frontiers | Frontiers in Water

TYPE Community Case Study
PUBLISHED 15 November 2024
DOI 10.3389/frwa.2024.1474411

OPEN ACCESS

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RECEIVED 01 August 2024
ACCEPTED 23 October 2024
PUBLISHED 15 November 2024

CITATION
Jagadisan S (2024) Promoting integrated blue–green infrastructure for urban resilience—lessons learned from case studies. *Front. Water* 6:1474411.
doi: 10.3389/frwa.2024.1474411

Promoting integrated blue–green infrastructure for urban resilience—lessons learned from case studies

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In recent years, the climate change crisis has become a serious concern and has heightened public perceptions of environmental awareness and the importance of ecological sustainability. Human-induced climate change poses a grave and dangerous threat to our entire ecosystem. Climate change profoundly impacts all life on Earth, driven by the overexploitation of resources and unsustainable choices. This threatens our health, security, and survival. Blue–green infrastructure presents significant opportunities to address complex multifaceted urban concerns, including global temperature rises and biodiversity loss. This research focuses on how blue–green spaces play a crucial role in minimizing the cascading risks through nature-based solutions as an efficient approach to managing natural resources sustainably. It also explores how the integrated blue–green infrastructure projects benefit human wellbeing and increase the livability quotient. This research utilizes a wide range of evidence to demonstrate how various global case studies involved in blue–green infrastructure (BGI) projects positively impact health and social cohesion. This study has important implications for policymakers and urban planning practitioners and can potentially help decision-makers prioritize more holistic and socially inclusive BGI projects.

KEYWORDS

blue–green infrastructure, Chennai, case studies, wellbeing, quality of life

1 Introduction

Urban blue–green infrastructure has the potential to tackle climate hazards, mitigate the rising risks of environmental change, restore biodiversity, and improve public health globally. In cities, integrated ecosystem services through blue–green spaces are receiving greater attention as they directly impact health and mental wellbeing. For various demographic groups, living in densely populated places is significantly linked with a stressful existence and a higher risk of mental health disorders (Srivastava, 2009). An interconnected network of multifunctional green spaces (natural and artificial), along with water bodies offers several environmental, social, and economic benefits, significantly enhancing the livability quotient of its inhabitants (Daniels et al., 2020). First, integrating BGI helps counteract air pollution, improve air quality, diminish noise, and prevent stress-related symptoms. Second, BGI provides a truly immersive and sensory experience that transcends visual aesthetics, highlighting multisensory aspects such as sounds, smells, and tactile qualities. These aspects have therapeutic effects that evoke feelings of calm, joy, and tranquility; for example, the softness and the texture of the grass while walking barefoot give a soothing effect (Spence, 2020). Third, including inclusive, equitable blue–green infrastructure public spaces in the neighborhood potentially encourages social cohesion and strengthens social capital.

1.1 Research objectives

The objectives of the study are as follows:

(i) To understand the potential of BGI spaces in an urban context and their beneficial impacts on human wellbeing.
(ii) To identify and present evidence on social and ecological co-benefits of BGI at different scales through national and international case studies.
(iii) To demonstrate how an integrated BGI project would be a proactive tool to rejuvenate and restore urban water bodies through a successful Chennai city case study. Example: Chetpet Ecopark.

2 Significance of blue and green spaces

BGI is characterized by its emphasis on contact with nature, such as parks, gardens, and green corridors, along with water components (ponds, lakes, rivers, etc.), with a blend of natural and semi-natural elements of integrated green and blue spaces (Barker et al., 2019). BGI operates at multiple levels on different scales to mitigate the adverse effects of stormwater runoff and seeks to improve hydrological performance. The human-induced climate crisis resulted in extreme weather disruptions, such as intense precipitation, heat waves, and devastating flooding. These unpredictable torrential rains have recently resulted in disastrous flash floods and landslides across several countries (Mishra, 2024). These recurring floods have caused catastrophic destruction to property, buried hundreds of villages, damaged infrastructure, and destroyed habitat. There is a growing awareness that integrated blue–green infrastructures would be a viable, innovative conservation approach to optimize urban flood risks. For instance, its application in small-scale infrastructure projects, such as promoting green spaces through vertical gardens on small balconies and terrace gardens in apartments, is considered a critical asset in modifying the microclimate in the built environment, aiding in air purification, thermal comfort, and recycling capacities. On a larger scale, projects help enhance resource efficiency, minimize heat gain, use sound-proofing barriers and natural air filters, enhance aesthetic appeal, and provide essential habitat for various species (Mell and Scott, 2023). Understanding the multifaceted concept of BGI varies according to varied geographic locations, many scales, and disciplines, leading to diversity in delivery. According to Canzonieri et al. (2007), the blue–green infrastructure (BGI) strategy prioritizes the functioning of biophysical dynamics mediating between the built environment and the local population. It is important to present the possibility of addressing the risks related to water management and improving flood resilience through ecological interventions (Voskamp and Ven de van, 2015).

