



**VISUAL PREFERENCE OF AESTHETIC QUALITY FOR PERMANENT
FOREST RESERVE IN URBAN KLANG VALLEY, MALAYSIA**

By

ALSAMMRRRAIE RIYADH MUNDHER SAMEEN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

March 2024

FRSB 2024 1

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment
of the requirement for the degree of Doctor of Philosophy

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March 2024

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Malaysia has experienced significant forest cover loss due to logging and urban development, particularly in urban areas. Although legislation for Permanent Forest Reserves (PFRs) exists, it lacks inclusivity, especially considering visual aesthetics as a crucial component of forest preservation. This omission has created gaps in public engagement, cultural appreciation, and emotional connections with these natural spaces, reducing the perceived value of PFRs among the public and policymakers and increasing the risk of degradation. This study addresses this gap by establishing a visual aesthetic quality assessment framework specifically tailored to PFRs in Klang Valley, Malaysia, using a converging approach that integrates public preferences and expert opinions. The framework involves two complementary approaches: the perception approach and the expert approach. The perception approach identifies suitable variables using the Participant-Generated Image (PGI) method, where participants capture images of visually appealing scenes, which are then classified by content. The expert approach determines the importance and weight of each variable through expert surveys and the Analytical Hierarchy Process

(AHP). This study provides valuable insights into assessing and enhancing urban forests to meet local communities' aesthetic expectations by identifying key variables and evaluating their significance and weight. The resulting framework uniquely measures visual aesthetic quality by considering variables with different weightings rather than assuming equal importance for all variables. As the first comprehensive framework to assess visual aesthetics with variable weightings, it offers a practical tool for sustainable management and planning, helping to protect areas with high aesthetic value and suggesting improvements for those with lower appeal. Ultimately, the study's findings support a more inclusive conservation strategy that emphasizes aesthetics, ensuring the framework is comprehensive and adaptable to the diverse aesthetic needs of urban populations in Malaysia.

Keywords: Visual Preference, Aesthetic Assessment, Aesthetic Quality, Urban Forest Preservation

SDG: GOAL 11: Sustainable Cities and Communities, GOAL 15: Life on Land

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**KEUTAMAAN VISUAL TERHADAP KUALITI ESTETIK UNTUK HUTAN
SIMPAN KEKAL DI KAWASAN BANDAR LEMBAH KLANG, MALAYSIA**

Oleh

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Malaysia telah mengalami kehilangan litupan hutan yang ketara akibat pembalakan dan pembangunan bandar, terutamanya di kawasan bandar. Walaupun wujud perundangan bagi Hutan Simpan Kekal (HSK), ia kurang inklusif, terutamanya dalam mempertimbangkan estetik visual sebagai komponen penting dalam pemeliharaan hutan. Pengabaian ini telah mewujudkan jurang dalam penglibatan awam, penghargaan budaya, hubungan emosi dengan ruang semulajadi, seterusnya mengurangkan nilai HSK dikalangan orang awam dan pembuat dasar serta meningkatkan risiko kemerosotan. Kajian ini menangani jurang tersebut dengan membentuk rangka kerja penilaian kualiti estetik visual yang khusus untuk HSK di Lembah Klang, Malaysia, dengan menggunakan pendekatan menumpu yang mengintegrasikan keutamaan awam dan pendapat pakar. Rangka kerja ini melibatkan dua pendekatan yang saling melengkapi: pendekatan persepsi dan pendekatan pakar. Pendekatan persepsi mengenal pasti pemboleh ubah yang sesuai menggunakan kaedah Imej Janaan Peserta (PGI), di mana peserta mengambil gambar pemandangan yang menarik secara visual, yang kemudiannya

