

Building the Nexus Between Urban Green Space, Livability, Quality of Life and Conservation Efforts Through Residents' Perspective

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ABSTRACT

Urban green space plays a crucial role in enhancing the residents' quality of life through their cultural ecosystem services in addition to their functions as ecological resources. The present study investigates the contribution of urban forests, parks and wetlands in improving a city's liveability and residents' quality of life. It evaluates how certain push-pull factors influence residents' visits to these spaces and their conservation efforts. The study adopted a mixed method approach, including a random sample survey with 500 residents, 10 in-depth interviews, 5 group discussions, and analytical methods: Kruskal-Wallis H test and Mann-Whitney U test to explore how these green spaces offer different services and experiences, and provides several perceived benefits towards residents' physical and mental well-being. The study found that residents are delighted with the well-maintained parks which contribute the most in enhancing quality of life compared to other green spaces. Easy accessibility and specific park features such as a majestic view of the mighty Brahmaputra River and activities like boating in Dighalipukhuri Park attract visitors to these green spaces. The natural landscapes (forests and wetlands) offer unique opportunities to experience nature and wildlife watching that adds to their intellectual development and spiritual enrichment. However, the natural landscapes offer limited recreational services and are facing a myriad of challenges such as encroachment, biodiversity loss and pollution. Females prefer accessible green spaces equipped with essential amenities to natural places since they are concerned about the safety and accessibility of these wild urban natural locations for them and their kids. Residents have a positive attitude towards the conservation of these green spaces. They support the development of natural landscapes as sites for sustainable tourism to attract more visitors but want conservation to be prioritised. Thus, planners can utilize these findings as they seek to design urban strategies that aim at improving residents' experience through maximizing cultural services and minimizing ecological damage.

Key words: Urban Green Space, Cultural Ecosystem Services, Residents' Perception, Liveability, Conservation Efforts

Introduction

Urban green spaces such as urban forests, parks and wetlands are recognized for their capacity to support biodiversity as well as for controlling and supplying ecosystem services like reducing pollution,

protecting against flooding, groundwater recharge, improving water quality, sequestering carbon, reducing greenhouse gas emissions, producing biofuel, enhancing biodiversity, eco-tourism, providing cultural and recreational services (Livesley *et al.*, 2016; Mexia *et al.*, 2018; Sheergojri *et al.*, 2024). In

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urban and peri-urban regions these green spaces play an important role in improving local climate regulation during summers and acting as natural sponges, absorbing and holding excess rainwater during heavy downpours, thereby preventing floods (Ferreira *et al.*, 2023; O'Brien *et al.*, 2022, Zimmermann *et al.*, 2016). The introduction of urban parks and the restoration of urban wetlands and forests require a strong driving force because they will change land use in the future and take up space that could be used for the development of other sectors. Especially, in developing nations like India where rapid urbanization has been occurring due to widespread migration to cities has led to competing demands for the limited amount of land available in urban areas (Turaga *et al.*, 2020).

Thus, it is essential to highlight the overall benefit of regulating, provisioning and cultural ecosystem services provided by the urban green space, which is important for sustainable urban development. Although, regulating and provisioning service values can be easily quantified to judge their performance, intangible qualities of cultural ecosystem services are hard to measure (Hanna *et al.*, 2024). People receive various cultural ecosystem services from these green spaces through recreation, tourism, social interaction, intellectual development, spiritual enrichment and aesthetic experiences. Therefore, expanding our knowledge about the cultural ecosystem services provided by these urban green spaces is essential.

People across the world are being disconnected from nature and are going through the phase of "extinction of experience" (Soga and Gaston, 2016). This loss of experience due to rapid urbanization is associated with fewer opportunities for people to engage with nature, which can affect their emotional attachment to it and their desire to preserve it as well as the numerous health and well-being advantages these interactions provide (Cox *et al.*, 2018; Fleming and Schwartz, 2023). Moreover, urban dwellers express a need for a connection with nature and a space for social interactions, as well as appealing surroundings for recreation, tourism, cultural education, aesthetic appreciation, and spiritual needs. Thus, a liveable city must have green spaces because they offer dwellers a variety of benefits and healthier surroundings. Living near usable greenery has been linked to improved health and happiness as these areas provide the ideal setting for unwinding from the stresses of daily life, socializing and

exercising, interacting with the natural world and spending time with ourselves (Bounoua *et al.*, 2020; Mudau *et al.*, 2020).

An increasing amount of research indicates strong correlations between the presence of green space in metropolitan areas and the degree of physical activity (Richardson *et al.*, 2013, Wang *et al.*, 2019). These spaces can serve as therapeutic areas for rehabilitative exercise, particularly for patients with coronary artery disease, and minimize the likelihood of being overweight or obese (Grazuleviciene *et al.*, 2015; Song, Li and Yu, 2023). In addition to improving physical health these spaces have restorative impacts on mental health and wellness and act as a buffer against stressful life occurrences (Berg *et al.*, 2010). Engaging in activities facilitated by urban green spaces including socializing or exercising reduces tension and anxiety, and enhances focus and mood (Pasanen *et al.*, 2023). Social interactions also contribute to the creation of social capital, the reduction of social isolation, and an increase in well-being, personal resilience, and neighbourhood satisfaction (Chen *et al.*, 2021).