Studies on urban blue–green spaces have concluded that they have a positive correlation with residents' mental health and wellbeing and provide a sense of fulfillment and satisfaction (Wang et al., 2022). People who spend more time in outdoor environments such as parks or other green spaces tend to feel better, and this type of engagement with nature can divert their attention from the issues they have been facing. In general, individuals surrounded by greenery feel more energetic and comfortable in a state of tranquility. Vante de Macedo et al. state that BGI should be strategically planned and designed to balance the relationship between nature and humans, as it is crucial to maintain the fundamental ecosystem services on which human survival depends (Valente de Macedo et al., 2021). Urban green–blue infrastructure (UGBI) is typically a hybrid infrastructure that manages surface runoff, protects biodiversity, filters pollutants, enhances water quality and quantity, and serves as a resilient cooling approach for any built environment. It also refers to blue spaces if aquatic ecosystems are included. UGBI is essential to the food chain as it influences pollination and nutrient cycling (Andreucci et al., 2019).

Lõhmus and Balbus (2015) assert that the existence of blue and green infrastructure will encourage people living in the nearby communities to engage in sporting activities (Lõhmus and Balbus, 2015). The residents had the chance to utilize the blue and/or green spaces, providing myriad community health benefits. Blue–green networks incorporate several nature-based solutions such as green roofs, rain gardens, permeable pavements, artificial wetlands, and urban forests. By utilizing natural systems, the goal is to improve the regeneration of ecosystem services and promote the livability of cities. Incorporating the active approach of blue and green spaces creates a novel framework for resilient and harmonious wellbeing to tackle environmental challenges. Blue–green infrastructure is a pivotal strategy widely used on amenities, and we could anticipate tangible benefits that are quantifiable and measurable from social and sustainability perspectives (Charlesworth et al., 2016). By bringing people and nature together, the implementation of blue–green infrastructure in urban settings offers profound social and cultural benefits.

As we are aware, SDG 11 has different degrees of interconnections with other SDG goals such as SDG 3, SDG 6, and SDG 13. The goal of SDG 11 which is sustainable cities and communities can be accomplished through the incorporation of blue–green infrastructure as shown in Figure 1.

The number of articles in the recent past demonstrates how blue–green infrastructures are becoming a crucial part of the urban fabric and need to be integrated (Meerow and Newell, 2017).

In the Indian context, the idea of blue–green infrastructure is relatively new, and many global cities have already begun the transition, driven by exacerbating climate impacts and events. While the green infrastructure concept is gaining attention in India, the country must consider integrating blue infrastructure as part of its sustainability framework (Driver and Mankikar, 2021). As per

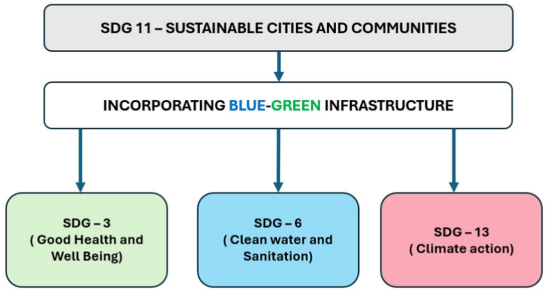

FIGURE 1
Achieving the goal of SDG 11 by using blue–green infrastructure which satisfies SDG 3, SDG 6, and SDG 13.

NAPCC (National Action Plan on Climate Change), the Government of India has two national flagship initiatives, i.e., Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Smart Cities Mission where both the missions focused on urban livelihoods by incorporating blue–green elements. The Smart City Mission aims to work on the core Infrastructure aspects such as providing reliable water supply and sanitation, striving to improve the quality of people's lives. However, AMRUT focuses on augmenting existing water supply and sanitation, revitalizing water bodies, and creating communal green spaces (MoHUA, 2023). Despite being a relatively new idea, several Indian cities, including Bengaluru, Delhi, Bhopal, and Madurai, include blue–green elements into their master or action plans to improve the existing natural blue systems and their surrounding public spaces through a thoughtful strategy. Delhi is one of the first cities in India to identify the opportunities for integrated blue–green infrastructure in its policy and published the draft Master Plan of 2041 (Driver and Mankikar, 2021). India needs to encompass comprehensive strategies to combine and protect hydrological elements of the urban landscape alongside the ecological while planning for adaptation and resilience to enhance cities economy and social stability.

