



GREENING THE CITY: CRITERIA AND INDICATORS FOR EVALUATING THE EFFECTIVENESS OF SMALL URBAN PARKS IN PROMOTING URBAN RESILIENCE TO CLIMATE CHANGE

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Abstract

As cities face the challenges of climate change, small urban parks offer a promising solution for promoting urban resilience. These parks can mitigate the impacts of climate change by providing carbon sequestration, reducing the urban heat island effect, and improving stormwater management. They can also serve as a key adaptation strategy by providing shade and cooling, reducing air pollution, and enhancing social cohesion and community engagement. However, there is a need for criteria and indicators that can guide the design, implementation, and management of small urban parks for climate change mitigation and adaptation. This paper proposes a set of criteria and indicators that can be used to evaluate the effectiveness of small urban parks in promoting urban resilience. The criteria include ecological, social, economic, governance dimensions, and the indicators are measurable, relevant, and practical. The proposed framework can support decision-making processes for planners, policymakers, and practitioners to prioritise and allocate resources for small urban parks that can contribute to climate change mitigation and adaptation in cities.

Keywords: Small Urban Park; Criteria and Indicator; Resilient Cities; Climate Change; Policies and Management

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INTRODUCTION

The United Nations (2018) reports that half of the world's population currently resides in urban areas, and this figure is projected to increase to two-thirds by 2050. While urbanisation has brought economic opportunities and improved living standards in some developing countries (Hannah & Max, 2018), it has also caused extensive environmental degradation and ecological destruction, with significant implications for climate change (Liang et al., 2019; Qasim et al., 2014). Urban areas are particularly vulnerable to the impacts of climate change, including extreme weather events, rising temperatures, and sea-level rise (Ezcurra & Rivera-Collazo, 2018; Gasper et al., 2011; Magadza, 2000). Climate change is widely recognised as the biggest global health and environmental threat of the twenty-first century that demands immediate action (Costello et al., 2009; Seddon et al., 2021). These impacts disproportionately affect vulnerable communities and exacerbate existing social and economic inequalities (Leichenko & Silva, 2014; Levy et al., 2015). As more than half of the global population now lives in cities, effective climate change mitigation and adaptation measures are urgently needed to ensure the resilience and sustainability of urban areas.

Small urban parks (SUPs) are increasingly crucial in cities with limited green spaces, as they offer numerous physical, mental, social, and ecological benefits (Fatiah & Pornahono, 2022; Hashim et al., 2019; Jasmani et al., 2017; Labuz, 2019a). However, with the challenges imposed by climate change, it is crucial to identify criteria and indicators for SUPs that contribute to climate change mitigation and adaptation efforts. To design and manage SUPs that maximise their potential for climate change resilience, a comprehensive understanding of the criteria and indicators that promote resilience is necessary. Despite its importance, there has been a lack of synthesis in the available information to identify the key criteria and indicators for designing and managing SUPs that promote climate change resilience.

Thus, this research article aims to identify the criteria and indicators for promoting urban resilience through SUPs with a specific focus on mitigating and adapting to the impacts of climate change. To achieve this goal, the review process will analyse various research works that have proposed a set of indicators based on sustainable park principles to evaluate the performance of green open spaces. By collecting and synthesising pertinent information, this article will establish essential criteria and indicators for designing and managing SUPs that effectively foster climate change resilience.

LITERATURE REVIEW

Background of small urban park

Small urban parks (SUPs), also known as pocket parks, play a vital role in promoting the concept of a “Green City” as envisioned by Sir Ebenezer Howard. These parks are crucial in bringing nature closer to people’s homes; providing access to green spaces and recreational opportunities; and mitigating the impacts of climate change in urban areas (Labuz, 2019; Lin et al., 2017; Rosso et al., 2022). While there is no universally agreed-upon definition of SUPs, in the Malaysian context, they are defined as land-based areas smaller than 2 hectares with vegetation, a distinct boundary, and an entrance. SUPs can be found in small available spaces, unused areas, vacant lots, and abandoned areas; they provide a convenient location for rest and recreation for urban residents (Fatiah et al., 2021; Fatiah & Pornahono, 2022; Jasmani et al., 2017).

Researchers have extensively explored the potential of SUPs in promoting sustainable urban development; their design and functions; and factors predicting their restoration. Despite the differing definitions and viewpoints, SUPs remain critical in advancing low-carbon cities and mitigating the impacts of climate change. Previous studies (Fatiah & Pornahono, 2022; Nordh et al., 2009) have focused on how SUPs can contribute to achieving the aforementioned goals.