diklasifikasikan mengikut kandungan. Pendekatan pakar menentukan kepentingan dan pemberat setiap pemboleh ubah melalui kaji selidik pakar dan Proses Hierarki Analitik (AHP). Kajian ini memberikan pandangan berharga dalam menilai dan meningkatkan hutan bandar untuk memenuhi jangkaan estetik masyarakat tempatan dengan mengenal pasti pemboleh ubah utama dan menilai kepentingan serta pemberat mereka. Rangka kerja yang terhasil mengukur kualiti estetik visual secara unik dengan mempertimbangkan pemboleh ubah dengan pemberat berbeza berbanding mengandaikan kepentingan yang sama untuk semua pemboleh ubah. Sebagai rangka kerja komprehensif pertama untuk menilai estetik visual dengan pemberat pemboleh ubah, ia menawarkan alat praktikal untuk pengurusan dan perancangan mampan, membantu melindungi kawasan dengan nilai estetik tinggi dan mencadangkan penambahbaikan untuk kawasan yang kurang menarik. Akhirnya, penemuan kajian ini menyokong strategi pemuliharaan yang lebih inklusif dengan menekankan aspek estetik, memastikan rangka kerja ini komprehensif dan boleh disesuaikan dengan keperluan estetik penduduk bandar yang pelbagai di Malaysia.

Kata Kunci: Keutamaan Visual, Penilaian Estetik, Kualiti Estetik, Pemeliharaan Hutan Bandar

SDG: MATLAMAT 11: Bandar dan Komuniti Mapan, MATLAMAT 15: Kehidupan Darat

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LIST OF ABBREVIATIONS

PFR	Permanent Forest Reserve
FDPM	Forestry Department of Peninsular Malaysia
NFP	National Forest Policy
NFA	National Forestry Act
MENR	Ministry of Energy and Natural Resources
SMS	Scenery Management System
VMS	Visual Management System
UFVC	Urban Forest Visual Character
UFVQ	Urban Forest Visual Quality
D	Dimension
LCG	Locational Center of Gravity
PGI	Participant Generated Image
AHP	Analytical Hierarchy Process
AHP-OS	AHP Online System
Dmv	Difference mean value
Hmv	Highest mean value
Lmv	Lowest mean value
Lv	Level of important value
GNU	GNU Octave tool
CR	Consistency Ratio
CI	Consistency Index
RI	Random consistency Index
λ max	principal eigenvalue
W	Weightage normalization
RW	Raw Weightage

MaxRW

Maximum Raw Weightage

v

normalized integer values



CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter offers a comprehensive overview of the research structure, encompassing the presentation of the research context and background that form the foundation of the issue being investigated, as well as the formulation of the research problem. Moreover, it addresses the research aim, which is further supported by objectives and relevant questions.

Furthermore, this chapter provides a concise description of the research methodology. It also outlines the scope of the research and delves into the significance of the study, elaborating on its potential impact and value in the relevant field. Lastly, it presents an organized outline for the thesis, serving as a guide for readers as they navigate through the subsequent chapters.

1.2 Research Context and Background

In recent years, increasing urbanization and changes in land use have led to a decline in urban green spaces. Urban forests, in particular, have been the most affected, with significant losses in forest cover over time. This decline is primarily due to the conversion of forest land for non-forest uses, such as agriculture, industry, mining, road construction, urban expansion, and residential development (Feeley et al., 2012; Jusoff and Setiawan, 2003; Levy-Tacher et al., 2019; Reygadas et al., 2023). The reduction in urban forest areas has contributed to various environmental issues affecting people, turning cities into residential zones lacking visual aesthetics

(Elmahdy and Mostafa, 2013; Kanniah et al., 2016; Kanniah et al., 2014; Tayyebi et al., 2018). Therefore, without serious intervention, the cities and their long-term survival could be jeopardized (Heidarlou et al., 2019; Minaei et al., 2018; Sánchez-Cuervo et al., 2012). Despite many widespread consequences of forest loss, natural forests are still being cleared to accommodate the needs of urban expansion and other human activities (Kanniah et al., 2015; Tan et al., 2010).

