Impact and Policy Research Review (IPRR)
Vol. 4, Issue 1, January - June 2025, pp. 58-77

Special Article

Assessing the Growth of Urban Green Spaces in the Kolkata Metropolitan Area: Effects of the AMRUT Scheme

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Abstract

The paper assesses the impact of the AMRUT scheme on urban green spaces (UGS) in the Kolkata Metropolitan Area (KMA), focusing on how UGS in Serampore and Kamarhati have changed due to policy initiatives. It examines the role of institutional structures, including property rights, governance, and financial allocation, in influencing the availability and quality of green spaces. Findings show that while the AMRUT scheme has led to slight improvements in green cover, most municipalities still fall short of WHO recommended green space levels. Data reveals that limited green space investment in smaller towns and disparities in resource allocation affect UGS distribution and access. Serampore and Kamarhati demonstrate unique challenges, such as rapid urbanization and ineffective local governance, which limit green space expansion. The study underscores the need for robust public land ownership and policy frameworks to improve urban green spaces in growing cities, ensuring environmental sustainability and public health benefits for urban residents.

Keywords: AMRUT, Kolkata Metropolitan Area, Urbanization, Urban Green Spaces

1. Introduction

Urban areas worldwide are becoming increasingly congested, polluted, and vulnerable to climate threats, posing serious risks to human well-being and environmental justice (Blanco et al., 2009). Among these threats, four major global perils—rising temperatures, natural disasters, extreme weather, and biodiversity loss—are expected to have a severe impact on urban settings. Efforts to address these challenges are increasingly focusing on the role of green spaces through the concept of green infrastructure.

Today's primary urban development challenge is not only to increase green space but also to preserve and strengthen existing green cover to maintain ecological balance and enhance resilience. Urban green spaces (UGS), often referred to as the "lungs" of urban areas, are crucial for promoting sustainable development and

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enhancing residents' quality of life (Anteneh et al., 2023). UGS provide numerous environmental benefits, such as regulating the city's microclimate (Li et al., 2021), reducing urban flooding risks (Liu et al., 2023; Pei et al., 2023), absorbing pollutants, and releasing oxygen (Li et al., 2018). Broadly categorized into public and private spaces, UGS include parks, sports fields, community gardens, street trees, and unconventional green areas like vertical gardens and narrow pathways (Roy, Byrne, & Pickering, 2012). Private green spaces, such as backyards and corporate landscaping, further contribute to urban greenery. However, access to green spaces is often inequitable, frequently divided by income, race, age, and other factors (McConnachie & Shackleton, 2010). Over the past two decades, unequal access has emerged as a significant environmental justice concern, especially as the benefits of UGS for public health are widely recognized (Johnson Gaither, 2012).

In India, rapid urban expansion has led to substantial reductions in green spaces, contributing to environmental degradation. For example, between 1973 and 2013, Bengaluru's built-up area expanded by 92.5%, while its green cover shrank from 68% to 14%. Similarly, Mumbai's vegetation decreased by 60% between 1977 and 2017 (Udas-Mankikar and Driver, 2021). These trends underscore the pressing need to not only introduce more green spaces but also protect and enhance existing ones. Recognizing these issues, the Government of India has introduced several guidelines to make cities greener and more sustainable. The Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines of 1996 set targets for recreational spaces, recommending a ratio of 12-14% for smaller towns, 18-20% for medium-sized towns and cities, and 20-25% for metropolitan areas. In 2015, the AMRUT (Atal Mission for Rejuvenation and Urban Transformation) scheme set a goal for cities to achieve over 15% green cover. This paper aims to assess green cover changes in the Kolkata Metropolitan Area (KMA) before and after the AMRUT initiative and to examine the institutional factors influencing urban green spaces through a focused case study of Serampore and Kamarhati.

Following the introduction, the second section conceptualizes urban green spaces. The third section examines how neoliberal urbanization influences perceptions of green spaces. The fourth section details the paper's methodology. The fifth section analyzes AMRUT initiatives in the KMA, focusing on case studies of Serampore and Kamarhati Municipalities. The following section discusses the role of institutional factors in sustaining urban green spaces and concludes with the opportunities and challenges for green spaces in the KMA.

2. Role of Green Space in Urban Environments

Urban green spaces (UGS) refer to areas of vegetation in cities that provide environmental, social, and health benefits to residents. These spaces include parks, gardens, greenways, nature reserves, and other areas with natural elements. UGS are essential for sustainable urban development, enhancing air quality, mitigating urban heat zones, and offering spaces for recreation. They also support biodiversity and contribute to the overall well-being of urban populations. The integration of UGS into city planning promotes a balanced urban ecosystem and enhances the quality of life for city dwellers.

Urban green areas play a vital role in improving the living standards in our communities and urban environments. The effectiveness and sustainability of urban areas are significantly influenced by how these spaces are designed, managed, and maintained. Additionally, open and public areas contribute to social connections and reflect the overall quality of urban environments. Research on the relationship between urban green spaces and health has predominantly concentrated on parks, with some studies also considering green cover (Bedimo-Rung, Mowen, & Cohen, 2005). Limited access to parks has been associated with increased mortality rates (Coutts, Horner, & Chapin, 2010). Moreover, green cover has been demonstrated to have protective effects on health (Villeneuve et al., 2012). Parks often offer chances for physical exercise, which is associated with better health results and a reduced likelihood of overall mortality and various chronic diseases. (Grahn & Stigsdotter, 2010). Numerous research efforts reveal a connection between the closeness of parks and increased physical activity (Cohen et al., 2006). According to estimates from the World Health Organization (WHO), a significant 3.3 percent of global mortality is attributable to physical inactivity, which is often related to poor walkability and insufficient access to recreational spaces (WHO 2016).

