Exploring the Relationship Between Quality of Life and Quality of Urban Open Space: Case Studies of Singapore, Mumbai, and Jabalpur

Ar. Shubham Kouraw[1], Dr. Ar. Mrs Anjali Patil[2], Ar. Ankit Kumar[3]
[1]Architect Student, MITS Gwalior, 591, Narsingh ward, Madan Mahal, Jabalpur, India.
[2]HoD, Department of Architecture and Town planning, MITS, Gwalior, India.
[3]Assistant Professor, MITS, Gwalior, India.
Emails: *shubhamkouraw@gmail.com[1], anjalipatil@mitsgwalior.in[2], kumarankeet@mitsgwalior.in[3]*

Abstract

This research paper investigates the relationship between the quality of urban open spaces and the quality of life in three diverse urban contexts: Singapore, Mumbai, and Jabalpur. Through a comparative analysis, the availability, accessibility, and quality of urban open spaces are examined, along with their influence on the overall well-being of residents in these cities. Singapore emerges as a model city with exemplary urban open space planning and management, resulting in high quality of life for its citizens. Mumbai faces challenges related to uneven distribution, poor maintenance, and environmental degradation, despite pockets of well-utilized urban open spaces. Jabalpur grapples with issues stemming from inadequate urban planning, loss of blue spaces, and encroachments, leading to a significant deficit in quality urban open spaces. The findings underscore the critical role of urban open spaces in enhancing quality of life and highlight the need for strategic interventions to improve urban open space quality in rapidly urbanizing cities.
Keywords: Accessibility; Comparative Analysis; Maintenance; Quality of Life; Sustainability; Urban Open Spaces; Urbanization.

1. Introduction

Urbanization, characterized by rapid urban growth, presents both opportunities and challenges for urban residents' quality of life (QoL). As cities expand, the demand for resources, services, and infrastructure increases, leading to complex socio-economic and environmental dynamics [1]. Amidst this transformation, urban open spaces play a crucial role in shaping residents' QoL and the urban environment. This paper explores the relationship between urban open space quality and QoL, focusing on Singapore, Mumbai, and Jabalpur. These cities represent diverse urban landscapes, each influenced by unique socio-cultural, economic, and environmental factors affecting urban open space provision and management. Comparing the availability, accessibility, and maintenance of urban open spaces provides insights into factors affecting QoL outcomes. Availability refers to the quantity of open spaces relative to population size, which is crucial in densely populated cities like Mumbai and Singapore. High availability of open spaces can mitigate urban stress, providing areas for recreation, relaxation, and social interaction, which are essential for mental and physical well-being. Singapore, known for its extensive and well-distributed open spaces, demonstrates how strategic urban planning can enhance QoL by integrating green areas into the urban fabric. Accessibility concerns residents' ease of accessing these spaces. This includes physical proximity, connectivity via public transport, and the inclusivity of spaces for all demographic groups. In Mumbai, despite the limited availability of open spaces, the focus on improving accessibility through public transport and pedestrian pathways can significantly enhance residents' QoL. Conversely, in Jabalpur, where urban sprawl and lack of efficient transportation can impede access, innovative solutions are necessary to ensure equitable access to open spaces. Maintenance encompasses upkeep and functionality, impacting their usability. Well-maintained open spaces can serve as vital community assets, promoting social cohesion and environmental

sustainability. Poor maintenance, however, can lead to underutilization and degradation, as observed in many urban areas of Jabalpur. Learning from Singapore's rigorous maintenance regimes can provide valuable lessons for cities like Mumbai and Jabalpur to improve the usability and attractiveness of their urban open spaces [2].

1.1. Singapore and Mumbai

Singapore exemplifies meticulous urban planning and green infrastructure, with abundant, evenly distributed, and well-maintained urban open spaces significantly contributing to residents' high quality of life (QoL). The city's strategic integration of parks, gardens, and recreational areas within its urban fabric promotes physical and mental well-being, social cohesion, and environmental sustainability. In contrast, Mumbai grapples with the challenges of rapid urbanization and inadequate planning [3]. The city's dense population and haphazard development result in many residents lacking easy access to green areas, which exacerbates pollution levels and deepens socio-economic disparities. Limited availability and poor maintenance of open spaces in Mumbai hinder their potential benefits, leading to overcrowding and underutilization. Addressing these issues requires focused efforts on improving the distribution, accessibility, and upkeep of urban open spaces to enhance the QoL for all residents, drawing lessons from Singapore's effective urban planning practices.

