




Review

Aesthetic Quality Assessment of Landscapes as a Model for Urban Forest Areas: A Systematic Literature Review

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Abstract: Aesthetic experience in a forest can typically be associated with attractive forest scenery that gives people a sense of visual pleasure. Characterized as a visual product based on people's reactions towards various combinations of landscape settings, features, and objects, this type of natural visual pleasure may benefit people's well-being, promotes natural and cultural heritage preservation, and encourages the growth of the eco-tourism industry. While most research on forest aesthetics focuses on non-urban settings, this study examines aesthetics in the context of urban forests. This study aims to systematically review landscape aesthetic assessment studies to propose a model for urban forests. We conducted a systematic review of research articles published from 2014 to 2020 by using three research journal databases, Science Direct, Scopus, and MDPI. In total, 55 research articles were identified and qualified for review based on the screening requirements. An additional 26 research articles were also included by using the snowball method to provide better understanding and outcomes for the study. The results were organized into these categories: definitions, benefits, philosophies, approaches, and variables for the aesthetic quality assessment in urban forest areas. In addition, we also found that aesthetic quality in urban forests is highly influenced by visual composition, visual sense, and visual conditions, which have also been proven to be important parts of forest functions and values that could contribute towards the preservation of urban green spaces.

Keywords: aesthetic quality; visual quality; scenic beauty; landscape character; forest area; urban forest; urban green



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1. Introduction

The term aesthetics is derived from the Greek word “aisthētikos”, meaning “perception by the sense”, which represents the initial point of the aesthetic sensation gained through physical pleasure [1]. For many centuries, the word “beauty” has been used to express human appreciation toward aesthetics. In 1750, German philosopher Alexander Baumgarten formally linked aesthetics to a taste of beauty, which served as the foundation for the development of aesthetic judgments and the quest for beauty's underlying rationale [2]. This era is known as the period of “enlightenment” that led to the modern understanding and measurement of aesthetics.

Aesthetic pleasure is a product of the human reaction that is unique among individuals [3–5]; it used to understand and interpret social perceptions toward beauty and is closely associated with acceptability perceptions [6–8]. Aesthetics, scenic beauty, aesthetic pleasure, and aesthetic acceptability are complex, dynamic, and evolving concepts that constitute the specific field of landscape aesthetics. Landscape aesthetics is based on the

interaction between physical characters and an observer's perception [3]. Therefore, a landscape aesthetics is defined as the product between a landscape features and people's reactions to those features [9]. Landscape aesthetics refers to people's perceptions of beauty, which usually involve judgment and assessment. In other words, landscape aesthetics is the basic output of human and landscape interactions [10].

In the context of natural environments, scenic beauty is considered the key category of aesthetics, although it depends on the scenic quality that brings pleasure to the senses [10,11]. Aesthetic attraction depends on the quantity and quality of the objects seen in nature, which affect the cognitive sensations of people who find them beautiful and pleasing [12]. Therefore, aesthetics can be used to indicate and quantify whether scenery is sufficiently beautiful to warrant humans' attraction to it [13].

Urban forests are essential components of the landscape, and they are all the trees, natural forests, and planted forests growing near or within densely populated urban areas. Despite the similarities between urban and non-urban forests, urban forests are distinguished by clear human influence in forest character formation [14]. Its uniqueness as a result of its proximity to highly populated cities is a source of strength for urban forests; however, the risks of rapid urbanization pose a threat to their extinction in many urban forest areas [15]. Urban forest areas are important and continue to gain importance due to their direct impact on the lives of urban residents. The benefits and uses of urban forests range from intangible psychological and aesthetic benefits to climate improvement and air-pollution reduction. Historically, the primary benefits of urban forests in cities have been health, aesthetics, and recreation. In addition, they have supported human life by providing food, fodder, fuel, wood, and building materials. People value urban forests primarily due to the personal, community, and cultural connotations they represent. They provide aesthetic enjoyment and a conducive environment for many outdoor activities. Urban forests also have significant educational value. Human contact with trees can aid their understanding of nature and natural processes, besides providing a natural experience in the city center [14,16,17]. In particular, the aesthetics of urban forests may provide urban residents with the opportunity to recover from daily stress, rebuild confidence, and strengthen their memories. Urban-forest aesthetics can indirectly stimulate tourism and boost economic development, by contributing to an attractive green city. Therefore, urban-forest aesthetics is recognized as an important component of planning approaches and forest management strategies [3,11,16]. Aesthetics has played a significant role in the modern landscape preservation and protection of urban forested areas considered exceptionally beautiful [18]. Urban-forest management must address sustainability issues that balance environmental, economic, and social values [19]. Several sustainable urban-forest management frameworks were criticized because of their lack of measures and criteria for aesthetic values [20], requiring urban-forest officials to reconsider their decisions on the assessment of urban-forest aesthetic quality [15].

Less attention towards the aesthetic assessment of urban forests could jeopardize their existence. Decision makers often face difficulties in implementing measurement standards in urban-forest aesthetic assessments, which could also provide strong justifications for urban green space preservation. The aim of this study is to conduct a systematic literature review on the topic of assessing the aesthetic quality of landscapes as a model for urban forests to understand and create a framework of aesthetic quality assessment for urban forest areas. In this regard, defining the aesthetics of urban forests and understanding their benefits are the primary purposes and arguments for studying their aesthetic assessment. In order to have an adequate understanding of the process of assessing the aesthetic quality of urban forests and create an integrated framework, it is essential to have knowledge of the philosophy and assessment background, assessment approaches, and assessment variables of landscape aesthetic assessment. Therefore, the findings are divided into the following categories presented in the homonymous sections:

- Defining of Urban-Forest Aesthetics;
- Benefits of Urban-Forest Aesthetics;

- Philosophy and Assessment Background of Landscapes Aesthetics as a Model for Urban-Forest Aesthetics;
- Assessment Approaches of Landscapes Aesthetics as a Model for Urban-Forest Aesthetics;
- Assessment Variables of Landscapes Aesthetics as a Model for Urban-Forest Aesthetics;
- Aesthetic Quality Assessment Framework for Urban Forest Area.