In the context of neoliberal planning agendas, the well-being effects of green spaces are increasingly discussed within the framework of 'austerity urbanism.' This perspective argues that efforts to assign a monetary value to nature and its benefits often trap policymakers in a mindset focused on reducing the burden on publicly funded services. Advocates of this strategy argue that allocating resources to green and natural areas can result in quantifiable cost reductions for public entities. In this framework, it is essential to grasp how institutional dynamics and local government choices influence the allocation of Urban Green Space (UGS).

3. Neoliberal Politics and Initiatives for Urban Greening in India

The significance of urban environmentalism in politics should be assessed not only in terms of the environment alone but also in relation to the socio-spatial transformations induced by neoliberal urban development. One characteristic of neoliberal urbanization is the fostering of a sense of well-being by means of the environment. However, the economic, socio-cultural changes associated with this form of urbanization have also led to widespread uncertainty, stress, and conflict. These modifications have also resulted in alterations and improvements within the welfare system. Within the context of neoliberal urban development, the environment has evolved into a domain where social welfare can be both conceptually framed and practically achieved with lower public expenditure than other areas like employment generation, housing, or healthcare services. (Brand, 2003).

It is argued that urban local body authorities, serving as managers of professional knowledge on environmental issues, have the capacity to redefine local spatial wellbeing by focusing on the city's interaction with the physical environment. They can position the city's quality of life not by focusing on social relationships, but rather by emphasizing the safeguarding and improvement of natural resource systems.

Under neoliberal policies, public green spaces may be privatized or commercialized, leading to restricted access and increased usage fees. These spaces often rely on corporate sponsorships for maintenance, which can shift the design and use of these areas to favor commercial interests over community needs. Additionally, the creation or improvement of green spaces can increase property values and rents, potentially displacing low-income residents—a phenomenon known as "green gentrification" (Brenner, 2004). This process can result in enhanced green spaces becoming exclusive areas that primarily benefit wealthier populations, further marginalizing vulnerable groups. Moreover, profit-driven development might focus on immediate benefits rather than long-term environmental sustainability, exacerbating social inequalities and disrupting communities. To counter these issues, it is crucial to engage diverse community stakeholders in the planning and decision-making processes, ensuring that green spaces meet the needs of all residents.

In June 2015, the Ministry of Urban Development, Government of India, developed an action plan to enhance green spaces and parks, aiming to progressively increase urban green cover to 15 percent within five years. The notion of Green Infrastructure (GI) emerged in the 1990s, bringing new perceptions to Urban Green Space (UGS) development. Lennon and Scott (2014) advocates, '. . . in its focus on connectivity and multifunctionality, a green infrastructure (GI) approach reverses traditional planning practices, wherein attention is directed at the provision of single functions (e.g. drainage, conservation, recreation) in specific locations, with little interest shown to spatial, scalar and institutional integration' (Lennon and Scott, 2014).

In the realm of UGS planning, this transition indicates a change in perspective from seeing GI literature as considering UGS merely as separate green areas that offer cultural, environmental, and social advantages to local communities. Instead, it views UGS as a cohesive network of linked green spaces that serve various functions. Although interpretations of GI can differ based on factors such as the specific field of study (Lennon, 2015), the concepts most commonly linked with GI planning principles are multifunctionality and connectivity. (Hansen and Pauleit 2014; Pauleit et al. 2017).

Urban Green Spaces (UGS) can fulfil a range of roles, including ecological, social, and economic functions. This paper examines how these functions are referenced in the context of the AMRUT scheme and Green City Mission (GCM) of West Bengal. For example, references to public health advantages, overall wellbeing, quality of life, and leisure activities imply an emphasis on social roles. Terms associated with climate control, pollution mitigation, and ecological stability highlight ecological roles, whereas mentions of economic gains, like boosted tourism income and enhanced business opportunities, suggest economic roles. Achieving multifunctionality, particularly the delivery of ecological benefits, relies heavily on connectivity across green spaces. We focus on geographic linkage (Lennon and Scott 2014) and review relevant documents for any references to physically linking newly planned or existing green spaces.

4. Methodology

Details of the methodology are discussed in the following sub-sections.

4.1 Data Source

To analyze the green infrastructure of the Kolkata Metropolitan Area (KMA), the State Annual Action Plan (SAAP) was utilized, assessing temporal data on green cover prior to 2015-16. Following the implementation of AMRUT, green cover was reassessed in 2017-18. For a detailed case study of green cover in Kamarhati and Serampore, satellite data spanning three decades was used. Following table 1 shows the details of the satellite data acquired for the analysis.

Table 1: Sensor Specifications of LISS-III and ETM Imageries Used

Date	Satellite/Sensor	Path/Row	Source
22/10/2002	Landsat 7/ETM	138/044	United States Geological Survey (USGS),
26/10/2012	IRS-R2/L3	108/56	NRSC, India
26/1/2024	IRS-R2/L3	108/56	NRSC, India

As previously mentioned, the AMRUT scheme was implemented in only 32 ULBs within the KMA, with the number of projects varying across these areas. Kamarhati municipality was selected for analysis because it had the highest number of projects implemented, not only within the KMA but across all ULBs in West Bengal. Serampore was chosen as a case study due to having the fewest green projects implemented.

4.2 Methods

The distribution of green cover throughout a city is essential. The amount and accessibility of urban green spaces are evaluated by analysing the most significant, measurable physical characteristics of these areas. This assessment focuses on two primary metrics: the percentage of green spaces relative to the total area and the amount of green space available per resident (measured in square meters). These metrics enable a comparative evaluation of green space availability in KMA. The World Health Organization (WHO) suggests that each individual should have access to at least 9 square meters of green space, with the optimal goal being 50 square meters per person. To aid in this analysis, vegetation indices are calculated using a combination of the red (Band 3) and near-infrared (Band 4) spectral bands from the LISS-III sensor. The vegetation index is estimated using the following formula: NDVI[2] = (NIR – Red) / (NIR+ Red).