3 Role of blue–green spaces for healthy cities

Urban blue–green spaces play an important role in creating healthy communities and can catalyze social cohesion. From a public health perspective, BGI can mitigate urban health risks, promote healthy behaviors, promote eco-health, and enhance urban aesthetics. Kirby and Scott (2023), in their research, declare that residing near blue spaces can lower the risk of developing a mental health disorder by as much as 6% in socioeconomically deprived communities (Kirby and Scott, 2023). WHO conceptualizes "mental health" as a state of wellbeing that enables individuals to realize and manage their everyday stress effectively. It helps the individual to build resilience and reach their potential for a harmonious life and a good work–life balance, which improves the general wellbeing community (WHO, 2021).

Wellbeing has been defined as an overall evaluation that an individual makes of their life in all important aspects. Several studies indicate that there is nearly double the amount of evidence demonstrating the positive impacts of GBI on quality of life and wellbeing than on improved mental health and reduced morbidity. Direct attributes such as increased physical activity and social cohesion were discovered, which can be measured through self-reported methods. However, indirect attributes like improved air quality or a reduction in urban heat islands can be evaluated through intensive clinical methods.

It was discovered that more evidence exists to support the role of direct attributes. The following are direct and indirect attributes of evaluating BGI benefits (refer to Table 1).

The WHO through case studies highlights the importance of having access to green and blue spaces in nature, which will serve as a refuge for the community to relax and increase their social cohesion. Inseparable and integrated BGI urban landscapes are highly valued in the urban fabric to ensure sustainable communities. BGI-based therapies can significantly promote individual health and wellbeing through (i) physical involvement; (ii) emotional positive resonance; and (iii) self-satisfaction (Li and Trivic, 2024).

TABLE 1 Direct and indirect attributes of BGI benefits (Source: Author).

Direct attributes of wellbeing	Indirect attributes of wellbeing
Increased physical activity	Healthy microbiome
Recreational benefits	Mitigation of heat island
Increased connection/exposure to BGI	Mitigation of noise pollution
Increased cognitive and physiological restoration	Mitigation of air quality
Social contact and cohesion	Mitigation of water quality

3.1 Examples of direct attributes of wellbeing

In traditional Kerala architecture, the essential feature while designing a house is the "ambal kulam," or pond (Figure 2), which is surrounded by large trees and plants. The major function of the vegetation surrounding the ponds is a determining factor for the ecosystem of ponds. These ponds act as a rainwater reservoir, harbor biodiversity, and alleviate flood risk by improving the runoff water quality. In addition, it contributes to healthier water-based recreation (Yadav and Goyal, 2022). In the olden days, most Kerala houses offered a human-centric living environment in which all the family members indulged in swimming and fishing, fostering physical and mental wellbeing, which led to longevity.

Similarly, temple tanks are an integral part of BGI in public spaces. The majority of South Indian temples have ponds, which are considered "sacred temple tanks" and are surrounded by sacred groves (Figure 3). These sacred sites hold immense value to devotees, and they believe that they gain spiritual possession after taking a dip in this water, and they perform their rituals. These cultural values are powerful catalysts for place identity and nurture social cohesion (Gruebner et al., 2017). Cultural value in BGI serves as regional symbolism, cultivates a positive social image, and promotes environmental justice. It fosters a strong sense of belonging and ownership among residents and serves as a religious connotation, revitalizing their indigenous culture and serving as a landmark. Engaging in these activities offers a profound impact in reducing stress, boosting strength, and supporting holistic healing, all of which contribute to longevity and a vibrant lifestyle.

Regrettably, over the past decades, these ponds have been subjected to tremendous pressure due to ever-expanding urban sprawl and encroachment, which has caused considerable shrinkage and deterioration of these natural water resources. As a ray of hope in 2023 the Union Government's Mission Amrit Sarovar Program has planned to harness the potential of ponds and rejuvenate them to tackle climate change. Over 1,000 ponds in Kerala were rejuvenated to conserve water and benefit the community and ecology. This ecosystem-based approach increased the water-holding capacity of the ponds. It enhanced their utility as this mission believes ponds are critical enablers for environmental sustainability and social wellbeing, serving as lifelines for the sustenance of rural livelihoods in an agrarian economy like India.

