THE INFLUENCE OF URBAN HEAT TOWARDS PEDESTRIAN COMFORT AND THE POTENTIAL USE OF PLANTS AND WATER AS HEAT AMELIORATOR IN KUALA LUMPUR CITY CENTRE AREA

By

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Kuala Lumpur, like other cities in a tropical environment faces serious environmental degradation of urban heat island, atmospheric pollution, traffic congestion and high energy consumption due to its rapid development and urbanisation. Unlike cities with a cool temperate climate and made worse by being in a valley set up, Kuala Lumpur outdoor living comfort is seriously affected by accumulation of heat and generation of dust and smoke. All these have resulted in a decrease in outdoor living comfort and quality, making outdoor life quite miserable, deterioration in public health and is even life threatening.

This thesis aims to provide a basis for understanding and create awareness on the importance of comfortable outdoor living environment for comfortable human life and living with serious attention on issues of urban heat and the effective use of natural elements such as plants and water as heat ameliorator. This will hopefully be a new tool to the city managers, planners, architects, engineers and even landscape architects to integrate the concern of their built environment with sustainable natural

landscape development toward sustainable and comfortable outdoor living environment.

This thesis is based on data obtained from survey questionnaires, site observations, field measurements and professional interviews. The data were analysed as to determine the needs and preferences of the outdoor users towards their outdoor comfort. Interviews were being justified through site observations and field measurements. Relevant professional groups were interviewed to gauge their understanding and views on their current approaches in planning, designing and managing the city outdoor environment.

The results showed that the temperature and humidity readings taken at vegetated and densely built-up areas in Kuala Lumpur city, showed a difference of an increase of 5°C to 8°C temperature and a reduction of 10% to 14% humidity. The general public displayed a lack of understanding and awareness on the impact of heat to their outdoor comfort. The professionals gave priority to requirements and guidelines in their own professional area rather than looking at the urban environment in total during the designing and implementation stage.

The research recommends continuous massive tree-planting programmes, encouragement of more vertical landscape or rooftop gardens and more moving water features to be the basis to ameliorate the urban heat while the professionals should integrate the their built environment with sustainable natural eco system. Political leaders, policy makers and the public need to understand and be more aware of the issue of the outdoor living comfort and how nature can help to comfort mankind and sustain a good outdoor living environment.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

PENGARUH HABA BANDAR KEARAH KESELESAAN PEJALAN KAKI DAN PENGGUNAAN BERPOTENSI TUMBUH-TUMBUHAN DAN AIR SEBAGAI PEMBAIK HABA DI KAWASAN PUSAT BANDAR KUALA LUMPUR

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Kuala Lumpur, seperti bandaraya lain dalam iklim tropika menghadapi degradasi persekitaran yang lebih serius jika dibandingkan dengan bandaraya yang beriklim sederhana sejuk. Keadaan persekitaran seperti kepulauan haba bandar, pencemaran udara, kesesakan lalu lintas dan penggunaan tenaga yang banyak adalah disebabkan oleh pembangunan pesat dan proses perbandaran.

Kedudukan bandaraya Kuala Lumpur di kawasan lembah menjadikan keadaannya lebih teruk. Keselesaan hidup di kawasan luaran di Kuala Lumpur terjejas dengan teruknya oleh pengumpulan haba, penjanaan habuk dan asap. Kesemua perkara ini telah mengakibatkan kehidupan di kawasan luaran menjadi kurang selesa dan sengsara, penurunan kualiti hidup dan kesihatan dan mengancam kehidupan.

Tesis ini bertujuan untuk menyediakan asas bagi kefahaman dan mewujudkan kesedaran tentang pentingnya persekitaran hidup di kawasan luaran yang selesa bagi manusia dan kehidupannya dengan memberi perhatian serius tentang isu haba dan

penggunaan unsur-unsur semula jadi yang berkesan seperti tumbuh-tumbuhan dan air sebagai elemen pembaik haba. Ini diharapkan akan menjadi alat baru kepada pengurus bandar, perancang, arkitek, jurutera dan malahan arkitek landskap untuk mengintegrasikan kepentingan persekitaran yang dibina dengan pembangunan landskap semula yang mapan bagi mencapai persekitaran luaran yang selesa dan mapan.