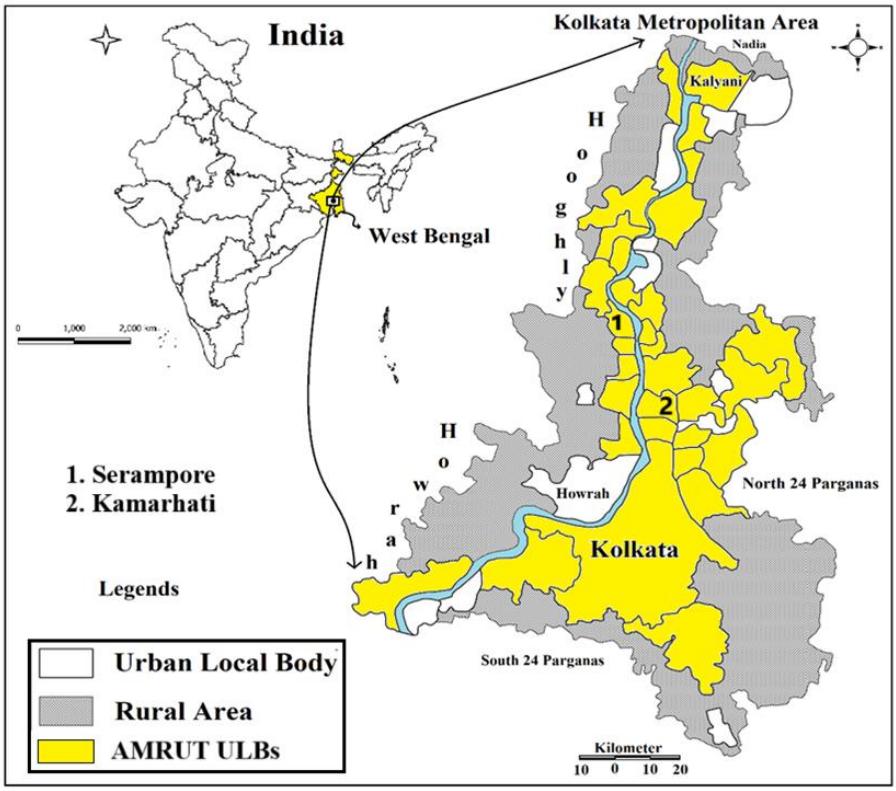
[2] Where NDVI stands for Normalized Difference Vegetation Index, and Red represents the visible region in the red spectrum.

This paper aims to evaluate the growth of green spaces in the Kolkata Metropolitan Area (KMA) and examine the impact of the AMRUT Scheme through two Urban Local Body (ULB) case studies within KMA.

4.3 Study Area

Kolkata metropolitan area (KMA) comprised of 4 municipal corporations, 41 municipalities, 70 non municipal urban areas, 14 out growths and 422 rural area. KMA spreads across 1851.41 sq. km. with a population of 14.69 million in 2011. The Hooghly River is flowing in the middle of the KMA as a result municipal corporations and municipalities are spread across the east and west bank of the river. Eastern bank municipalities are Kolkata municipal corporation, Bidhannagar municipal corporation, Dum Dum, North and South DumDum, Baranagar, Kamarhati, Panihati, Khardah, Titagarh, Barrackpore, North Barrackpore, Garulia, Bhatpara, Naihati, Kanchrapara, Halisahar, Kalyani, Mahyamgram, New Barrackpore, Gayeshpur, Haringhata, Budge Budge, Pujali, Maheshtala, Rajpur-sonarpur and Baruipur.

Figure 1: Location Map



The western bank municipalities are Howrah Municipal Corporation, Chandannagore municipal corporations, Uttarpara-Kotrung, Konnagar, Rishra, Serampore, Bhadreswar, Baidyabati, Uluberia, Dankuni, Champdany, Hooghly-Chinsura and Banshberia municipality. Both the eastern and western bank municipalities are situated across six districts include Kolkata, North and South 24 Parganas, Howrah, Hooghly and Nadia. The AMRUT scheme was selectively implemented across municipalities in the Kolkata Metropolitan Area (KMA), with only 32 Urban Local Bodies (ULBs) included.

On the west bank of the Hooghly River, the scheme was rolled out in ULBs such as Serampore, Bhadreswar, Baidyabati, Champdany, Hooghly-Chinsura, Bansberia, and Uluberia Municipality. On the east bank, it covered areas within the Kolkata Municipal Corporation, Bidhannagar Municipal Corporation, and municipalities including Dum Dum, North Dum Dum, South Dum Dum, Baranagar, Kamarhati, Khardah, Titagarh, Barrackpore, North Barrackpore, Bhatpara, Naihati, Kanchrapara, Halisahar, Kalyani, Madhyamgram, New Barrackpore, Maheshtala, and Rajpur-Sonarpur.

To provide a thorough assessment of green space development, two case studies were selected for analysis. Kamarhati was chosen due to its high number of AMRUT projects, making it an ideal example of extensive green space initiatives. Conversely, Serampore was selected because it had the fewest green space improvement projects, offering insight into areas with limited intervention. This contrast allows for a comparative understanding of the impact and effectiveness of green space improvements under differing levels of project implementation.

5. Examining the Urban Greening Initiative Under AMRUT and GCM in KMA

India does not have a long-established tradition of urban greening initiatives following independence. Typically, the greening of urban areas is incorporated into individual city plans or metropolitan development plans as recreational areas. In traditionally planned cities, urban planners determine how much space should be allocated for green areas and which locations should be designated for recreational purposes, as these are considered open and green spaces. In 1966, the first metropolitan development plan for Kolkata and its surrounding regions was published under the name Basic Development Plan (BDP) after independence. In this document, the plan for recreational space was ‘omitted’ because it was claimed that the contribution of recreational space to regional development is ‘indirect.’

