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# Sustainable Urbanism: Pathway to Resilient Strategies in Adapting Early Malay Town towards Low Carbon City

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**Abstract.** Due to an alarming rate on the impact of global climate change, the integration of low-carbon goal in regeneration of historic urban areas is regarded as a key part towards the implementation of sustainable urbanism practises based on Sustainable Development Goal (SDG). Much studies on the planning and design of low carbon strategies concerned overwhelmingly on the new planned cities without much emphasis given on the implemented at old town centre. In the context of Malay early town, the adaptation of the low carbon planning as shifting in environmental conditions is regarded as paramount importance particularly in the planning of the urban form to address the growing complexity of urban fabric at the town. This paper therefore explores the developed framework of Low Carbon City initiative and integration of resilience as an approach in urban transformation and regeneration of Malay early town to provide the platform for understanding the complexity of urban-natural environment from morphological perspective. The purpose of this research is two-fold; firstly, to examine the role of discourse in implementing Low Carbon City Framework (LCCF) in Malaysia at large. The second objective is to identify the place-specific mechanisms based on resilience approach to understand the capacity of urban form system to absorb, adapt or transform in ensuring the dynamic equilibrium of the urban-natural system. Considering Kota Bharu as representative of Malay town, a discursive-analytical perspective framed to examine the upsurge of the LCCF that helps to understand the pathway towards integration of framework at national, state and district level. Such comprehension on implementation measure formed a basis to identify the interactions between environmental performance and urban forms pattern as strategies for resilience. A case study with mapping analysis were employed that revealed significant relations between socio-cultural and environmental dimension which shaped the formation and transformation of urban morphology of the town. This study concludes with an examination of possible future directions for integration of space-morphological approach to general urban resilience for future adaptation planning of Malay towns towards Low Carbon City.

## 1. Introduction

The global phenomenon of climate change and global warming, associated with the continued increase of greenhouse gas (GHG) concentrations in the atmosphere, gained tremendous popularity and has been discussed worldwide [1, 2, 3]. The United Nations have addressed such concern in the Paris Agreement and the objective of the United Nations Framework Convention on Climate Change (UNFCCC). Central concern focused on the greenhouse effect primarily the emissions of carbon dioxide (CO<sub>2</sub>) as the primary GHG responsible for global warming and the largest contributor to Global Warming Potential (GWP),



owing to its large occupancy volume trapped the heat in the atmosphere with about 70% of emissions [4]. Consequently, the intensity of discussion on the escalating levels of CO<sub>2</sub> emissions has prompted The Intergovernmental Panel of Climate Change (IPCC) to claim the impacts brought about by climate change are irrefutable, and thus, the challenging task lies in managing the unavoidable effects and previous increases in CO<sub>2</sub> emissions levels. The rising level of CO<sub>2</sub> concentration caused by human activities, particularly in the last two centuries, is marked from 280 to more than 380 ppm by volume, and the rate is continuously growing. Such situations resulted in an increased global average temperature far from under 1.5 °C as pledged in the Paris Agreement 2016; instead, it is heading towards 3 °C [5].

Thus, a concerted effort is needed to keep the global temperature increase to less than 2 °C in which the emission of CO<sub>2</sub> into the atmosphere needs to be limited to roughly 800 gigatons of CO<sub>2</sub> (GtCO<sub>2</sub>). The Paris Agreement and most countries around the world's nationally determined contributions (NDC) represent an important commitment to climate action. However, the collective plan to keep the global temperature increases below 2 °C has not been reached; thus risking the development of integrated efforts that incorporate the scaling up of low-carbon strategies and resilient climate infrastructure which able to guide every country in formulating the potentiality adverse impact of some climate policies on development prospects and economic growth [6] while simultaneously achieving the UN Agenda 2030 that includes 17 targets for Sustainable Development Goals (SDGs). In the environmental context, specifically in Goal 13 of Climate Action, the emphasis centered on urgent action to combat climate change and its impacts. Improving awareness-raising and human as well as institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning is amongst the stated strategies which then be aligned with climate action and the sustainable development objectives at the local, national and global levels through defining key sustainability challenges to support policies.