1.2. Jabalpur

Jabalpur struggles with poor planning and maintenance, leading to the loss of green spaces and limited access for residents. Inadequate urban planning and lack of resources result in the underutilization and neglect of existing open spaces, diminishing their potential to improve quality of life (QoL). By comparing the contexts of Jabalpur, Singapore, and Mumbai, this paper highlights the dynamics shaping urban open space quality and its impact on QoL. The contrast between Singapore's exemplary green infrastructure, Mumbai's challenges of rapid urbanization, and Jabalpur's deficiencies in planning and maintenance provides a comprehensive understanding of the factors influencing urban open spaces. Insights from this analysis can guide policy

interventions and urban planning strategies aimed at enhancing the availability, accessibility, and maintenance of urban open spaces. Such improvements are crucial for fostering sustainable and equitable cities, ensuring that all residents can benefit from the environmental, social, and health advantages of well-managed urban open spaces [4].

2. Method

The study employs a comparative analysis approach, utilizing quantitative data on urban open space availability, population density, and access, along with qualitative insights from urban planning documents, government reports, and community surveys [5]. Parameters such as per capita open space availability, the ratio of population density to open space, ease of access, and the quality of open space maintenance are examined to assess the differences and similarities among the selected cities.

3. Results and Discussion

3.1. Urban Open Space Quality in Singapore

3.1.1. Singapore's Urban Planning Strategy: Greening the City for a Better Tomorrow

Singapore, renowned for its meticulous urban planning, has consistently focused on increasing and maintaining its green areas, creating a model for sustainable urban development [6]. This strategic emphasis on green infrastructure has not only enhanced the city's aesthetic appeal but also played a crucial role in addressing several environmental challenges, significantly improving the quality of life for its residents (Figure 1).
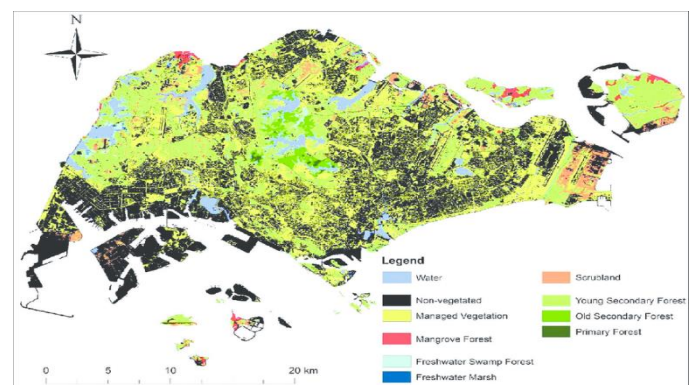

Figure 1 Vegetation Distribution of Singapore

3.1.2. Combating the Urban Heat Island Effect

One of the most significant achievements of Singapore's green urban planning is its success in mitigating the urban heat island effect (Figure 2 & 3). By incorporating extensive green spaces, vertical gardens, and green roofs, the city has effectively reduced ambient temperatures. These green areas act as natural coolants, absorbing heat and providing shade, which helps in lowering the overall temperature of the urban environment. This cooling effect is particularly beneficial in a densely populated city like Singapore, where concrete and asphalt can otherwise lead to intense heat accumulation.
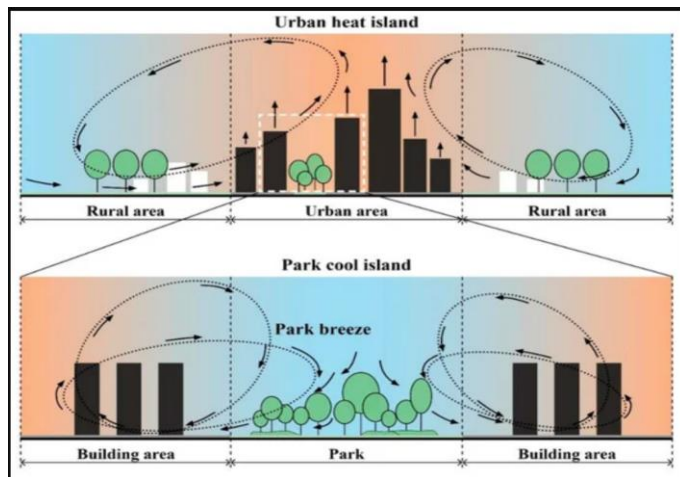

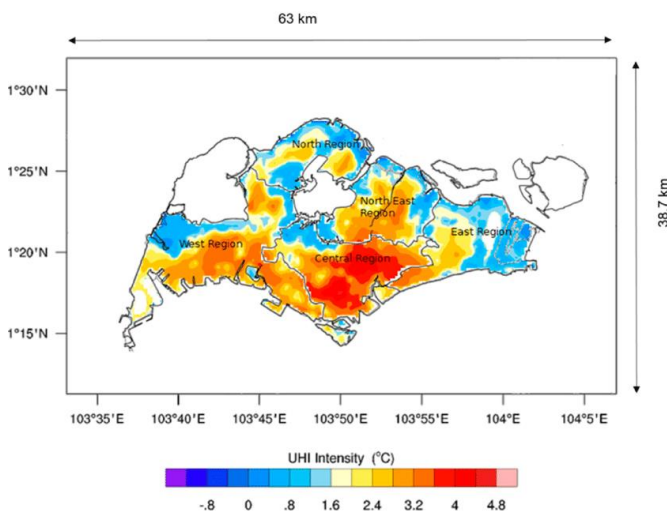**Figure 2 Schematic Illustration of the Park Cool Island and Park Breeze**