Therefore, it was not emphasized as a major source of governmental investment. However, they recommended that urban open spaces be identified, preserved for recreation, and their use controlled so that they could be economically developed later for these purposes. In the 1990s, a publication on metropolitan development plans mentioned that ‘organized’ open spaces would occupy 2% of the total land. A decade Later, in the early 2000s, there was departure from the previous understanding with the publication of the Kolkata 2025 Perspective Plan, which highlighted the need for an urban forestry program within the Kolkata Metropolitan Area, investing nearly 20 million rupees in its implementation. This plan also identified several towns for the urban forestry program, including Barrackpore, Baidiyabati, Khardah, Konnagar, Uttarpara-Kotrung, and North Barrackpore. In 2015, the Ministry of Urban Development, Government of India, introduced new guidelines for cities to enhance their green cover to over 15 percent as part of the Atal Mission for Rejuvenation and Urban Transformation (AMRUT). A total of 32 ULBs within the KMDA participated in this program. The details of their participation are presented in Table 2.

Table 2: Number of Projects and Their Investment across ULBs of KMDA

ULBs	No. of Projects	Investment per project (Rs in Lakh)	ULBs	No. of Projects	Investment per project (Rs in Lakh)
Kamarhati	12	8	Uluberia	4	18
Bidhannagar	9	44	Krishnanagar	4	18
Kolkata	8	131	Kanchrapara	4	16
North Dum Dum	8	14	Bhardeswar	4	14
Panihati	8	14	Rishra	4	14
Sonarpur-Rajpur	8	14	Baranagar	4	14
Madhyagram	7	10	Bhatpara	3	33
Naihati	7	10	Baidyabati	3	18
South DumDum	6	19	Serampore	3	18
Barrackpore	6	10	North Barrackpore	3	18
Bansberia	6	9	Khardaha	3	18
Uttarpara-Kotrung	6	9	Titagarh	3	18
Kalyani	6	9	Champdani	2	28
Maheshtala	5	23	Hooghly-Chinsura	2	28
Chandannagar	5	23	DumDum	2	28
Barasat	5	20	Halisahar	2	28

Under the AMRUT initiative, a total of 23 recommendations have been proposed to enhance the city's green spaces. Urban Local Bodies (ULBs) in KMA have undertaken between 2 and 8 projects each to transform the city's existing green areas, with investments ranging from 8 lakh to 1.3 crore rupees per project. These projects encompass the development of parks, playgrounds, beautification of *jheel* sides, and large water bodies. The SAAP report does not provide data on areal coverage of the project. During my visit to the KMDA office, I found that they also lack this information. From my field observations, it is evident that parks under AMRUT are predominantly medium to small in size, ranging approximately from a few hundred to a thousand square meters, with no large-sized parks present.

Table 3 below illustrates the green space coverage of ULBs both before the commencement of the AMRUT program and after three years of its implementation.

Table 3: Green Coverage before and after the AMRUT

Percentage of Green Cover	ULBs	
	2015-15	**2017-18**
0- 5	Baidyabati, Bhardeswar, Barasat, Barrackpore, North Barrackpore, Kanchrapara	---
5-10	Bansberia, Champdani, Hooghly-Chinsura, Serampore Kolkata, Baranagar, DumDum	Baidyabati, Bhardeswar Serampore, Baranagar, Barasat, Barrackpore,

	Halisahar, Madhyagram, Titagarh, Maheshtala, Naihati Chandannagar, Bhatpara Bidhannagar, Kalyani	DumDum, Halisahar, North Barrackpore Kanchrapara, Chandannagar Bhatpara, Bidhannagar, Kalyani,
10-15	Rishra, Uttarpara-Kotrung Uluberia, Khardaha, Sonarpur-Rajpur, Kamarhati, Uluberia	Bansberia, Champdani, Hooghly-Chinsura ,Rishra Uttarpara-Kotrung, Kolkata Uluberia, Khardaha, Madhyagram, Titagarh Maheshtala, Sonarpur-Rajpur Naihati, Kamarhati, Uluberia
15-20	North Dum Dum, South DumDum	North Dum Dum, South DumDum

Source 1: State Annual Action Plan, 2017-18 to 2019-20

The table 3 provides insights into the green cover percentage across various Urban Local Bodies (ULBs) in the Kolkata Metropolitan Area (KMA) before and after the implementation of the AMRUT scheme, highlighting the scheme's impact on green space development. In 2015-16, a number of ULBs had low green cover, with many falling in the 0-5% and 5-10% ranges. Notably, ULBs like Baidyabati, Bhardeswar, Barasat, and Barrackpore reported less than 5% green cover, indicating a need for substantial intervention.

Meanwhile, larger urban areas, such as Kolkata, Baranagar, and DumDum, had a slightly better, though still limited, green cover between 5-10%. By 2017-18, following AMRUT initiatives aimed at enhancing urban green spaces, several ULBs experienced measurable improvements. For example, ULBs like Bansberia, Champdani, and Hooghly-Chinsura progressed from the 5-10% green cover range to the 10-15% range, signaling AMRUT's role in facilitating green space expansion. Additionally, ULBs such as North Dum Dum and South Dum Dum maintained their 15-20% green cover, reflecting the impact of sustained green space management efforts.

The case of Kamarhati is particularly significant, as it moved to the 10-15% range, aligning with its high number of AMRUT projects. In contrast, Serampore, with fewer AMRUT green space projects, remained within the 5-10% range, underscoring the limited improvements achieved there. Overall, the table demonstrates that AMRUT has positively influenced green cover enhancement in several KMA ULBs, especially in areas with a higher concentration of AMRUT projects. This variation highlights how the extent of project implementation can affect green space development outcomes across different ULBs.

The table 4 shows the change in per capita green space (in square meters) across Urban Local Bodies (ULBs) in the Kolkata Metropolitan Area (KMA) between 2015-16 and 2017-18, highlighting the impact of the AMRUT scheme on urban green space availability.

