

Importance of small urban parks towards becoming low-carbon cities: Analyzing Malaysian policies and strategies for climate change mitigation

Siti Afiqah Mohammad Sabri¹, Zakiah Ponrahono^{1*}, Aishah Abu Bakar¹ and Fatiah Abd Aziz¹

¹Department of Environment, Faculty of Forestry and Environment, University Putra Malaysia, Serdang Selangor

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✉*Corresponding author:
Dr Zakiah Ponrahono
Department of Environment,
Faculty of Forestry and
Environment, University Putra
Malaysia, Serdang Selangor
Email: zakh@upm.edu.my

Abstract

With urban expansion and densification escalating, Small Urban Parks (SUPs) have emerged as crucial components in urban landscapes, offering diverse ecosystem benefits. This paper aims to achieve two primary objectives: (i) conduct an extensive analysis of Malaysia's national climate and planning policies, evaluating their incorporation of preservation open spaces and interconnected climate change considerations, and (ii) explore sustainable strategies for SUP management, underlining their contribution to cultivating green, low-carbon urban environments. The study employs a content analysis approach to examine Malaysia's environmental policy documents, gauging their alignment with the objective of utilizing open spaces for climate change mitigation. The findings emphasize the importance of embedding SUPs in urban planning as a strategic approach to carbon sequestration and highlight the pivotal role of local authorities in realizing a carbon-neutral urban vision by 2050. Supported by robust policy frameworks and grassroots endeavors, urban green spaces, regardless of their size, can make significant strides towards a sustainable urban future.

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1. INTRODUCTION

In the contemporary era, urban areas across the globe are witnessing rapid transformation due to escalating urbanization and population growth (United Nations, 2018). This phenomenon has brought about an array of challenges and issues that necessitate urgent attention. As urban centers expand, they often encroach upon natural landscapes, resulting in deforestation, reduced green spaces, and heightened concerns in high-density cities (Hannah & Max, 2018; Shadman et al., 2022). The confluence of factors such as land scarcity (Ahmed Abd El Aziz, 2015), infrastructural demands (Balai Kerishnan et al., 2020), and residential growth (Rosso et al., 2022a) exacerbates these issues and raises fundamental concerns about the sustainability of urban environments.

In 2023, Malaysia's overall population was 33.2 million and 75.1 per cent of which resides in cities (DOSM, 2023). As highlighted in the 4th Biennial Update Report under the UNFCCC, Malaysia's energy sector was responsible for a whopping 78% of total emissions (Ministry of Natural Resources, 2022). Therefore, the urban areas must be the focus of efforts towards achieving human development goals and maintaining economic growth (Gouldson et al., 2018). Figure 1, highlights a distinct urban population concentration, underscoring that the environmental implications of urbanization are key drivers of climate change.

Demographic Statistics Malaysia First Quarter 2023

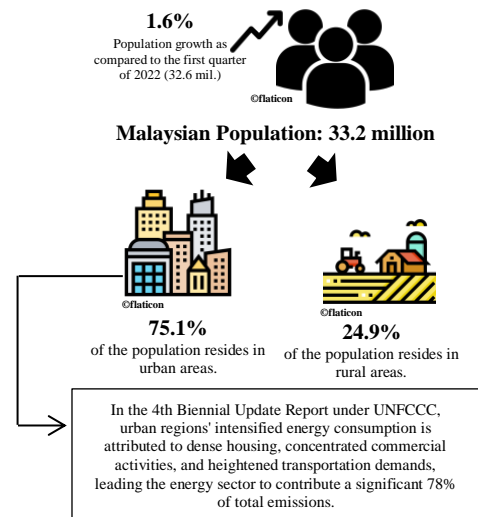


Figure 1: Malaysia's urban-centric population distribution is a key driver of its climate change challenges

Source: (DOSM, 2023; Ministry of Natural Resources, Environment & Climate Change, Malaysia, 2022)

Urban parks, acting as the "lungs" of a city, contribute to transforming urban areas into low-carbon cities by regulating microclimates and promoting infiltration through permeable surfaces, thereby offering essential ecosystem buffering services for rapidly urbanizing cities (Alison Blake, 2016). City dwellers rely

on these vital urban park systems to cool and purify the air, sequester and store carbon, absorb and clean runoff, boost biodiversity, and reduce energy consumption, particularly in densely populated areas (Kim & Coseo, 2018). However, in many developing countries, urban parks are under severe threat from the effects of urban sprawl and rising populations (Bahriny & Bell, 2020). Research, exemplified by (Fares et al., 2017) study, has shown that the prevalence of ample vegetation in rural areas leads to decreased CO₂ concentrations, underscoring the potential of urban green spaces to significantly mitigate local CO₂ levels.