Cultural ecosystem services provided by urban green space play a crucial role in the urban environment to enhance the physical and mental well-being of residents and are closely related to their social integration, sense of belonging and interactions with nature. Thus, the integration of urban green spaces improves the liveability of the city and consequently enhances the resident's quality of life. Moreover, the services provided by these green spaces, especially urban wetlands and forests lack observable prices since they are not exchanged on established economic markets due to which instances of overuse and destruction of these urban green spaces are observed worldwide. Thus, comprehending the latent elements underlying people's choice behaviour and stated environmental values such as perceptions, beliefs, attitudes, and values is important to have a better understanding of the interests that each individual has in conservation efforts. Studies have reported that evaluations of people's perceptions and attitudes are important in research on conservation and the management of urban ecosystems (Sonti *et al.*, 2020; Haq *et al.*, 2021; Barona *et al.*, 2022).

Understanding people's attitudes and perceptions is crucial to the survival of these green ecosystems and the effectiveness of conservation efforts ecosystems (Obradović *et al.*, 2023). Furthermore, the viewpoints and attitudes of nearby populations

might shed light on people's actions and level of cooperation with a given resource. However, limited research has been done on how urban green spaces influence the liveability of a city and its residents' quality of life through peoples' perceptions and conservation efforts, particularly in North-east India. Thus, this study aims to analyse the residents' perception regarding cultural ecosystem services provided by urban green space, particularly: urban forests, parks and wetlands, and explore their contribution towards enhancing the city's liveability and residents' quality of life (Figure 1), in addition to understanding dwellers' attitude towards conservation of these spaces.

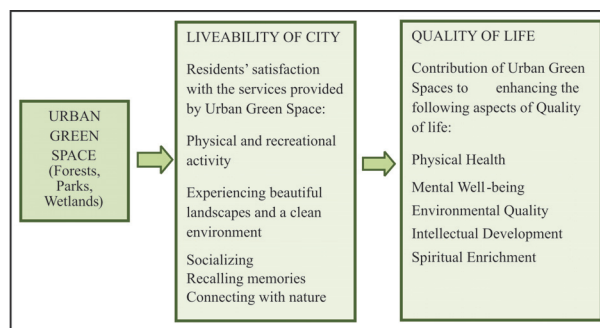


Fig. 1. Nexus between urban green space, liveability and quality of life

Materials and Methods

Study Area

The data gathered from the citizens of Indian City: Guwahati served as the foundation for the empirical study (Figure 2). Situated on the south bank of the Brahmaputra, Guwahati is the largest city in North-east India and among the fastest developing cities in the country. The city is home to 963,429 people and the urban local body Guwahati Municipal Corporation (GMC) covers an area of 216 square kilometres under its jurisdiction (Census, 2011).

Guwahati has been chosen as the empirical research area for several reasons. The city is served by three ecologically rich wetlands: Deepor Beel, Silsako Beel and Borsola-Sorusola Beel (Guwahati Development Department n.d). Guwahati in total has six Reserve Forests (South Kalapahar RF, Fatasil RF, Jalukbari RF, Gotanagar RF, Hengrabari RF, Sarania Hill RF) inside its periphery and Rani RF, Garbhanga RF, Amsing RF in the nearby areas, and has numerous urban parks across the city including

Nehru Park at Panbazar, Shraddhanjali Kanan near State Zoo, Sankar Dev Udyan at Bharalumukh and Botanical Garden at Fancy Bazar, to name a few (Guwahati Development Department n.d). However, recent urban development's and lack of maintenance have raised concerns about the environmental health of these wetlands and forests. Moreover, the urban parks must focus on minimizing concretization and providing maximum greenery. Thus, this study assists planners and authorities in formulating citizen-centric urban green policies that align with residents' needs and expectations.

Data Collection

Intending to explore residents' perception towards urban forests, parks and wetlands the current study adopted a mixed method. Urbanites' attitude towards these green spaces and their willingness to conserve these urban ecosystems was captured through primary surveys. Cochran's statistics indicate that a sample size of at least 384 is required to represent Guwahati City's total population. Thus, a random sample survey was conducted across the city with 500 residents which include both open-ended and closed-ended questions.

Additionally, qualitative methods such as 10 in-depth interviews and 5 focus group discussions with different sections of society were carried out to understand the qualitative perspectives and experiences of these green spaces by its residents. These tools allowed the research participants to communicate their experiences of these green spaces in detail using a variety of expressive mediums.

Questionnaire

Liveability of the city: To explore how these green spaces contribute towards improving the city's liveability survey respondents were asked to rate their degree of satisfaction with the facilities provided by the city's green spaces such as physical and recreational activities, and services including experiencing the beautiful landscape, socializing, recalling memories, connecting with nature and enjoying solitude (Figure 1). They were asked to rate on a 5-point Likert scale and responses were captured as "1 = *not at all satisfied*, 2 = *slightly satisfied*, 3 = *moderately satisfied*, 4 = *substantially satisfied*, 5 = *extremely satisfied*".

Residents' Quality of Life: During the survey, the participants were asked to rate how much these green spaces contribute towards enhancing certain aspects of their quality of life on a 5-point Likert