Table 4: Green Space per person in KMA

Green Space per person (sq. meter)	ULBs	
	2015-15	2017-18
Less than 1	Barasat	---
1 -- 5	Baidyabati, Bhardeswar Champdani, Kolkata, Baranagar, Barrackpore, Kanchrapara, Titagarh, Naihati, Bidhannagar Kalyani, DumDum, Halisahar, North Barrackpore	Kolkata, Baranagar, Barrackpore Kanchrapara, Titagarh, Bidhannagar, Kalyani
5--10	Bansberia, Hooghly-Chinsura Rishra, Serampore, Khardaha Madhyagram, Chandannagar South DumDum, Kamarhati	Baidyabati, Bansberia Bhardeswar, Champdani Hooghly-Chinsura, Rishra Serampore, Barasat, Khardaha Naihati, Kamarhati, DumDum Halisahar, North Barrackpore
10--20	Uttarpara-Kotrung, Uluberia North Dum Dum, Panihati Bhatpara, Uluberia	Uttarpara-Kotrung, Uluberia Madhyagram, North Dum Dum Panihati, Chandannagar South DumDum, Uluberia
20--50	Maheshtala	Maheshtala, Bhatpara
> 50	Sonarpur-Rajpur	Sonarpur-Rajpur

Source 2: : Calculated from State Annual Action Plan, 2017-18 to 2019-20

In 2015-16, many ULBs offered limited green space per person, with Barasat having less than 1 sq. meter and several ULBs, including Kolkata, Baranagar, and DumDum, falling within the 1–5 sq. meter range. This lack of green space per capita in densely populated areas reflects a high demand for urban green infrastructure. Under the AMRUT scheme, several ULBs aimed to increase green spaces to improve livability. By 2017-18, some ULBs showed improvement, with many that were initially in the 1–5 sq. meter range (e.g., Baidyabati, Bhardeswar, Champdani) moving to the 5–10 sq. meter range. This increase indicates that AMRUT initiatives, such as park development and green belt expansions, were successful in expanding green space availability, particularly in mid-sized towns. For towns like Kamarhati, which saw numerous AMRUT projects, green space per capita rose to the 5–10 sq. meter range, suggesting a tangible impact from increased green infrastructure investment.

Conversely, Kolkata remained within the 1–5 sq. meter category, possibly due to spatial and population density constraints, limiting the effectiveness of green space initiatives. ULBs with more land availability, such as Maheshtala and Sonarpur-Rajpur, maintained or increased their green space per capita, with Sonarpur-Rajpur reaching over 50 sq. meters per person by 2017-18. This wide disparity indicates that while AMRUT has helped improve green space, its impact varies based on ULB characteristics such as available land and urban density.

Overall, the data reflects that while AMRUT has positively influenced green space per capita, its effectiveness is moderated by the urban structure, land availability, and population density of each ULB.

However, the data also highlights an overall lack of adequate green space across ULBs in the KMA and points to slow progress in improving per capita green coverage under the AMRUT scheme. Despite some ULBs moving into higher green space categories, the SAAP report reveals that municipalities have submitted an insufficient number of green projects, limiting the scope of AMRUT's impact. Most projects are focused on park development rather than adopting a comprehensive approach to green space enhancement that could include green belts, tree-lined streets, or community gardens. This limited focus restricts green space improvements primarily to localized areas and underscores the need for a more expansive strategy to achieve significant urban greening across KMA. Therefore, while AMRUT has made some positive strides, the program's narrow project scope and insufficient green space initiatives highlight the need for broader, more innovative urban green strategies to address the pressing green space deficiencies across ULBs in the KMA.

Building on these efforts, the Government of West Bengal, after rejecting the Smart Cities Mission (SCM), launched the Green City Mission (GCM). The GCM aims to create an "environmentally friendly, sustainable, livable, energy-positive, and safe city," while also focusing on "job creation and affordable housing for the poor." The program includes components such as greening, blueing, and cleaning the city, alongside the development of an energy-positive, safe, secure, and technology-efficient urban environment (GoWB, 2017). Under the greening plan, the focus is on projects like urban afforestation, park creation, and plantation along road medians, while the blueing plan prioritizes the conservation of water bodies, waterfront development, and water-based recreational activities.

Initially, the state government invested 650 crore rupees in GCM (Laha Roy, 2017). It was decided that 50 lakh rupees each for all the 125 Urban Local Bodies (ULB) will be allotted (Ghosal, 2016). On July 25th 2018, the government of West Bengal informed the assembly that they spent 1372 crore rupees (Business Standard, 2018). Since the start of the Green City mission, up to 3109 projects have been approved at an estimated cost of 1605.89 crore rupees. Of these, 806.45 crore rupees were released to ULB authorities primarily in the areas of LED street lights, water body restoration, green space development, and various projects such as seating arrangements, bus stops, communal toilets, and water ATM etc. However, newspaper reports indicate that the Green City Mission prioritized LED lighting over the creation of green spaces within ULBs.

6. AMRUT Initiatives in Serampore and Kamarhati

As previously mentioned, to accurately assess the green coverage of ULBs, two case studies—Serampore and Kamarhati—have been examined. Serampore, located on the western bank of the Hooghly River, was once a Danish colony before being ceded to the British East India Company. The town still preserves numerous colonial-era buildings and landmarks, such as Serampore College, St. Olav's Church, and the

Government House, which showcase its Danish and British heritage along with its significant green spaces. As part of the Kolkata Metropolitan Area, Serampore has experienced urban development and modernization over the years. Serampore has total 10 parks spreads unevenly across 29 wards.