In the national context, the Malaysian government is cognizant of the effect of climate change and expanded the effort to prevent escalating global levels of CO<sub>2</sub> emissions through development planning and guidelines. For instance, in 2009, during the legally binding international environmental agreement of the United Nations Climate Change Conference (COP-15) in Copenhagen, Denmark, Malaysia pledged to reduce carbon emissions intensity by 40% as compared to 2005 levels per GDP, conditional upon the transfer of technology and finance from developed nations [7]. Although the reduction level is targeted to achieve by 2020, the target has not reflected optimism regarding accomplishment efforts [7]. The commitment has not been greeted with careful delineation of adaptation strategies, given limited support from existing legislation and restrained environmental awareness [8]. Malaysia too, in 2015, signed and ratified the Paris Agreement with 0.52% greenhouse gases for ratification and pledged to cut 45% of its Gross Domestic Population (GDP) per capita greenhouse gas emissions by 2030 [9]. Much of the controversial discussion on implementing reduction strategies is geared toward the urban settings; which focuses on the two important measures that are mitigation strategies which involve planning strategies for climate hazards and the mitigation of their effects, and adaptation strategies which concern the methods and best practices to identify general climate change signals, adapt to the effect and therefore minimise the changes.

Malaysia's effort on environmental issues started with the United Nations Conference on the Human Environment in 1972. Following the sequence of actions and commitment in the Rio Summit in 1992, the Malaysian National Environmental Policy was established and became the basis for attention to environmental issues in the country. A substantial commitment to planning for abatement of CO<sub>2</sub> emissions, specifically in urban areas, was reflected in 2011 with the establishment of Low Carbon City Framework and Assessment System (LCCF) that charted the significant pathway and direction in adopting a blueprint of action for embracing the SDG.

The Low Carbon Cities framework, which has been implemented globally, has been defined in different terms; yet shared a clear objective for reference to a province, city, municipality or community to pursue a systematic process to achieve GHG emission reductions. In Malaysia, various ministries, departments and agencies are implementing the notion of Low Carbon to help Malaysia's government curb the carbon emissions by 2030. In the context of cities and towns, many cities have set a low-carbon vision or developed a low-carbon action plan in Phase 1 (Introduction and Awareness) of LCCF

implementation. Some local authorities have also geared further commitment towards preparing GHG inventories that can help track low-carbon action parallel to Phase 2 (Baseline Development) of LCCF. However, the LCCF is only applied to participating local authorities in Malaysia, particularly for new township development. As a record, in 2020, only 52 local authorities took part in the LCCF Programme, which encourages strategies and actions to reduce carbon emissions at the local level. The figure seems far from the target number of 100 participating partners planned to be achieved in 2021 [10].

Moreover, the participating low carbon zones only concentrated mainly in the new planned urban areas covering Kuala Lumpur, Iskandar Malaysia, Seberang Perai and Malacca which showed commitment to minimise the carbon footprints without much attention and participation from early Malay towns based on traditional and royal growth influence. Inasmuch, few explorations and practices discuss the implementation of low-carbon goals, planning and design strategies and technical methods that should not be ignored in community regeneration, especially in the rejuvenation of historical districts. Therefore, this paper explores Low Carbon City's developed framework to provide the platform for understanding the complexities of sustainable urbanism in Malaysia, particularly in the urban regeneration of historical districts in early Malay towns. From the viewpoint of social-ecological systems, the approach of resilience were explored to identify the place-specific strategies based on the adaptability and transformability capacity of the physical urban form and social fabric in early Malay town in ensuring the dynamic equilibrium for the development of Low Carbon City.