Despite their potential significance, the role of small-sized urban parks (SUPs) in achieving low-carbon cities remains underappreciated. The qualitative attributes of these spaces and their potential for simultaneously addressing carbon reduction have been overshadowed. This paper underscores the commitment of Malaysian local authorities to the conservation of green spaces with an objective to augment carbon storage, mirroring the country's aspiration to attain carbon neutrality by 2050. The primary objectives of the paper are (i) to conduct a comprehensive analysis of Malaysia's national climate and environmental policies, plans, and legal structures, assessing their focus on preservation open spaces and interconnected climate change concerns, and (iii) to delve into sustainable strategies for the effective management of SUPs, highlighting their role in fostering green, low-carbon urban landscapes.

2. LITERATURE REVIEW

2.1 Small Urban Parks in Urban Setting

Small urban parks (SUPs), also known as pocket parks, bring the concept of a "Green City" to life, as envisioned by Sir Ebenezer Howard, by providing green spaces closer to people's homes (Fatiah et al., 2021). These parks improve the quality of urban life by offering recreational opportunities and mitigating the effects of climate change (Tian and An, 2022). A lack of consensus exists in previous research regarding the specific size criteria for defining pocket parks, resulting in varying proposed definitions. Zhang and Han (2021) contribute to understanding SUPs by identifying multiple criteria, including spatial, typological, organizational, locational, and functional perspectives, providing a comprehensive comprehension of their characteristics and attributes. Within Malaysia, small urban park (SUPs) encompasses land areas under 2 hectares, featuring vegetation, entrances, and clear boundaries, frequently repurposing abandoned spaces such as vacant lots to provide urban dwellers with accessible leisure and relaxation options (Fatiah & Pornahono, 2022a).

2.2 Unleashing the Carbon Sequestration Potential of SUPs

Despite their small size, SUPs play a crucial role in reducing cities' carbon footprint, providing recreational spaces for communities and contributing to mental health resilience. They offer various benefits, including carbon storage, heat island mitigation, improved air quality, and wildlife habitat provision (Fatiah and Pornahono, 2022). Integrating carbon management strategies into urban green space design and maintenance maximizes their potential in mitigating climate change (Brown et al., 2014). Carbon sequestration involves capturing and storing carbon dioxide from the atmosphere within vegetation and soil (Misni et al., 2015). Urban green spaces present a valuable opportunity for carbon storage, as trees and vegetation absorb carbon dioxide and store it within their tissues as they mature (Bao et al. 2022). As these plants mature, they contribute significantly to carbon sequestration processes within the urban environment. Well-maintained soils in urban green spaces can also store carbon as organic matter (Fan and Wei, 2022). Prioritizing the planting of native, fast-growing tree species with high carbon sequestration capabilities enhances SUPs' climate change mitigation potential. By adopting such approaches, cities can harness the full potential of SUPs in creating sustainable urban environments.

While previous studies have demonstrated the carbon reduction potential of SUPs, current Malaysian policies have yet to prioritize their role in climate change initiatives. This study aims to fill this gap by investigating sustainable strategies for optimizing SUPs, emphasizing their contribution to cultivating low-carbon urban environments.

3. METHODOLOGY

Adopting the methodology outlined by (Seng Yeo et al., 2023), this study employs content analysis to intricately dissect Malaysia's environmental policy documents. Through this qualitative approach, the research meticulously evaluates the congruence between these documents and the objective of harnessing open spaces for climate change mitigation. By meticulously examining seven pivotal national planning policy documents, the research underscores Malaysia's commitment to nurturing open spaces and using them as a tool to counteract the impacts of climate change.

The research utilized Excel as a software tool to facilitate the content analysis of policy documents. This tool enabled systematic coding and the identification of thematic patterns within the selected documents. Employing a thematic analysis approach, significant themes emerge that underscore the pivotal role of open spaces in activities such as carbon sequestration, urban planning, and broader efforts to mitigate climate change.

4. FINDINGS AND DISCUSSION

Within the scope of this study, two significant findings have emerged. The first centers on the identification of existing approaches within preservation open spaces that actively contribute to the development of low-carbon cities, with a particular emphasis on their applicability in Malaysia. The second discovery pertains to the potential utilization of SUPs as a mechanism for fostering a greener and low-carbon urban future.