Figure 3

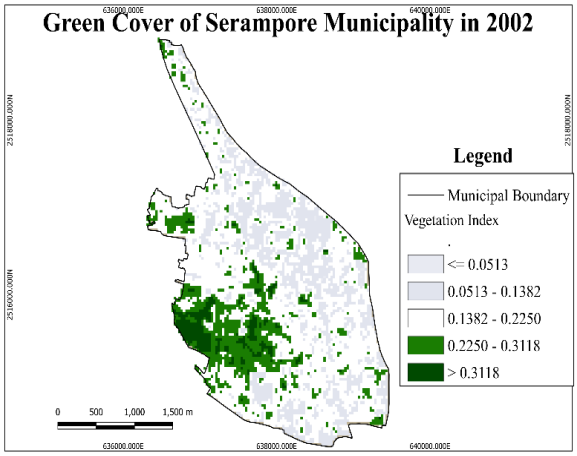


Figure 2

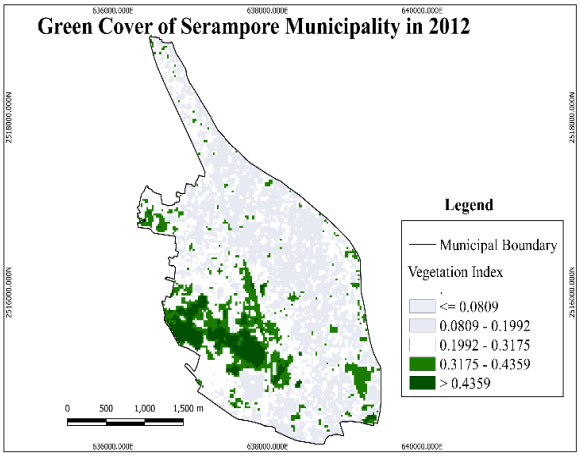


Figure 4

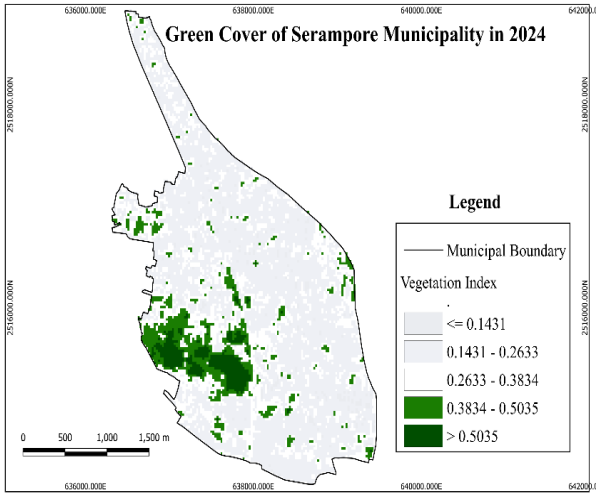


Figure 5

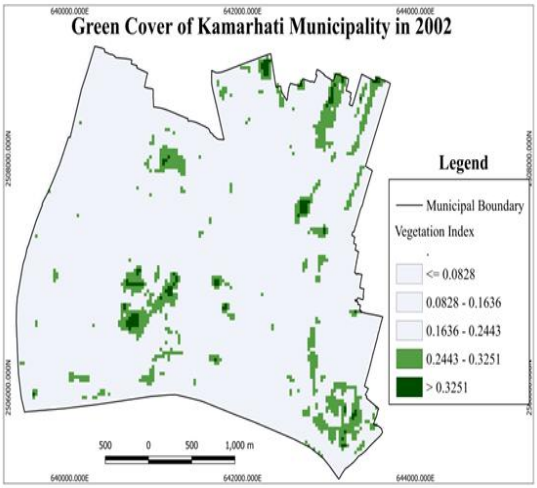


Figure 6

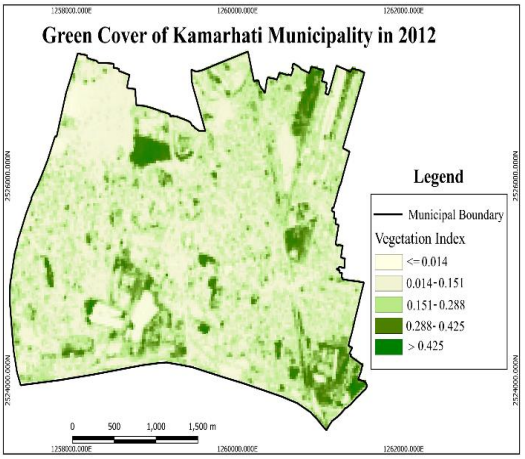
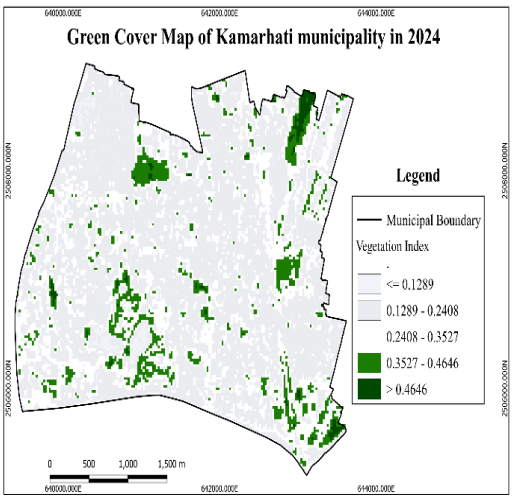


Figure 7



Under the AMRUT scheme, only two parks have been developed in Serampore—one on K.L. Goswami Road and the other on BP 1st Lane. Beyond parks, Serampore's green spaces primarily consist of agricultural land, ponds and their surroundings, roadside greenery, school and college playgrounds, private gardens, and green areas within the premises of government buildings, old mills, and along the banks of the Hooghly River.