## 2. Background

### 2.1 Development Planning of Low Carbon City in Malaysia

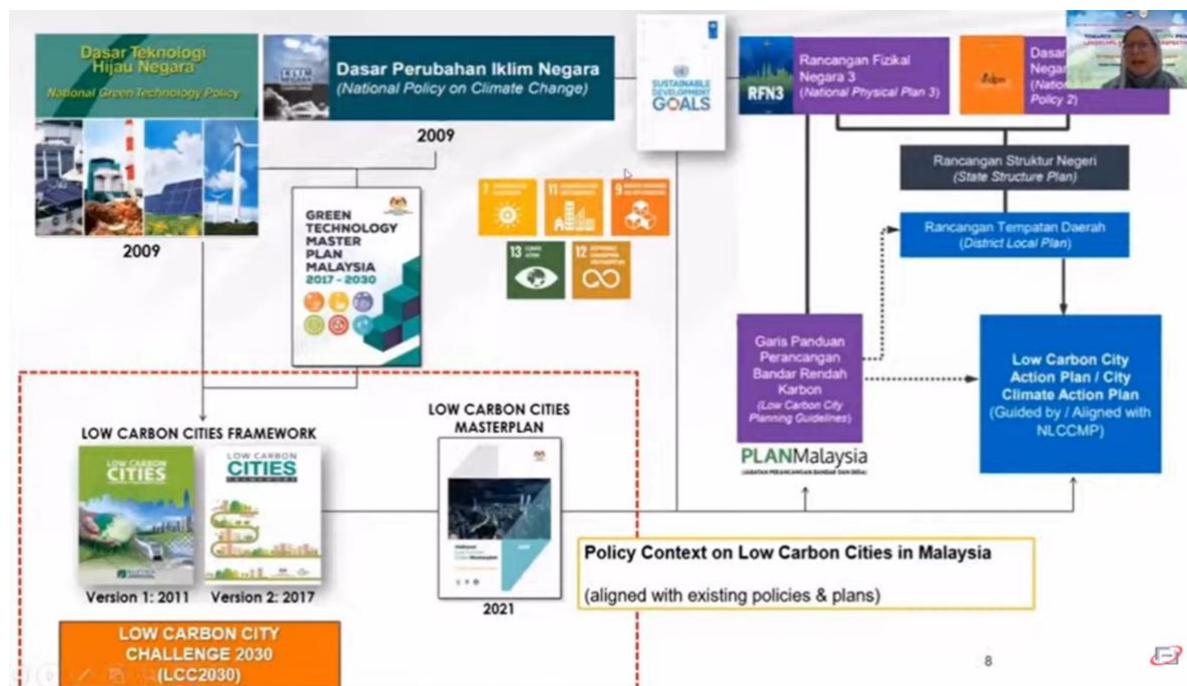
Low carbon cities (LCC) are an effort to reduce carbon emissions and mitigate global warming and climate change. It refers to cities planned with sustainable principles and features as well as initiatives that preserve the environment and reduce the negative impacts of human activities on the environment. Important components of LCC include reductions of usage on energy, water, and solid waste in cities [9]. The movement of LCC in Malaysia indeed as a testified effort to reduce carbon emissions intensity by 40% during the pledge in COP-15 in 2009. However, domestic environmental awareness and industrial demands for major sectors encompassing transportation, oil and gas, manufacturing, power industry, oil palm and timber logging do not indicate optimism voluntarily in achieving the pledge of a 40% reduction, as seen in the poor implementation of the law that does not make compliance with sustainability as mandatory. Furthermore, the establishment of the six National Key Result Areas (NKRAs) announced in July 2009 also does not relate to a cut in carbon emission or environmental sustainability within the NKRAs matrix. Such absence in policy integration is also reflected in the National Green Technology Policy (NGTP) and the accompanying Renewable Energy Policy and Action Plan roadmap also do not link up with any of the components of the NKRAs.

The unveiled of NGTP, although it seems fragmented rather than integrated, led to the objectives that promote a reduction in carbon emissions by working at the individual and societal level. It became a turning point in the initiatives on sustainable growth and development in which one of the many initiatives is to showcase Putrajaya and Cyberjaya as the pioneer of green cities. Subsequently, in line with the NGTP, the Low Carbon Cities Framework and Assessment System (LCCF) was initiated in 2011 and further improved in 2017 for the assessment system provides a binding national framework to guide and assess the development of cities to achieve sustainable developments that will subsequently reduce carbon emissions in Malaysia. The framework assists multilevel users of all stakeholders in measuring the impact of their development decisions contributing to carbon emissions and abatement measures regardless of any size of development and settings comprising cities, townships or neighbourhoods, either new or existing [11].