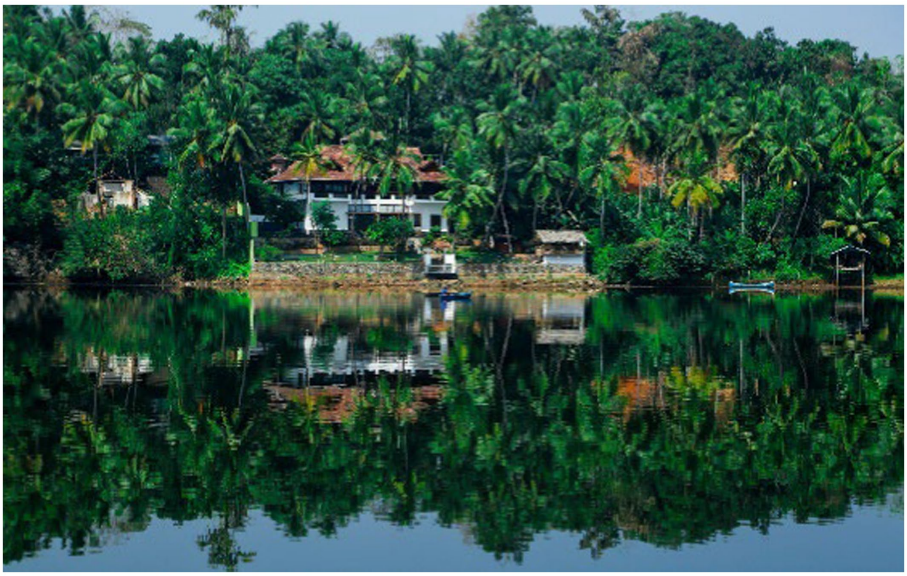

FIGURE 2
Kerala house with pond (Source: Unsplash).

FIGURE 3
Typical temple tank (Source: Author).

4 Benefits of BGI

The benefits of BGI in terms of economy, environment, and community are shown in Figure 4.

5 International and national case studies

5.1 International case studies

5.1.1 Case study 1: city level: Sponge City project, China

The idea of 'Sponge City' (Table 2) was first introduced by Chinese President Xi Jinping in 2012. It was the most ambitious and promising approach to mitigate the risks associated with water management, such as flooding and waterlogging concerns in Chinese cities. According to statistical data from the Office of State Flood Control and Drought Relief Headquarters in 2013, China has 641 cities at risk of flooding, with more than 100 cities experiencing flooding annually (Griffiths et al., 2020).

Concept: The philosophy of Sponge City is to manage stormwater by designing a drainage along with green spaces in urban areas allowing them to absorb water like a sponge. It is a nature-based solution to make the cities resilient to flood and drought.

Guidelines: The Ministry of Housing and Urban–Rural Development of the People's Republic of China (2016) issued the following guidelines:

- Outdoor drainage design code
- Sponge City construction technology guide
- The City Flood Control Engineering Design code

The author has used the case of Ningbo City to demonstrate that the principles of Sponge City guidelines have been applied at the local (neighborhood) level.

Contextual setting: In the last decade, Ningbo City has been sprawling outward beyond pre-defined boundaries and there is a dynamic transformation in land use. The unique feature of the Yangtze River delta place in Ningbo is the most dynamic and densely populated place known for its concentrated industrial hub, where existing farmlands and parklands are converted into high-density development, which considerably reduces naturally permeable landscapes.