Tesis ini berdasarkan data yang diperolehi daripada tinjauan soal selidik, pemerhatian ditapak, pengukuran di tapak dan temubual dengan para profesional. Data telah dianalisa untuk menentukan keperluan dan kecenderongan pengguna di persekitaran luaran ke arah keselesaan mereka. Temubual kemudiannya dijustifikasikan melalui pemerhatian dan pengukuran tapak. Sementara keputusan temubual dengan profesional membantu menetapkan pendekatan bersepadu di dalam perancangan, rekabentuk dan pengurusan persekitaran luaran bandar.

Hasil kajian menunjukkan pembacaan suhu dan kelembapan di antara kawasan bertumbuhan hijau dan kawasan terbangun bertepu tinggi di sekitar Kuala Lumpur mewujudkan pembezaan peningkatan suhu di antara 5°C hingga 8°C dan penurunan kelembapan di antara 10% hingga 14%. Sementara orang ramai didapati kurang kefahaman dan kepekaan terhadap impak haba bandar terhadap keselesaan persekitaran mereka. Para profesional pula didapati memberi lebih keutamaan bagi memenuhi kehendak dan peraturan profesion masing-masing daripada menyelesaikan masalah persekitaran secara keseluruhan semasa peringkat rekabentuk dan implementasi.

Kajian mencadangkan bahawa program penanaman pokok secara besar-besaran, landskap menegak di bangunan, taman atas bumbung, elemen arca air bergerak wajib di perbanyakkan sebagai kaedah dan pendekatan semulajadi dan berkesan untuk mengatasi masalah haba bandar. Manakala para profesional patut mengintegrasikan kepentingan persekitaran yang dibina mereka dengan ekosistem semulajadi yang mapan. Pemimpin politik, para pembuat dasar dan orang ramai wajib memahami isu ketidakselesaan hidup di persekitaran luaran dan bagaimana alam semula jadi dapat membantu memberi keselesaan kepada manusia sejagat dan mengekalkan persekitaran luaran yang mapan.

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I certify that an Examination Committee met on 8th November 2004 to conduct the final examination of Siti Zakiah bte Mohammed on her Master of Science thesis entitled "The Influence of Urban Heat Towards Pedestrian Comfort and the Potential Use of Plants and Water as Heat Ameliorator in Kuala Lumpur City Centre Area" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

_____

SITI ZAKIAH BTE MOHAMMED

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LIST OF ABBREVIATIONS

CHKL	-	City Hall Kuala Lumpur
Etc.	-	Etcetera
L. S. T	-	List Standard Time
m	-	Metre
No.	-	Number
URTI	-	Upper respiratory tract infection
°C	-	degree Celsius
%	-	Percentage

GLOSSARY OF TERMS

Within this study, several terminologies will be used to explain the meaning of these terms in the context of the research wherever applicable.

Comfort - Comfortable weather for walking. Comfort will be the function of individual perception, expectation and needs which depend on individual physiological (elements of noise and pollution) and psychological (mental) responses to the environment.

Outdoor user - One who uses the external area or surrounding.

Outdoor living - Area (world) occupied for various activities of work, play, leisure, entertainment etc., outside of houses or any buildings.

Pedestrian - People who uses the outdoor spaces only, specifically the walkway areas and those who were involved during the survey questionnaires and interviews.

User comfort - A positive emotional reaction to external surroundings and situation including physiological, physical and psychological reaction.

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   - Webster's Encyclopedia Unbridged Dictionary of the English Language.

CHAPTER 1

INTRODUCTION

In the beginning of the twentieth century, 14% of the world inhabitants lived in the cities. As cities fast become humanity's premier habitat, the challenge of the future is to give people a sense of existential security and comfort. Cities should become socially, economically and ecologically sustainable fulfilling basic human needs for shelter, subsistence, social cohesion and living comfort (Herbert, 1997). According to Nordin (2003), cities are developed to bring prosperity and comfort in terms of physical, social or psychological to man's living. Cities would not be fulfilling their vital function if they fail to provide a healthy environment for their inhabitants. A successful city can be described as a city which meets multiple goals such as good standard of living, high quality environment and good health including outdoor living comfort (Herbert, 1997).

However as urbanisation moves and takes place steadily, the impact is seen in the changes to the physical city environment, such as the 'concrete jungle' which is taking place rapidly and progressively in the urban areas together with other infrastructure developments. This creates a tendency towards city environmental degradation and problems such as heat, dust and air pollution through industrial, vehicles and anthropogenic activities ranging from house, workplace and to the outdoor space.