In Malaysia, forested areas of Peninsular Malaysia cover 5.69 million ha, which is equivalent to 44% of the land area. From the total forested areas, 4.81 million ha are designated Permanent Forest Reserves (PFR) or Wildlife Reserves, including Taman Negara (The National Park). The forest area, however, has been cleared mainly for conversion into agricultural lands, mining activities, recreational and industrial development, and indiscriminate logging, especially in the lowlands where only patches of primary forest remain. In the state of Kelantan, the rate of deforestation was approximately 2.3% per year, with 73,236 ha of PFR converted to non-forested uses within eight years (1989-1997) (Geist and Lambin, 2002; Jusoff and Setiawan, 2003). In addition to excessive logging and extensive agricultural activities, another main reason for the loss of forest areas is due to the sprawl of urbanization (Levy-Tacher et al., 2019). In 2020, due to the fast population and economic growth, the urbanization rate of Malaysia reached 78%, leading to the loss of forests. According to World Population Prospects, Malaysia's population is projected to increase to more than 40 million by 2050, which is approximately 85 % of the population will be living in urban areas (Kanniah, 2017; Kanniah and Siong, 2017; Mon et al., 2012). Also, the Permanent Forest Reserves (PFR) in Kuala Lumpur has experienced a significant decline of approximately 50% since its establishment in the early 20th

century due to the fast population and economic growth (Kanniah, 2017). The data from government statistics on Malaysia's permanent forest reserve have shown that forest reserve areas are declining despite being protected under the existing legislation. The same pattern can also be observed for forest areas not subject to the same legal protection as permanent forest reserves. Statistics reported by the Forestry Department of Peninsular Malaysia (FDPM) indicated a shortage of 0.10 million hectares (100 thousand hectares) of permanent forest reserve area between 2011 and 2020 (FDPM, 2020). The decline in permanent forest reserves appears to be continuing for several reasons, the most important of which is the gap in forest protection laws and the difficulty of implementing these laws (Kanniah, 2017; Kanniah and Siong, 2017). All these factors have contributed to continuous land-use change, leading to the loss of permanent forest reserves, especially in urban areas; the impact of these factors has made forest preservation efforts even more difficult (Adhikari et al., 2017; Ngo Bieng et al., 2021; Pijanowski et al., 2014; Stefanidis et al., 2016).

Despite ongoing efforts to conserve Permanent Forest Reserves (PFR) in Malaysia, including the establishment of laws and comprehensive monitoring and assessment, a gap remains in their preservation strategy. The preservation assessments focus outlined by the Forestry Department of Peninsular Malaysia primarily addresses ecological, economic, recreational/social, and research/educational aspects. Still, it neglects the visual aesthetic aspect, which is a crucial motivator for PFR preservation. However, Golivets (2011) emphasized the importance of visual aesthetic assessments in the management and preservation of urban forests. By ensuring that these spaces are visually appealing, aesthetic assessments foster greater

public support and engagement, leading to active involvement in conservation efforts (Rosley et al., 2024). They also guide urban planners in integrating green spaces into city designs that balance functionality with natural beauty, contributing to the creation of harmonious urban environments (Barron et al., 2016; Zheng et al., 2019). Furthermore, visually appealing urban forests offer significant psychological benefits, such as stress reduction and mood enhancement, underscoring the importance of maintaining these spaces for the well-being of city residents (Reyes-Riveros et al., 2021). The recognition of urban forests as beautiful encourages a culture of environmental stewardship, driving the protection and preservation of these valuable areas. Additionally, the economic value of urban forests is amplified through their aesthetic appeal, attracting tourists, increasing property values, and stimulating investment (Kim et al., 2021). Thus, the loss of forests, particularly in urban areas, is closely linked to the need to focus on aesthetics because visual appeal plays a significant role in how people perceive and value natural environments. When forests lose their aesthetic qualities, they are often seen as less valuable or less worthy of preservation by the public and policymakers. This diminished perception can lead to a lack of public support for conservation efforts, making it easier for these areas to be repurposed for other uses, such as infrastructure development or urban expansion. Therefore, focusing on aesthetics is not merely about making forests look good; it is about ensuring they are perceived as valuable and irreplaceable components of the urban landscape. By incorporating visual aesthetics into conservation strategies and legislation, we can strengthen the case for preserving these critical areas, ensuring they remain integral to the urban environment both ecologically and culturally. This approach can lead to more effective conservation outcomes and prevent further loss of forested areas in urban areas, Malaysia. Finally,