2. Materials and Methods

2.1. Keyword Selection

The selected keywords for the search were divided into three major components: aesthetics, urban forests, and investigations. Previous research refers to the landscape aesthetic components of the environment using the terms “scenic beauty”, “aesthetic quality”, “landscape quality”, and “visual quality” [10,21]. “Scenic beauty” can be defined as visual aesthetic quality for landscape assessment, making scenic beauty and visual quality the main components of landscape aesthetics [2,3,10,22]. Therefore, aesthetic components were included in the systematic review by searching for the keywords “aesthetic quality”, “visual quality”, and “scenic beauty”. In the urban-forest component, the “forest” term is the most common, but we specifically chose to focus on urban forests because they directly impact human life. Although research on urban areas frequently uses the phrases “urban forests” and “green urban areas”, we included the keyword “forest area” in the search to provide more detailed information [14]. Urban-forest components were included in the systematic review using the keywords “forest area”, “urban forest”, and “urban green”. The investigation component attempted to add clarity to the variety of topics covered by searching for assessments, benefits, approaches, and values. Ultimately, the systematic review was based on a search using the keywords: “aesthetic quality” OR “visual quality” OR “scenic beauty” AND “forest area” OR “urban forest” OR “urban green” AND “assessment” OR “values” OR “approaches” OR “benefits”.

2.2. Relevant Literature Screening

Our methodology for screening the relevant literature followed the guidelines for systematic reviews incorporating our chosen keywords (Figure 1). An initial literature review was conducted using three databases: Science Direct, Scopus, and MDPI. Papers were included if they were: (first) published between 2014 and 2020; (second) research papers, review papers, or proceeding papers; and (third) published in English-language scientific journals. After reading 620 papers to determine which were relevant and screen out duplicates, 55 papers met the selection criteria. We also added 26 documents that did not meet all the criteria and by the snowball method. The snowball method refers to identifying other publications by using a paper’s reference list or citations to increase information, achieve more realistic results, and cover all relevant research. Ultimately, the dataset consisted of 81 documents, including three book chapters, two conference papers, and one thesis, all published between 1999 and 2020.

2.3. Data Collection

We conducted a comprehensive full-text reading of each documents meeting the inclusion criteria. All data collected from the papers were summarized and tabulated in a spreadsheet (Microsoft Office Excel 2010, Microsoft Corporation, Washington, DC, USA). The data collected included author/s name, title, year, journal/publisher, document type, source, landscape character, approach, variables, benefits of aesthetic, and gaps/future studies extracted from each of the 81 documents, Appendix A (Tables A1 and A2).

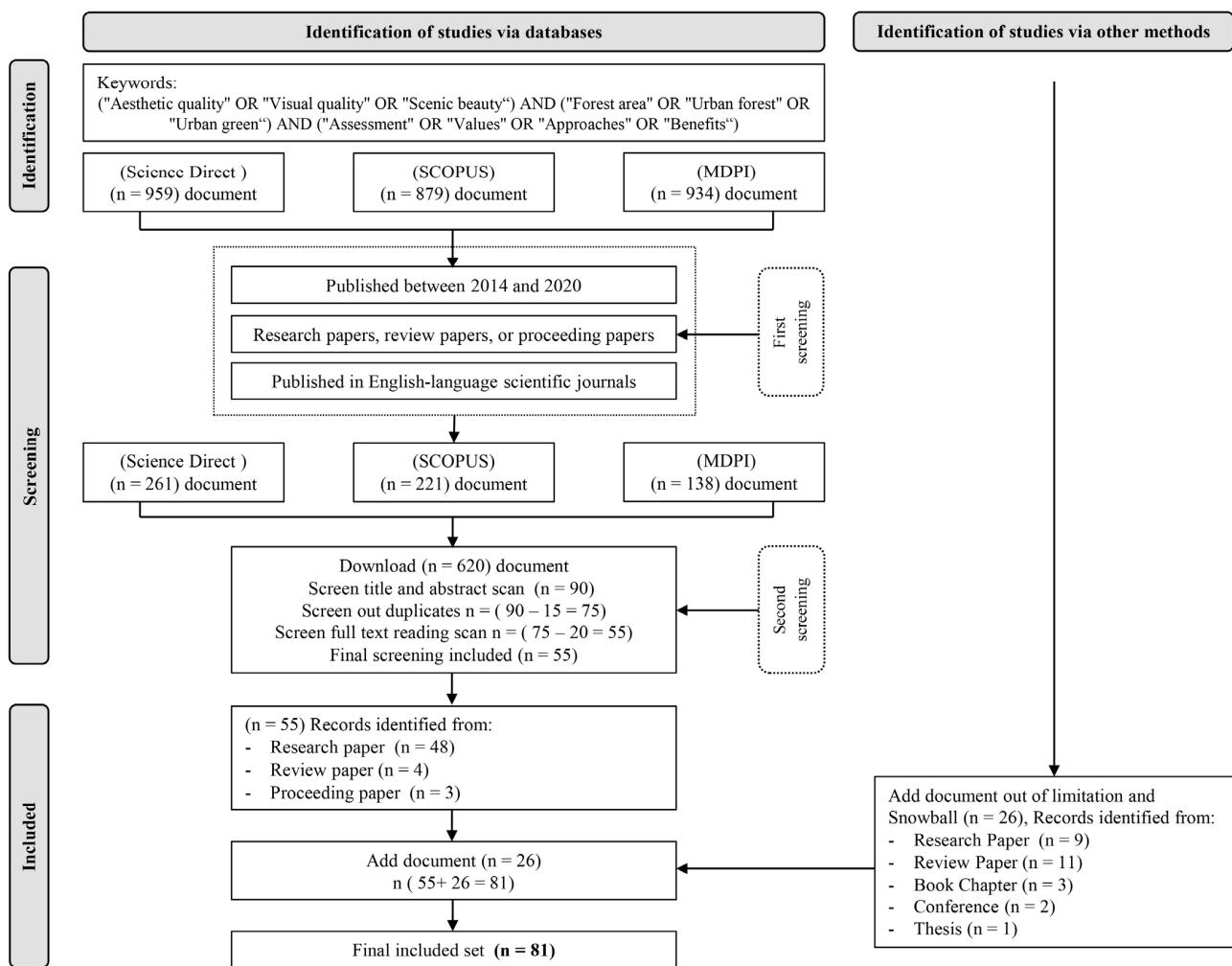


Figure 1. Document flow diagram summarizing the search findings and the screening process used in the systematic review.

