ASSESSMENT OF URBAN GREEN SPACE BASED ON LANDSCAPE ECOLOGICAL PRINCIPLES

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This dissertation is dedicated to my family.

It is your love that keeps me going.

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ABSTRACT

Ecological factor has not always been the main factor to be concerned with when planning a city, thus a city has always been forgotten to be regarded as an ecosystem. If the city is treated as an ecosystem, there is a need to conserve adequate green space to fulfill the ecosystem services. Although the Malaysian statutory planning system through its development plan provides allocation of open space, the contribution of these open spaces towards urban ecosystem is still questionable. Therefore, this research is done to evaluate the ability of the planned urban green space of Johor Bahru City Council (MBJB) in two levels: neighbourhood and city to perform other function than just as a recreational space. By using GIS as a tool, assessment is done by using landscape ecological principles such as landscape element (urban green space), landscape structure (size, connectivity, shape and distribution) and landscape function (recreational and habitat for biodiversity) to assess whether the urban green space is able to function as a recreational space and habitat for biodiversity. The research finds that the urban green space is hard to become a habitat for biodiversity in terms of the connectivity. Nevertheless, in terms of the size of green space on the city level, it has a good potential to become a habitat compared to the size of green space in the neighbourhood level. Finally. the research concludes with recommendations for future research and recommendations to improve the green space condition to be able to perform another landscape function which is to become a habitat for biodiversity.

ABSTRAK

Faktor ekologi jarang dijadikan sebagai faktor utama dalam perancangan bandar, lalu menjadikan sebuah bandar tidak dianggap sebagai sebuah ekosistem. Keperluan untuk mengekalkan kawasan hijau akan wujud jika sebuah bandar dilihat sebagai sebuah ekosistem untuk memastikan bandar tersebut dapat menerima kesan-kesan positif kawasan hijau tersebut. Walaupun dalam aspek perundangan perancangan telah menetapkan penyediaan kemudahan kawasan lapang di dalam pelan perancangan, namun, sumbangannya terhadap ekosistem bandar masih tidak jelas dan kurang dirasai. Oleh itu, kajian ini dijalankan untuk melihat sama ada kawasan hijau yang dirancang di dalam kawasan Majlis Bandaraya Johor Bahru di dua peringkat: kejiranan dan bandar mampu untuk memberi servis kepada ekosistem bandar Johor Bahru selain daripada menjadi tempat rekreasi untuk orang awam. Penilaian kawasan hijau dijalankan melalui prinsip ekologi landskap seperti element landskap (kawasan hijau bandar), struktur landskap (saiz, perhubungan, bentuk dan taburan) dan fungsi landskap (tempat rekreasi dan habitat untuk biodiversiti) dengan menggunakan bantuan perisian GIS. Kajian ini mendapati kawasan hijau yang dirancang sukar untuk menjadi habitat untuk biodivesiti jika dilihat dari segi perhubungan antara kawasan-kawasan hijau tersebut. Walaubagaimanapun, saiz kawasan hijau di peringkat bandar mampu untuk menjalankan fungsi sebagai habitat jika dibandingkan dengan kawasan hijau di peringkat kejiranan. Akhir sekali, langkah-langkah untuk memperbaiki struktur landskap kawasan hijau dan skop untuk penyelidikan di masa hadapan bagi kawasan hijau bandar menjalankan fungsi selain daripada fungsi rekreasi dicadangkan sebagai kesimpulan kajian ini.