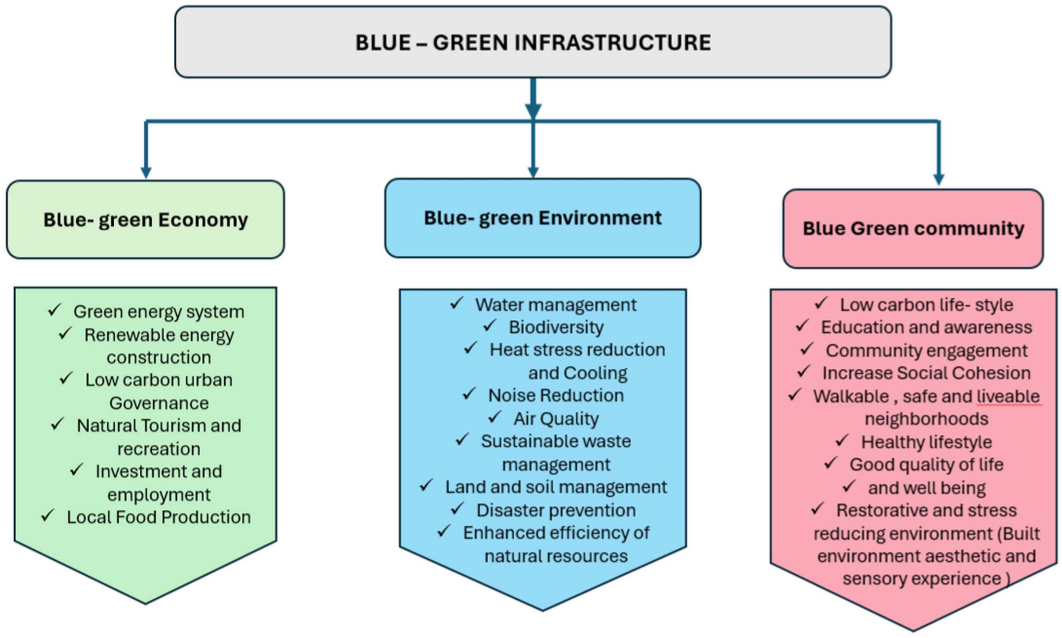

FIGURE 4
Benefits of BGI in terms of economy, environment, and community.

TABLE 2 Case study 1: city level: Sponge City project, China.

Scale	City and country	Year	Issues	BGI approach/strategy	Outcomes	Direct benefits
City level	Ningbo, Zhejiang Province, China	2014	Traditional urban drainage systems had limited capacity to manage runoff during heavy precipitation. More polluted runoff from impervious surfaces, such as roads, sidewalks, and parking areas, led to more frequent floods.	The Ningbo City Drainage and stormwater strategies are as follows: "Sponge City" strategy—six functions: infiltration, stagnation, storage, purification, usage, and discharge. To evaluate and improve the existing stormwater drainage network. To promote infiltration and to create water storage systems through sustainable drainage construction methods. To increase permeable surface area ratio to a minimum of 40% in new development to reduce hydrograph peak. Volume runoff objectives: According to the goals of Sponge City, the total yearly runoff rate will be restricted to 15–20%. To enhance the quality of urban livelihood by conserving water resources and enhancing the water ecosystem To improve the water environment and to conserve water sources. Improving the urban livelihood.	Rehabilitation of urban water ecology Urban flood design for a minimum of 20 years City stormwater and pumping stations are to be designed as per the outdoor design drainage code. Urban heat island reduction.	**Environmental** **Social**

5.2 Case study 2: neighborhood level: green street steward program

Case study 2 is explored in Table 3.

5.3 National case studies

5.3.1 Case study 1: city level: future proofing Indian cities project

The Future Proofing Cities project (Table 4) has been carried out by the consulting firm Atkins in collaboration with the Department for International Development (DFID) of the UK and the Development and Planning Unit at University College London (UCL) (CDKN, 2016).

The DHAN Foundation is the delivery partner of Madurai City Corporation located in Madurai, Tamil Nadu, helping to future-proof local development initiatives.

Concept: Future-proofing Indian cities is a collaborative and emerging approach that relies on diverse stakeholders' engagement and promotes the multifaceted benefits of integrated blue–green infrastructure as a climate change adaptation strategy in cities.

Guidelines: Atkins in partnership with UCL and DFID developed an Action Plan under six themes prioritizing the issues identified by stakeholders.

The author has used the case of Madurai City to demonstrate the Action Plan of Future Proofing project, which has been applied at the local (neighborhood) level for strengthening blue–green infrastructure.

TABLE 3 Case study 2: neighborhood level: green street steward program.

Scale	City and country	Year	Issues	BGI approach/strategy	Outcomes	Direct benefits
Neighborhood level	Portland Oregon, USA	2005	Portland, Oregon, has a history of 'nuisance flooding' causing roadblocks, basement and house flooding, and poor water quality.	Development and Installation of Bioswales as part of stormwater management and reduce flooding • Street safety strategies: Establishing Refuge Island for pedestrians. • Bike lanes were introduced prioritizing cyclists' safety. To create pocket parks as part of flood protection. The community participated and engaged at the project level.	Increased community satisfaction, flood risk management, improved water quality, and air quality. Overall fair equitable and sustainable outcomes through community participation.	Increased community exposure and awareness of BGI (Bioswales, less litter) **Environmental** **Social**

TABLE 4 Case study 1: city level: future proofing Indian cities project.