3. Results

3.1. Defining of Urban-Forest Aesthetics

Aesthetics is a broad research topic covering a variety of issues that can be interpreted diversely by field. To avoid misunderstandings and focus on urban forests alone, we use the term “urban forest aesthetics”, although urban-forest aesthetics can be defined similarly to landscape aesthetics [10,21] (Box 1). Urban-forest aesthetics might be considered trivial when the necessities of survival are paramount. However, even the earliest civilizations showed an appreciation for urban-forest aesthetics by acknowledging “pleasant views”, which have been confirmed to be attractive to contemporary humans [3]. Urban-forest aesthetics is how humans receive pleasure from viewing forest elements (e.g., plants and water), contributing to emotional well-being by giving humans a sense of balance and harmony with nature [11]. Multiple studies have revealed that urban-forest aesthetics can give people an increased sense of vitality and optimism and expand their energy and performance levels by improving their state of mind. Similarly, urban-forest aesthetics can be defined as the feelings that give people a positive outlook on life and make them feel livelier and more active [10,13,14,23–27]. A highly aesthetic setting can influence psychology and human behavior by influencing a person’s vision. In addition to their direct role in shaping emotions, aesthetic principles play related roles in influencing urban-forest attractiveness. In several aesthetic studies in natural settings, people gave high rating scores and reacted positively to scenes they liked, such as trees, streams, and mountains, while they gave low scores and responded negatively to scenes that appeared threatening [28–31].

Box 1. Definitions of urban-forest aesthetics.

- **Urban-forest aesthetics** is a sensation of pleasure that gives people a positive outlook on life and makes them feel livelier and more active when viewing urban forests.
- **Urban-forest “objectivist” aesthetics** is an intrinsic quality of urban-forest physical elements.
- **Urban-forest “subjectivist” aesthetics** is a quality in the eye of the beholder that differs from one person to another according to personal values and psychological towards urban forests.

Studies have shown that urban-forest features objective physical characteristics that account for a large portion of the differences in public perception of aesthetics. In this sense, urban forests’ physical elements are the primary keys to the perception and assessment of urban-forest aesthetics [3,21]. However, some studies have shown that the observer’s social and cultural personality traits affect the evaluation of scenic beauty and urban-forest aesthetics. Aesthetics is a quality in the eye of the beholder, and it is a subjective beauty that differs from one person to another according to personal values [15,21]. The question remains: is the interaction that people display with a scene fixed to physical characteristics or does it depend on the relative beauty that varies among individuals based on personal values?

3.2. Benefits of Urban-Forest Aesthetics

Urban forests are national treasures that must be preserved for ecosystem services, including timber, food, water, air purification, and carbon sequestration [32]. Urban forests also have national and international significance in preserving biodiversity [17,31], and their scenic beauty is often an essential standard for their protection and preservation [11]. Studies have also revealed that protected urban forests could support local wildlife and preserve natural resources within cities [33]. Urban forests have been demonstrated to have benefits for human health and well-being [16], prompting forest management plans to include social and economic objectives [19].

Traditionally, urban-forest visual aesthetics has had great importance in local communities, as it impacts human health and well-being and serves as the provision for social and tourism services [34–38]. They are accepted in certain world regions as essential natural resources, comparable to soil and water, and are beneficial for physical and psychological well-being [10,14,26,34,39]. The aesthetic quality of urban forests plays a significant role in enhancing the physical health of urban people generating benefits such as reduced stress, enhanced disease recovery, improved physical well-being for the elderly, improved attention capacity, walking motivation, a sense of good health and satisfaction, physical activity, and behavioral improvements [10,13,14,23–27]. As a result, the greater the aesthetic quality of urban forest areas is, the higher the health benefits for humans are [13].

The most important role of visual aesthetics in eco-tourism can be associated with a scenic urban forest that becomes a place of attraction [2,11,34,40,41]. The scenic urban forest provides the opportunity for mental stimulation and clarity and affects human behavior. For example, people living near beautiful natural areas have a greater interest in the natural environment; thereby, they are motivated to regularly visit outdoor spaces [28]. Urban-forest aesthetics has been an important component of visitor satisfaction in most research on tourism management. Urban forests also serve as places that attract natural photographers to indulge into the aesthetics of nature [42]. Aesthetic qualities affect tourists’ experience and satisfaction, increasing their loyalty to a given place and their desire to return. When people prepare to travel, they mainly search for destinations with aesthetic qualities that would maximize their pleasure [4]. Thus, it is important to manage and improve an urban forest’s visual aesthetics as key elements for the tourism industry [1,43,44]. This would significantly contribute to increasing the economic revenue and monetary value of urban forested areas [10,45].

One of the main benefits of the urban-forest aesthetics is that it helps to protect nature with the enjoyment of the user, which makes the forest a vital attraction that affects human behavior [21,28,46]. The preference and attractiveness of urban-forest aesthetics through natural ecosystems can play important roles in determining approaches to enhance

human behavior and achieve conservation objectives [47]. Several studies have shown that aesthetic values are essential components for the protection and planning of urban forests [7,18,48–50]. Aesthetic values also have the advantage of preserving unmanaged urban forest areas [51]. Besides, urban-forest aesthetics and the pleasure people derive from it can represent significant cultural and environmental services for protecting natural cultural heritage [34,52]. The broad agreement between aesthetic values and landscape preferences shows how important urban forests are for cultural ecosystem services [36,40]. On the other hand, urban-forest aesthetic preference is a major determinant of planning, urban design, and sustainable management [10,14,53–55]. Additionally, urban-forest aesthetic benefits manifest in property value increases, incentivizing homeowners near forests to recommend forest aesthetic conservation due to the impact on real estate prices [14,56,57]. Therefore, improving the urban forest’s aesthetic value benefits local economies [16,45,57] (Table 1).