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$\sqrt{\quad}$ - The mean of the study population

GLOSSARY OF TERMS

DTCP	-	Department of Town and Country Planning
NUP	-	National Urbanisation Policy
KLSP	-	Kuala Lumpur Structure Plan
MBJB	-	Johor Bahru City Council
MNND	-	Mean Nearest Neighbour Distance
LSI	-	Landscape Shape Index
MPS	-	Mean Patch Size

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CHAPTER 1

BACKGROUND OF THE STUDY

1.1 Introduction

An ecosystem is the overall interaction between biotic and abiotic factors in a habitat. Biotic factor is the living organisms such as humans, wildlife, plants and microorganisms that live in a habitat and abiotic factor refers to the non-living things such as the soil, water, air or the environment in which they live. Habitat can be defined as a place where organisms live and get all their needs to live. Therefore, urban area is eligible to be considered as an ecosystem too. The study about ecosystem has always been more focused towards natural ecosystem only. The studies on urban ecosystem becoming more frequent in recent years parallel with sustainable development movement. Urban ecological study is very important where interactions between biotic and abiotic factors can be observed and managed according to landscape ecological principles. Although sustainable development encompasses three main components- environment, social and economy can be considered as the components of our ecosystem, the environment component can be considered as the most prominent as its quality affects greatly on the other two components.

An ecologically stable habitat is needed to ensure our quality of life. In the world that we live in today, a more sustainable urban planning has to be practised as a solution for urban habitat's major problems by providing adequate green space around the city. Green spaces in cities could be used by planners to counter climate-

related threats to biodiversity, as well as to improve flood control and air quality, and reduce urban heat island effects (Wilby and Perry., 2006). Urban area is inevitably could not be 'green' or sustainable without literally being green with abundant of green space. As ecologically sustainable urban area is usually associated with vast greenery.

Therefore, the task of environmentally sympathetic development is arduous because the land use planning, especially in urban areas, is a grueling and complex job, because to strike a balance between development and environment requires a great deal of mental exercise (Ismawi, 2006). Different than them, there are some countries, like the United Kingdom and Malaysia, who have some provisions for protecting the natural resources in their planning legislations supplemented with some independent laws for protection of the environment (Ismawi, 2006). By looking at these problems that a green space should solve, the quality of urban green space is assessed in order to know its level of service based on the landscape ecological principles. As urban green space plays an important role in urban ecosystem, it should have a good quality in order to serve other functions than being a recreational space for the urbanites.

1.2 Background of Problem

The urban area suffers environmental problems such as pollutions, flash floods, urban heat islands, species scarcity which affects the ecosystem health. These problems originate from the consumption of land for development that is usually in the name of human survival. Development is not the only mean to ensure human's ability to survive in their habitat. The environment that human live actually plays a vital role in determining the quality of life and the quality of life ensure the survival of human species. Nevertheless, by not focusing on the survival of human species alone, the ecosystem health also must be in a good condition in order to ensure the survival of all species. The ecosystem health can be measured by the quality of environment; pollution level, frequency of flash flood occurrence, temperature of urban areas. These qualities also depend on the eco-services provided by green spaces around cities. Green space functions as habitats for organisms, providing

oxygen, lowering temperature, strengthening the soil, managing storm water, providing recreational value and improving the living environment. Unfortunately, green space are usually underutilised from performing its fullest potential. Green space in urban areas usually planned for recreational use only. In this modern era, with the sustainable development as a target, green space should become of the tools in mitigating the climate change and many other useful functions that should be optimized by green space. Yet still, it is implied that the existing open spaces are not valued as the city‘s heritage; therefore, the spaces are constantly under threat of land acquisition, changes and modification (Federal Department of Town and Country Planning, 2005). In addition to the matter, the open spaces have also loss their importance to physical development in which, their provision in many developments are usually either compromised for, largely being ignored or merely treated and included as leftover spaces (Mansor, M., 2007).

The pressure of meeting the demands for new housing, offices and transportation networks leads to the exploitation of new areas causing more pressure on the remaining nature in urban areas (Mortberg et.al, 2007). Now, planners have been facing the reality of having to bear the cause of past developments which compromised on the need of having a stable urban ecosystem through providing adequate green space. Green space should not just be preserved but if an area is to be developed into a green space, it has to follow certain criteria according to sustainable urban planning practise. The green space should not be provided merely to fulfil the requirement for development plan’s approval only. It has to fulfil the requirement of being sustainable enough for the city which will make the city more sustainable for the future.