Development is absolutely necessary for the progress of any city. As the city develops the size of the city will increase as it accommodates the increasing city population.

This will result in more of the natural landscape within the city area to be replaced with built hard surfaces as to provide more facilities to its city dwellers (Nordin, 2003). This massive conversion or urban morphology, taking place without proper consideration being accorded to its negative side effects on the existing natural environment, will only lead to urban discomfort and low living quality. Public using the outdoor spaces will be the immediate entity and prime victims of these negative impacts. Not only from the environmental degradation surrounding them, but also the microclimate that can totally change from its natural state due to urbanisation. Therefore, rapid development if not controlled will upset a city's microclimate and its environment.

The modified climate impact is prone in areas such as the city centre. This area is normally densely populated with massive development to cater for all kinds of daily activities. This is also an area which becomes a central point for people using the outdoor and indoor spaces; where they congregate, meet, crowd and carry out their daily activities. Thus climate is one of the most influential factors that determine human comfort level in public areas and their social life as well. Many researchers have indicated that urbanisation has altered the city climate (Sham, 1987; Shaharudin 1997; Nordin, 2003). This is made worst in most hot humid cities like Kuala Lumpur, Bangkok and Jakarta where climatic changes bring about the urban heat and atmospheric pollution with reduced humidity and the air is polluted with dust and pollutants and the surrounding temperatures increase.

This is expressed by Sham (1983) that stagnant atmospheric condition of the heat also trap pollutants in the urban areas and add the stress of severe pollution to the already

stressing hot weather, can create health problems of undiscovered dimension. Sham (1986) further added that tall buildings, the concrete and asphalt of the city absorb and store greater quantities of solar radiation than do the vegetation and soil typical of rural area. The urban heat island phenomenon had been addressed since the early 19th century and by many (Chandler, 1964, 1965; Peterson; 1969, Oke, 1974, 1979, 1982) as quoted by Sham (1974, 1983, 1987 and 1993).

The physical properties of the city surfaces are impermeable. With rapid rainfall, the quick run-off of water results in severe reduction in evaporation. This radical change in the physical surfaces according to Sham (1987) cause an increase of 10°C observed in the city areas as compared to rural areas. Added to this, domestic household sources such as home heating and air conditioning, paved surfaces; industry and transportation have intensified the release of greenhouse gases and increased the consumption of energy.

Increase of greenhouse gases in the atmosphere, produces a big impact to the city environment especially the urban outdoor living environment. Compared to the indoor living environment, the outdoor living environment is considerably unpleasant as the indoor living is easily controlled by air conditioning or heating to decrease or increase room temperatures (Nordin, 2003). The outdoor environment cannot be controlled because it becomes part of the area exposed directly to the climatic condition. The city heat becomes more severely felt on very hot days and is very stressing water vapour evaporates very fast and make the surrounding air dry and hot. To make worse, these cities when planned, seldom put planting trees and water feature in mind and usually the last issue of concern resulting in harsh, hot and polluted cities (Salleh

and other 1990). Though cities are landscaped, the intention is mainly for beautification, as an attraction and pleasing the eyes. Thus landscape environment is an important issue that directly affects the life and living of mankind. If this is not tackled wisely in the modified city environment, it can caused life and living to become miserable, uncomfortable and life threatening as well (Nordin, 2003).

Plants and water are natural ways of arresting city heat build up. This is convinced by Nordin (2003) that in the tropical zones where temperatures are very hot, vegetation particularly trees play a major role as climate ameliorator where they help build up the high humidity that helps in cooling the area. Water on the other hand is an effective tool in maintaining a good refreshing air quality and as heat absorber (Hubbard, 2003). Combining trees and water elements with concrete landscape should be the main concern for a sustainable outdoor living comfort.

The need to understand that a sustainable outdoor city environment is important for the people using the outdoor spaces is crucial for city that sprawls rapidly. These people using the outdoor spaces are the main living entity that makes a city alive and vibrant. Therefore their outdoor living comfort should be addressed to ensure man's comfortable living. This will further help to create a stable man and ensure the sustainability of mankind (Nordin, 2003). A need for a well planned design and management of landscape is a very important agenda for city outdoor environment. Thus bigger commitment from all levels of management, practitioners and individuals should be the main tool towards a sustainable outdoor city environment. This help to alleviate human being uncomfortable feeling due to heat.