Table 1. Overview of benefits of urban-forest aesthetics.

Benefit of Urban-Forest Aesthetics	Descriptions	References
Health	H1. Reduced stress	[10,13,14,16,17,23–26,34–39]
	H2. Improved attention capacity	
	H3. Physical and psychological well-being	
	H4. Walking motivation and further physical activity	
	H5. Behavioral improvements that enhance the mood	
Tourism	H3. Enhanced disease recovery, physical well-being of the elderly	[1,2,4,10,11,28,34,40–45]
	T1. Visitor attractions	
	T2. Green tourism industry	
	T3. Photographer attractions	
	T4. Loyalty to a place and desire to return	
Economy	T5. Increased appeal of tourist attractions	[10,14,16,45,56,57]
	E1. Increased economic revenue	
	E2. Increased neighboring real-estate prices	
	E3. Revenue generated by urban-forest use fees	
Protection	E4. Increased monetary value of urban forested areas	[7,17,18,21,28,31,34,35,46–49,51,52]
	P1. Conservation of biodiversity	
	P2. Protection of the natural cultural heritage	
Planning	P3. Preservation of unmanaged urban forest areas	[7,10,14,18,48–50,53–55].
	L1. Sustainable management	
	L2. Improved aesthetics of cities	
	L3. Evaluating the societal quality of life	
	L4. A significant determinant of planning and urban design	

3.3. Philosophy and Assessment Background of Landscape Aesthetics as a Model for Urban-Forest Aesthetics

Historically, aesthetics has been a complex topic of debate for philosophers, artists, and architects. Classical philosophers regarded aesthetic experiences as influenced by the physical characteristics of an environment. Socrates (469–399 BC) claimed young people would be positively impacted by living surrounded by beauty. Plato believed that beauty was defined by an object’s physical properties or was indefinable, but that it was apparent in its internal unity. Plato believed things were intrinsically beautiful, meaning that they were beautiful in their very nature. He held that things could not be “good in one point of view and foul in another, or good in one position and foul in another”; that is, beauty is absolute, not relative. Aristotle further advanced Plato’s theory, claiming that beautiful objects had to be of a particular scale, not too minute or vast, so that an observer could appreciate their unity and gain a sense of the whole [2]. The concept of beauty defined by Plato, Aristotle, and St. Thomas Aquinas as that “which gives pleasure when seen” asserted that beauty exists within an object and is not subject to a partial assessment by observers [4]. Later, in 1639–1650, Descartes’ philosophy began to emerge and had a gradual, widespread influence as it evolved over the following centuries. He distinguished “what is out there” from “what is in here”, effectively separating nature from the mind and leading to the development of a new subjectivist aesthetic concept. The distinction between nature and the mind paved the way for a human understanding of the role of subjective feelings in determining aesthetic preferences. At the beginning of the 18th century, Hume and

Kant argued that beauty is subjective, and they described aesthetics as the “beauty in the eye of the beholder”, indicating that aesthetics cannot be judged objectively since it relies on personal beliefs and values. Landscape-aesthetic philosophy varied in principle as the result of two points of view with opposing interpretations. These differences led to the development of two critical models for the philosophy of landscape aesthetics, both of which rely on methods of evaluating landscapes and are known as the objectivist, or physical, paradigm and the subjectivist, or psychological, paradigm [2].

The objectivist or physical paradigm is the traditional view that the visual quality of a landscape is an inherent feature of the environment and its physical qualities, just as the soil, water, and color [18,22]. The landscape elements’ physical qualities make them the attractors of scenic beauty, contributing to a local landscape’s peculiarity and uniqueness [43]. Planners, geographers, and other practitioners make generalized assumptions about landscapes, such as the assumption that mountains and bodies of water provide a high-quality landscape assessment. Based on these assumptions, landscapes are classified on a descriptive scale and classified as high, medium, or low quality. This approach assumes that the landscape has an inherent quality and that this quality is a physical characteristic (meaning it exists and can be measured), indicating that the aesthetics can be measured similarly to physical characteristics [2,58]. It should be noted that the aesthetic requirements in this aspect are determined by processes describing aesthetic quality, including factors influencing human psychological reactions, regardless of personal background. This paradigm aims to understand the physical components of urban forests, mostly used for research-based management goals. However, this paradigm lacks empirical rigor, is non-replicable and unique, and lacks supporting statistical evidence [2,22]. This approach has generated results for mapping urban-forest quality; the main contributing factors have been applied especially throughout Britain, somewhat in Australia, and, on a more limited basis, in USA and Canada [2].

The subjectivist or psychological paradigm is the landscape quality resulting from human sentiment; it focuses on the perceptions, experiences, imaginations, and meanings evoked by the beholders, whereby “beauty is in the eye of the beholder” [2,18,22,58]. The landscape is an aesthetic aspect of natural resources, and the value of aesthetic satisfaction and appraisal varies greatly depending on subjective opinions [53]. The preferences for the aesthetic qualities of landscape vary among individuals according to their different personal characteristics, such as age, occupation, background, experience, culture, and social group [2,18,22,53,58]. This paradigm aims to understand human preferences to consider the physical components that contribute to a landscape’s quality. The subjectivist approach of landscape quality assessment uses psychophysical methods to analyze community preferences for landscapes and then statistical analysis to determine the overall quality of the landscape. This paradigm provides an approach that is scientifically and statistically reliable, replicable, and impartial; represents the community’s expectations; and has an associated degree of accuracy in its findings [2,18]. This approach has generated results that characterize the identity of urban forests in compliance with local people’s views, with the main factors contributing to their quality and relative importance mainly being applied in the USA, Canada, and, to a more limited extent, Britain [2].