in Table 1.1, the justifications and examples demonstrate the multifaceted importance of aesthetics in the sustainability and preservation of urban forests.

Table 1.1 : Justifications and Examples that Demonstrate the Role of Visual Aesthetics in the Preservation of Urban Forests

Visual Aesthetics Role	Justifications	Examples
Enhancing Public Engagement	People are more likely to support and engage with urban forests that are visually appealing. When the aesthetic quality of an urban forest is high, it attracts more visitors, leading to greater public interest and involvement in its preservation.	The High Line in New York City, an elevated urban park, is celebrated for its visual appeal, which has transformed it into a popular public space and strengthened community support for green initiatives.
Guiding Urban Planning and Development	Aesthetic assessments help urban planners integrate green spaces into city designs that enhance the overall visual landscape. By prioritizing aesthetically pleasing forested areas, planners can create balanced urban environments that combine functionality with natural beauty.	In Singapore, the "City in a Garden" concept incorporates aesthetically pleasing urban forests and parks throughout the city, blending nature with urban infrastructure to create an attractive and sustainable environment.
Supporting Mental and Emotional Well-being	Visually appealing urban forests provide psychological benefits, such as reducing stress and improving mood. Aesthetic assessments ensure that urban forests are designed and maintained to maximize these benefits for city residents.	Studies show that residents living near visually attractive green spaces, like Vancouver's Stanley Park, experience better mental health and well-being, emphasizing the importance of aesthetics in urban forest design.
Promoting Environmental Stewardship	People who perceive urban forests as beautiful are more likely to value and protect them. Aesthetic assessments highlight the importance of maintaining and enhancing the visual qualities of these spaces, fostering a culture of environmental stewardship.	The preservation of historic oak trees in cities like New Orleans is often driven by their iconic beauty, which plays a key role in community-led conservation efforts.
Economic Benefits	Aesthetic qualities can increase the economic value of urban areas by attracting tourists, boosting property values, and encouraging investment. Visual aesthetic assessments help identify and enhance these economic benefits.	London's Hyde Park's aesthetic draws millions of visitors each year and contributes to the high real estate values in surrounding areas, illustrating the economic impact of aesthetically pleasing urban forests.

1.3 Problem Statement

Urban forests are invaluable national assets, and nations worldwide are committed to finding effective ways to preserve them. As a result, many countries have enacted regulations aimed at protecting natural forests, especially in urban areas. However, the rapid increase in population, urbanization, and economic activities has put significant pressure on local governments to meet the demands for new infrastructure and economic development. This often involves converting urban forests and natural areas into buildings, roads, and other developments, leading to substantial forest loss. Despite the existence of robust policies and guidelines for forest protection and management, the rate of forest loss remains alarmingly high, particularly in highly urbanized regions like Klang Valley, Malaysia (Kanniah, 2017). Malaysia has made significant efforts to preserve its forests, including the establishment of the Permanent Forest Reserve (PFR) legislation by the Forestry Department of Peninsular Malaysia (FDPM) under the National Forestry Act of 1984. This legislation aims to protect and manage natural forests by designating them as permanent forest reserves. However, as McMorrow and Talip, (2001) highlight, the effectiveness of these preservation efforts is often undermined by political decisions that prioritize economic gains over conservation. Despite being in place for over 40 years, the Malaysian forest legislative policy is criticized for being less inclusive and failing to address the complexities of forest conservation fully (Wan Talaat et al., 2012). The absence of comprehensive and inclusive policies continues to be a significant challenge in effectively protecting forest areas (Heidarlou et al., 2019; Li et al., 2013; Robalino et al., 2015).