Figure 3 UHI Distribution in Singapore

3.1.3. Reducing CO2 Emissions Per Capita

Singapore's commitment to green spaces also contributes to reducing its CO2 emissions per capita. Trees and plants in urban areas serve as carbon sinks, absorbing CO2 and releasing oxygen (Figure 4). By integrating green corridors and increasing the urban tree canopy, Singapore has managed to enhance its air quality and lower its carbon footprint. This is complemented by the city's efficient public transportation system and policies encouraging sustainable living, further driving down emissions.
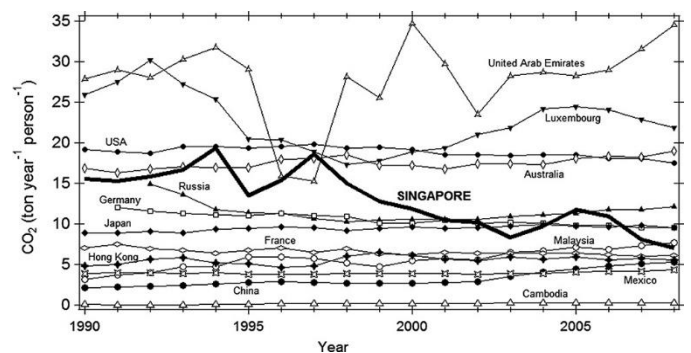

Figure 4 Co2 Emission Per Capita

3.1.4. Maintaining Accessible Public Spaces

Accessibility to well-maintained public spaces is a cornerstone of Singapore's urban planning strategy (Figure 5). The city has ensured that parks, gardens, and recreational areas are evenly distributed and easily accessible to all residents, regardless of their location. This emphasis on accessibility promotes inclusivity and ensures that the benefits of green spaces are enjoyed by everyone. Regular maintenance of these areas guarantees that they remain attractive and functional, encouraging frequent use by the public.

Vegetation cover	Percentage (%)
Managed vegetation (urban green spaces)	**27.5**
Public parks	3.2
Roadside greenery	3.7
Green spaces in other public and private estates	20.6
Unmanaged vegetation	**28.5**
Scrubland	5.92
Young secondary forest	19.6
Old secondary forest	1.37
Primary forest	0.16
Mangrove forest	0.91
Freshwater marsh	0.11
Freshwater swamp forest	0.39
Total vegetation cover	**56.0**

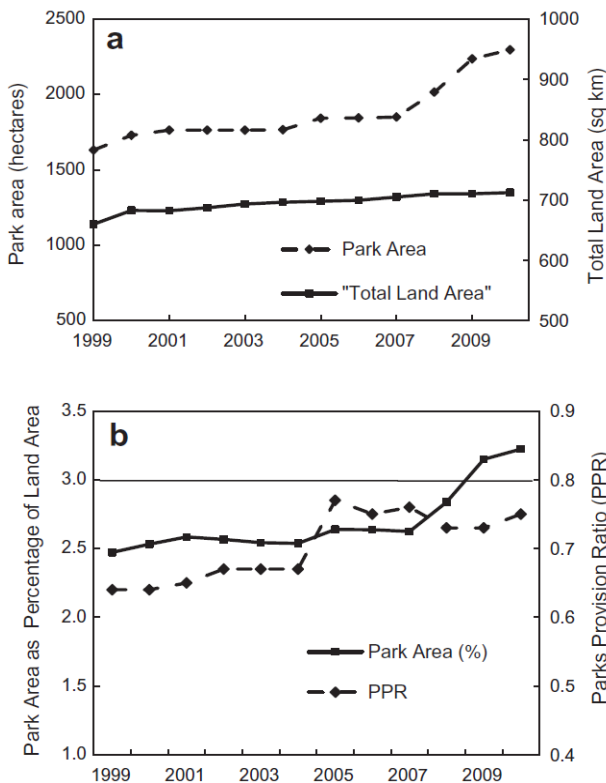**Figure 5 Distribution of Vegetation Cover (per cent of land) in Singapore**

Figure 6 a) Changes in total area of public parks maintained by the National Parks Board (primary vertical axis) and Singapore's total land area (secondary vertical axis); (b) park area as percentage of total land area (primary vertical axis) and parks

3.1.5. Benefits to Citizens' Well-being

The strategic focus on green spaces and their maintenance has provided numerous benefits to the well-being of Singapore's citizens. These spaces offer a respite from the urban hustle, promoting mental health by providing tranquil environments for relaxation and recreation. Physical health is also enhanced as residents engage in outdoor activities such as jogging, cycling, and other forms of exercise in these green areas. Moreover, the availability of clean, green public spaces fosters social interaction and community bonding, contributing to a more cohesive society. (Refer Figure 6 & 7).