Scale	City and country	Year	Issues	BGI approach/strategy	Outcomes	Direct benefits
City level	Madurai City, Tamil Nadu, India	2014	Water scarcity, encroachment around water bodies, frequent flooding, and blockage in stormwater drains.	Some of the following themes are related to integrating and strengthening BGI. Sewer system rehabilitation through mapping and bridging gaps in the existing infrastructure. Channel and tank restoration through public participation. The Vaigai riverbed has become the primary site for industrial wastewater discharge in the city. Currently, the city hosts water walks every 2 weeks, which provide a valuable platform for the local government to operate effectively, foster community trust, and provide local expertise on blue–green infrastructure. Reviving the long-standing bond between the community and the river by conducting events like the Vaigai River Pageant (conducting artistic and cultural events) is a promising initiative to bring stakeholders together to create awareness to fight against the global water crisis.	Community participation through water walks Protection of Vaigai's historic fabric and conservation of cultural values. Community capacity building in the restoration of channels and tanks.	**Environmental** **Social** **Cultural**

Contextual setting: Madurai is one of the ancient temple cities and the second largest city of the South Indian state of Tamil Nadu. Over the past few decades, flooding in Madurai has been exacerbated due to the blockage of stormwater drains and encroachment of slum communities around water bodies. Despite extensive networks of water bodies, Madurai faces extreme water shortages for drinking and irrigation.

5.3.2 Case study 2: neighborhood level: India's pond rejuvenation program

As a component of the Azadi Ka Amrit Mahotsav (to celebrate and commemorate 75 years of India's Independence) Mission Amrit Sarovar 2022 (Table 5) was established to rehabilitate and build 75 Amrit Sarovars (ponds) across all districts of the nation to conserve water for future generations (PIB, 2022).

Concept: With a minimum pondage size of one acre (0.4 hectares) and a maximum water-holding capacity of 10,000 cubic meters, this mission aims to create 50,000 water bodies. Through pond-based livelihood initiatives, the Mission identifies the economic worth of the pond.

Guidelines: The author has used the case of a man-made pond, which was created at Bhood Khera village, Sapotra block, Karauli District, Rajasthan which is a dry humid zone to address the challenge of water scarcity, reeling drought, and a depleting groundwater table.

6 Best practices: successful case example

Project Name: Chetpet Ecopark, Chennai, Tamil Nadu, India
Year: 2016
Location: Chennai

Overview: Chetpet Lake, popularly called "Chethupattu Aeri," is the only existing park covering 16 acres surrounded by a 9-acre rain-fed lake. It is located in the heart of Chennai city near Chetpet railway station and belongs to Tamil Nadu Fisheries Department Corporation Limited (TNFDC).

History: According to the historian K.V. Raman's writings, the people of Settruppedu, Thudarmuniyurnadu, received a gift of gold from a noble in the army of Rashtrakuta King Krishna III, which was given to the Tiruvottriyur temple (Sriramv, 2019). This village, he recognized, is a contemporary Chetpet. A map from 1798 shows that the village of Chetpet is cited in a 1958 Adyar Library Bulletin article. During that period, Namberumal Chetty (1856–1925) was a well-known builder and contractor in Madras (currently officially Chennai). Owning a brick kiln, Namberumal has undertaken multiple government projects and is well known in Chennai for his red brick construction. This location was once a brick field in the 19th century. As the soil was excavated to make bricks during those periods, it eventually transformed into the lake it is today.

According to the vision of colonial civil service officer Sir Frederick Nicholson and engineer Sir Alfred Chatterton, who later became the Director of Industries and taught at the College of Engineering, Guindy, the Madras Presidency was envisioned as an industrialized region. Both individuals played a crucial role in the industrialization of the Madras Presidency (Ravichandran, 2019). Their programs, like the promotion of fisheries, were crucial to the economic growth of the area. The fact that the Fisheries Department took control of Chetpet Lake in the 1930s is a testament to their commitment and foresight.

Issues: The tremendous increase in population density and rampant urban sprawl in Chennai creates immense pressure on water bodies, and they have undergone varying degrees of environmental degradation such as refuse and sewage, and massive depletion of water sources. This Chetpet Lake has been heavily encroached upon and inevitably turned into a dumping ground for illegal sewage outfalls, and illegal dumping of building rubble, and debris for several years.

Vision: In 2013, Former Chief Minister J Jayalalitha paved the way for the transformation of this lake into an ecological park. Chetpet

TABLE 5 Case study 2: neighborhood level: India's pond rejuvenation program.

Scale	City and country	Year	Issues	BGI approach/ strategy	Outcomes	Direct benefits
Neighborhood level	Bhood Khera village, Sapotra block, Karauli District, Rajasthan, India (Kanojia et al., 2024).	2022	Inadequate Rainfall water scarcity, reeling drought, and a depleting groundwater table	It emphasizes the preservation of water, public involvement, and the responsible use of soil removed from bodies of water to support infrastructure projects. Benefits gained from ecological functions must be preserved or restored, initiating capacity building, particularly to create awareness for local populations in charge of these ecosystems.	A new pond which covers an area of 7 ha was created with a depth of 7 m by TBS (Tarun Bharat Sangh) agency. The pond played a pivotal role in rejuvenating the Sherni River and its surrounding environs, increasing the irrigation area for agricultural practices, recharging the water table, and increasing the sense of ownership.	**Environmental** **Social** **Economic**

EcoPark (Figure 5) is a fine example of a lake revival model that demonstrates how the lake restoration has not only improved the ecological state but also offered multiple socio-economic benefits, creating a transformative impact on the quality and wellbeing of the community. It has brought multifaceted endeavors such as sensitizing communities for community-engaged restoration projects and the need for healthy spaces and boosting their social cohesion (TNFDC, 2018).