Kamarhati is a municipality located in the North 24 Parganas district of West Bengal and is part of the Kolkata Metropolitan Area. Known for its dense population and industrial activities, including jute mills, factories, and small-scale industries, Kamarhati faces challenges such as inadequate infrastructure, limited green spaces, and pollution, common to many urban areas in KMA. Under the AMRUT scheme, the municipality prioritized the creation of quality urban green spaces to provide relief from the highly congested developments and enhance the city's aesthetics and design. As part of this initiative, a total of 10 parks were developed in Kamarhati, including Prabartak Pally Park, B.T. Park, Madhyapara Park, Phalguni Park, Salpata Bagan Sishu Udyan, Uttarayan Ladies Park, Sonar Bangla Park, Prabhas Sarkar Sishu Udyan, Loknath Park, and Maydivan Pally Park. Beyond parks, the green spaces in Kamarhati municipality include areas within the compounds of old and closed mills, stretches along railway lines, pond and roadside areas, household gardens, school and college playgrounds, and private gardens.

With the increasing population, green spaces have significantly declined in both municipalities. To assess the actual state of green cover in these areas, maps from three different decades have been generated. Figures 2, 3, and 4 illustrate the temporal changes in green cover in Serampore municipality, while Figures 5, 6, and 7 depict the temporal changes in green cover in Kamarhati. The green cover maps of Serampore and Kamarhati reveal an uneven distribution of green spaces, with only a few large areas of greenery remaining. In Serampore, significant green spaces are primarily concentrated in the southwestern part of the municipality. However, due to rapid urbanization, largely driven by the real estate sector, this green cover is diminishing quickly. In Kamarhati, sizable green areas are found in both the extreme northern and southern parts of the municipality, with scattered patches near the western area where the city's water treatment plant is located. The sharp decline in green spaces in Kamarhati is attributed to the rapid expansion of the real estate industry and a lack of efforts to preserve green areas. The following Table 5 illustrates the temporal changes in green cover for both Serampore and Kamarhati municipalities.

Table 5: Temporal Change of Green Cover

Year	Green Cover in percentage	
	Serampore	**Kamarhati**
2002	8.85	13.23
2012	6.22	11.44
2024	8.31	12.14
2032*	9.70	12.61

*Source 3: Landsat 7 and LISS 3, *Estimates based on linear interpolation*

Table 5 shows the percentage of green cover in the Serampore and Kamarhati municipalities across four periods: 2002, 2012, 2024, and an estimate for 2032. In Serampore, green cover decreased from 8.85% in 2002 to 6.22% in 2012, reflecting a notable reduction likely driven by urbanization and real estate development. However, by 2024, green cover is expected to rise to 8.31% due to greening initiatives such as AMRUT. The projection for 2032 is a further increase to 9.70%, contingent upon effective regulations to preserve existing green spaces and expand them.

In Kamarhati, green cover fell from 13.23% in 2002 to 11.44% in 2012. A slight improvement is anticipated by 2024, with green cover reaching 12.14%, and a further rise to 12.61% by 2032. This increase will depend on appropriate actions taken by both local and metropolitan governments. Overall, the data indicates that both municipalities saw a reduction in green cover between 2002 and 2012, followed by a gradual recovery likely influenced by urban greening efforts and improved environmental management practices.

7. Financing Green Space in ULBs

This section of the paper examines the institutional factors affecting urban green spaces within urban local bodies, focusing on government financial concerns related to revenue and expenditure. Institutional factors can be divided into several key categories: the organizational structure of institutions, the initial allocation of property rights, mechanisms for delivering urban green spaces (UGS), the capability of institutions, and the connection between government funding and the provision of UGS. Institutional arrangements consist of rules, policymaking processes, and programs that shape social practices, allocate roles to individuals, and regulate interactions between them. (Young, 2002). In the context of land use and urban green space (UGS) provision, these frameworks shape the decision-making processes and impact the resulting outcomes. The primary factors involved are the institutional framework, land ownership, available tools, and the capacity of institutions.

Here institutional structure refers to the organizational networks, including key agencies across various levels of government and non-governmental participants. It plays a pivotal role in governance practices and frameworks (Neuman 2012). Studies focusing on Chinese cities have highlighted a significant connection between the organized framework of a society and the design and layout of its urban open spaces. For example, in societies where institutional hierarchies are well-defined, the resulting open-space designs tend to be more hierarchical, as observed in places like China and, to a lesser degree, Europe.

On the other hand, in societies with more fluid institutional boundaries, such as those in the Middle East, open-space designs tend to be less rigid. (Alsayyad and Bristol 1992). In the municipalities of Serampore and Kamarhati, the connection between local authorities and residents when it comes to maintaining urban green spaces is quite weak. This is largely attributed to the high population density and the absence of a direct platform at the ward level for involving the community.

As a result, there is minimal engagement with the local population in the design and planning of green spaces.The initial allocation of land possession or right can be divided into four main categories: unassigned rights (open access), collective or communal property (rights held by a group), private property (rights granted to an individual), and public or state property (rights managed by the government). Each type has unique features and enforcement mechanisms that impact how resources are distributed and the efficiency of the economy (Buitelaar and Segeren 2011; Ostrom, 2003).

In urban development, possession of property are often assigned as a comprehensive set, and this initial allocation can significantly influence both the direct and indirect aspects of urban design and structure. The large urban green spaces in both Serampore and Kamarhati municipalities are primarily classified as collective property or open access.

Many of these green areas include old, closed mill properties, which occupy significant portions of land. However, due to the high value of real estate, these green spaces are rapidly being converted for other uses.

There are three primary approaches through which government bodies can manage and create urban green spaces (UGS): regulatory measures, public land acquisition, and market-based incentives (Bengston, Fletcher, and Nelson 2004; Romero, 2003). Regulatory measures involve setting restrictions on development, employing administrative and legal frameworks to ensure adherence, and imposing fines for non-compliance. For instance, zoning laws might limit land use to certain types and prevent UGS areas from being repurposed (Romero, 2003). Another approach is public land acquisition, where the government buys land to safeguard it, enhance peoples access to green areas, and reduce the need for ongoing regulatory oversight (Romero 2003).