Prevalence# and mean level of non-communicable diseases and their risk factors among Singapore residents aged 18 to 69 years, 1992, 1998, 2004 and 2010

Disease/Risk Factor	1992	1998	2004	2010
Diabetes mellitus [plasma glucose 2 hours post-OGTT ≥ 11.1 mmol/l]	8.6% (11.5%)	9.0% (11.3%)	8.2% (9.0%)	11.3%
Hypertension# [systolic pressure ≥ 140 mmHg or diastolic pressure ≥ 90 mmHg]	22.2% (27.7%)	27.3% (32.5%)	24.9% (26.8%)	23.5%
Blood cholesterol				
• Total cholesterol ≥ 6.2 mmol/l	19.4% (23.6%)	25.4% (28.2%)	18.7% (19.1%)	17.4%
• Mean total cholesterol (mmol/l)	5.3	5.5	5.3	5.3
• LDL-cholesterol ≥ 4.1 mmol/l	22.9%	26.5%	19.8%	15.2%
• HDL-cholesterol < 1.0 mmol/l	12.8%	11.7%	5.5%	8.1%
Obesity [BMI ≥ 30 kg/m2]	5.1% (5.5%)	6.0% (6.3%)	6.9% (6.7%)	10.8%
Regular exercise [1exercised ≥ 20 minutes for ≥ 3 days per week, 2exercised ≥ 20 minutes for ≥ 3 days per week moderate or greater intensity]	13.6%[1] (14.4%)	16.8%[1] (17.7%)	17.0%[2] (16.9%)	19.0%[2]

Figure 7 Health Data as Per National Health Survey 2010

3.1.6. Conclusion

Singapore's urban planning strategy, with its focus on greening the city, exemplifies how thoughtful, sustainable development can address environmental challenges while enhancing the quality of life for residents. By combating the urban heat island effect, reducing CO2 emissions, and maintaining accessible public spaces, Singapore has created a livable, vibrant urban environment. The benefits of this approach extend beyond environmental sustainability, significantly contributing to the general well-being and happiness of its citizens. As cities worldwide grapple with the pressures of urbanization, Singapore's experience offers valuable lessons in building resilient, sustainable urban futures. Singapore's urban open space quality stands as a paragon of effective planning and management, setting a global benchmark. The city-state's meticulous approach is characterized by a harmonious blend of functionality, aesthetics, and accessibility, ensuring that urban open spaces cater to the diverse needs of its residents. Sufficient availability of open spaces per capita is a cornerstone of Singapore's urban planning ethos. Through strategic land-use policies and innovative design strategies, the city has integrated green spaces seamlessly into its urban fabric, creating oases of tranquility amidst the bustling cityscape. From sprawling parks to vibrant community gardens, Singapore offers a diverse array of open spaces that cater to recreational, cultural, and ecological needs. Equitable distribution of urban open spaces is another hallmark of Singapore's approach. Rather than confining green spaces to affluent neighborhoods, the city has prioritized inclusivity, ensuring that residents across socio-economic strata have access to high-quality open spaces within close proximity to their homes. This commitment to social equity fosters a sense of belonging and community cohesion among Singaporeans, enhancing overall quality of life. Moreover, Singapore's dedication to high-quality maintenance ensures that urban open spaces remain pristine and inviting. Meticulous landscaping, regular upkeep, and innovative amenities contribute to the aesthetic appeal and functionality of these spaces, enhancing the overall urban experience.

Additionally, the integration of sustainable practices, such as water recycling and energy-efficient lighting, underscores Singapore's commitment to environmental stewardship. Easy accessibility is another key feature of Singapore's urban open spaces. Well-connected pedestrian pathways, efficient public transportation networks, and universal design principles ensure that residents of all ages and abilities can enjoy these spaces with ease. This accessibility fosters social interaction, physical activity, and a sense of well-being, ultimately enriching the urban experience for all. In summary, Singapore's exemplary urban open space planning and management have positioned the city as a global leader in sustainable urban development. By prioritizing availability, equity, maintenance, and accessibility, Singapore has leveraged its green infrastructure to enhance the quality of life for its residents, setting a precedent for cities worldwide.