Harnessing the Potential of Small Urban Parks for Sustainable Urban Development in the Face of Climate Change

SUPs have emerged as a powerful tool for promoting sustainable urban development and mitigating the negative effects of urbanisation on the environment and human health. Research has shown that these green spaces, particularly when strategically designed and located, can help reduce urban heat island effects, improve air quality, sequester carbon, and support biodiversity (Ariluoma et al., 2021; Fatiah & Pornahono, 2022; Jasmani et al., 2017). One study conducted in Melbourne, Australia, found that SUPs with high vegetation cover can significantly reduce surface temperatures, leading to energy savings and increased comfort for park users (Motazedian et al., 2020). Another research conducted in Helsinki, Finland, using the i-Tree planting tool found that planting trees and mixing biochar into a growing medium of SUPs can significantly increase carbon storage and sequestration, with the potential to store up to 330,000 tonnes of CO₂ over 50 years at the city level. These findings highlight the important role of SUPs in mitigating and adapting to climate change while promoting sustainable urban development (Ariluoma et al., 2021). By prioritising the development of SUPs and green spaces in urban planning and policymaking, policymakers and urban planners can create more liveable, sustainable, and resilient urban environments that benefit both people and the planet.

SUPs offer a promising solution to enhancing the adaptive capacity of urban areas to climate change impacts, such as flooding, by functioning as green infrastructure for stormwater management and providing recreational and social spaces. In cities like Copenhagen and Beijing, green infrastructure in the form of SUPs designed for stormwater management has been found to significantly reduce the risk of flooding while providing aesthetic and recreational benefits. These findings highlight the potential of SUPs to contribute to the various aspects of sustainable urban development, including climate change mitigation and adaptation (Liu et al., 2019). However, it is crucial to carefully plan and design these green spaces and ensure their ongoing maintenance and management to fully realise their potential. The Malaysian government has set a target through the National Urbanization Policy to provide 2 hectares of open space for every 1000 people by 2020, but such a measure has proven challenging due to limited urban spaces and land scarcity, particularly in cities such as Kuala Lumpur and Penang. However, the establishment of SUPs presents a potential solution to address the issue of limited open space in densely populated areas. Such parks can help fulfil the goal of the National Urbanization Policy while providing a range of benefits to urban residents, including improved physical and mental health, social interaction, and enhanced biodiversity.

METHODOLOGY

To foster resilient cities in the face of climate change, it is essential to conduct a comprehensive literature analysis to develop effective evaluation criteria and indicators for SUPs. Content-matrix analysis can be utilised to identify themes and patterns in the literature and categorise them according to specific criteria, thus enabling the development of criteria and indicators for assessing the effectiveness of SUPs. This analysis can identify critical factors, such as the provision of green space, conservation of biodiversity, adaptation to climate change, and community engagement, which contribute to the effectiveness of SUPs in promoting urban resilience to climate change. By categorising and quantifying the prevalence of each factor, researchers can discern patterns and themes that can guide policy and practice related to the design, management, and evaluation of SUPs, ultimately leading to the development of effective strategies for addressing the impacts of climate change in urban areas.

ANALYSIS AND DISCUSSION

Development of Criteria and Indicators for Evaluating the Effectiveness of Small Urban Parks in Promoting Urban Resilience to Climate Change

A recent systematic literature review by Dizdaroglu (2021) found that no urban park worldwide has implemented all the sustainable design criteria proposed. The study aimed to contribute to the development of a comprehensive sustainable

park design practice for future cities by identifying potential performance indicators that could assist stakeholders in evaluating their progress towards sustainability. Similarly, Firmansyah et al. (2018) proposed a set of indicators based on sustainable landscape design principles to evaluate green open spaces' performance in Bandung City, covering ecological, sociocultural, health, and economic aspects. These indicators could also be applied to SUPs to promote sustainable and liveable cities. Likewise, Chan et al. (2018) proposed a sustainable park management framework for Hong Kong, incorporating sustainable urban landscape indicators and parameters derived from sustainable landscape design principles. Mohamed Ikhwan Nasir Mohamed Anuar & Saiful Arif Abdullah (2022) underscore the advantages of green infrastructure by transforming lost highway spaces into vibrant public spaces, a concept especially impactful in densely populated urban areas. Sarhan et al. (2016) developed a matrix defining six-measure priority for each park type and the quantity value of attributes driven within each measure, which could serve as criteria and indicators for evaluating the effectiveness of SUPs in promoting urban resilience to climate change.