4.1 Existing Approaches in Preservation Open Space contribute to Low Carbon Cities Development and in Malaysia

Open space planning and management are central in Malaysia's drive to forge low-carbon cities (Md Dali et al., 2022). Central to this initiative is the harmonious integration of open spaces into urban frameworks, which are instrumental in crafting sustainable, low-carbon cities. The 12th Malaysia Plan outlines the nation's clear direction, aiming for carbon neutrality by 2050. Complementing this, Malaysia has revised its NDC target, aspiring to a 45% reduction in GHG emission intensity by 2030. Open spaces in urban areas form the backbone of this strategy, functioning not only as communal recreational zones but also as invaluable ecosystem service providers and carbon sinks (Hazarin et al., 2019). The Town and Country Planning Act of 1976 (Act 172) anchors this dedication, necessitating the incorporation of such spaces in both structural and localized planning. Local authorities are instrumental in translating these legislation directives into tangible action (Ayu Abdullah et al., 2022). Specifically, Act 172 mandates that open and recreational spaces be integrated into local plans.

The National Physical Plan (NPP4) underscores the significance of establishing green, blue, and brown urban corridors, aligning with the ambitious goal of forest coverage encompassing half the nation by 2050, thereby contributing to the pivotal role of forests as carbon sequestration agents (Brack, 2019; Gao et al., 2023; Rocha et al., 2023). Simultaneously, the National Urbanization Policy has a goal of allocating 2 hectares of lush recreational areas for every 1,000 residents. These green spaces are intended to be seamlessly integrated into the urban fabric, with the purpose of enhancing the quality of life for a diverse population. Furthermore, the National Landscape Policy aims to allocate 30% of cities for the purpose of green spaces, strategically implemented to enhance the visual attractiveness of urban environments and safeguard vital ecological assets. Similarly, according to the (PLAN Malaysia, 2021) (GP0052021) guidelines, it is stated that urban areas allocate 10% of their land for the

purpose of open green spaces. Following the process of beautification, these places are placed within the purview of local authority, thereby strengthening Malaysia's commitment to the implementation of organized green urbanization.

The policy frameworks align with the objectives outlined in the National Low Carbon Cities Masterplan. Key Direction 9 deserves special attention as it outlines a comprehensive plan for urban areas to effectively mitigate their greenhouse gas emissions. This directive emphasizes the significance of designating green open spaces, enhancing public areas through the planting of trees, achieving a park standard of 2 hectares per 1,000 individuals, advocating for shared amenities, and strengthening the presence of trees in urban environments. The combination of these thoughtfully designed regulations and programs not only demonstrates Malaysia's commitment to achieving carbon neutrality but also offers a clear framework for utilizing urban planning to effectively achieve this commendable goal.

Table 4 presents a comprehensive compilation of insights obtained from a wide range of policies and documents. It illustrates how these directions play a crucial role in guiding and influencing the incorporation of open spaces in the pursuit of urban growth that is environmentally sustainable and reduces carbon emission.

4.2 Leveraging Small Urban Parks for a Green and Low-Carbon Urban Future

SUPs address the prevalent issue of the 'lack of green spaces,' as highlighted by Lin et al., (2017), by extending the benefits of parks across urban neighborhoods and improving citizen accessibility, as noted by Balai Kerishnan & Maruthaveeran, (2021). In the period between 1964 and 2010, pocket parks gained significance as vital community spaces in Europe, especially in cities with limited green areas. These spaces held substantial value for residents in scattered locations, as emphasized by Armato, (2017). The adaptability and innovative designs made possible by the cost-effective and versatile nature of SUPs, as pointed out by Rosso et al., (2022), have transformed them into tools for urban planning. Consequently, they have revitalized specific areas and reinvigorated urban structures, as highlighted by Armato, (2017).

Analyzing the SWOT analysis of small urban parks (SUPs) yields valuable insights into how these parks can support local governments, particularly in aligning with the National Low Carbon City Masterplan. SUPs offer strengths, as highlighted by Ahmed Abd El Aziz, (2015) and Fatiah & Pornahono, (2022), such as their convenient proximity to local communities, enabling easy access and use.