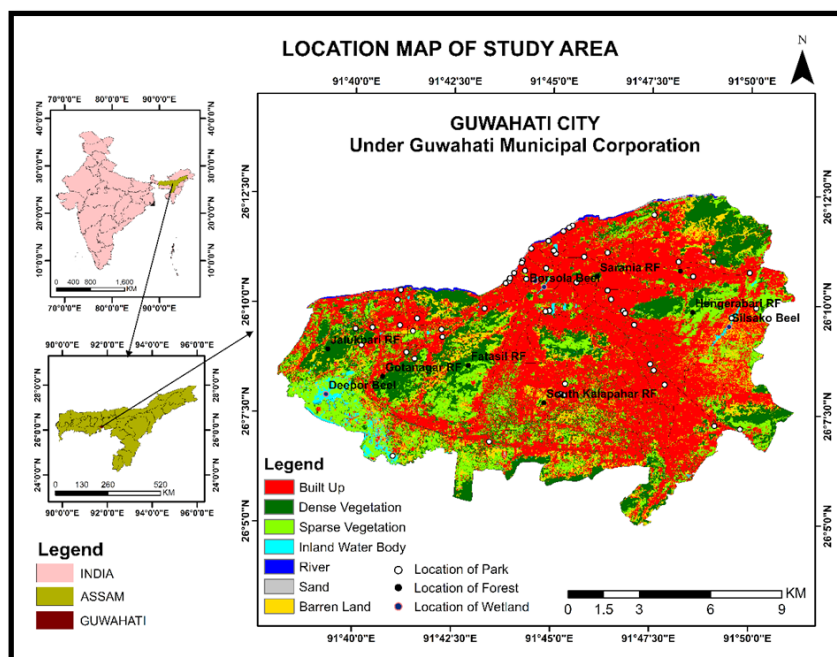


Fig. 2. Location Map of the Study area.

scale and responses were captured as “1= no contribution, 2 = slight contribution, 3 = moderate contribution, 4 = substantial contribution, 5 = maximum contribution”.

Lastly, resident’s attitudes and responses towards conserving these green spaces were recorded across a wide range of positive, neutral and negative responses. Moreover, open-ended questions were asked such as:

“Are you aware that Guwahati city has several urban forests, parks and wetlands?”

“If, yes, how do these green spaces enhance the overall quality of your life?”

“What are the facilities and services that pull you to visit the urban forests, parks and wetlands?”

“What facilities do you expect from the authorities to improve your experiences in these green spaces?”

“Why do you think conservation of these green spaces is important for the city and its residents?”

Moreover, the 5 aspects of quality of life and 6 activities, as well as experiences facilitated by urban green space were selected based on the literature reviewed and a pilot survey conducted with 100 residents. In the pilot survey residents were asked a few open-ended questions:

“How does green spaces enhance your life?”

“What are the activities you usually perform in these green spaces?”

“What kind of experiences are facilitated by these green spaces?”

“How do you think you can preserve and conserve these green spaces?”

Methods for data analysis

The statistical analyses were performed using IBM SPSS Statistics 24. The Kruskal-Wallis H test was run to determine if there are statistically significant differences between residents’ perceptions concerning different urban ecosystems. To investigate pair wise differences, the Mann-Whitney U test was employed. It was assumed that if the P value is greater than 0.05 there is no statically significant difference between how respondents perceive these different green spaces regarding their contribution towards improving the liveability of the city and citizens’ quality of life. Thus, the research question addressed is:

“Is there a difference between how residents perceive urban forests, parks and wetlands regarding their contribution to enhancing the city’s liveability and dwellers’ quality of life?”

Results and Discussion

Descriptive statistics of the sample population

In the sample surveyed, there are 57% men and 43%

women among the 500 respondents (Table 1). Age group 25-54 account for 28.2% of the total number of respondents, with 15-54 (24%), 55-60 (21.4%), <14 (20.2%) and >60 (6.2%) following in order. The Class 12 graduates made up a little over-representation of respondents for categories based on educational qualification (39.2%). Additionally, 33.6% of respondents indicated that they work in the technical sector, which represents the largest percentage among the categories of occupation. With respect to family monthly income, the most reported range was 40,000 -1,50,000 rupees (38.8 %), then 20,000-39,999 rupees (21.4%), <20,000 rupees (20.6%) and >1,50,000 rupees (19.2%).

Influence of Urban green space on liveability

Green areas are becoming an essential part of contemporary urban development, helping to make cities more sustainable and liveable. In the middle of the concrete jungle that makes up a large portion of today's urban landscape, green spaces such as urban forests, parks and wetlands provide cultural ecosystem services and add to the city's liveability. In the present study, residents reported a high degree of satisfaction with the services offered by the parks and are perceived as the most suitable urban green space among the three spaces scoring median values of 5 "extremely satisfied" in categories such as expe-

riencing beautiful landscape, socializing and recalling memories. Respondents are also substantially satisfied (median score 4) with the physical and recreational activity offered by the parks and create a safe environment for spending alone time with themselves; on the other hand, wetlands and forests moderately satisfy (median score 3) the dwellers in these categories.

Residents cherish urban parks as a perfect location for various physical activities such as jogging, yoga, outdoor exercises and recreational games, and offer children a wide range of opportunities to be physically active. The beautiful sights and sounds of the parks provide a feeling of tranquillity that helps people establish a closer bond with their loved ones, connect with themselves and practise inner bonding. Parks are also reported as an ideal place for families and friends to spend quality time together, and create lasting memories that people cherish for life. In addition, residents are fond of frequently organized art festivals and displayed fine art sculptures. These immersive art galleries offer a platform for individuals with diverse backgrounds and viewpoints to interact and foster social cohesiveness and cultural exchange.

However, many find forests in and around the city to be unsettling, frightening, and wild places that lack clear entrance points. According to the resi-

Table 1. Descriptive statistics of the sample population

Attributes	Sub Category	Sample Size	Percentage(%)
Sex	Male	285	57
	Female	215	43
	<14	101	20.2
	15-24	120	24
	25-54	141	28.2
	55-60	107	21.4
	>60	31	6.2
Education	Middle School and Below	74	14.8
	High School (class 10) pass	84	16.8
	Higher Secondary (class 12) pass	196	39.2
	Graduate	94	18.8
	Post Graduate and above	52	10.4
Occupation	Housewife/ student/retired (non-pensioners)	81	16.2
	Self-employed/ Freelancer	117	23.4
	Business	49	9.8
	Technical Sector	168	33.6
	Service Sector	85	17
Monthly Family Income	<20,000	103	20.6
	20,000-39,999	107	21.4
	40,000-1,50,000	194	38.8
	>1,50,000	96	19.2

dents, urban forests are not easily accessible, lack facilities for recreational services, and create disservices like fear of crime, thereby reducing perceived safety. Moreover, the encroachment of these reserve forests destroys the natural habitat of many species which has led to man-animal conflicts. Respondents are also concerned that developing recreational activities and eco-tourism might stimulate ecological loss. Literature has revealed that growing non-forest anthropogenic development is causing significant losses and fragmentation of the forests. A recent study has reported a decrease in dense and moderately dense forests by 44% and 43%, respectively between 1976 to 2018 (Pawe and Saikia, 2022). Only three of the eight designated forests in the city still have dense forest sections.

