THE PERCEPTION ON HUMAN THERMAL COMFORT AND MICROCLIMATIC CONDITION IN A PARK WITH DIFFERENT LANDSCAPE DESIGNS

SITI NADIAH BINTI MARIKAH @ YUSOF

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SITI NADIAH BINTI MARIKAH @ YUSOF

FACULTY OF FORESTRY
UNIVERSITI PUTRA MALAYSIA

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By

SITI NADIAH BINTI MARIKAH @ YUSOF

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DEDICATION

For my beloved Parents:

Marikah @ Yusof bin Daud

Noraini Binti Dollah

Also, my siblings:

Siti Aishah, Siti Farah, Mohd Faiz

All my friends:

Thank you for all friends for always support and help.

Thank you for everything. May Allah Bless All of us.

ABSTRACT

The microclimate and human thermal comfort benefits of urban park are important as the environmental conditions will be affected according to surrounding landscape and will consequently affect those who use the park for recreational activities. Therefore, this study aimed to evaluate the influence of different landscape concepts on microclimatic conditions and human thermal comfort perception. The study site was located at Taman Saujana Hijau at Precinct 11, Putrajaya that has three different landscape concepts namely European Garden, English Garden and Oriental Garden. Microclimate parameters including air temperature, relative humidity, solar radiation and wind speed were measured with 20 sampling points which were established at each garden. ANOVA analysis showed that there were significant differences between microclimate parameters in different landscape concepts suggesting that adding trees and more species to provide better thermal comfort of park users. For human thermal comfort perception measurement, 107 questionnaires were distributed and analyzed by linear regression analysis. The result from regression analysis showed that the park achieved the neutral human thermal comfort thus suggesting that the visitors were thermally satisfied with the environment condition of the English Garden. In addition, the microclimate parameters were clearly greater during noon compared to evening due to heat released. The results from this study will be beneficial for the urban park managers and stakeholders with respect to landscape designs for example, by adding more trees to improve microclimate.

ABSTRAK

Manfaat iklim mikro dan iklim terma manusia di taman bandar adalah penting kerana keadaan persekitaran akan terjejas mengikut landskap sekitarnya dan seterusnya akan memberi kesan kepada mereka yang menggunakan taman untuk aktiviti rekreasi. Oleh itu, kajian ini bertujuan untuk menilai pengaruh konsep landskap yang berlainan terhadap keadaan mikroklimatik dan persepsi keselesaan terma manusia. Tapak kajian ini terletak di Taman Saujana Hijau di Precinct 11, Putrajaya yang mempunyai tiga konsep landskap yang berbeza iaitu Taman Eropah, Taman Bahasa Inggeris dan Taman Oriental. Parameter mikroklimatik termasuk suhu udara, kelembapan relatif, sinaran suria dan kelajuan angin diukur dengan 20 titik pensampelan yang ditubuhkan di setiap taman. Analisis ANOVA menunjukkan terdapat perbezaan yang signifikan antara parameter mikroklimat dalam konsep landskap yang berbeza yang menunjukkan bahawa menambahkan pokok dan lebih banyak spesies untuk menyediakan keselesaan terma pengguna taman yang lebih baik. Untuk pengukuran persepsi keselesaan terma manusia, 107 sampel soalan diedarkan dan dianalisis dengan analisis regresi linier. Hasil daripada analisis regresi menunjukkan bahawa taman itu mencapai keselesaan termal manusia yang neutral dengan itu menunjukkan bahawa pelawat berpuas hati dengan keadaan persekitaran Garden English. Di samping itu, parameter mikroklimat jelas lebih tinggi pada waktu tengah hari berbanding petang kerana haba dikeluarkan. Ini hasil dari kajian ini akan memberi manfaat kepada pengurus taman bandar dan pihak berkepentingan berkenaan dengan reka bentuk landskap sebagai contoh, dengan menambah lebih banyak pokok untuk meningkatkan iklim mikro.

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APPROVAL SHEET

I certify that this research project report entitled "The Perception on Human Thermal Comfort and Microclimatic Condition in A Park with Different Landscape Designs" by Siti Nadiah Binti Marikah @ Yusof has been examined and approved as a partial fulfilment of the requirements for the degree of Bachelor of Forestry Science in the Faculty of Forestry, University Putra Malaysia.