Eventually, aesthetic philosophers have defined the objectivistic and subjectivist paradigms to understand and assess landscape aesthetic quality. Both of these paradigms have long histories, finding their origins in the contributions of philosophers over many centuries. In this study, the philosophy of landscape aesthetics is employed as a paradigm for urban-forest aesthetics. Consequently, two models for assessing and managing the philosophy of urban-forest aesthetics may be identified: objective and subjective paradigms. Objectivist approaches assume that aesthetic quality assessment is intrinsic and determined by an urban forest’s physical characteristics. In contrast, the subjectivist paradigm sees urban-forest aesthetic quality assessment depending on the eye of the beholder (Table 2).

Table 2. Summary of the philosophy paradigms used to assess urban-forest aesthetics.

Objectivist Paradigm	Subjectivist Paradigm
<ul style="list-style-type: none"> • Generally lacks a theoretical framework. • Urban-forest aesthetic is an intrinsic quality. • Urban-forest aesthetic quality assessment uses physical variables to understand the aesthetics of physical components of urban forests and is an assessment mostly used for research-based management goals. • Place- and location-specific; results cannot necessarily be extended beyond the field of research. Looks for no clarification of preferences. • Lacks empirical rigor and statistical evidence; is non-replicable and unique; and is always based on an assessment by a single evaluator. • Relatively easy and rapid. • Assessments are often field-based. 	<ul style="list-style-type: none"> • Generally derived from a theoretical framework. • Urban-forest aesthetic is a quality in the eye of the beholder. • Urban-forest aesthetic quality assessment uses psychological variables to understand human preferences of physical components and their relationships and is mostly an assessment used for aesthetic research to support urban-forest management. • Not place- or location-specific; seeks outcomes for broader use. It can be used to comprehend preferences. • Provides an approach that is scientifically and statistically reliable, replicable, and impartial; represents the community's expectations; and shows the degree of accuracy of its findings. • Relatively difficult and slow. • Assessments use surrogates (e.g., photos).

3.4. Assessment Approaches of Landscapes Aesthetics as a Model for Urban Forests Aesthetics

Although aesthetics has been divided into the objectivist and subjectivist paradigms, those who research aesthetic preference assessment methods believe there is a likely correlation between the physical characteristics of an urban forest and the psychological reactions of those perceiving the urban forest [10,17,25,34]. The assessment of aesthetics utilizes a visual basis for evaluation in most methodologies [3,34]. Based on our systematic review, the majority of research papers that adhered to the philosophy of aesthetic paradigms used physical characteristics or visual criteria to assess urban-forest aesthetics. Ref. [3] divided the visual quality methods into the expert (objectivist) and perception (subjectivist) approaches. He also added a combined approach so that the aesthetic quality of the urban forest is based on the interaction between physical characteristics and the perception of the observer. Therefore, the urban forest aesthetic approach is defined as a combination of the visual quality of an object's inherent beauty and the perception in the eye of a beholder [25,34]. Ref. [3] divided aesthetic visual assessment into three approaches according to philosophy and aesthetic backgrounds: expert, perception, and converging approaches (Table 3).

Table 3. Summary of the approaches for assessing urban-forest aesthetics.

Expert Approach	Perception Approach	Converging Approach
<ul style="list-style-type: none"> • Objectivist (physical). • Expert assessment. • Qualitative. • Less time and effort. • Tools: expert scores, GIS-based mapping, remote sensing, and spatial maps. • Lack of accuracy, validity, and reliability. • Assessment by narrative and explanation or assessments by levels like (high, medium, and low). • Ease of assessment application based on specific rules or guidelines. • Assessments are often field-based. • Assessments are not relevant to the individual's background. • Assessment reveals no differences in opinion. • Mostly used for research-based management goals. 	<ul style="list-style-type: none"> • Subjectivist (psychological). • Public assessment. • Quantitative. • More time and effort. • Tools: surveys, focus groups, and photo-preference surveys. • Accuracy, validity, and reliability. • Assessment by numerical accounts. • Challenges in assessment application. • Assessments often utilize photographs or virtual reality. • Assessments are relevant to the individual's background. • Assessment reveals the variation in opinion among respondents. • Assessment mostly used for aesthetic research to support urban-forest management. 	<ul style="list-style-type: none"> • Subjectivist and objectivist. • Expert and public assessments. • Qualitative and quantitative. • Most time and effort. • Tools: expert scores and public surveys. • Accuracy, validity, and reliability yet to be proven since the approach is still new. • Assessment by both explanation and numerical accounts. • Challenges in assessment application. • Assessments often utilize photographs. • Assessments are relevant to the individual's background. • Assessment reveals the variation in opinion between the expert and the public. • Used for both research and management.

3.4.1. Expert Approach

An expert approach leans strongly toward the aesthetic philosophy's objectivist side, in which the premise of the nature of the landscape can be calculated by the professional expertise on the specific urban-forest feature, known as the aesthetic object [3]. The expert-based assessment follows prescribed rules or guidelines, which shows that the aesthetic assessment of urban forests is not directly linked to the individual's background. The individual's background minimally influences the forest aesthetics value ratings. The expert evaluation is much more manageable and consumes less effort than the typical public survey [15]. The expert-based approach systematically evaluates an urban forest's beauty with respect to its physical features (e.g., form, texture, and color) and relationships among these features (e.g., variety, unity, and harmony). Thus, it is not surprising that expert-based assessments are widely employed in urban-forest management [3,4]. Aesthetic value can be assessed in two ways: first, an aesthetic judgment is rendered based on narrative and explanation, rather than analyzing numerical accounts [48], or second, through rating scale (e.g., high, medium, and low value). The expert's data collection to assess urban-forest aesthetics is heavily based on qualitative methods, and the results are typically represented using GIS maps [52]. In this approach, the expert's role is to identify the importance of the point of view and evaluate the scene's aesthetics. Nonetheless, [59] stated that expert judgment could also be influenced by one's previous understanding and experience relative to the characters and elements that shape how important the urban forest is [18]. Ref. [3] found that individual assessments of urban-forest visual quality may vary significantly between different experts who evaluate the same urban forest. Thus, expert assessment of urban-forest visual quality has been criticized for lack of accuracy, validity, and reliability. The lack of precision analyses and decision-making processes places urban-forest aesthetic assessments at a significant disadvantage [59]. In this case, the evaluations are unlikely to be consistent if repeated.