Wetlands are also shrinking at alarming rates due to rapid urban expansion and encroachment, and have been ravaged by construction, soil fills up, dumping of garbage, sewage drains and wastewater

as reported by the surveyed respondents which have been corroborated by different works of literature (Baruah, 2020, Hazarika *et al.*, 2022). The foul odour emanating from the uncompacted garbage dumped in these wetlands often attracts flies and rodents making these spaces unsuitable for public use. Thus, authorities have eco-tourism plans for one of the Ramsar sites: Deepor Beel however, urbanites fear that development should not happen at the ecological cost and conservation must be prioritised. The biggest issue affecting Deepor Beel is pollution mainly from the GMC (Guwahati Municipal Corporation) dump site in the Belortol area of East Boragaon. The lake is still heavily polluted even after efforts were made to move the waste disposal location from West Boragaon to Belortol.

Surprisingly, few residents from the younger generation and lower economic classes who have recently settled in the city reported that they are unaware of Silsako Beel and Sola Beel. Deepor Beel

Table 2. Influence of urban green space on the liveability of the city: Median Scores and results of the Kruskal-Wallis H Test

Residents' satisfaction with the facilities provided by the urban green spaces		Median Scores			Kruskal-Wallis H	Asymp. Sig.
		Forest	Park	Wetland		
Physical and Recreational Activity	Residents' satisfaction level with facilities provided by urban forests/parks/wetlands to carry out different physical and recreational activities such as: exercising, cycling, walking and trekking.	3	4	3	511.99	0.00
Experiencing Beautiful Landscape	Residents' satisfaction level with the natural and cultural landscape of urban forests/parks/wetlands.	2	5	3	927.98	0.00
Socializing	Residents' satisfaction level with the services provided by the urban forests/parks/wetlands to socialize with friends and family.	2	5	2	865.99	0.00
Recalling Memories	Residents' satisfaction level with the urban forests/parks/wetlands in providing an environment to create memories they can recall and cherish for a lifetime.	2	5	2	869.25	0.00
Connecting with Nature	Residents' satisfaction level with the urban forests/parks/wetlands in providing an environment to connect with nature and feel closer to them.	4	3	4	329.55	0.00
Enjoying Solitude	Residents' satisfaction level with the urban forests/parks/wetlands in providing a peaceful environment to spend alone time with themselves.	3	4	3	682.93	0.00

is very well known among the residents and a significant part of the wetland still provides picturesque views and is a prime spot for witnessing a large variety of migratory birds (Hoque and Sharma, 2020). The only category where wetlands and forests have outshined parks is connecting with nature with a median score of 4 reflecting that these spaces substantially satisfy the residents and play a crucial role in connecting them with the natural surroundings and sharing a strong emotional attachment with them. Urban parks being man-made landscapes try to bring nature close to home but re-

spondents feel wetlands and forests have demonstrated their better ability to foster nature connections.

The result of the Kruskal-Wallis H test signified that there is a significant difference between residents' satisfaction level with these urban green spaces in facilitating recreational activities and offering experiences including exploring the aesthetically pleasing landscape and immersing in its beauty, socializing, recalling memories, connecting with nature and enjoying solitude (Table 2). Thus, the pair wise comparison is examined by conducting the

Table 3. Influence of urban green space on liveability of the city: Results of the Mann-Whitney Test

Residents' satisfaction with the facilities provided by the urban green spaces		Urban Green Space	Mean Rank	Z-score	Asymp. Sig.	Effect Size
Physical and Recreational Activity	Residents' satisfaction level with facilities provided by urban forests/parks/wetlands to carry out different physical and recreational activities such as: exercising, cycling, walking and trekking.	Forest	362.94	-15.776	0.00	0.70552
		Park	638.06			
		Park	688.03	-21.265	0.00	0.95100
		Wetland	312.97			
		Wetland	427.29	-8.466	0.00	0.37861
Experiencing Beauty	Residents' satisfaction level with the natural and cultural landscape of urban forests/parks/wetlands.	Forest	573.71			
		Park	266.65	-27.069	0.00	1.21056
		Park	734.35			
		Park	730.01	-26.672	0.00	1.19281
		Wetland	270.99			
Socializing	Residents' satisfaction level with the services provided by the urban forests/parks/wetlands to socialize with friends and family.	Wetland	533.12	-3.803	0.00	0.17008
		Forest	467.89			
		Forest	279.26	-25.289	0.00	1.13096
		Park	721.74			
		Park	729.23	-26.341	0.00	1.17801
Recalling Memories	Residents' satisfaction level with the urban forests/parks/wetlands in providing an environment to create memories they can recall and cherish for a lifetime.	Wetland	271.77			
		Wetland	511.97	-1.344	0.179	0.06011
		Forest	489.03			
		Forest	267.18	-26.786	0.00	1.19791
		Park	733.82			
Connecting with Nature	Residents' satisfaction level with the urban forests/parks/wetlands in providing an environment to connect with nature and feel closer to them.	Park	709.46	-24.070	0.00	1.07644
		Wetland	291.55			
		Wetland	553.03	-6.266	0.00	0.28022
		Forest	447.97			
		Forest	631.39	-14.971	0.00	0.66952
Enjoying Solitude	Residents' satisfaction level with the urban forests/parks/wetlands in providing a peaceful environment to spend alone time with themselves.	Park	369.61			
		Park	357.27	-16.315	0.00	0.72963
		Wetland	643.73			
		Wetland	519.78	-2.229	0.026	0.09968
		Forest	481.22			
		Forest	282.04	-24.614	0.00	1.10077
		Park	718.96			
		Park	669.67	-19.495	0.00	0.87184
		Wetland	331.33			
		Wetland	565.83	-7.448	0.00	0.33308
		Forest	435.17			