3.2. Challenges and Opportunities in Mumbai
3.2.1. Mumbai's Urban Planning: The Consequences of Neglecting Open Spaces

Mumbai, India's financial capital, is a bustling metropolis known for its rapid urbanization and dense population. However, its town planning approach has long neglected the critical need for open spaces, leading to a cascade of environmental and social challenges. This neglect has manifested in the exacerbation of urban heat islands, a decline in air quality, increased pollution, and a detrimental impact on the well-being of its citizens. The city's high population density poses a formidable challenge to the equitable provision of open spaces. Rapid urbanization and population growth have led to increased pressure on land resources, resulting in the proliferation of informal settlements and encroachments on public spaces. As a result, many residents, particularly those in densely populated areas, lack easy access to green spaces, depriving them of the physical and psychological benefits associated with urban nature. Figure 8 Showing the change in land use of Mumbai between 1991-2018, the figure accurately depicts the continuous decline of open and green spaces as the built area increased.
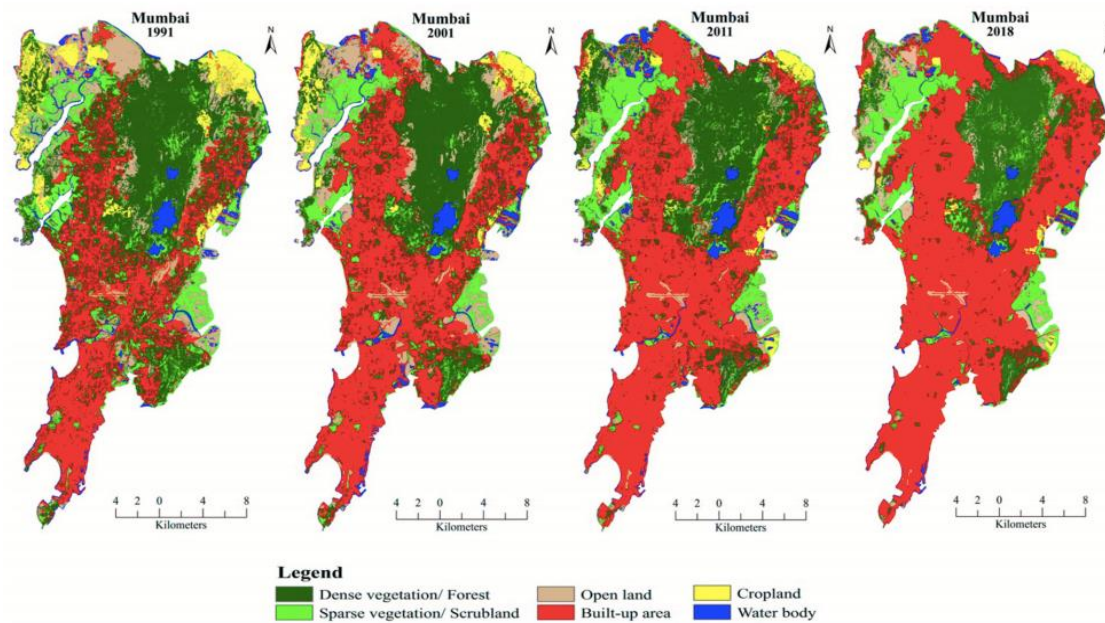
Figure 8 Showing the Change in Land use of Mumbai between 1991-2018

3.2.2. Rise of Urban Heat Islands

One of the most pressing issues stemming from Mumbai's inadequate urban planning is the rise of urban heat islands. The city's dense construction, lack of green spaces, and extensive use of concrete and asphalt have led to higher temperatures in urban areas compared to surrounding rural regions. This effect is compounded by the intense human activity and vehicular traffic, creating hot zones that significantly affect the quality of life. The lack of sufficient vegetation and green cover fails to provide natural cooling, resulting in heat retention and discomfort for residents.
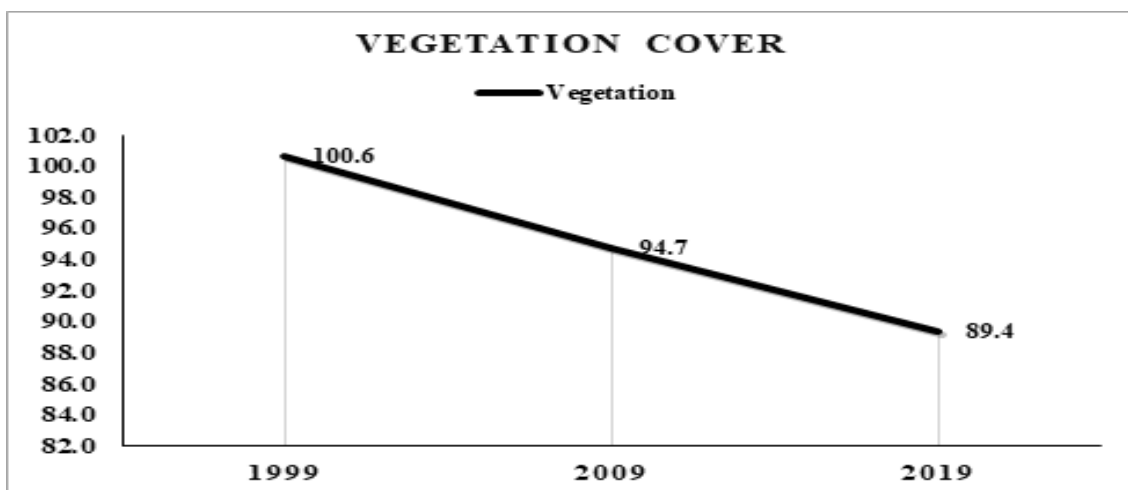