While this method is highly effective for preserving open spaces, it tends to be the most expensive (Bengston, Fletcher, and Nelson 2004). Lastly, market-based incentives involve using rewards or penalties to influence behavior and promote the creation of UGS. However, participation in these incentives is voluntary (Bengston, Fletcher, and Nelson, 2004). In the case study areas, there are few regulations in place to protect green spaces. In fact, regulations focus more on protecting blue spaces than green ones. Additionally, neither urban local body (ULB) has the authority to acquire land for green spaces, and there are no market incentives in the ULBs of KMA to promote the creation of green areas.

The significance of institutional capability in environmental planning and the development of urban green spaces (UGS) on a global scale is widely acknowledged, affecting both developing and developed areas. A research project in Albay, Philippines, utilizing the organizational analysis and development agenda, highlights that local governments' institutional capacity to influence behaviour and promote collective action is vital for integrating sustainability into local land-use planning (Cuevas et al. 2016). However, the institutional capacity of KMA's urban local bodies (ULBs) is notably weak due to limited financial resources and budget deficits. Table 6 below illustrates the expenditure on green space.

Table 6: Expenditure on Civic Amenities in Serampore and Kamarhati Municipality

Year	Serampore	Kamarhati
2022-23	0.09	1.06
2021-22	0.49	1.16
2020-21	1.47	1.71
2019-20	4.06	3.67

Source 4: Ministry of Housing and Urban Affairs, GOI, 2023, Figures in million rupees

There has been a dramatic decrease in expenditure on civic amenities in Serampore, dropping from 40.6 million rupees in 2019-20 to only 0.09 million rupees in 2022-23. This signifies a substantial reduction in investment over the years. In contrast, Kamarhati's expenditure has fluctuated but remained relatively steady, peaking at 1.71 million rupees in 2020-21 and slightly declining to 1.06 million rupees in 2022-23. Overall, while Serampore has faced a significant reduction in spending, Kamarhati has maintained more stable and moderate expenditure levels.

The low expenditure on civic amenities by the ULBs suggests a lack of financial capacity to invest in these areas. In fact, following the implementation of AMRUT, these ULBs have not been able to increase their investment in civic amenities. Consequently, they have struggled to expand green spaces in urban areas. Table 7 below shows per capita expenditure and the allocation of funds to green spaces by urban local bodies (ULBs).

Table 7: Expenditure on Civic Amenities and Allocation to Green Spaces

Year	Per 100-person Expenditure (in rupees) on Green Space		Percentage of Expenditure on Green Space	
	Serampore	Kamarhati	Serampore	Kamarhati
2022-23	283	229	0.04	0.13
2021-22	25	250	0.07	0.13
2020-21	17	368	0.23	0.21
2019-20	6	786	0.74	0.58

Source 5: : Ministry of Housing and Urban Affairs, GOI, 2023

Table 7 shows per 100 persons expenditure on green space and the percentage of that expenditure allocated to green spaces in Serampore and Kamarhati. In 2022-23, Serampore spent 283 rupees per 100 people with only 0.04% going to green spaces, while Kamarhati spent 229 rupees per 100 people with 0.13% allocated to green spaces. Expenditures were higher in previous years, peaking at 786 rupees per 100 people in Kamarhati in 2019-20, but the percentage of expenditure on green spaces has generally remained low, indicating limited investment in green infrastructure. Limited investment highlights the crucial role of the aforementioned institutional factors. Therefore, investment will be more effective if ULBs consider these factors and focus on engaging various stakeholders responsible for protecting and managing green spaces.

8. Limitation of the study

The study faces several limitations, including restricted data availability, particularly the lack of detailed areal coverage information from official sources. Its focus on small to medium-sized parks excludes larger green spaces, potentially narrowing the scope of analysis. The geographic coverage is limited to Serampore and Kamarhati, which may not fully reflect the diversity of green space dynamics across the Kolkata Metropolitan Area. Institutional weaknesses and financial constraints within local governance systems pose challenges to implementing green initiatives, affecting the findings. Furthermore, the short timeframe analyzed may not provide a comprehensive understanding of the long-term impacts of urban greening projects.

9. Conclusion

This paper explores the issue of urban green spaces in the Kolkata Metropolitan Area (KMA) within the framework of the AMRUT program. It examines temporal changes in green cover and per capita green space across various Urban Local Bodies (ULBs) in KMA, both before and after the program's implementation. The study also incorporates case studies to analyze the role of institutional factors in maintaining existing green spaces. The findings suggest that institutional arrangements influence government responses to promoting and financially supporting urban green spaces, as well as the allocation of resources in development projects.

The major findings of the study include: first, while the AMRUT scheme has led to modest improvements in green cover across the region, most municipalities still fall short of the WHO's recommended levels. Second, the distribution of green spaces is uneven, with smaller towns receiving less investment and facing disparities in resource allocation. Third, case studies from Serampore and Kamarhati reveal that rapid urbanization and ineffective governance significantly hinder green space development. Fourth, parks developed under AMRUT are mostly small to medium-sized, with no large parks, limiting their overall impact. Fifth, weak institutional frameworks and limited financial resources prevent urban local bodies from effectively planning and maintaining green spaces. Finally, the findings highlight the critical role of public land ownership and strong policy frameworks in sustaining and expanding urban green infrastructure for both environmental and social benefits.

The study concludes that initial property rights assignments and related instruments play a significant role in shaping government revenue, expenditure, and decision-making regarding urban green spaces. As cities grow and private property ownership increases, the ability to provide adequate green space becomes constrained by changes in land-use policies. This trend has been evident in both Serampore and Kamarhati, underscoring the need for cities to leverage opportunities for initial public landownership to improve urban green space provision.

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