Mann-Whitney Test for 3 pairs: I. Forests and Parks, II. Parks and Wetlands, III. Wetlands and Forests (Table 3). The results obtained reveal that residents' satisfaction levels with wetlands and forests in comparison to parks are significantly different with an effect size of more than 0.5 and residents reported low satisfaction levels for wetlands and forests compared to parks with lower mean rank values along with median scores in most of the categories as perceived by the dwellers. The perceived satisfaction levels of residents regarding wetlands and forests are significantly different in all the categories except socializing, however moderate and low effect size values reflect that residents' opinions regarding wetlands and forests are almost similar. The only category where forests and wetlands have higher median values and mean rank values is "connecting with nature" signifying that residents feel more connected with nature in natural landscapes than human-designed landscapes.

Contribution of urban green space towards enhancing quality of life

Urban forests and wetlands both contribute to improving people's quality of life in essentially the same ways. According to the study, urban forests and wetlands contribute moderately to almost all measures of quality of life. However, compared to the other two green areas, the forests made the biggest contribution to intellectual development. Stud-

ies have demonstrated the benefits of forests in cognitive and attention restoration (Berman, Jonides and Kaplan, 2008). The five senses: sight, sound, smell, taste, and touch are widely acknowledged to be essential to a child's development and forests are full of intriguing things such as the chirping of birds, fragrant leaves, colourful flowers, scratchy bark and scary worms, thereby supporting the process of sensory integration among children.

The parks are reported to be the most significant factor influencing people's quality of life with median values: "5= maximum contribution" and "4= substantial contribution". In line with previous literature, the study reveals that parks have greatly improved the physical health and mental well-being of residents (Sturm and Cohen, 2014; Lin *et al.*, 2023). Visitors' emotions and energy levels are much improved by physical activity in parks, while mental health advantages such as relaxation and revitalization are obtained through connecting with nature. These parks are also credited with projecting an aesthetically pleasant picture of the city, which enables residents to spend quality time together, take in these stunning cultural settings and recover from stress and attention fatigue. The experience of solitude helps residents develop their sense of autonomy, focus, and self-efficacy. Additionally, parks allow people to see and interact with one another, which fosters greater familiarity, simulates a sense of belonging, and thereby improves social cohesion

Table 4. Contribution of urban green space on residents' quality of life: Median Scores and results of Kruskal-Wallis H Test

Aspects of Quality of Life		Median Scores			Kruskal-Wallis H	Asymp. Sig.
		Wetland	Forest	Park		
Physical Health	Urban forests/parks/wetlands contribute towards improving my physical health.	3	3	5	574.88	0.00
Mental Well-being	Urban forests/parks/wetlands contribute to enhancing my mental well-being.	3	3	5	626.90	0.00
Intellectual Development	Urban forests/parks/wetlands contribute towards enriching intellectual abilities.	3	4	3	356.01	0.00
Environmental Quality	Urban forests/parks/wetlands contribute to improving the urban environment and provide access to a healthy environment.	3	3	5	956.12	0.00
Social Cohesion	Urban forests/parks/wetlands encourage positive social interactions and contribute to promoting social cohesion.	3	3	4	36.77	0.00

(Larson, *et al.*, 2016).

Although the median values are identical in most aspects representing the quality of life, the study also examined the data set with Kruskal-Wallis H to determine if there are statistically significant differences in the contribution of these green spaces towards residents' quality of life according to their perception (Table 4). The result shows that there is a significant difference in the way residents perceive the contribution of these green areas to all 5 aspects of quality of life. Thus, the Mann-Whitney U test is run to evaluate the pair wise differences between I. Forests and Parks, II. Parks and Wetlands, III. Wetlands and Forests.

The Mann-Whitney U test reported a significant and large difference in the contribution of urban parks compared with wetlands and forests with all

the aspects of quality of life, with effect size values of more than 0.5 (Table 5). The mean rank values report similar findings as median values that parks contribute the most among the three green spaces in enhancing all the aspects of quality of life, except intellectual growth. The pair wise comparison test between wetlands and forests reflected that there is no significant difference and are perceived as having a similar impact on people's mental well-being, offering a healthy environment and building social cohesion. However, in the case of physical health and intellectual development, both spaces have statistically different contributions. The wetlands with a higher mean rank score have a greater contribution to enhancing residents' physical health whereas; forests excel in providing an environment with a wide range of species and experiences that

Table 5. Contribution of urban green space on residents' quality of life: Results of Mann-Whitney Test