Table 4: Synergistic Framework and Influence of Current National Government Documents on Open Space Integration in Low Carbon Urban Development

Target			
Under the 12th Malaysia Plan, Malaysia has set an ambition to be a carbon neutral nation by 2050 upgraded its NDC target to reduce intensity of GHG emissions by 45% by 2030 unconditionally			
Open Space		Low Carbon Urban Development	
Government Document	Implementation Strategies	Government Document	Implementation Strategies
Town and Country Planning 1976 (Act 172)	Mandates the inclusion of open and recreational spaces in the structure and local plans.	National Low Carbon Cities Masterplan	Targeted outcome of Key Direction 9 in developing citywide/sectoral low carbon strategies to help cities and urban areas reduce GHG emissions, focusing on green open space gazettement, enhancing public open spaces through tree planting, achieving a ratio of 2 hectares of parks per 1,000 population, promoting shared facilities and amenities, and increasing tree coverage in urban areas.
National Physical Plan (NPP4)	Establish green, blue, and brown corridors for urban green spaces and parks, with the goal of achieving 50% forest cover by 2050.		
National Urbanization Policy (DPN2)	Achieve 2 hectares of recreational areas per 1,000 population by adequately providing open spaces and recreational areas to meet the needs of a diverse population. This includes integrating green spaces and natural features into urban landscapes.		
National Landscape Policy	Focuses on improve urban landscape quality, allocating 30% green spaces, protecting resources, and promoting harmonious hardscape design.		
Garis Panduan Perancangan Kawasan Lapang (GP0052021)	Urban areas must provide 10% open space, which must be handed to local authorities after tree planting and beautification, according to the hierarchy of open spaces.		

Source: Adopted from Town and Country Planning Act 1976 (Act 172), National Physical Plan (NPP4), National Urbanization Policy, National Landscape Policy, *Garis Panduan Perancangan Kawasan Lapang* (GP0052021) and National Low Carbon Cities Masterplan.

Their management under local authorities ensures customized development that meets community needs, and their space efficiency allows them to be developed in small areas, even within densely populated cities. Weaknesses of SUPs, as identified by Othman et al., (2016), include potential limitations in vegetation density and diversity, which might restrict their capacity to store carbon compared to larger urban spaces, and their inherent size constraints, which could affect their effectiveness in carbon storage relative to larger parks.

SUPs present opportunities, as highlighted by Labuz, (2019) in potentially enhancing accessibility through non-motorized transport modes, aligning with the concept of car-free cities. They offer spaces for recreation and leisure, promoting healthier lifestyles and fostering community interaction. Furthermore, they can play a role as carbon sinks, aiding in the absorption of carbon dioxide and contributing to urban climate mitigation. Limitations of SUPs, as indicated by Yang & Hong, (2023) include potential policy guidelines, a lack of public awareness and appreciation, which could hinder their utilization and benefits, as well as the possibility of conflicts with other development priorities, which might impede their growth and overall impact.

The SWOT analysis illustrated in Figure 2 underscores the potential alignment between SUPs and the National Low Carbon City Masterplan. It highlights

the significance of effective landscape planning within SUPs and green networks. This planning can enhance carbon capture, accessibility, and ecosystem services while mitigating fragmentation and influencing microclimates. By leveraging SUPs for urban expansion and preservation, local governments can efficiently reduce carbon emissions, especially in densely populated regions. This strategic approach aligns with Malaysia's goal of carbon neutrality by 2050, as outlined in the National Low Carbon City Masterplan.

5. CONCLUSION

In conclusion, Malaysia's aspiration for sustainable development within the context of rapid urbanization underscores the crucial role of integrating open spaces as a strategic approach to mitigating carbon emissions and elevating the quality of urban life. By incorporating Small Urban Parks (SUPs) into urban planning, these green spaces hold the potential to be transformed into effective carbon sinks, thereby aiding in emissions reduction and facilitating the shift towards a low-carbon trajectory in response to the environmental challenges posed by urban growth and escalating greenhouse gas emissions. Beyond their provision of recreational and aesthetic value to residents, SUPs also offer a vital ecosystem service by actively absorbing and storing carbon dioxide. The concept of SUPs seamlessly