Visitors: As of June 2017, a total of 3,31,616 individuals have visited the Ecopark (TNFDC, 2018).

As of 2023, the park gets 300 visitors/per day, and approximately 1,000 visitors on weekends.

Objectives of the project:

(i) To establish best practices to create and develop a replicable model project of international standards to maintain, develop, and conserve Chetpet Lake.

(ii) To conserve and preserve the lake to its original glory.

(iii) To attract diverse groups of people to interact with the restored Ecopark to engage them with nature and include it as part of their identity.

(iv) To formulate plans and undertake the implementation of programs, to regenerate the Indigenous fauna and flora, and to maintain and preserve ecological and natural resources, such as flora and fauna, waterways, water bodies, and wastewater recycling, preserving rare and all species.

(v) To formulate, evolve, and identify the suitable mechanism for augmenting necessary revenues through commercial operation.

Budget: Rs. 42 crores.

The proposal aims to restore and regenerate both natural and semi-natural ecosystems to establish a natural habitat along the

FIGURE 5
Proposal plan for Chetpet ecological park (Source: recreated by Author).

edge of the water. The area features two water bodies according to the proposed plan, and it is bordered by plantations and low-impact, sustainable constructions; 96% of the chosen species are indigenous and promote insect and bird life. Many of the chosen species are resistant to drought. Ground covers and grasses selected will serve the purpose of soil stabilization and filtering of runoffs (Author, 2024).

Currently, the depth of the lake is 13 feet and to a maximum of 18 feet lacks a natural source of freshwater: instead, a tertiary sewage treatment plant treats sewage, and approximately 20,000 L of treated water is discharged into the lake every day (TNFDC, 2018).

These projects benefit the public in several ways. Once a dumping ground filled with sewage and sludge, the Chetpet Lake today is a bustling eco-park in the heart of the city. The 16-acre eco-park consists of angling decks, facilities for boat rides, a play area for children, a walking/jogging track, a multi-level car park, and a cafeteria (Table 6).

According to a park administrator, for maintenance purposes, the majority of the amenities of the park are leased to outside companies to manage. For example, as discussed one portion of the lake (3 acres) has been leased out for fishing. Twenty pedal boats are being used by a private party for boating in the remaining area.

6.1 Goals of Chetpet EcoPark

Chetpet ecosystem conservation achieved the following goals (Figure 6):

a Water quality restoration
b Reintroduce local flora
c Facilitate the return of native fauna
d Water management
e Wellbeing of the community (as a recreation spot for all age groups)

The human interface strategy aims to:

a Develop an educational campaign to raise awareness of sustainability and blue–green infrastructure.
b Promote the region as an ECOPARK-certified environmentally sustainable location.

In recent years, residents of Chennai have begun to realize that restoring and conserving the city's landscape may strengthen the local economy. Reversing the loss of natural capital requires the implementation of landscape restoration projects, an underutilized strategy. About the idea of multifunctionality, this Chetpet Ecopark serves successful case study to demonstrate how integrated blue–green infrastructure could be potentially used to optimize community benefits.

The worldwide aim of reducing climate change and conserving biodiversity can greatly benefit from ecological restoration. A paradigm shift is urgently needed at this juncture to understand how ecological restoration can bring back the entire ecosystem to a healthy state by altering a degraded area to its original or pre-disturbance state.

TABLE 6 Successful case example: Chetpet Ecopark, Chennai, Tamil Nadu, India.