Through a content analysis of the literature, the study found significant similarities between the identified indicators and those proposed in previous research. The study then presented a matrix analysis (Table 1(a)-(c)) that integrates both analyses in terms of their indicators for each term. The indicators suggest that greenery coverage, accessibility, and community involvement in planning and maintenance play a crucial role in the effectiveness of SUPs in promoting urban resilience. Additionally, these parks offer socio-economic benefits that can mitigate the adverse effects of climate change, including enhanced physical and mental health, social cohesion, and economic development. To evaluate the effectiveness of SUPs in promoting urban resilience, a comprehensive set of criteria and indicators is necessary, encompassing ecological, social, economic, and governance dimensions. By utilising the criteria and indicators outlined in the article, policymakers and park managers can assess the performance of SUPs and work towards creating sustainable and liveable cities.

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Table 1 (a): Matrix Analysis of Ecological Aspects Evaluating

Measures for park system sustainability	Purpose	Planning	Maintenance and Management	Access	Satisfaction	Safety	Ecological Services	Health and well-being	Economic benefits
Indicator									
Climate and microclimatic modifications (e.g., UHI effect mitigation; temperature moderation through evapotranspiration and shading; wind speed modification)							●		
Air quality improvement (e.g., pollutant removal; lower emissions)							●		
Reduced building energy use for heating and cooling (e.g., shade via trees; building covered by green roof and green walls)							●		
Hydrological regulation (e.g., flow control and flood reduction; regulation of water quality; water purification)							●		
Improved soil quality and erosion prevention (e.g., soil fertility; soil stabilization)							●		
Noise level attenuation							●		
Biodiversity protection and enhancement (e.g., communities; species; genetic resources; habitats)							●		

Table 1 (b): Matrix Analysis of Social Aspects Evaluating

Measures for park system sustainability	Purpose	Planning	Maintenance and Management	Access	Satisfaction	Safety	Ecological Services	Health and well-being	Economic benefits
Indicator									
Food production (e.g., urban agriculture; kitchen gardens; edible landscape and community gardens)							●		
Opportunities for recreation, tourism, and social interaction (i.e., community livability)									●
Improved pedestrian paths and connectivity (e.g. quality of path; connectivity and linkage with other modes)				●					
Accessible for all ages				●					
Provision of outdoor sites for education and research								●	
Reduction of crimes and fear of crime (e.g., comfort; amenity and safety)						●			
Attachment to place and sense of belonging (i.e., cultural and symbolic value)								●	
Enhanced city attractiveness (e.g., more desirable views; restriction of undesirable views)								●	
Improved physical well-being (e.g., physical outdoor activity; healthy food; healthy environments)								●	
Better social well-being (e.g., social interaction; social integration; community cohesion)								●	
Improved mental well-being (e.g., reduced depression and anxiety; recovery from stress; attention restoration; positive emotions)								●	

Table 1 (c): Matrix Analysis of Managerial and Institutional Aspects Evaluating

Measures for park system sustainability		Purpose	Planning	Maintenance and Management	Access	Satisfaction	Safety	Ecological Services	Health and well-being	Economic benefits
Managerial and Institutional Aspects	Indicator									
	Public mandate/mission for park purposes.	●								
	Stakeholders involvement		●							
	Contractor service quality assessment			●						
	Regular Park users surveys and analysis.			●						
	Park maintenance and management expenses.			●						
	Police patrol frequency in park.						●			
	Public definition of park core services/themes.	●								
	Management and maintenance guidelines	●								
	Facilities and play equipment checks frequency.			●						
	Percentage of qualified staff in park management-related disciplines.			●						
	Integrated park and recreation plan in citywide urban planning.		●							
	Government financial allocation.		●							
	Park security guard.						●			
	Policies supporting park's educational function.		●							
	Geo-referenced database for park mapping		●							
	Distance to nearest public transport access points.					●				
	Adequate lighting							●		

Source: Adopted from Chan et al. 2018; Firmansyah et al 2018; Mohamed Ikhwan Nasir Mohamed Anuar & Saiful Arif Abdullah 2022; Dizdaroğlu 2022

The criteria and indicators proposed in the framework (Figure 1) can offer valuable insights into the factors that contribute to the effectiveness of SUPs in promoting urban resilience to climate change. These insights can inform policy and practice related to the design, management, and evaluation of SUPs, and contribute to the development of effective strategies to address the impacts of climate change in urban areas. By continuously monitoring and evaluating the performance of SUPs, policymakers and park managers can identify best practices for designing and managing SUPs, leading to sustainable urban development and enhanced resilience of cities to the impacts of climate change.