3.4.2. Perception Approach

The perception-based approach is explicitly drawn from a subjectivist philosophy and uses standard survey research and psychological scaling methods to obtain quantitative measures of the perceived aesthetic quality of an urban forest. The perception-based approach perceives urban-forest quality indices based on choices or ratings (with urban forests usually being represented by photos) given by the public [3,4]. Perceiving aesthetics reflects sensory emotional processes and is a crucial determinant of understanding how people perceive a place [35]. However, beauty's sensory and emotional processes are different from self-love satisfaction, which can be identified by distinguishing between aesthetic judgment and subjective expression of enjoyment [48]. Visual aesthetics has been shown to achieve a better assessment when people's desires are included in the assessment process [24]. Advanced technology such as virtual reality has also been used to determine the level of visual aesthetics perceived by the public and is considered more cost-effective in terms of predicting future impacts on the natural environment [60]. The perception-based approach to assessing urban-forest aesthetics relies mostly on quantitative methods, including focus groups or photographic-preference surveys [52].

The reliability of perception-based visual aesthetic assessment has been consistently high. The results produced by this approach are more significant than the observation made by a single person [59]. Methods focused on perception explicitly emphasize the human viewer side of urban-forest quality interaction and recognize the biophysical environment's important role. Perceived visual quality factors such as visibility, complexity, coherence, and mystery or emotional responses (e.g., attention and stress-reduction) have also been used in the perception-based approach [3]. Aesthetics are reasonably subjective in terms of quality, and irrespective of a vast body of research across fields, the application of aesthetic assessment remains a challenge [4,10]. Nevertheless, perception-based assessments have been widely recognized for their accuracy, validity, and reliability in spite of significant variations among the public.

3.4.3. Converging Approach

Ref. [3] suggested assessing forest visual aesthetics by incorporating both the expert- and perception-based assessment approaches. This converging approach is a comprehensive management system that aims to achieve a parallel perception-based evaluation of visual aesthetic quality based on the opinions of experts and the public. Merging the expert approach with the perception approach culminated in the creation of the Scenery Management System (SMS) by United States Department of Agriculture in 1995. The SMS manages activities ranging from inventory, assessment, and valuation to the design and implementation of forests' visual aesthetic components. By using a systematic approach to assess the aesthetic quality of National Forests in USA, the SMS aims to maintain high-quality scenery for future generations. Professionals such as landscape architects or other trained visual experts carry out critical landscape evaluations, and public surveys are included to achieve a parallel perception-based assessment of the overall visual aesthetic quality. A combination of results obtained from these two approaches provides richer information that could increase the confidence of forest managers and other stakeholders in making management decisions [3]. However, this approach is time-consuming and typically needs large-scale efforts to be implemented.

3.5. *Assessment Variables of Landscapes Aesthetics as a Model for Urban-Forest Aesthetics*

Aesthetic assessment can be difficult to accomplish, at least because of the complexity of knowledge, context, and variation in variables that researchers place on the aesthetic assessment of the urban forest [3,7]. Several of the reviewed studies have shown conceptual origins focused on assessing urban forests' physical characteristics as the primary keys to the perception of urban-forest aesthetics; in addition, some other studies have shown reliance on the perception principles using visual assessments. Vision has been directly linked with human emotion, indicating the need to approach aesthetic quality assessment through visual investigation. How people perceive the aesthetic value of the urban forest depends on both the physical features and its visual qualities [61]. In this investigation, the urban forest aesthetic assessment is first defined by urban forest visual character (descriptions) and then measured using the urban forest visual qualities according to either or both experts and public preference. These two components are defined using all variables gathered from published studies that demonstrate the aesthetic quality of urban forest areas.

3.5.1. Urban-Forest Visual Character

Urban-forest visual character (UFVC), or landscape visual character, is described as "a distinct, recognizable, and consistent pattern of urban-forest elements that makes one landscape different from another, rather than better or worse" [62–64]. Similarly, [65] defined UFVC as the presence, variety, and arrangement of urban-forest features that give the urban forest a specific identity and distinguish it from the surrounding area. In other words, the physical elements that constitute the scene vary from each other, and gathering them in one unique scene represents a certain character. Character distinguishes every aspect of the urban forest and gives each aspect its unique sense of place [62,66,67]. The European Landscape Convention proposed that UFVC is defined as "the overall performance of the landscape". UFVC is an objective process of characterizing, identifying, classifying, mapping, and defining an urban forest's visual character. There have been attempts by many researchers to utilize UFVC as an assessment tool; yet, this tool that practitioners have at hand tends to be handled as an objective unit, which is not suitable alone to deal with the complex aesthetic relationships of urban forests [68]. UFVC classification is the first step in identifying and incorporating urban-forest character for aesthetic assessment [69]. Our systematic review found two categories of UFVC variables that reflect a forest's physical characteristics: landform, and land cover. Landform indicates the land's topography, such as mountains, hills, slopes, plains, valleys, or flatlands. Land cover indicates physical land elements, such as green, water, and human-made elements [4,18,22,43,65,66].

3.5.2. Urban-Forest Visual Quality

Urban-forest visual quality (UFVQ), or landscape visual quality, can be defined as “the relative aesthetic excellence of the landscape” and is typically measured in terms of viewer appreciation of the scenery [3,36,56]. Landscape visual quality is an index that decision makers could use to assess and design urban forest areas and is considered the best way to convey public preferences for urban forest areas [24]. A large volume of research indicates visual perceptions as a way to define an urban forest’s visual aesthetic quality value [7,28,56,66]. Therefore, UFVQ is a central part of urban-forest perception and aesthetic preference research [17]. Ref. [3] focused on visual quality as the proper tool for assessing and analyzing an urban forest’s aesthetics. UFVQ assessment refers to methods and instruments than can be used to define and explain an urban forest’s aesthetics [3,34]. According to [70], visual assessment models that were uniquely developed based on specific regions or countries have been proven to deliver consistent outcomes, even after landscape changes. However, the use of the visual assessment model is still in the infant stage in many parts of the world and is yet to be properly recognized as part of local urban-forest management systems. Visual quality assessments assign a value to the aesthetic quality that represents the degree of importance of the urban-forest attributes and recognizes the main aspects that help to predict aesthetic quality changes resulting from urban-forest management activities [58]. Many researchers have utilized a different set of variables to carry out their reviews in the field of visual quality assessment. This systematic review found seven major visual quality variables that reflect human perception; these are organized into three main criteria: urban-forest visual composition, urban-forest visual sense, and urban-forest visual condition. Urban-forest visual composition comprises included variables (coherence, complexity, legibility, and mystery), urban-forest visual sense comprises clarified variables (openness and uniqueness), and urban-forest visual condition comprises an indicated variable (cleanliness) (Table 4).