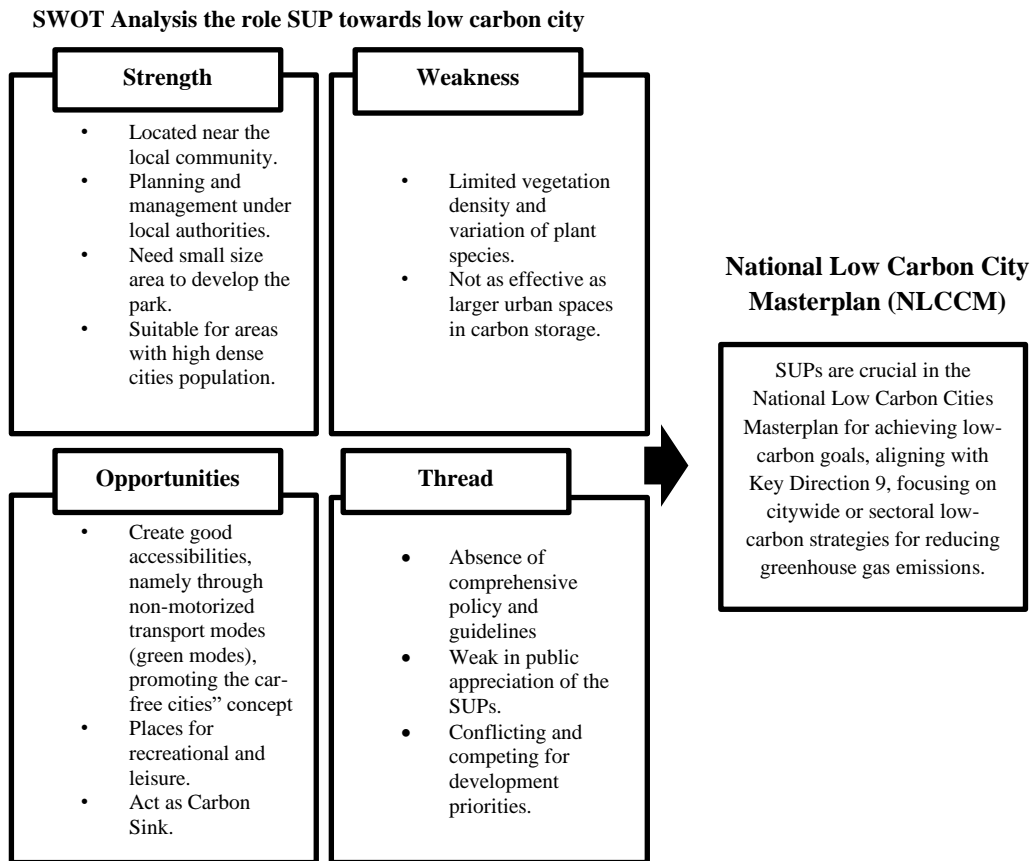


Figure 2 : SWOT Analysis that highlights the potential alignment between Small Urban Parks (SUPs) and the National Low Carbon City Masterplan.

aligns with the national agenda of transitioning to a low-carbon economy (Li et al., 2022), as these spaces inherently facilitate carbon sequestration while enhancing urban resilience.

To fully unlock SUPs' carbon reduction potential, the Malaysian government must acknowledge the pivotal role of open spaces in mitigating urbanization's impacts. The formulation and implementation of comprehensive policies, standards, and guidelines are imperative to systematically integrate SUPs into urban development plans. Collaboration between local authorities, urban planners, environmental experts, and communities is essential for the effective design and maintenance of SUPs. By recognizing SUPs as significant carbon sinks, the government can pave the way for an environmentally conscious urban landscape and make substantial contributions to achieving the nation's goals of low-carbon cities.

However, it is important to acknowledge certain limitations of this study. Notably, the analysis primarily draws upon policy documents at the federal or national level, which may not fully encompass the intricate and dynamic real-world implementation of

these policies. The focus on high-level policy documents might not provide a comprehensive understanding of the actual effectiveness and challenges faced in local-level planning and execution. As urban planning and environmental strategies often manifest differently in local contexts, the study's reliance on broader policy documents could potentially overlook critical nuances in the practical application of these policies at the grassroots level. Therefore, while the study sheds light on the strategic alignment between SUPs and national climate policies, a more granular exploration of how these strategies translate into on-the-ground practices at the local level would enhance the study's comprehensiveness and applicability.

This study opens the door to several promising avenues for future research.

- i. Conducting empirical investigations to quantitatively measure the actual impact of SUPs on carbon sequestration and their role in mitigating urban carbon footprints across diverse urban contexts is of paramount importance. By collecting robust data and conducting comprehensive analyses, researchers can provide a clearer

- understanding of the tangible contributions that SUPs make to carbon reduction strategies.
- ii. Interviewing local government officials and stakeholders can offer invaluable insights into the strategies, challenges, and successes at the grassroots level. Exploring the perspectives and decision-making processes of those involved in SUP planning and management can provide a deeper understanding of the real-world implementation and effectiveness of policies.
 - iii. Undertaking a comparative study involving countries with exemplary urban planning and successful low-carbon city initiatives would enrich the research landscape. Analyzing best practices and lessons learned from these contexts can offer valuable guidance for Malaysia's efforts to integrate SUPs into its low-carbon urban development strategy. This cross-national approach can shed light on effective strategies, potential pitfalls, and innovative solutions.

By pursuing these avenues, researchers can expand upon the foundation laid by this study, advancing our understanding of the practical implications of SUPs in carbon reduction strategies, exploring local-level dynamics, and drawing inspiration from successful international models.

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