Aspects of Quality of Life		Urban Green Space	Mean Rank	Z-score	Asymp. Sig.	Effect Size
Physical Health	Urban forests/parks/wetlands contribute towards improving my physical health.	Forest	305.91	-22.003	0.00	0.98400
		Park	695.09			
		Park	623.05	-14.131	0.00	0.63196
		Wetland	377.95			
		Wetland	621.71	-13.965	0.00	0.62453
Mental Well-being	Urban forests/parks/wetlands contribute to enhancing my mental well-being.	Forest	379.29			
		Forest	315.12	-21.020	0.00	0.94004
		Park	685.88			
		Park	695.54	-22.145	0.00	0.99035
		Wetland	305.46			
Intellectual Development	Urban forests/parks/wetlands contribute to offering an environment rich in diverse plants and animals.	Wetland	484.73	-1.851	0.064	0.08278
		Forest	516.27			
		Forest	498.16			
		Forest	653.6	-17.704	0.00	0.79175
		Park	347.4			
Environmental Quality	Urban forests/parks/wetlands provide us with a beautiful landscape to experience that is aesthetically pleasing to the eyes and enjoy our time.	Park	382.81	-13.764	0.00	0.61554
		Wetland	618.19			
		Wetland	454.43	-5.450	0.00	0.24373
		Forest	546.57			
		Forest	266.76	-27.277	0.00	1.21986
Social Cohesion	Urban forests/parks/wetlands contribute to improving the urban environment and provide access to a healthy environment.	Park	734.24			
		Park	737.22	-27.613	0.00	1.23489
		Wetland	263.78			
		Wetland	513.32	-1.505	0.132	0.06731
		Forest	487.68			
		Forest	454.43	-5.450	0.00	0.24373
		Park	546.57			
		Park	543.22	-5.037	0.00	0.22526
		Wetland	457.78			
		Wetland	502.84	-.276	0.782	0.01234

promote intellectual growth.

According to the surveyed respondents, forests in Guwahati have a lot of scope in developing recreational facilities and activities promoting physical fitness and eco-tourism, which includes biking, hiking, water sports, camping, fishing, hiking, picnicking, sightseeing, and swimming. But, sadly authorities fail to provide these services and lack proper maintenance of the forest area. Residents express concern regarding rapid deforestation and encroachment of wetlands and forests by migrants from nearby rural areas. Moreover, they believe that the safety of the neighbourhood and visitors is directly threatened by poorly managed forests. The unmaintained spaces are more likely to be the scene of violent crimes, shelters for lawbreakers and locations for illegal dumping and unlawful activity (Heinze *et al.*, 2018).

Comparatively, wetlands are considered safer by the residents for walks and exercise. Deepor Beel has become a favourite for morning and evening walks in the neighbourhood and a bustling picnic and bird watching spot. However, residents feel that Silsako

Beel and Sola Beel also have great potential for promoting physical well-being. They suggest that authorities must focus on restoring these water bodies, create dedicated space for physical activity and encourage walking, exercising, running or other outdoor activities such as yoga, swimming, and cycling, that can positively influence people's physical activity behaviours.

Moreover, physical activity outside seems to have greater mental health benefits than indoor activities. Exercise in natural settings has been linked to improved energy levels, reductions in stress, disorientation, rage, and sadness, as well as higher sensations of renewal and positive involvement (Wicks *et al.*, 2022). There is an imperative need to restore and manage these green spaces, especially urban forests and wetlands by the government to ensure residents' physical and mental well-being.

Residents' attitude towards conservation of urban green space

Residents' attitudes regarding the conservation of these green spaces ranged widely, with positive,

Table 6. Residents' attitude towards conservation of urban green spaces

Residents' attitude towards conservation of urban green space	Urban Green Space	Yes	No	Neutral
I like the existence of urban wetlands/ forests/parks in the city.	Forest	79.6	3.6	16.8
	Park	97.2	0.6	2.2
	Wetland	83.4	1.8	14.8
While visiting urban wetlands/ forests/parks I keep myself consciously aware that my actions must not destroy or degrade the quality of these green spaces.	Forest	77.0	3.8	19.2
	Park	91.2	2.6	6.2
	Wetland	79.6	2.6	17.8
I do not support the conversion of wetlands/forests/parks for constructing built-up areas.	Forest	84.8	1.4	13.8
	Park	92.8	1.4	5.8
	Wetland	85.0	1.4	13.6
I believe that the encroachment of people in urban wetlands/ forests/parks must be stopped and rehabilitated into new areas.	Forest	85.8	3.4	10.8
	Park	84.0	3.6	12.4
	Wetland	80.6	3.6	15.8
I think that authorities must limit the use of urban wetlands/ forests/parks.	Forest	80.6	10.0	11.4
	Park	81.2	12.0	6.8
	Wetland	66.2	4.2	29.6
I support that authority must extract penalties for conducting activities that lead to the destruction and degradation of urban wetlands/ forests/parks.	Forest	91.8	1.8	6.4
	Park	92.2	2.0	5.8
	Wetland	98.6	2.4	9.0
I am ready to participate in the community-based management program for protecting and conserving urban wetlands/ forests/parks.	Forest	94.8	1.0	4.2
	Park	82.2	5.2	12.6
	Wetland	91.4	1.0	7.6
If required I shall donate money for conducting activities to protect and conserve urban wetlands/ forests/parks.	Forest	74.6	8.6	16.8
	Park	70.2	15.4	14.4
	Wetland	64.6	7.6	27.8

neutral, and negative reactions (Table 6). Most residents expressed that they like the presence of urban forests, parks and wetlands in the city. They believe that green spaces are beneficial for the efficient functioning of the city and the lives of its residents. Among the green spaces, parks are the most likeable area with 97.2 % (n = 486) of respondents positively reacting to the statement "*I like the existence of urban wetlands/forests/parks in the city*". Residents who visit urban wetlands and forests are more likely to appreciate the opportunity to experience nature and a sense of attachment, on the contrary, park visitors are usually drawn to specific park features and activities. For instance, residents reported that they often visit Brahmaputra River Front Park for a panoramic view of the mighty Brahmaputra River with a beautiful sunset and Dighalipukhuri Park for boating facilities. The survey also reflected that females mostly avoid natural landscapes (wetlands and forests) and prefer groomed park areas. Women are afraid that these places of untamed urban environments are unsafe or inaccessible for them and their kids. Among children, Nehru Park one of the oldest parks are the favourite place. Located at the heart of the city the park also serves people from different localities with free entry for morning walks, thereby attracting more visitors.

