

Modelling City Green Space and Sustainable Urban Development

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Abstract:

The modelling of city green space with consideration of sustainable urban development benefits (health) is indeed a necessity in Georgetown, Penang. Urban green space (sustainable urban development) promotes positive activities that will ensure fairness, effectiveness, divergence, less disparity, less discrimination, green elements that has effect on health, well-being, nice feelings, social safety, positive effects, restoration of stress, restoration of attention fatigue, a positive relationship between green space and physical and mental health and longevity among the city population. The objectives of the study are to analyse the current issues related to modelling city green space and sustainable urban development; to identify the importance of green space to be included in the urban development; and to formulate the benefits of green space to the urban public in Georgetown, Penang. This study adopted quantitative method, utilized survey technique to collect data using convenience sampling from 384 respondents living in Georgetown, Penang. Pearson correlations were used in analysing the data to answer all the objectives. In general, the findings showed that the score for health effect, in the sustainable urban development practices and modelling city green space in Georgetown, Penang recorded fairly well with an average value between 4.02 and 4.26. The results of Pearson correlation analysis show the benefits of the urban green space is also significant at level $p \leq 0.01$ and $r = 0.143$. This means that respondents' belief in the urban green space beneficial to the urban populous is good but the prevailing relationship is still weak or low (approximately 14.3%). Therefore, this study suggests that a comprehensive channels should be established, whether formally or informally to ensure the role of various parties can be increased more effectively in ensure modelling of city green space is more efficient at Georgetown, Penang.

Keywords: Green space, city, sustainable, urban development, artificial environment, health

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1. Introduction

Urban green spaces provide an array of benefits, or services to the ecosystem, that support

our physical, psychological and social health. However, in many cases these advantages are not distributed equitably across various urban

populations [1]. Biodiversity in urban green spaces is well known for providing humanity with a variety of ecosystem services. Hence, green spaces are recognized as one of today's most popular urban ecosystem resources. Increasing urbanization and population growth over the past decades have resulted in significant habitat loss in the urban landscape [2] and accompanied by many environmental issues, such as green space reduction and deterioration of the ecosystem [3]. A number of studies have currently pointed to urban green spaces as a resource for promoting public health and providing valuable ecosystem services to urban residents [4],[5],[6],[7] and [8]. The effect of green space on life expectancy was studied by a group of researchers and the finding shows a positive trend between the two variables.

Monitoring changes in land use in the urban environment is an important issue in planning and management, and remote sensing and geographic information systems are regarded as the most effective techniques for such studies. Using these modern tools, a number of recent studies have focused on tracking urban growth trends, land use and land cover modifications, urban green space patterns, and urban biodiversity conservation [9], [5], [6],[10], [11], [12], [8] and [13], exploring how the choice of UGS measure and analytical scale may affect UGS-health relationships in Singapore. Overall, on most scales canopy cover displayed the strongest mental health associations. The strongest relationships between UGS and health are observed at medium scales. We recommend that future studies should carefully select UGS measurements and determine the limit to calculate UGS carefully. In addition, it is also recommended to examine UGS-health associations in multiple scales within a study [13]. Considering the fact that urbanization has a tremendous impact on the local, regional and global environment [14], urban researchers are gaining momentum in the trend of studying various aspects of urban green spaces.

Conservation of biological diversity and ecosystem services in urban environments requires valuable ecological information that can be incorporated into planning and management of urban green space. Hence, the study focuses on how modelling city green space in an urban environment will enhance the health aspects of city dwellers in Penang, Malaysia.

2. The Problem Statement

Study by [15] shows that green space can attenuate the negative health impacts of stressful life events. Their study shows that the relationships of stressful life events with the number of health problems and perceived general health are significantly moderated by the amount of green space within a 3-km radius. Respondents with a high amount of green space in a 3-km radius were less affected by a stressful life event than those in this radius with a low amount of green space. While it was slightly significant, the same pattern was found for perceived mental health. The moderating effects of green space was observed only for green space within 3 km, not for green space within 1 km of residents' homes possibly because the 3-km indicator is more influenced by the existence of larger areas of green space, which are supposed to sustain deeper types of restoration. These results support the idea that green space can provide a buffer against the negative impact of stressful life events on health.

In Malaysia, the open space defined as 'any land whether enclosed or not reserved or reserved to be specified in whole or in part as a public garden, public parks, sports fields and recreation areas, dining areas, wind areas, walking areas or as a public place' (Town and Country Planning Department, 2000). It is also generally referred to as recreational areas and public parks for the same function [16]. The demand and need for green spaces especially related leisure activities force the government provide a recreation area in parallel with the economy

development. According to [16] and [17], the provision of open spaces and public parks next to neighbourhood must be developed and made available in every locality and with at least a Local garden of state capital to achieve the vision of Malaysia National Park set in the National Landscape Policy. Rapid urban development has raised the issue of the ability of green areas and open space to accommodate the increasing population. The adequacy of the provision of green spaces and leisure in Malaysia becoming increasingly serious public park in Malaysia showed only able to accommodate the needs of social recreation for 6.81 people, while 9.15 million Malaysians who are residents of the city [16] and [2]. This situation is further complicated when the needs of urban land use accommodates another use of the land which has more economic impact than for the purpose of open space and green. This leads to limited land use issues adequacy and accessibility of the public to the open spaces and green in the city to be serious which shows that about 15.09 million Malaysians categorized as urban dwellers [16]and [17].