The formulation of the outlined framework of LCCF paved the way for establishing the National Low Carbon Cities Master Plan (NLCCM) under the Green Technology Application for the Development of Low Carbon Cities (GTALCC) initiative. In realising the objective of the Paris Agreement and as a global response to the increasing country's temperature, rainfall and sea levels over the last 40 years and projected to hike between 1.2 °C to 1.6 °C by 2050 reported in Malaysia's climate

change report to UNFCCC in 2019, The United Nations Development Programme (UNDP) has fostered the collaboration and initiatives of GTALCC with the Ministry of Environment and Water (KASA) and the Sustainable Energy Development Authority (SEDA) to implement a low carbon cities project. GTALCC is a five-year project (beginning mid-2017) aimed at removing barriers to integrated low-carbon urban planning and development in Malaysian cities through policy support, awareness & capacity building and demonstration projects. Five pilot cities (Putrajaya, Iskandar Malaysia, Cyberjaya, Petaling Jaya and Hang Tuah Jaya) are participating in GTALCC to implement sustainable city solutions for greener cities and leverage national support of NLCCM through the outlines of the direction and plans for the transition toward low carbon cities in Malaysia.

The policy document of NLCCM establishes a common definition of low carbon cities as ‘a city that implements low carbon strategies to meet the environmental, social, and economic needs of the city. The city measures, manages and mitigates greenhouse gas emissions to reduce its contribution to climate change’ [10]. Other than that, several key actions and targets for cities were identified based on the notion to localising the Sustainable Development Goals (SDGs) and making the SDGs real to communities, households, and cities. Figure 1 outlines the development of policy context on Low Carbon Cities in Malaysia.



**Figure 1.** Development of Policy Context on Low Carbon Cities in Malaysia (Source: Adapted from Webinar on Towards Low Carbon Society from Landscape Architecture Perspectives, 2021)

### 3. Methodology

The research employed a case study as a research approach as explorative for interpretivist research as outlined by [12, 13, 14] to understand the adaptation of resilience strategies in a place-specific context.

### 3.1. Case Study Location

This study is conducted in Kota Bharu, the capital city of Kelantan, located in the eastern part of Peninsula Malaysia (latitude 6°8'0.9 N, longitude 102°14'18.0 E) to represent the early Malay town. Built formally since 1845 with the construction of the royal palace of Istana Balai Besar, Kota Bharu has been recognized as one of the nine prominent Royal Towns in Malaysia alongside with Alor Star (Kedah), Arau (Perlis), Johore Bahru (Johor), Klang (Selangor), Kuala Kangsar (Perak), Kuala Terengganu (Terengganu), Pekan (Pahang) and Sri Menanti (Negeri Sembilan) [15]. The strategic location of the town near the mouth of Kelantan River influenced the growth and development of the town in the early the years of late 19<sup>th</sup> century as a port and trading centre, which drew the concentration of settlers and traders and thus encouraged the transformation of the surrounding settlements as a focal point for urban development.

The significant growth of town development resulted in the changes in urban components to support the function of the town as the capital state of Kelantan government. For instance, the construction of the Mosque (Masjid), administrative and institutional buildings, including the court house (*Mahkamah*), market (*Pasar*) and open space (*Padang*) were invariably built-in proximity to the Istana Balai Besar; creating the distinctive urban components and unique character of early Malay town. These urban components have shaped the distinctive spatial structure and patterns of its physical urban form, forming a strong axial line that can be drawn from Tambatan Diraja as a trading port toward Istana Balai Besar with a unique Malay town's urban fabric and morphological character.