Figure 9 Comparative Green Area Cover of Mumbai, Between 1999-2019

Figure 9 (Spatial Analysis of Green Cover Change in Mumbai City, n.d.) By Priyanka Shantaram, Amaladas Pushparaj, and A. Rajasekaran.Institute of Forest Genetics and Tree Breeding, Coimbatore - 641002, India.
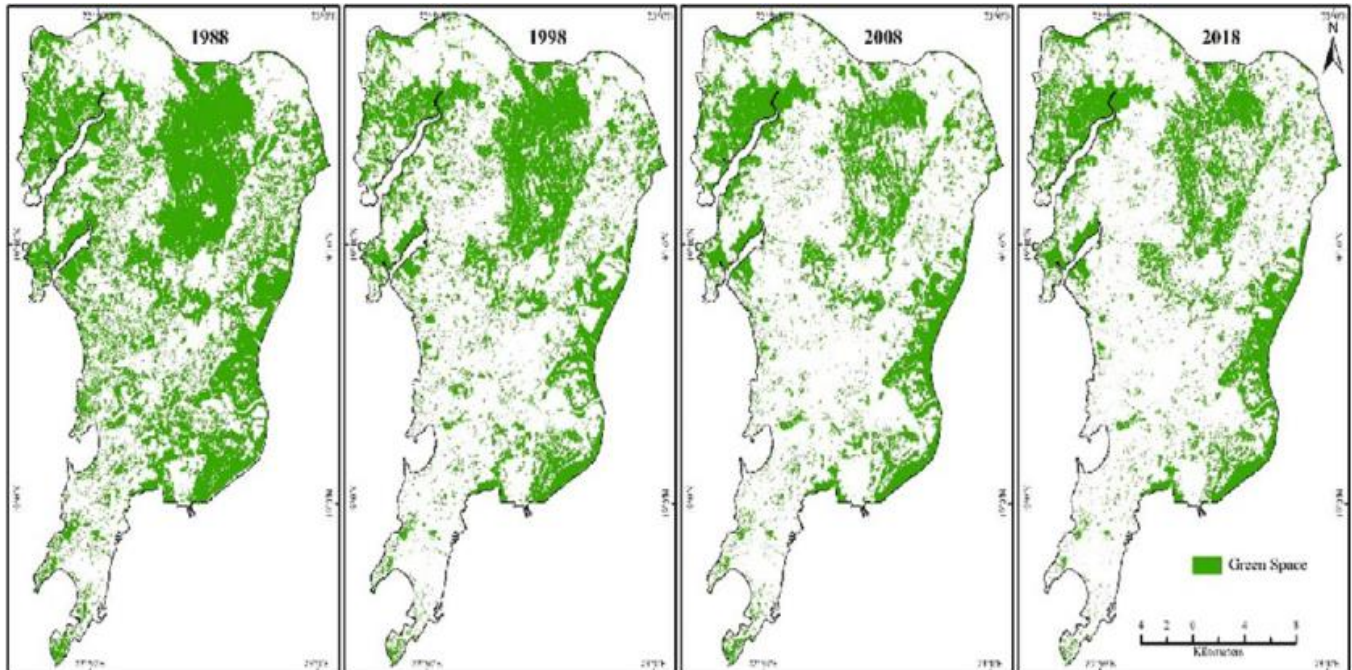
Figure 10 Decline of Urban Open/Green Spaces of Mumbai Between 1988-2018

3.2.3. Decline in Air Quality

The scarcity of open spaces and green areas in Mumbai has also contributed to a marked decline in air quality (Figure 10). Trees and plants play a vital role in filtering air pollutants, including particulate matter and harmful gases such as nitrogen dioxide and sulfur dioxide. With limited green cover, the city's natural ability to cleanse its air is severely compromised. The consequence is an increase in respiratory and cardiovascular diseases among residents, further straining the public health infrastructure.