A critical shortcoming of the current legislation is its focus on ecological, economic, social, and educational aspects, while neglecting other important factors such as visual aesthetics. Visual aesthetics have long been recognized as a powerful motivator for the protection of natural areas (Golivets, 2011). Despite this, the aesthetic value of forests has not been fully integrated into forest management strategies. Sheppard (2001) stressed the importance of considering aesthetics alongside other environmental values, particularly in projects with significant landscape impacts. Mazurczyk et al. (2018) also emphasized that visual aesthetic value is crucial for landscape conservation planning. The influence of visual aesthetics on public attitudes towards forest sustainability is profound, underscoring the need to incorporate aesthetic considerations into forest management practices to preserve PFRs effectively. Contrarily, the absence of a structured approach to assessing and integrating visual aesthetics into forest management is a critical gap in the current preservation strategies for PFRs in Malaysia. This gap has practical implications: without recognizing and enhancing the visual appeal of these forests, conservation efforts may fail to inspire the level of public and political commitment needed for long-term preservation. Moreover, ignoring visual aesthetics can undermine people's cultural and emotional connections with these natural areas, further diminishing their perceived value.

The neglect of visual aesthetics in current preservation strategies, particularly for PFRs in Malaysia, has created a gap in fostering public engagement, cultural appreciation, and emotional connections with these spaces. Thus, the lack of emphasis on aesthetics hinders conservation efforts, as aesthetically neglected PFRs may not be seen as worth preserving by the public and policymakers. This can lead

to further degradation or even conversion of these areas for other uses. Thus, this study focuses on the importance of visual aesthetics in PFRs and strengthens preservation efforts by developing a framework for assessing the visual aesthetics of forest reserves in urban areas. However, since the physical characteristics of urban PFRs influence visual aesthetic value, a global framework assessment can be challenging. Therefore, establishing a local visual aesthetic quality assessment framework is necessary to enhance the preservation of PFRs in Malaysia. Finally, this study is essential to establish a comprehensive visual aesthetic assessment framework that ensures PFRs are not only ecologically valuable but also aesthetically valuable and culturally significant for urban areas in Malaysia.

1.4 Research Aim and Objectives

The continuing threats to and shortage of permanent forest reserves in Malaysia can be attributed to the lack of inclusivity in forest preservation legislation. Specifically, the absence of visual aesthetic quality as a significant aspect of preserving permanent forest reserves in urban areas is a concern. Although several studies have demonstrated the role of visual aesthetics in forest preservation, it is difficult to assess visual aesthetic quality universally due to variations in the physical characteristics of permanent forest reserves in urban areas. Therefore, the main aim of this research is to establish a visual aesthetic quality assessment framework that enhances the preservation of valuable permanent forest reserves in Klang Valley urban areas, Malaysia. Accordingly, this thesis aims to achieve four objectives, which are listed below:

Objectives:

- i. **RO1:** To investigate the existing and potential variables for visual aesthetic quality assessment of urban forests as a model for permanent forest reserves in urban areas.
- ii. **RO2:** To identify suitable variables of visual aesthetic quality assessment for permanent forest reserves in Klang Valley urban areas, Malaysia.
- iii. **RO3:** To determine the level of importance and weightage of variables for visual aesthetic quality assessment of permanent forest reserves in Klang Valley urban areas, Malaysia.
- iv. **RO4:** To establish a framework of visual aesthetic quality assessment for permanent forest reserves in Klang Valley urban areas, Malaysia.