S. No.	Amenities	Features	Direct benefits
1	Boating	This lake serves as an idyllic space, a natural paradise amidst the bustling city of Chennai. One of the popular spots for boating, picnics, and jogging.	A diverse range of activities caters to all age groups. Improves mental health and wellbeing
2	Angling	The lake provides a habitat for diverse aquatic flora and fauna and has a few varieties of fish such as Catla, Rohu, and Mrigal. Several bird and plant species such as common mormon, lemon pansy, black rajah, and painted lady can be found here. Additionally, youth fishery education programs to encourage sport fishing are available here.	Conservation of Biodiversity A platform for environmental education
3	Walking	With its 1.5 km of paved walkway, the eco-park is the ideal place for walks in the morning and evening. Outdoor seatings, benches, and dustbins are made of ecologically sensitive materials.	Health benefits Place-making and social cohesion Sustainable construction
4	Children's play area, aquarium, 3D theater, and butterfly space	Play area of children with many active play activities such as slides, climbing bars, and swings. An aquarium featuring exotic species and biotopes that mimic specific regions' environments and fish life. It is lined with photographs of sea creatures. Augmented reality/virtual reality multimedia are available for the visitors.	Safe environment for children -creates a powerful learning platform across all areas of development—intellectual, social, emotional, and physical.
5	Other facilities	Restaurants, information boards and paintings, sculptures, multilevel car parking, and amphitheater (10,000 capacity)	Attracts visitors to enjoy various activities Economic generation

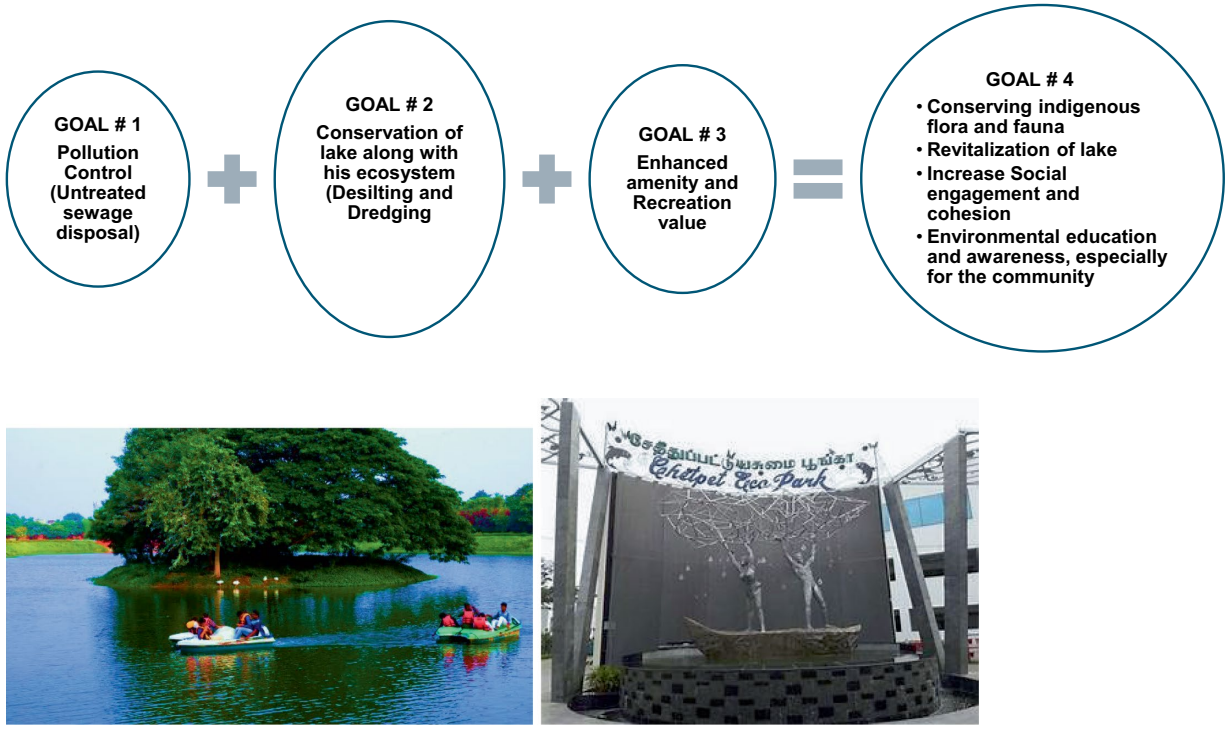

FIGURE 6
Goals and photographs of Chetpet EcoPark (Source: Author).

7 Conclusion

All the above case studies gather and summarize data regarding the possible advantages of creating blue–green infrastructure (BGI) to improve wellbeing, physical health, and mental health. The lessons learned from best practices show that the concept of integrated BGI is universally valued and a vital component to battle climate change crisis and will support practitioners in advocating to policymakers for health-promoting BGI, integrating it into investment, master planning, and policy, and designing BGI to optimize health benefits.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Author contributions

SJ: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft.

Funding

The author(s) declares that financial support was received for the research, authorship, and/or publication of this article. The author received financial support from the Vellore Institute of Technology for the publication of the article.

Conflict of interest

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