In response to the question of whether residents consciously kept themselves aware that their actions must not destroy or degrade the quality of urban parks, 91.2% (n = 456) replied "yes," 2.6% (n = 13) said "no," and 6.2% (n = 31) indicated they are "neutral". Whereas, in the case of urban forests and wetlands only 77% (n = 385) and 79.6% (n = 398) said "yes". Residents feel that constant monitoring through video surveillance and security guards as well as penalties being imposed for damaging property restricts people from doing activities that might degrade the quality of parks, which is missing in urban forests and wetlands. These natural landscapes with no proper fencing and monitoring are not capable of making anyone accountable for their activities. The study also reveals that most of the respondents (more than 80%) are strictly against the encroachment of these green spaces and their conversion to build-up areas or for any other purpose related to urban development. However, they strongly support that evicted families must be given proper compensation and rehabilitation by the authorities since they had been paying property taxes for many years and even the government gave le-

gitimacy to these settlements by building roads and providing services such as electricity connection.

A substantial percentage of the respondents (more than 80%) favours limiting the use of urban parks and forests. Urban parks must be closed on specific days of the week for maintenance purposes and in forests residents must be prohibited unless specifically allowed by authorities. However, regarding wetlands, 66.2% of respondents support limiting the use of wetlands and more than 25% gave a neutral reaction. In the case of wetlands compared to the other two spaces more people are inclined towards a neutral response because these water bodies act as lifelines for the communities living in the neighbourhood. For instance, the 14 communities of the villages surrounding Deepor Beel depend on the wetland for its economic foundation, which employs roughly 30% of the households (Mozumder and Tripathi, 2014) and opportunities for economic activities such as agriculture, fisheries, timber and other building materials, and herbal medicines. The wetland provides daily essential food materials and nutrients, thereby preventing poverty and hunger and ensuring stability of livelihoods. The local communities desire a conservation ethic that would acknowledge their traditional knowledge, rather than prevent them from using the resources they have long relied upon. More than 90% of respondents agreed that penalties must be applied to those who degrade or destroy the quality of these spaces. The study also revealed that the majority of respondents have a positive attitude towards participation in community management programs to protect forests and wetlands. Residents' views about donating money for the maintenance of these spaces 74.6%, 70.2% and 64.6% of the respondents indicated they would be ready to donate money to protect wetlands, forests and parks of the city respectively. However, a significant percentage of more than 25% are not sure about donating money. Many respondents believe that they are already paying the government in the form of taxes and it is their responsibility to look after the maintenance and conservation of the green spaces.

Pull-Push factors of Urban Green Space and suggestive measures from residents

The current research reveals the similarities and variations in the way residents perceive the green spaces of the city and their pull-push factors (Table 7). The three urban green spaces equally provide

Table 7. Pull-Push factors of Urban Green Space and suggestive measures from residents:

	Residents' Perception Regarding Pull Factors of Urban Green Space	Residents' Perception Regarding Push Factors of Urban Green Space	Suggestive Measures by Residents to Improve the Urban Green Space
Parks	• Facilitates recreational activities and outdoor physical activities • Provide eateries • Clean environment and attractive landscape • Natural sounds, delightful music, light shows • Art festivals, cultural shows • Easy accessibility	• Excessive concretization • Safety during evening time • Presence of security guards	• Naturalization of parks • Appropriate lighting • Video surveillance • Proper park fencing
Wetlands	• Diverse species of flora and fauna • Migratory birds • Sunrise and sunset	• Lack of recreational facilities • Safety concerns • Lack of cleanliness • Encroachment by people	• Construction of trail for walking, running and cycling • Introduction of a few dedicated spaces for physical activities such as yoga, cardio exercise, dancing and outdoor games • Introduction of a few dedicated spaces for children's recreational activities • Picnic spots for green picnics with required facilities • Space for recreational fishing • Proper spots for bird-watching • Boating facilities • Constructing natural swimming pools to Avail swimming facilities • Appropriate street lights in spots where visitors usually visit • Video surveillance in areas where visitors usually visit • Presence of security guards • Proper fences in dedicated spaces for visiting, picnic spots and recreational activities • Create a buffer area of a few metres and install fences around the wetland. • Cleaning up litter and trash from the area that visitors often pay • Proper cleaning of the trails • Proper cleaning of the physical structure dedicated to physical and recreational activities • Pollutant removal treatment to clean the water in wetlands • Penalties for dumping garbage • Penalties for encroachment • Rehabilitation of settlement inside the boundary of wetlands to new areas