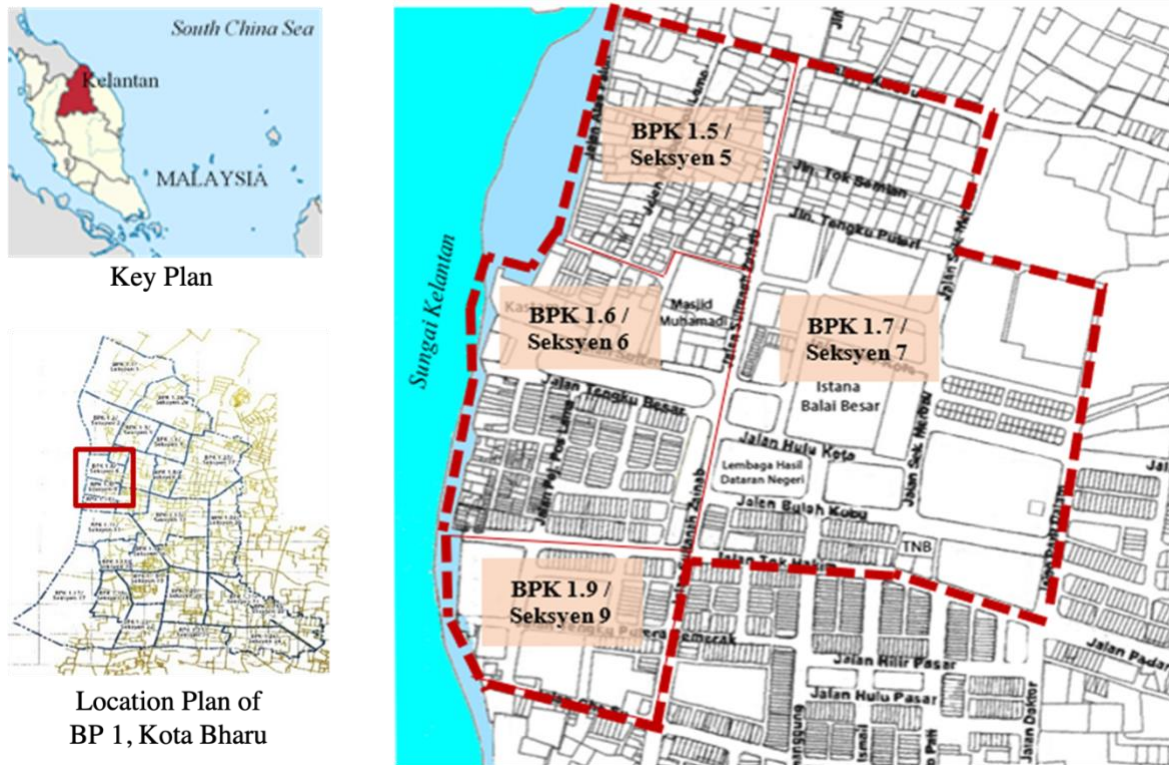
Regarding planning administration, Kota Bharu is divided into 15 Planning Blocks (Blok Perancangan, BP). The study area is concentrated in Planning Block 1 (BP1), the central part of Kota Bharu. Based on the administrative and operational area, BP1 Kota Bharu consists of 28 Small Planning Blocks (Blok Perancangan Kecil, BPK), also known as Section. Among these 28 BPK, the focused study area is the Old Town Center of Kota Bharu, locally known as Bandar Lama Kota Bharu. Bandar Lama Kota Bharu, amongst others, encompasses four BPK that became the focus of the study area, namely BPK1.5, BPK1.6, BPK1.7 and BPK1.9. These areas comprise a total land size of 65.90 hectares with mixed commercial, residential, and administration land use [16]. Figure 2 depicts the study area boundary in Bandar Lama Kota Bharu, Kelantan. The selection of the four BPK mentioned above was determined based on the SWOT Analysis (Strengths, Weaknesses, Opportunities, and Threats) as summarised in Table 1. In addition, the delineation of the study area according to BPK guides the mapping analysis in determining appropriate carbon reduction measures based on the performance criteria as outlined in LCCF.