3.2.4. Increased Pollution Levels

Mumbai's struggle with pollution is multifaceted, involving air, water, and land pollution. The lack of green spaces exacerbates air pollution, while insufficient parks and recreational areas mean that urban waste often lacks proper disposal avenues, leading to littering and unsanitary conditions. The haphazard urban sprawl has led to the degradation of natural water bodies, further compounding the pollution problem. These environmental issues are interlinked, creating a vicious cycle that degrades the city's livability. Air Pollution Levels of Mumbai is shown in Figure 11.
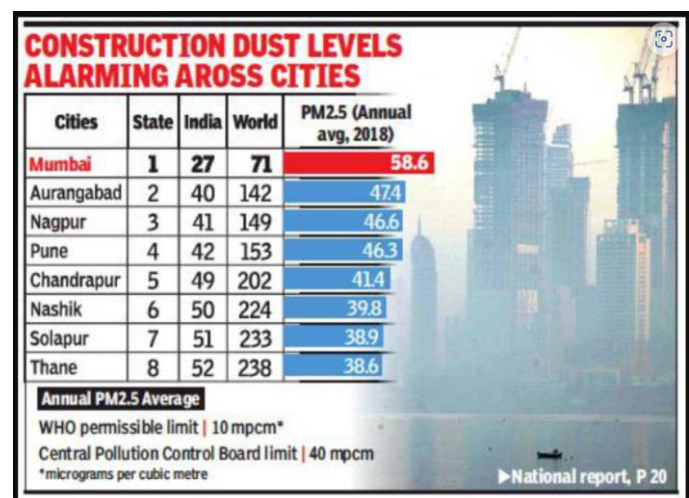

CONSTRUCTION DUST LEVELS ALARMING AROSS CITIES

Cities	State	India	World	PM2.5 (Annual avg, 2018)
Mumbai	1	27	71	58.6
Aurangabad	2	40	142	47.4
Nagpur	3	41	149	46.6
Pune	4	42	153	46.3
Chandrapur	5	49	202	41.4
Nashik	6	50	224	39.8
Solapur	7	51	233	38.9
Thane	8	52	238	38.6

Annual PM2.5 Average
WHO permissible limit | 10 mpcm*
Central Pollution Control Board limit | 40 mpcm
*micrograms per cubic metre
▶National report, P 20

Figure 11 Air Pollution Levels of Mumbai

3.2.5. Impact on Citizens' Well-Being

The neglect of open spaces in Mumbai has had a profound impact on the well-being of its citizens. Green spaces provide essential areas for recreation, relaxation, and social interaction, contributing to mental and physical health. Their absence means that residents, especially children, lack safe places to play and adults miss out on spaces to unwind and exercise.

This deficiency in recreational facilities has led to increased stress levels, reduced physical activity, and a decline in overall well-being. Moreover, the social implications are significant. Well-maintained public spaces foster community interaction and social cohesion. In their absence, social isolation and the sense of community deteriorate. The disparity in access to any available green spaces also highlights socio-economic divides, as affluent areas may still have some greenery, while poorer neighborhoods are often devoid of such amenities (Figure 12).
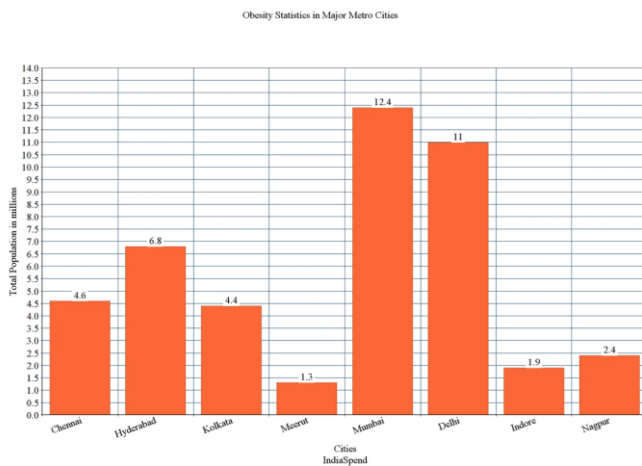
Figure 12 Total Obese Population of Major Indian Metro Cities (Mumbai has about 12.4 million obese)

Furthermore, pollution, both air and water, poses a significant threat to the quality of urban open spaces in Mumbai. Industrial emissions, vehicular traffic, and waste disposal contribute to poor air quality, while untreated sewage and industrial effluents contaminate water bodies, undermining the ecological integrity of urban green spaces. These environmental stressors not only degrade the aesthetic appeal of open spaces but also pose health risks to residents, exacerbating existing socio-economic inequalities. Despite these challenges, Mumbai presents ample opportunities for enhancing urban open space quality and improving the quality of life for its residents. Strategic interventions, such as revitalizing neglected waterfronts, reclaiming derelict industrial sites, and promoting rooftop gardens, hold promise for expanding the city's green

infrastructure and enhancing public access to open spaces. Moreover, leveraging technology and citizen engagement platforms can empower communities to participate in the co-creation and maintenance of urban green spaces, fostering a sense of ownership and stewardship. In conclusion, Mumbai's urban open space challenges are multifaceted, rooted in the complexities of rapid urbanization, environmental degradation, and socio-economic disparities. However, by embracing innovative solutions and collaborative governance models, Mumbai can capitalize on its diverse urban landscape to create inclusive, sustainable, and resilient open spaces that enrich the lives of its residents.

