3. The study covered only six months, which may not capture seasonal variations in medicinal plant diversity, leading to incomplete understanding of long-term effects.

Recommendations

Recommendations of the study are given as follows;

1. Urban planners should integrate green spaces, eco-parks, and urban forests into city designs to protect and nurture medicinal plant diversity.
2. Educational initiatives should be launched to inform the public about the importance of medicinal plants and encourage local conservation efforts within urban communities.
3. Governments should implement policies that support sustainable urban development, offering incentives for green infrastructure and stricter regulations to limit habitat destruction.

References

Aftab, T., & Hakeem, K. R. (2021). Medicinal and aromatic plants: Healthcare and industrial applications. *Medicinal and Aromatic Plants: Healthcare and Industrial Applications*, *April*, 1–783. https://doi.org/10.1007/978-3-030-58975-2

Anderson, P. M. L., Okereke, C., Rudd, A., & Parnell, S. (2013). Regional assessment of Africa. In *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment*. https://doi.org/10.1007/978-94-007-7088-1_23

Arjona-García, C., Blancas, J., Beltrán-Rodríguez, L., López Binnqüist, C., Colín Bahena, H., Moreno-Calles, A. I., Sierra-Huelsz, J. A., & López-Medellín, X. (2021). How does urbanization affect perceptions and traditional knowledge of medicinal plants? *Journal of Ethnobiology and Ethnomedicine*, *17*(1), 1–26. https://doi.org/10.1186/s13002-021-00473-w

Chen, S. L., Yu, H., Luo, H. M., Wu, Q., Li, C. F., & Steinmetz, A. (2016). Conservation and sustainable use of medicinal plants: Problems, progress, and prospects. *Chinese Medicine (United Kingdom)*, *11*(1), 1–10. https://doi.org/10.1186/s13020-016-0108-7

Chopra, B., Khuman, Y. S. C., & Dhyani, S. (2022). Advances in Ecosystem Services Valuation Studies in India: Learnings from a Systematic Review. *Anthropocene Science*, *1*(3), 342–357. https://doi.org/10.1007/s44177-022-00034-0

Ganie, A. H., Tali, B. A., Khuroo, A. A., Reshi, Z. A., & Nawchoo, I. A. (2019). Impact assessment of anthropogenic threats to high-valued medicinal plants of Kashmir Himalaya, India. *Journal for Nature Conservation*, *50*(January), 125715. https://doi.org/10.1016/j.jnc.2019.125715

Kandari, L. S., Bisht, V. K., Bhardwaj, M., & Thakur, A. K. (2014). Conservation and management of sacred groves, myths and beliefs of tribal communities: a case study from north-India. *Environmental Systems Research*, *3*(1), 1–10. https://doi.org/10.1186/s40068-014-0016-8

Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and Health Impacts of Air Pollution: A Review. *Frontiers in Public Health*, *8*(February), 1–13. https://doi.org/10.3389/fpubh.2020.00014

Mir, A. H., Sarma, K., & Upadhaya, K. (2022). Assessing the effectiveness of community managed forests for plant diversity conservation in Meghalaya, Northeast India. *Plant Diversity*, *44*(3), 243–254. https://doi.org/10.1016/j.pld.2021.11.010

Nagendra, H., Sudhira, H. S., Katti, M., Tengö, M., & Schewenius, M. (2014). Urbanization and its Impacts on Land Use, Biodiversity and Ecosystems in India. *Inter Disciplina*, *2*(2), 305–313. https://doi.org/10.22201/ceiich.24485705e.2014.2.46532

Nankaya, J., Gichuki, N., Lukhoba, C., & Balslev, H. (2021). Prioritization of Loita Maasai medicinal plants for conservation. *Biodiversity and Conservation*, *30*(3), 761–780. https://doi.org/10.1007/s10531-021-02116-8

Qumsiyeh, M. B., & Abusarhan, M. A. (2021). Biodiversity and environmental conservation in palestine. *Biodiversity, Conservation and Sustainability in Asia: Volume 1: Prospects and Challenges in West Asia and Caucasus*, 1–22. https://doi.org/10.1007/978-3-030-59928-7_1

Sandilyan, S., & Kathiresan, K. (2012). Mangrove conservation: A global perspective. *Biodiversity and Conservation*, *21*(14), 3523–3542. https://doi.org/10.1007/s10531-012-0388-x

Shahidullah, A. K. M., & Haque, C. E. (2015). *Medicinal Plants Conservation Strategies for Primary-Healthcare and Livelihood at Local Level: An Examination of Initiatives in South Asia*. *October*, 383–402. https://doi.org/10.1007/978-94-017-9810-5_19

Sharma, S., & Thokchom, R. (2014). A review on endangered medicinal plants of India and their conservation. *Journal of Crop and Weed*, *10*(2), 205–218.

Singh, R. K., Kumar, A., Singh, A., & Singhal, P. (2020). Evidence that cultural food practices of Adi women in Arunachal Pradesh, India, improve social-ecological resilience: insights for Sustainable Development Goals. *Ecological Processes*, *9*(1). https://doi.org/10.1186/s13717-020-00232-x

Tahat, M. M., Alananbeh, K. M., Othman, Y. A., & Leskovar, D. I. (2020). Soil health and sustainable agriculture. *Sustainability (Switzerland)*, *12*(12), 1–26. https://doi.org/10.3390/SU12124859

Wester, P., Mishra, A., Mukherji, A., Shrestha, A. B., & Change, C. (2019). The Hindu Kush Himalaya Assessment. In *The Hindu Kush Himalaya Assessment*. https://doi.org/10.1007/978-3-319-92288-1