1.5 Research Questions

The main question of this research is how to establish a visual aesthetic quality assessment framework that would enhance the preservation of valuable permanent forest reserves in Klang Valley urban areas, Malaysia? Consequently, this thesis has to achieve four questions, which are listed below:

Questions:

- i. **RQ1:** What are the existing and potential variables for visual aesthetic quality assessment of urban forests as a model for permanent forest reserves in urban areas?
- ii. **RQ2:** What are the suitable variables of visual aesthetic quality assessment for permanent forest reserves in Klang Valley urban areas, Malaysia?
- iii. **RQ3:** What are the level of importance and weightage of variables for visual aesthetic quality assessment of permanent forest reserves in Klang Valley urban areas, Malaysia?

- iv. **RQ4:** What is the framework of visual aesthetic quality assessment for permanent forest reserves in Klang Valley urban areas, Malaysia?

1.6 Overview of Research Methodology

This study presents the research strategy and outputs with validation used to establish a framework for assessing the visual aesthetic quality of permanent forest reserves in Klang Valley urban areas in Malaysia. The study utilizes a converging approach that combines the perception approach and the expert approach to assess visual aesthetic quality.

In the perception approach, the participant-generated image (PGI) method determined participants' preferences by having participants capture scenes they preferred along the trail. Subsequently, the classification of photos based on their content used a combination of the researcher's classification and validation through reclassification by experts. This resulted in identifying suitable variables of visual aesthetic quality assessment for permanent forest reserves in Klang Valley urban areas in Malaysia.

In the expert approach, the expert survey assessment method determined the importance of each variable's visual aesthetic quality by assessing photos for each variable. In addition, the photo representation of variables was validated through the expert survey description. Subsequently, Analytical Hierarchy Process (AHP) was used to determine the weights of the variables through pairwise comparisons based on their importance and validation of the weightage by consistency ratio. This resulted in determining the importance and weightage variables for visual aesthetic

quality assessment of permanent forest reserves in Klang Valley urban areas in Malaysia.

Ultimately, this study clarifies how combining participants' preferences and expert opinions can result in the establishment of a visual aesthetic quality assessment framework to enhance the preservation of valuable permanent forest reserves in Klang Valley urban areas in Malaysia.

1.7 Research Scope

In accordance with the aim of this research, the visual aesthetic quality assessment framework enhances the preservation of valuable permanent forest reserves in Malaysia's urban areas. This assessment framework reduces the increasing urbanization of urban forest shortages by expanding forest preservation legislation's scope. Accordingly, the research was limited to natural forests within dense urban areas that are subject to PFR preservation legislation and classified as permanent forest reserves. Since the visual aesthetic value depends on the physical characteristics of permanent forest reserves in urban areas, it was challenging to create a universal visual aesthetic quality assessment framework. Therefore, the research was limited to the preferences and opinions of locals. Consequently, this framework was achieved using a mixed-methods approach known as the converging approach: it combined the results of identifying suitable variables based on the preferences of local participants with the results of determining the importance and weightage of variables based on the opinions of local experts in order to reach the establishment of a sustainable assessment framework. Additionally, to account for the subjective and challenging nature of assessing visual aesthetic quality, it was

determined that photos should be adopted as a basis for identifying suitable variables and assessing them. Thus, utilizing photos for classification and assessment provided the appropriate method for establishing a comprehensive framework. Finally, the scope of this thesis is explained as follows:

- i. Adopted natural forests within urban areas that have been classified as permanent forest reserves.
- ii. Adopted forest has man-made paved trails and is open and accessible to the public.
- iii. Adopted a mixed-methods approach based on local participants' preferences and local experts' opinions.
- iv. Adopted photos as a basis in the process of identifying and assessing variables.

1.8 Research Significance

This study's significance is the identification of suitable variables for assessing the visual aesthetic quality of permanent forest reserves in urban areas of Malaysia. This includes defining and understanding a description of visual aesthetic factors and variables as well as a thorough explanation of visual aesthetic theories to comprehend how to assess the visual aesthetic quality of urban forests. Defining and understanding variables and theories for visual aesthetic quality can be a foundation and valuable future step that will assist researchers, managers, and decision-makers in managing and assessing the visual aesthetics of urban forests.