### 3.2 Mapping Analysis

The framework of mapping analysis delineates the zoning and categorising to the specific targeted approach of resilient strategies according to the Urban Environment (UE) as one of the four main elements for cities' GHG reductions in LCCF other than Buildings (B), Urban Infrastructure (UI) and Urban Transportation (UT). The consolidation of adaptation strategies is further focused on three Performance Criteria of UE as measurable strategies to reduce carbon emission, specifically on carbon capture.

Concerning the urban form elements in each zoning, the study addresses four key elements of the urban form comprised of buildings, streets, blocks and open spaces to investigate the interrelationships between these elements that shape the spatial patterns and structure of the town. As a subject of mapping analysis, urban form is treated as a product of the continuous tension between recovery and adaptation for resilience strategies on several spatial and temporal scales of urban transformation. The mapping analysis process was arranged in three processes that formed the hierarchical scale of mapping analysis, as depicted in Figure 3.





**Figure 2.** Study Area in Old Town Centre or Bandar Lama Kota Bharu, Kelantan

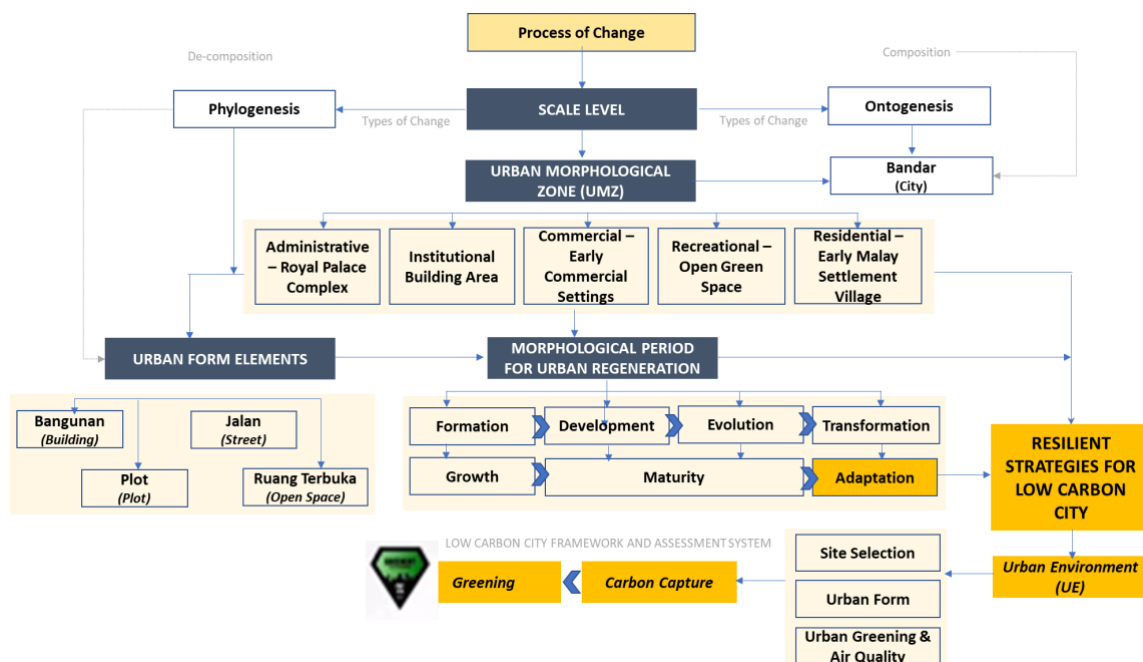
**Table 1.** Determinants of Case Study Area for Urban Regeneration of Old Town Centre

	Key Determinants	Evaluation Criteria
Strength (S)	Physical factors of the study area	- The earliest urban area in Kelantan developed since the opening of the capital city of Kota Bharu in 1845 and has a long period of urban development to be studied. Undergone various stages of the formation and transformation of urban form and exhibiting significant morphogenetic characteristics.
Weakness (W)	Exiting conditions of the study area	Dysfunctional area at old commercial centre alongside Sungai Kelantan. Rapid changes in development partially destroyed urban fabric with the development of mega-scale development projects. The adoption of modernism has caused a dispersal and disconnection from the urban form character of Malay town.
Opportunity (O)	Urban pattern analysis criteria	Comprise a variety of land uses to depict the urban complexities of traditional Malay towns. The presence of components of Malay town partially settled in places such as Istana Balai Besar, Masjid Muhammadi and Padang Merdeka, which are still kept intact at the core

area of the town, enables the acquisition of gathering formal data following the diachronic comparison process.