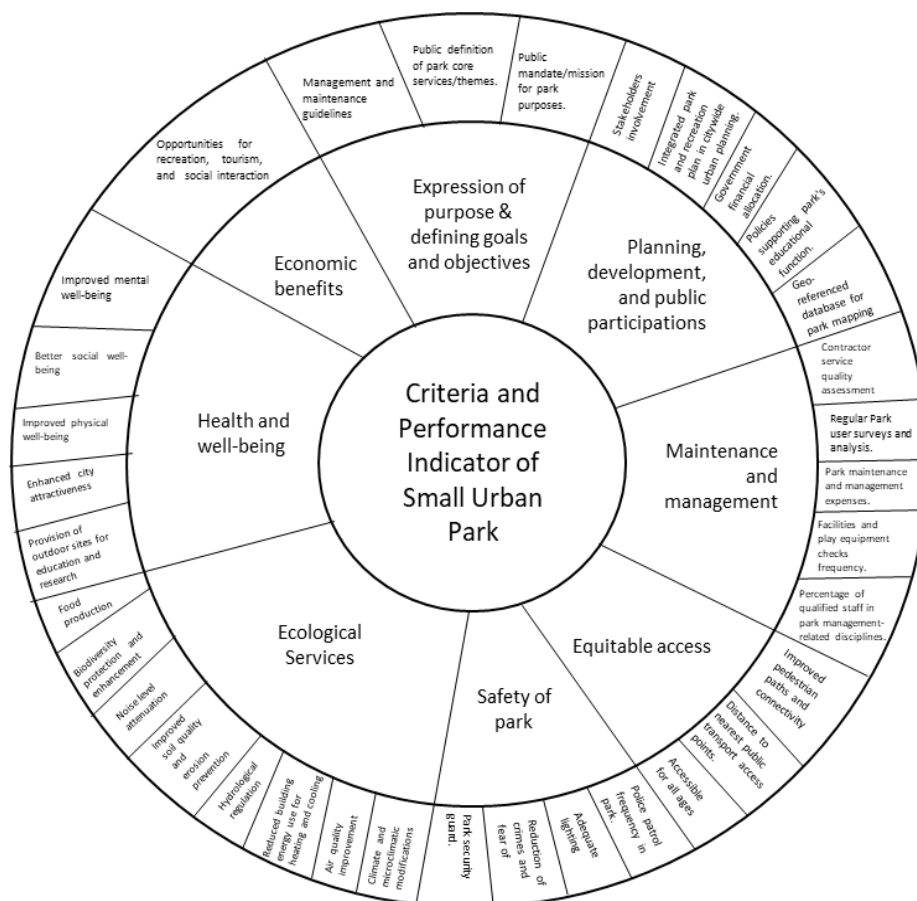


Figure 2: Proposed Framework for Evaluating the Effectiveness of SUPs in Enhancing Urban Resilience to Climate Change.
 (Source: Author)

CONCLUSION

The incorporation of carbon sinks into urban planning, such as the development of SUPs in high-density cities, is essential to improve urban resilience to climate change. Local authorities play a significant role in managing, planning, and regulating the expansion of territories under their jurisdiction, and they are granted a considerable level of discretion through the statutes designed to regulate local governments. Proper administration and planning are crucial for maintaining green urban areas and ensuring their benefits for society and the environment. Therefore, future research may focus on identifying best practices

for designing and managing SUPs to maximise their benefits for sustainable urban development. These practices could inform policymakers and park managers in creating effective strategies to address the impacts of climate change in urban areas.

Limitations or Potential Biases of the Research Approach

Although this study utilised a comprehensive search of multiple databases and sources, limitations are noted in terms of publication bias due to heavy reliance on the published literature. Further research may employ the Delphi method to gather information from relevant stakeholders in Petaling District as a case study on the proposed criteria and indicators framework. Also, the study focused solely on SUPs and disregard other forms of green infrastructure, such as green roofs or bioswales, which may also contribute to promoting urban resilience and climate change mitigation and adaptation. It is imperative to note that the developed criteria and indicators framework may not apply to all contexts. Further research may replicate the current study in different urban environments and communities.

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