Furthermore, the primary significance of this thesis is to establish an integration framework for assessing the visual aesthetic quality of permanent forest reserves in

urban areas in Malaysia that can enhance their protection. This integrated framework refers to a comprehensive approach that combines multiple variables, each with different weightage, to evaluate visual aesthetics. It justifies the need for this framework based on the existing gap in forest preservation strategies, where visual aesthetics are often overlooked. Also, by involving both public and expert input, the framework seeks to provide a more holistic and reliable assessment, which is crucial for effective forest management and decision-making. This integration of diverse perspectives ensures that PFRs are visual aesthetic assessments from multiple angles and strengthens the argument for their preservation. Additionally, the framework addresses the unique challenges posed by urbanization, aiming to expand the scope of forest preservation legislation to better protect these valuable urban green spaces.

The significance of this framework lies in its distinction from previous studies that primarily relied on general perceptions to assess landscape visual quality. For example, the Scenery Management System (SMS) used by the U.S. Forest Service effectively incorporates both public and expert evaluations to manage visual resources. While this method is robust, it tends to focus mainly on natural landscapes and does not fully address the complexities of urban forests, where aesthetic factors are significantly influenced by urbanization. Additionally, SMS assumes that all variables have equal importance and weight when evaluating visual aesthetics, which this new framework aims to refine by assigning different weightage to variables based on their relevance to urban contexts.

This study's significance can help urban forest managers determine the quality of urban forest visual aesthetics and contribute to improving their management and

preservation by providing a much more rigorous assessment tool. Advanced instruments designed to measure urban forests' visual aesthetic quality with greater precision and validity. These tools are expected to go beyond simple surveys or observational studies by incorporating them with more sophisticated techniques. This tool will offer a more accurate and actionable evaluation of visual aesthetic quality by incorporating statistical methods for variable weighting and participatory approaches for integrating public and expert input. This rigor in assessment is crucial for urban forest managers, as it provides a solid foundation for making informed decisions that balance ecological preservation with cultural and aesthetic considerations.

Overall, the integrated framework and rigorous assessment tools developed in this study will serve as a valuable resource for enhancing the management and preservation of urban forests, potentially influencing forest preservation legislation and promoting more sustainable urban development practices. It also encourages wider participation in forest conservation and restoration by local communities, conservation and management organizations, and academics. Also, this study will assist designers, forest managers, and decision-makers in making decisions through a simple and efficient process using the final visual aesthetic quality assessment form. Lastly, it can serve as a reference for future research and a starting point for the development of similar frameworks in other contexts or different countries, leading to the creation of more livable and sustainable urban environments.

1.9 Research Keywords Definition

Visual aesthetics covers a wide range of topics and can be understood in various ways, making it a subject of interest across multiple scientific disciplines. Additionally, the concepts of urban forests and permanent forest reserves in urban areas are fundamental to this thesis. To prevent any confusion, the definitions of the terms "urban forests," "permanent forest reserve (PFR)," "visual aesthetics," and their synonyms used in this study are provided below.

- Urban Forests are defined as natural forests, planted forests, permanent reserves, and all associated trees growing within or near densely populated urban areas. Urban forests may also be referred to by other terms, such as urban natural forests, forest patches, urban woodlands, or urban forested parks. A common element in these definitions is the association with population density, though there is no established standard for the population size required to define an urban forest. The reciprocal relationship between urban forests and city dwellers is a key characteristic. Urban forests influence the lives of city residents, who, in turn, are involved in the care, management, and advocacy of these forests. This interaction contributes to the complexity of urban forests, which often involves a mix of native, non-native, and human-cultivated species. Finally, urban forests are uniquely defined by their location in or near urban areas and the dynamic relationship between people and nature. This study focuses on natural forests within urban contexts, acknowledging the broader definitions and varied terminology.
- Permanent Forest Reserves (PFRs) are legally protected forest areas established by governments to ensure long-term conservation and sustainable use. Governed by strict regulations, PFRs are designed to remain forested indefinitely, safeguarding biodiversity, soil and water resources, and providing essential ecosystem services. In Malaysia, these reserves are designated by the Forestry Department of Peninsular Malaysia (FDPM) under the National Forestry Act of 1984, focusing on preserving natural forests and protecting them from deforestation. PFRs differ from other forest