A reasonable area size between 50 to 150 hectares to allow the execution of pattern analysis.

Threat (T)	Current development practice	<p>Insensitive development in areas with high historical values without considering the relationship of traditional urban form patterns and functions.</p> <p>Unresponsive development emphasizes on aesthetic function.</p> <p>The development practice employs the notion of a new urbanist project targeting for developer's marketing campaign rather than appraisal of the natural evolutionary character of the Malay town</p>
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**Figure 3.** Mapping Analysis Framework depicting the Pathway for Adaptation of Resilience Strategies in Early Malay Town towards Low Carbon City

#### 4. Result and Discussion

##### 4.1 Resilience Strategies and Socio-Cultural Emphasis

The concept of resilience, defined as the capacity of the system (city as socio-ecological system) to absorb, adapt or transform as strategies in adapting early Malay towns towards Low Carbon City reflects the emphasis of cultural values in preserving the physical urban character of the towns within the prism of sustainability with socio-cultural emphasis. In the case of Old Town Centre of Kota Bharu, the city has grown in complexity regarding the spatial morphology, infrastructures and services that must adapt



to the needs of present and future urban dwellers and shifts in environmental baseline conditions. Thus, adaptive strategies mitigate the effects of disruptive anthropogenic change from intense heat and climate change relative to energy generation has a close relationship with the capacity of 'energy land' from green areas that can act as carbon sink and storage.

In balancing the equilibrium of socio-ecological system of the early Malay town, the integration of socio-cultural dimensions in green space planning with emphasising the sense of place is regarded as paramount importance [17]. The link between sustainable urban design and nature conservation often signifies the provision of green space in urban areas as a widely accepted strategic framework in ecological city planning [18, 19]. This contribution briefly reflects on the evolution of nature in the city according to the existing literature on ecological landscape and urban planning tradition. Growing empirical evidence indicates that the presence of natural areas contributes not only to functional to natural ecosystem services but extended to cultural ecosystem services which is much related to improve the quality of life in many ways. Urban green spaces serve as places of identity, memory, and belonging; enrich human life with meaning and emotions by providing important social and psychological benefits; and enhance citizens' quality of life, which is a key component of sustainability. Besides, urban landscape of green space has the vital role in enhancing the nature conservation framework as part of urban identity which contributes to strengthen the social cohesion amongst urbanites.

#### 4.2 Greening for Resilience Strategies

Given the extensive applicability of LCCF, the strategies of resilience outlined in performance criteria of Urban Environment (UE) generated several interpretations in planning for urban greenery and improving air quality, of which spatial morphological is one of the key determinants for consideration [20]. One of the examples of such design interpretation can be delineated from the implementation of 'urban green sponge' with maximising the greenery in urban areas as strategies for reducing the CO<sub>2</sub> emissions and increasing carbon absorption from land energy footprint (Figure 4).



**Figure 4.** The Exploration of Design Ideas based on Sponge City concept through Greening the City to Increase CO<sub>2</sub> Sequestration (Design Credit to Green Sponge Group Concept of SGL2346 Urban Landscape Design Studio Semester February 2021/2022)

## 5. Conclusion

This study set out to establish the analytical discourse of the integration of LCCF in terms of policy and guidelines establishment in the context of urban planning and design in Malaysia. Central focus is emphasised on the adaptation strategies of resilience approach specifically in the historic urban centers as part of regeneration mechanism to understand the capacity of urban form system to absorb, adapt or transform in ensuring the dynamic equilibrium of the urban-natural system through the exploration of urban sponge city concept. Such understanding is crucial to ensure the formulation of guidelines on urban design and conservation planning mainly during the preparation of the development plan that consider the urban fabric and character of Malay town.

## Acknowledgement

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