Thus, people in this city definitely need green areas and open space for recreational purposes which can directly or indirectly has positive effects on city populous health. Furthermore, recreational parks that are supposed to meet the satisfaction of the public, including women, children, the elderly and disabled to the concept of inclusivity in sustainable development can be applied. Hopefully this study can motivate the urban planners to plan friendly and sustainable cities with emphasizes on green space.

3. Methodology

The objectives of the study is to analyse the current issues, to identify and formulate the importance of green space related to modelling city green space and sustainable urban development in Penang, Malaysia

General Hypothesis

H₁ There is a significant general correlation between modelling city green space and sustainable urban development in Georgetown, Penang.

Advance Hypothesis

H₂ There is a significant correlation between modelling city green space and health (sustainable urban development) in Georgetown, Penang.

This study has followed the approach of social quantitative case study covering primary and secondary data. Two main stages of the study are usually as follows:

Stage 1: The first stage involved preparatory work to collect data for the study. This involved literature review, the primary and secondary data collection, by way of file reviews, books, reports and maps.

Stage 2: Surveys was conducted using cluster sampling techniques by region. According to [18] and [19], the purpose of cluster sampling is that it can control the distribution of samples in a wide area. Given population populations in the area of research very much in different types of homes, it is quite possible for researchers to populate the population at random because there is no complete information about the demographic profile either based on the type of residence or list of resident names. The cluster is broken down by section in Georgetown, Penang which has a population of 279,932 people (MBPP, 2015). In order to ensure that the sampling framework did not forget about the quality of data in a large area and a large population, the study determined it based on the recommendations of [20] and [21]. They suggested the sample size are 384 with a margin of error 5 percent. Techniques for determining respondents' selection, this study uses convenience sampling techniques, a technique that is easy to do in a wide or open area without any

complete demographic information or profile such as a list of residents in an area. In this case, the respondents were taken among the adult population based on the age range of 21 years and above that is the dimension of maturity eligible to vote for Malaysians. The process is to meet the household heads of respondents at the residence. In order to ensure that the location of the residence is random, some populated areas are sampling locations for each study area. According to [18], respondents in household heads are important because they represent family, even home visits are also considered good because in the event of incomplete information, the survey forms can be repeated in the future. The data collected will be qualitatively analysed to identify the issues and problems. The sample size is 384 with quantitative-purposive approach collected throughout Penang, Malaysia.

4. Findings and Discussion

Based on the results of the study, the mean value is 4.40 i.e. the respondents strongly believe that health influences modelling city green space in Georgetown, Penang. The lowest mean value of

4.28 is that the item on “Urban green space can enhance individual health state”. The highest mean value is 4.60 related to the item “City green space can boost overall health of city dwellers”. Additionally, the median registering 4.00 also shows that respondents realize that urban green space can influence the health in the city. The standard deviation was 0.515 indicating no significant difference between test items tested (Table 1).

The recently passed Sustainable Development Goals (SDGs) "includes a variety of explicit and implicit goals that tackle urban green space health benefits [23]. The study statistically proves that utilization of urban green space has complimented on issues such improved health on respiratory illness and stress related illnesses. Although formulations remain vague and abstract targets, as a central issue, the SDGs go much further than previous development goals. The article evaluates their ability to become discursive resources for fundamental reforms of established development ideas against the backdrop of insights from research on inequality.

Table 1. Health (sustainable urban development) and modelling city green space

Test Item	Scale	Frequency (%)	Min	Median	SD
Urban green space is related closely to clean air.	HNA	0 (0.1)	4.29	4.00	0.528
	NA	0 (0.1)			
	LA	10 (2.5)			
	A	251 (65.2)			
Urban green space is very important for recreational activities which can reduce stress.	HA	123 (32.0)	4.30	4.00	0.474
	HNA	0 (0.0)			
	NA	0 (0.0)			
	LA	3 (0.8)			
Urban green space is ideal place for physical exercise.	A	264 (68.8)	4.43	4.00	0.531
	HA	117 (30.4)			
	HNA	0 (0.0)			
	NA	0 (0.0)			
Urban green space can enhance individual health state.	LA	7 (1.8)	4.28	4.00	0.487
	A	205 (53.4)			
	HA	172 (44.8)			
	HNA	0 (0.0)			
Urban green space can enhance individual health state.	NA	0 (0.0)	4.28	4.00	0.487
	LA	7 (1.7)			
	HA	172 (44.8)			