types due to their legal status and specific management objectives, which emphasize ecological, economic, and social values. Unlike other forests that may be subject to logging or land conversion, PFRs are shielded from such activities, ensuring their continued existence. These reserves can encompass various forest types, including natural and secondary forests, based on management goals. In urban areas, PFRs play a vital role in conserving green spaces amid urbanization, offering ecological benefits and enhancing the quality of life for city dwellers.

- Visual aesthetics refers to the pleasure derived from the visually perceptible characteristics of a scene's spatial elements. Rooted in the Greek word "aisthētikos," meaning "perception by the senses," this concept captures the initial experience of aesthetic pleasure through visual stimuli. Visual aesthetics are inherently subjective, shaped by individual reactions influenced by personal, social, and cultural backgrounds. This means that what one person finds beautiful or pleasing may not evoke the same response in another. In landscapes, visual aesthetics are particularly significant as they involve the interaction between the physical characteristics of a scene—such as the arrangement of trees, water bodies, and other natural elements—and the observer's perception. The resulting aesthetic pleasure not only measures beauty but also enhances emotional well-being by fostering a sense of harmony with the environment.

1.10 Thesis Organization

This research encompasses five chapters representing the introduction, literature review, materials and methods, results and discussion, and conclusion and recommendations for future research. The organization of this thesis is as follows:

- i. **Chapter 1** describes the introduction that explains the research structure, including the research context and background, problem statement, and research aim and objectives/questions. In addition, brief research

methodology, research scope, research significance, research keywords definition, and research organization.

- ii. **Chapter 2** includes the literature review, shedding light on the role of urban forests as a model for permanent forest reserves in urban areas. This review includes an examination of their definition, characteristics, and the benefits they offer. Also, it covers the legislative, classification, and assessment of permanent forest reserves in Malaysia. Additionally, the chapter delves into the assessment of visual aesthetics in urban forests, exploring its definition, benefits, and philosophical aspects, as well as various assessment approaches and methods. Moreover, an overview and framework are provided regarding the existing and potential variables used to assess the visual aesthetic quality of urban forests.
- iii. **Chapter 3** covers the research materials and methods used, which starts with study area selection. Subsequently, it covers the method to identify suitable variables based on the perception approach, which combines data collection strategies based on participant preferences and data classification based on photo content. Additionally, it covers the method to determine the level of importance and weightage of variables based on the expert approach achieved through an expert survey assessment and an analytical hierarchy process.
- iv. **Chapter 4** provides the research results to achieve the research objectives and aims. It covers the results for identifying suitable variables based on photo content classification using variables retrieved from the literature. Also, it covers the results for determining the importance and weightage of variables based on expert survey assessment to find the importance of variables and the analytical hierarchy process to calculate the final weightage of variables.
- v. **Chapter 5** This chapter explores urban forests' visual aesthetic quality assessment, focusing on the permanent forest reserves (PFR) in Klang Valley, Malaysia. It examines the importance of evaluating visual aesthetics in urban forests and how different approaches and key variables contribute to

this understanding. It also discusses how participants from different backgrounds perceive and evaluate these forest reserves. By discussing the importance and weightage of these variables, the chapter aims to provide insights into optimizing urban forest designs to meet public preferences and environmental objectives. Finally, it presents a research discussion of the findings that offer a framework for assessing the visual aesthetic quality of PFRs in Klang Valley's urban areas in Malaysia.

- vi. **Chapter 6** This chapter summarizes the findings, discusses the research contributions and guidelines, implications, determines limitations, offers recommendations for future research, and concludes the study.

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