Table 4. Urban-forest visual quality variables were obtained from the systematic review.

Variables	Synonyms	References
B-1	Urban-Forest Visual Composition	
Coherence	Unity, Uniformity, Balance, Harmony, Fittingness, Compatibility.	[4,9,12,18,49,54,55,60,66,67,71–77]
Complexity	Diversity, Variety, Richness, Heterogeneity.	[4,9,12,18,22,37,38,43,54,55,60,67,71,73–79]
Legibility	Clearness, Visual Access.	[18,54,71,76]
Mystery	Explore the Place, Inferred Exploration.	[18,55,71,75,76]
B-2	Urban-Forest Visual Sense	
Openness	Visibility, Enclosure, Visual Scale, Perspective, Vastness.	[12,23,54,55,66,67,74,76,77,79]
Uniqueness	Imageability, Vividness, Sense of Place, Distinctive, Place identity, Memorable, Attractiveness, Familiarity, Novelty.	[4,9,37,38,43,47,49,55,60,67,74,75,77]
B-3	Urban-Forest Visual Condition	
Cleanliness	Stewardship, Order and Care, Upkeep, Maintenance, Safety.	[4,12,56,67,74,76,77]

3.6. Aesthetic Quality Assessment Framework for Urban Forest Area

Philosophers, either overtly or implicitly, have built on what preceded them in dealing with the complex, intangible issues of beauty, and it has been incredibly challenging to lay a solid foundation on which to build an explicit theory for assessing urban-forest aesthetics [2]. Urban-forest aesthetic assessment has been largely attributed to physical features—landscape elements that determine urban-forest aesthetic understanding [28,79]. Nevertheless, those features’ aesthetic values are far from wholly understood [30], so efforts to measure landscape aesthetic quality using physical metrics alone provide only a partial solution to a complex problem [52]. Ref. [2] recommended the further development of the subjectivist framework and its application to assess urban-forest quality, which could help define urban-forest quality as an environmental feature that can be measured, regulated, and predicted. Subjectivist paradigm preference modeling provides an urban-forest assessment technique that can be used in conjunction with previous aesthetic assessment methods, so that new standards, protocols, or techniques for aesthetic quality can be developed [11,80,81]. Some research has been carried out on urban-forest aesthetics as a

social and environmental benefit, and some techniques have been developed to ensure that investigations are carried out systematically and consistently [30,31]. In some countries, such as the United Kingdom or United States, there are standards and procedures for aesthetics, but their study has been limited; aesthetics is relatively subjective and dependent on national, cultural, and environmental values [11]. However, a lack of a unified framework for assessing urban-forest landscape aesthetic quality still persists [21]. There is a need to establish new frameworks to simplify the assessment of aesthetics within urban forest areas [4,10,37,38].

The majority of existing visual management system often fails to ensure the continuity of urban-forest aesthetics and does not sufficiently include urban-forest preservation and enhancement. Therefore, an integrated system that supports the needs and preferences of the public would be beneficial [41,82,83]. Ref. [3] emphasized that urban-forest aesthetic values are the result of interactions between biophysical urban-forest features and associated human perceptual processes. In this study, the previous definition was adopted along with the information found in the above sections of this manuscript to create a unified framework for assessing the aesthetic quality of urban forests based on a “convergent approach” (a combination of expert and perceptual approaches) by means of urban-forest character and urban-forest visual quality (Figure 2).