3.3. Urban Open Space Constraints in Jabalpur

Jabalpur, a historic city nestled amidst the lush landscapes of central India, confronts a myriad of constraints in the realm of urban open space quality. Decades of rapid urbanization and haphazard development have strained the city's green infrastructure, leading to the loss of vital urban blue spaces and the degradation of green areas (Figure 13).

Figure 13 Urban Open Space Constraints in Jabalpur

Poor urban planning strategies lie at the heart of Jabalpur's urban open space challenges. Inadequate zoning regulations, lax enforcement of land-use

policies, and fragmented governance structures have facilitated unplanned urban expansion, resulting in the encroachment and conversion of open spaces for commercial and residential purposes (Figure 14). As a consequence, large segments of the population are deprived of access to quality urban green spaces, exacerbating socio-economic inequalities and diminishing overall quality of life. The loss of urban blue spaces, including rivers, lakes, and ponds, further exacerbates Jabalpur's urban open space deficit. Encroachment, pollution, and unchecked development along water bodies have degraded these natural assets, compromising their ecological functions and recreational potential. Moreover, inadequate infrastructure and drainage systems exacerbate the risk of flooding and waterborne diseases, posing additional challenges to urban resilience and public health.

Figure 14 Land Mafia in Jabalpur

Inadequate maintenance exacerbates Jabalpur's urban open space challenges, further undermining the quality of life for its residents. Neglected parks, overgrown vegetation, and littered public spaces detract from the aesthetic appeal and usability of urban green areas, deterring residents from engaging in recreational activities and social interactions. Moreover, the lack of amenities and safety measures diminishes the perceived value of open spaces, perpetuating a cycle of disinvestment and neglect. Despite these constraints, Jabalpur presents opportunities for revitalizing its urban open spaces and enhancing quality of life for its residents. Strategic interventions, such as reforestation efforts, ecological restoration projects, and community-driven initiatives, can help reclaim and rehabilitate degraded open spaces, fostering biodiversity conservation and environmental stewardship. Moreover, promoting public-private partnerships and leveraging sustainable financing mechanisms can mobilize resources for the maintenance and upkeep of urban green areas, ensuring their long-term viability and accessibility. In conclusion, Jabalpur's urban open space constraints underscore the urgent need for proactive planning, policy interventions, and community engagement to address the city's sustainability challenges. By embracing a holistic and participatory approach to urban green space management, Jabalpur can reclaim its natural heritage, enhance public health and well-being, and create a more livable and resilient urban environment for present and future generations.

Conclusion

In conclusion, this research underscores the pivotal role that urban open spaces play in shaping the quality of life (QoL) in urban environments across diverse contexts. Through the comparative analysis of Singapore, Mumbai, and Jabalpur, it becomes evident that the availability, accessibility, and quality of urban open spaces significantly impact the well-being and satisfaction of residents. Singapore emerges as a beacon of exemplary urban open space planning and management, characterized by its commitment to sustainability, equitable distribution, and high-quality maintenance. The city-state's proactive approach to green infrastructure has not

only enhanced the physical, mental, and social well-being of its citizens but also set a global benchmark for urban development. Conversely, Mumbai and Jabalpur confront a myriad of challenges that impede the realization of quality urban open spaces. Mumbai's uneven distribution, pollution, and encroachments highlight the urgent need for strategic interventions to improve accessibility and maintenance. Similarly, Jabalpur's poor urban planning, loss of blue spaces, and inadequate maintenance underscore the imperative for proactive measures to reclaim and revitalize urban green areas. Despite these challenges, there exist opportunities for transformative change. By embracing innovative solutions, collaborative governance models, and community engagement, cities can overcome barriers and unlock the potential of urban open spaces to enhance QoL for all residents. Strategic interventions such as reforestation, ecological restoration, public-private partnerships, and citizen-driven initiatives can catalyze positive change and create more inclusive, sustainable, and livable urban environments. In essence, the findings of this research underscore the importance of prioritizing urban open spaces as integral components of urban planning and development. By addressing the challenges and leveraging the opportunities inherent in urban open space management, cities can foster vibrant, resilient, and equitable communities where residents thrive and flourish. Thus, investing in the availability, accessibility, and quality of urban open spaces is not only a matter of urban planning but also a fundamental imperative for enhancing the overall QoL in urban environments.

Acknowledgements

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