1.3 Problem Statement

In the ever-changing world today that faces the challenge of rapid development especially in the city, the effectiveness and quality of urban green space towards achieving sustainability is still questionable. As according to Tyrvainen (2001) and Neilan (2008) , there is a lack of reliable and robust approaches to the valuation of urban green spaces that effectively support decision making. According

to Gairola and Noresah (2010), as urban green space studies have great significance in the near future in accommodating the increasing urban population and as studies on urban green spaces have not received much attention, more studies should be focused on urban green spaces of Malaysian cities. Green space are not fully-utilized to carry out other functions that will benefit the whole urban ecosystem but rather been focused to serve as recreational space only. Urban green space should be able to perform other functions such as to promote habitat for biodiversity and although it is mostly agreed that green space gives many benefits, yet, green spaces are not evaluated to see whether the design and provisions really aimed and be able to provide those benefits.

1.4 Research Goal and Objectives

This research is aimed to assess the ecological quality of planned green space of Majlis Bandaraya Johor Bahru (Johor Bahru City Council) by using landscape ecological principles. The main objectives of this research are:

i. To assess the ability of urban green space to perform multiple ecosystem services.
ii. To evaluate the quality of the urban green space according to landscape metrics.

1.5 Research Questions

i. What is the quality of current urban green space?

ii. Can the current green space become habitat for biodiversity?

1.6 Study Area

Johor Bahru district is located in the State of Johor at the southern tip of the Peninsula Malaysia and is connected to Singapore by road and rail via a causeway. Being a tropical country, the average temperature is 27^{o}C with high humidity. The minimum range of the mean relative humidity varying from 80% (in February) towards 88% (in November). Johor Bahru has been recognized as the growth centre for the southern part of the Peninsular while Kuala Lumpur in the centre and Pulau Pinang for the northern region. Johor Bahru is separated from Singapore by the Johor Straits and become the main entrance for Singaporeans to come to Malaysia. Johor Bahru is the most rapidly growing city in Johor with a population of 1,159,079 or 42.49 percent of the total population of the Johor State in the year 2000. This study focuses on the areas under Johor Bahru City Council (MBJB) which is one of five local authorities in the District of Johor Bahru. There are fifteen planning blocks under MBJB that constitutes 11.86% (21,551.40 hectares) of the total area of Johor Bahru district which is 181,776.20 hectares. The city center of Johor Bahru under the Planning Block1: Daerah Sentral.