		• Difficulty in accessibility • No options for food services • Lack of recreational facilities	• Providing direct transport services to these areas from the main transit points of the city • Introduction of a few eateries
Forests	• Diverse species of flora and fauna • Attractive forest scenery that offers a visual aesthetic experience • Beautiful views of the city from certain spots of forests	• Safety concerns area • Lack of cleanliness • Encroachment by people • Difficulty in accessibility • No options for food services	• Construction of a trail for walking, running, hiking, trekking and cycling • Introduction of a few dedicated spaces for physical activities and adventure sports like rock climbing, biking • Introduction of a few dedicated spaces for children's recreational activities • Picnic spots for green picnics with required facilities • Proper facilities for wildlife watching and camping • Proper demarcation and fencing around the forest • Properly designate entrance and exit points of the forest • Appropriate lights in spots where visitors usually visit and along the walking trails • Video surveillance in areas where visitors frequently visit and along the walking trails • Presence of security guards • Proper fences in dedicated spaces for visiting, picnic spots and recreational activities • Cleaning up litter and trash from the area that visitors often pay a visit • Proper cleaning of the trails • Penalties for dumping garbage • Penalties for encroachment • Rehabilitation of settlement inside the boundary of wetlands to new areas • Penalties for exploiting forest resources • Providing direct transport services to the entrance points of these forests from the main transit points of the city • Introduction of a few eateries at the entrance and exit points of the forests with proper maintenance without destroying the ecosystem

opportunities to relax and soak up nature however, it is observed that more individuals are inclined towards socializing, spending time with family, and kids or alone time in the park. Natural settings of wetlands and forests are found to be attractive spaces to feel connected with the living world. The diverse species of flora and fauna, forest scenery offering a visually aesthetic experience, and beautiful sunrises and sunsets at wetlands attract nature lovers.

The cultural landscape (parks) provides facilities such as recreational activities, availability of eateries and a clean environment, attractive landscape with natural sounds, delightful music, light shows, art festivals and cultural shows that attract the residents and motivate them to visit, socialize, spend some

quality time, improve their mood and boost feelings of happiness and well-being. Moreover, easy accessibility to the park is one of the primary factors that attracts respondents towards them, according to the survey and in-depth interviews conducted in the study. Residents believe that more efforts should be taken to naturalise the parks because this would provide opportunities for recreation in proximity to nature, thereby enhancing mental well-being. Naturalizing parks will also encourage greater biodiversity by providing habitat for diverse species and letting people feel more connected with the natural world.

It has been demonstrated that positive and negative emotions can be evoked by the "mystery" and sense of ambiguity that urban natural spaces bring

(Jorgensen and Tylecote, 2007). However, the current study also found that many respondents declined to explore the natural landscapes (wetlands and forests) due to their personal preferences, hesitation, or particular worries about kid safety, accessibility, or suitability. Although natural landscapes are mysterious and interesting, memories and news of violent crimes that took place in these urban natural environments often cause more fear than curiosity among residents. Therefore, the negative association may be changed to a positive one by pleasant lived experiences. Furthermore, the lack of appropriate street lights, video surveillance security guards, and no proper fencing has created a sense of fear among the residents. Thus, authorities must install these essential services and address the resident's special concerns about accessibility, safety, or suitability of these natural landscapes for children.

Residents also suggest developing this isolated landscape into eco-tourism sites to attract more visitors without compromising its quality and affecting the livelihood of the communities dependent on them and start with providing services including trails for walking, running and cycling, facilities for physical activities such as yoga, cardio exercise, dancing and outdoor games and children's recreational activities, recreational fishing, spots for bird watching and picnic, boating facilities. They also believe that converting these natural landscapes into eco-tourism sites will financially help the authorities in their maintenance and management by generating revenues since cleanliness is another important aspect that requires immediate attention to prevent further degradation of these spaces. Lastly, encroachment of this green infrastructure is another serious threat to these spaces which is the by-product of rapid urbanisation and migration of people from nearby rural areas. Thus, residents strongly support imposing penalties for exploiting natural resources and violating laws protecting wetlands and forest areas.

Therefore, from a broader perspective with easy accessibility and high-quality services, urban parks are the most attractive green space and are frequently visited by the dwellers. Urban forests and wetlands also provide unique experiences; unfortunately, they are going through other challenges such as encroachment, deforestation, habitat destruction, exposure to pollutants and loss of biodiversity, which turns them into unsafe, isolated and

unmaintained spaces. Although residents have a positive attitude and willingness to visit the wetlands and forests they are reluctant due to safety concerns, lack of services, accessibility issues and deteriorating quality of these spaces. These findings will help the authorities and planners as they work to improve visitors' experience, safety, and accessibility of these green spaces and balance with their protection and conservation.

Conclusion

The study has confirmed that residents perceive distinct experiences and advantages from manicured and natural green spaces of the city. Urban parks are rated high on most measured aspects representing liveability and quality of life. Moreover, it is observed that females are more hesitant to visit wetlands and forests due to safety concerns. Women's experiences in green spaces often involve children, be it for outdoor activities, recreation or socialising, therefore their choice and usage of various green spaces will always be influenced by what they consider to be kid-friendly. Thus, early exposure to safe and secure wild urban environments may pave the way for a lifetime of interaction with these areas and help women and kids see urban natural areas as secure spaces. Therefore, along with creating a safe environment, authorities can also plan environmental programs such as tree planting, invasive plant removal, guided walks, and nature discovery games to let them perceive urban natural areas as safe environments. Future studies can explore how gender, age and past bad experiences play a crucial role in evoking fear of crime in urban green spaces and influencing people's desire to visit these places.

Residents are enthusiastic about wetlands and forests as well but they limit their affection and frequently use parks mostly due to easy accessibility, quality services, safety, and comfort. Most importantly residents have a positive attitude towards the conservation and protection of these green spaces. Thus, the government must undertake sustainable tourism initiatives by encouraging local community involvement, thereby empowering the local people by creating jobs and preserving the lake's rich biodiversity through their traditional ecological knowledge. The suggestive measures derived from the primary survey will assist the authorities in formulating plans aiming at enhancing the cultural ecosystem services provided by these green infra-

structures. Thus, the current study provides a better understanding of the residents' desired experiences and facilities in these green spaces which will assist policymakers in formulating effective developmental plans by aligning cultural ecosystem services and ecological management goals. The participatory planning approach will help the planners in incorporating social values into the management of urban green infrastructure as a socio-ecological system.

Conflict of Interest: None

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