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Dr. Ruzana Adibah Mohd Sanusi
Faculty of Forestry
Universiti Putra Malaysia
(Supervisor)

____

Prof. Dr. Mohamed Zakaria Bin Hussin
Dean
Faculty of Forestry
Universiti Putra Malaysia

Date:

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PMV	Predicted Mean Value
HTC	Human Thermal Comfort
SPSS	Statistical Package for Social Science
ANOVA	Analysis of Variance

CHAPTER 1

INTRODUCTION

1.1 General Background

Urban Park with different landscape designs that consists of different landscape elements such as trees and other vegetation may provide different microclimate benefits such as air temperature, solar radiation and wind velocity reductions and increase relative humidity (Streiling & Matzarakis, 2003). Different landscape designs that consist of different landscape elements such as building infrastructures, trees and other vegetation may provide different microclimate benefits (Nowak & Heisler, 2010). Moreover, different landscape elements can influence human thermal comfort (HTC) (Matzarakis *et a*l., 2015). HTC benefit to users is also important since urban park is commonly used as recreation area. Tree canopies are able to modify to microclimatic environments because of reflection and absorption of solar radiation and control wind speed and improve HTC (Lin *et al*., 2010).

Tree is one of the landscape components of a park (Oke, 1989). Tree helps in the cooling of urban areas through shading and evapotranspiration process. The presence and orientation of trees in park are impacting the microclimate of the environment (Harbich *et al*., 2015). Moreover, parts of tree such as leaves and branches are able to block solar radiation so that only a small amount of solar reaches the area below the canopy of a tree, resulting in low surface temperatures below the canopy of the tree (Oke, 1989). With cooler ground surfaces, heat transmitted into buildings and the atmosphere, can be reduced (Gaitani *et a*l., 2011).

The presence of trees in park are impacting the microclimate of the environment (Harbich *et al*., 2015) such as air temperature, relative humidity, solar radiation and wind velocity and helps in the cooling of urban areas through shading and evapotranspiration process (Streiling & Matzarakis, 2003). Trees which is single arranged, improved the direction and velocity of wind (Bardisy *et al*., 2015). Hence, the thermal comfort of a person is affected after adding trees, regardless its type, decreases the wind velocity due to the dragging force of the densely trees linear arrangement (Streiling & Matzarakis, 2003). The tree provides benefits in the microclimate and human thermal comfort by lower temperatures and higher relative humidity (RH) values (Harbich *et al*., 2015).

1.2 Problem Statement and Justification

In recent years, the urbanization is the critical necessity of creating more outdoor spaces for leisure and recreation activities of citizens. The thermal conditions and the thermal comfort of users have not been fully explored in outdoor environments in hot and humid climate. This fact explains the need for considering human thermal comfort (HTC) in outdoor spaces with such climates (Bardisy et al., 2015). It is a necessity to create more outdoor spaces for leisure and recreation activities of citizens.

Microclimate has a significant influence on the use of outdoor spaces. Air temperature, solar radiation, and wind speed are shown to be the most significant factors to human thermal comfort (HTC) (Cheng, 2012). Microclimate and HTC benefits of outdoor spaces are important because the environmental conditions will be affected according to the surrounding landscape and will consequently affecting those who use the green spaces for recreational activities (Ren *et al*., 2011). For example, impermeable surfaces, evapotranspiration of plants manufactured objects and trees significantly gave impacts to the HTC (Matzarakis *et al*., 2010).

Putrajaya is a strategic model concept city and administrative capital of Malaysia. It is built to reflect the country's commitment to green environment (Salleh *et al*., 2012). Besides, many people conducting leisure activities at the parks in Putrajaya. One of the most visited parks in Putrajaya especially during weekend and public holidays for recreational purposes is Taman Saujana Hijau. This park however, has three different landscape concepts. Therefore, it is necessary to investigate how the different landscape concepts influence the microclimate condition of the park. Moreover, as this park is highly used by the urban residents, it is also important to look at human thermal comfort (HTC) perception of the users of this park to give some insight on how recreational park can influence the thermal comfort satisfaction of the park users.

Microclimate and human thermal comfort (HTC) benefits of the park are important because these benefits will be influenced by the surrounding landscapes. Consequently, it affects those who use the area for recreational activities (Ren, 2011). Different park landscapes may contribute to different microclimate benefits. Park is used by the urban residents hence it is important to look at HTC perception. This will give some insights on microclimate benefits of different landscapes and how it influences the HTC perceptions of the users.

1.3 Objectives

Therefore, the objectives of this study were:

i. To evaluate the influence of different landscape concepts on microclimatic conditions of Taman Saujana Hijau, Putrajaya.
ii. To assess the user's perception on human thermal comfort of Taman Saujana Hijau, Putrajaya.

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