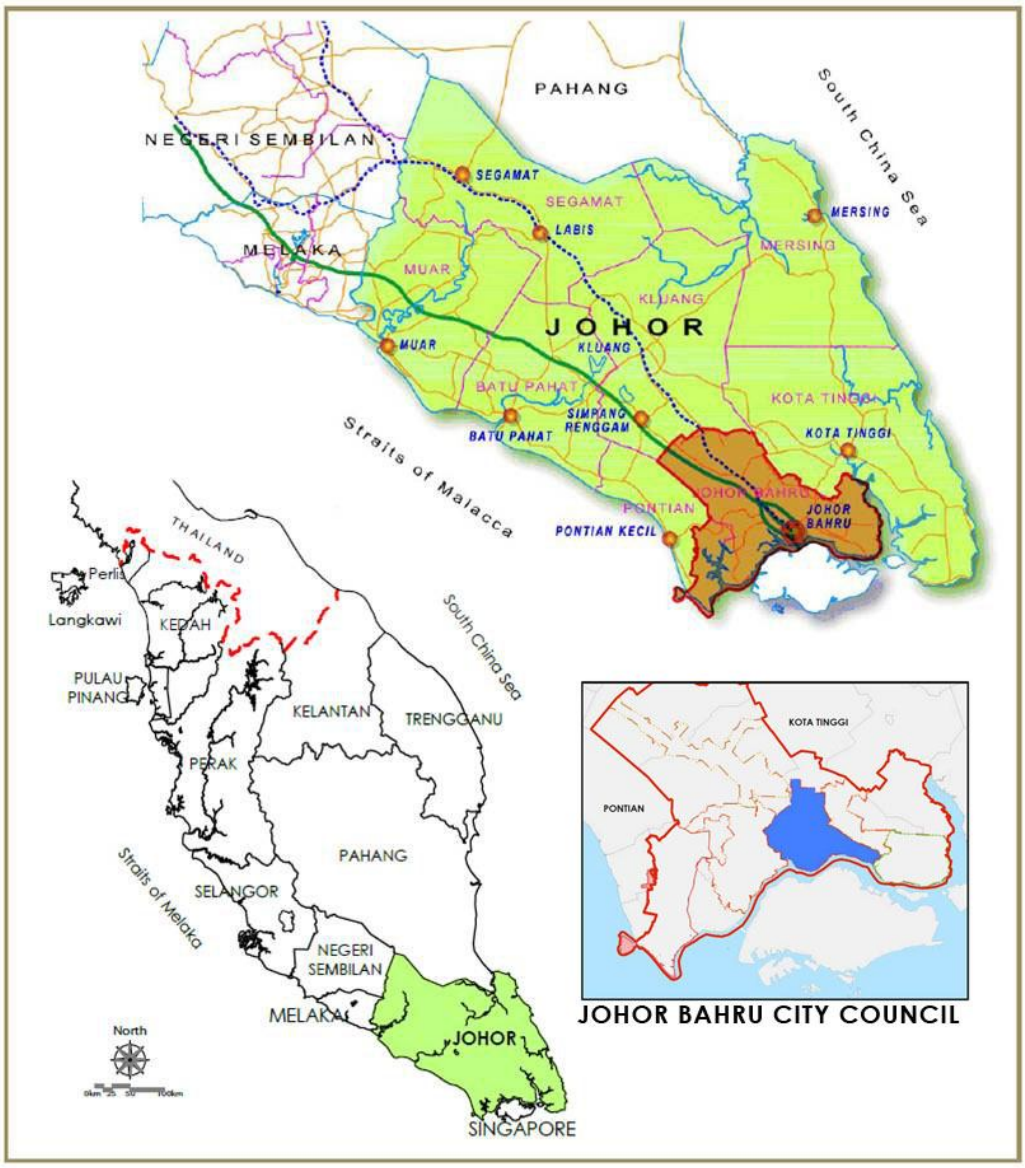

Figure 1.1: The regional context of Johor Bahru City Council.

(Source: Adapted from SJER CDP)

1.7 Scope of Research

The scope of this research is focused on how spatial characteristics of green space are suitable for encouraging the habitat for biodiversity function of green space according to landscape ecological principles. Green spaces which are assessed are planned spaces classified as 'open space' in Johor Bahru District Local Plan only. Data of the green space are obtained through secondary resources such as GIS database from local authority, Johor Bahru District Local Plan 2020, South Johor Economic Region Comprehensive Development Plan and also through observations. Landscape ecological principles are applied in the analyses which are conducted through metrics.

1.8 Significance of Research

The research will show the importance of a good quality green space to the urban environment. The quality of urban green space is evaluated based on landscape ecological principle to show whether urban green space is trusted to serve the urban ecosystem ecologically. The ability for urban green space to perform as habitat for biodiversity is assessed. This research will show the landscape ecological requirements for urban green space to perform the function.

1.9 Research Design

The study uses the principles of landscape ecology to assess the quality of green space in urban area. Although there are many authors who discussed and identified the principles of landscape ecology, the landscape ecological principles used in this study are selected principles which are considered relevant with the context of Johor Bahru besides considering the related statutory requirement on green space development. This will be discussed in Chapter 4: Research Methodology.

1.10 Chapter Outlines

In this study, Chapter 1 explains the direction of this study and the aspects that will be covered by the rest of the chapters and showing the relevance behind conducting this study. Chapter 2 discusses the aspect of urban green space. Chapter 3 examines the landscape ecological concept and principles. Chapter 4 explains about the methods used in the study. Chapter 5 discusses the data and analysis for the assessment of green space of MBJB. Finally, Chapter 6 will summarize and conclude for the study.

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