	A	261 (68.2)			
	HA	116 (30.1)			
Urban green space can reduce chronic deceases.	HNA	0 (0.0)	4.39	4.00	0.517
	NA	0 (0.0)			
	LA	5 (1.4)			
	A	223 (57.9)			
	HA	156 (40.7)			
Urban green space can contribute to clean water.	HNA	0 (0.0)	4.43	4.00	0.527
	NA	0 (0.1)			
	LA	5 (1.2)			
	A	206 (53.8)			
	HA	172 (44.9)			
Urban green space can increase aesthetic perception.	HNA	0 (0.0)	4.53	5.00	0.518
	NA	0 (0.0)			
	LA	4 (0.9)			
	A	175 (45.5)			
	HA	205 (53.5)			
Urban green space will encourage more recreational activities which can reduce blood pressure.	HNA	0 (0.0)	4.37	4.00	0.516
	NA	0 (0.0)			
	LA	6 (1.6)			
	A	228 (59.4)			
	HA	150 (39.0)			
Urban green space is good to improve mental health.	HNA	0 (0.0)	4.33	4.00	0.516
	NA	1 (0.3)			
	LA	5 (1.4)			
	A	243 (63.40)			
	HA	135 (34.9)			
City green space can boost overall health of city dwellers.	HNA	0 (0.0)	4.60	5.00	0.533
	NA	2 (0.4)			
	LA	4 (1.0)			
	A	140 (36.5)			
	HA	238 (62.1)			
Average			4.40	4.00	0.515

N = 384; Overall Min = 4.40

Note:

HNA-Highly Not Agreeable NA-Not Agreeable LA-Less Agreeable A-Agreeable
HA-Highly Agreeable

The result shows that there is a relationship between health and urban green space, thus responding to the study's objectives, 'the importance to the pubic of urban green space'.

Table 2 shows the relationship between the variables using Pearson Correlation. The analysis is to test the correlation between dependant variable, Y-Health (Sustainable urban

development practices) and dependant variable X (Modelling City Green Space). Thus, the relationship is significant at the $p \leq 0.01$ level and accepts the study goal. Thus, there is significant correlation between Health (Y) and Modelling City Green Space (X) formulating the urban green space in Penang, Malaysia. The findings also shows that all the hypothesis (general and

advance) were accepted due to the significant of the findings at the level of $p \leq 0.01$. Tested items on Health (Y) recognizes that clean air, clean water, aesthetic, recreation, free of stress, a place

to exercise and chronic diseases influences the Modelling City Green Space (X) process in Penang, Malaysia.

Table 2. Correlation between Health (Sustainable Urban Development) and Modelling City Green Space

Relationship between sustainable urban development (Y) and Modelling City Green Space (X)	Modelling City Green Space (X)	
	r	0.047
Health	Sig.	0.193
X ₁	Hypothesis	Accepted
	Modelling City Green Space (Y)	
	r	0.143**
Sustainable Urban Development (X)	Sig.	0.000
	Hypothesis	Accepted

N = 384

Note: ** significant $p \leq 0.01$

In general the analysis shows that there is relationship between health effects towards modelling city green space. Issues such as green elements that has effect on health, well-being, feelings, social safety, positive effect, restoration of stress, restoration of attention fatigue, a positive relationship between space and physical and mental health and longevity many others item need to scrutinized by implementation process, so that the sustainable urban development practices can moot the modelling city green space [22], [31], [32], [33] and [34].

The findings of the research shows that the main reasons for immediately and rigorously integrating sustainable urban development issues into modelling city green space are as follows: more sustainable patterns of behaviour are urgently necessary to sustain the viability of the Earth's ecosystems; a huge untapped market

potential exists for sustainable urban green space investment products and consulting services; sustainable urban clearly outperform their conventional competitors in all relevant areas (i.e. environmentally, socially and financially); neglecting the benefits of sustainable urban green space design leads to healthy life style; and reflecting sustainability issues in urban green space already possible and the validity of this decision depends solely on the value's capability and sophistication to explain and justify his/her assumptions within the valuation report. It is also shown, however, that efforts are needed to improve the definition of green space in transaction databases to provide the knowledge databases needed to empirically validate the decision of a price to grant a "valuation bonus" to a sustainable urban green space.

5. Conclusion

The study shows that the relationship between urban green development and public health is significant (positive) and further supported by multiple past studies. So, it is vital for modelling of a city taking into considering the benefits of green space to the dwellers of urban space. The tested items such as clean air, clean water, aesthetic, recreation, free of stress, a place to exercise and chronic diseases influences the Modelling City Green Space in Penang, Malaysia. Additionally, the median registering 4.00 also shows that respondents realize that urban green space can influence the health in the city. More studies using rigorous study design are needed to enable generalizations, and meta-analyses, of these and other health outcomes. These findings may assist urban managers, organizations, and communities in their efforts to increase new or preserve existing green space [24], [25], [26], [27], [29], [30] and [35].

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