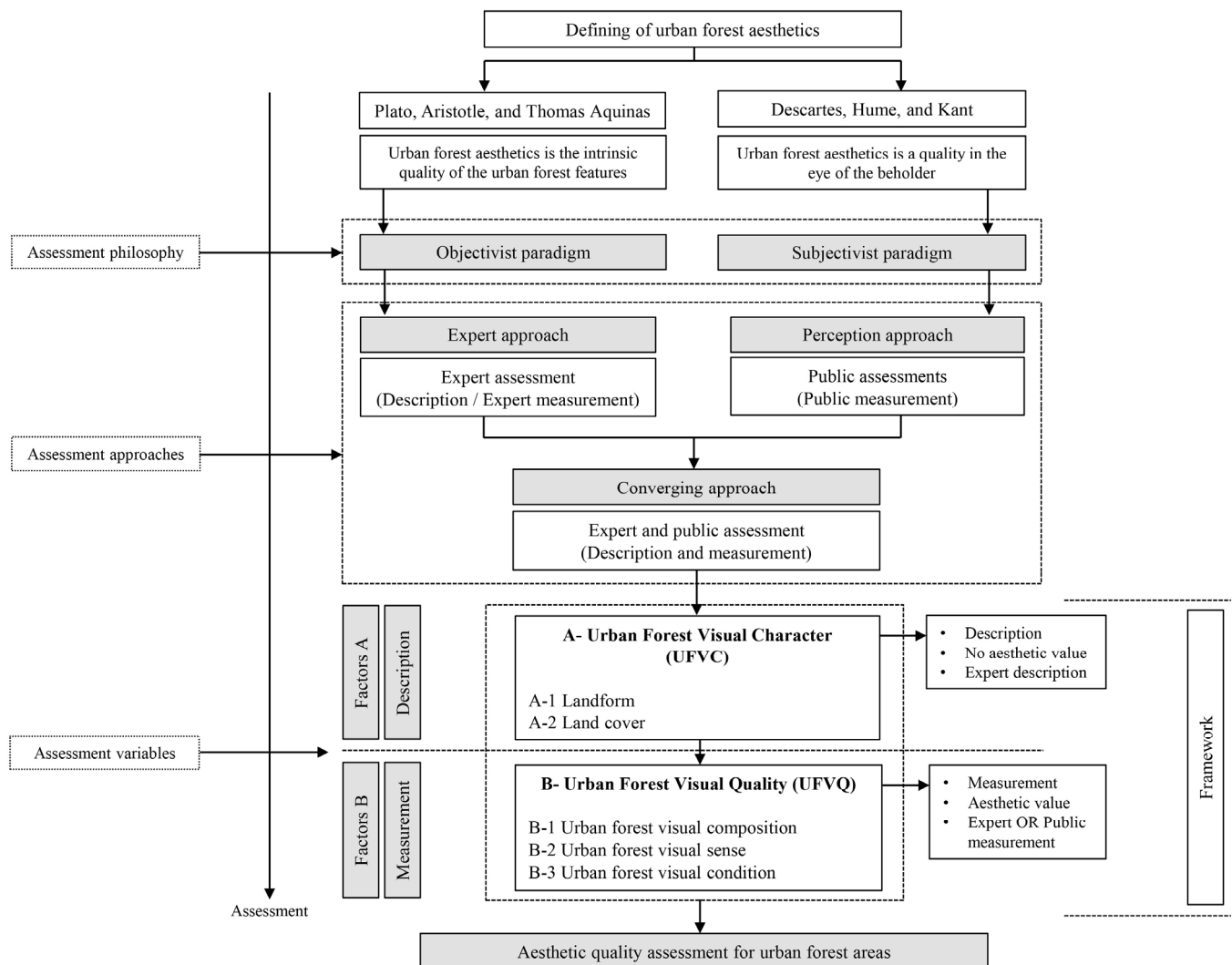


Figure 2. A framework for aesthetic quality assessment of urban forest areas.

4. Discussion

In our study, we used landscape aesthetic studies as the basis for a model of urban forest areas to understand and create a framework for the aesthetic quality assessment of urban forest areas. Therefore, in this section, we highlight some of the most relevant findings from the 81 selected research documents and discuss our overall perspective on the aesthetic quality assessment of urban forest areas. Based on the number of published studies on this subject, it is evident that there have been limited efforts to review and understand such assessments in recent years, especially during the period from 2014 to 2020. Due to the lack of a clear framework assessment of aesthetics, researchers have used the preference method to determine aesthetic values. In addition, several studies have relied on the respondents' consensus decision to decide on aesthetic preferences as a criterion for assessing aesthetics. Researchers and decision makers have used aesthetic consensus to challenge the dynamic difficulties in measuring aesthetic quality, including a lack of measurement techniques, multiple forms of metrics, and the inapplicability of techniques to specific contexts [11,13,34,39,55,80,84]. This finding emphasizes the significance of our research study as a current and comprehensive source of urban-forest aesthetics assessment.

Urban-forest aesthetics can be defined as the emotions that give people a positive effect and make them feel more energetic and optimistic [10–14,23–27]. They determine the way in which humans enjoy viewing urban-forest elements, which contributes to emotional well-being by providing a sense of balance and harmony with nature. The impact of urban-forest aesthetics on city dwellers is critical because of its impact on their daily lives. It can give them an increased sense of vitality and a chance to recover from daily stress while increasing their energy levels and performance by improving their state of mind. Furthermore, it can stimulate tourism and promote economic development. In addition to contributing to the establishment of attractive, green space, urban-forest aesthetics conveys the image of a pleasant, nature-oriented city [11]. The importance of social aspects toward aesthetic values has grown over time, especially in urban areas [83]. Natural beauty is often the primary criterion for urban-forest protection and preservation. Therefore, urban-forest aesthetics must be recognized as an important element in planning and management approaches. However, there is a limited number of literatures relevant to the management and assessment of urban-forest aesthetics [41]. Besides, there are no clear urban-forest policies designed to promote aesthetic assessment and values. Therefore, the development of future urban-forest policies should include aesthetic assessments that can ultimately lead to the preservation of urban forests and achieve sustainable management.

During the course of our research study, we identified aesthetics as a source of pleasure; however, while defining the aesthetics of urban forests, an issue that forms the basis of the assessment process was raised—is this pleasure derived from the physical qualities of the urban forest's components, or is it psychological and based on individual values? This question sparked an interest in the aesthetic philosophy of urban forests and its effect on the assessment process. An examination of the chosen documents revealed that they all conformed to and even relied on philosophical ideas when establishing the process of assessing aesthetics. Philosophically, there are two paradigms for assessing and regulating the philosophy of urban-forest aesthetics: the objective and subjective paradigms. The objective paradigm assumes that the assessment of aesthetic quality is intrinsic and based on the physical features of the urban forest. In contrast, the subjective paradigm assesses the aesthetic qualities of urban forests through the eye of the beholder. Both paradigms have been supported by various philosophers and researchers specialized in aesthetic assessment.

In accordance with aesthetic philosophy, different methodologies can be adopted for assessing the aesthetics of the urban forest, which include the expert and perceptual approaches. Expert approaches lean heavily toward the objective paradigm of aesthetic philosophy, in which the urban-forest aesthetics is assessed solely through the expert's professional experience. On the contrary, the perceptual approach leans heavily towards the subjective paradigm of aesthetic philosophy, and the assessment process in this approach is

based on public opinion. We realize that although these two approaches differ philosophically, they each have strong arguments in their favor. This is because aesthetic assessment is a rather complex issue. Experts may believe that they have attained proficiency after accumulating extensive knowledge and performing research in this field; however, public opinion can vary according to many factors. Therefore, it is important for experts to have in-depth knowledge of these changing opinions [68]. Conversely, relying solely on public perception may lead to a departure from the expertise and valuable opinions of experts in the field. Therefore, these two approaches have recently been combined to create a new approach called the “convergent approach”, one that includes the opinions of both experts and the public. We endorse this combination that uses a comprehensive framework to describe and quantify aesthetics, which includes both objective and subjective paradigms, using urban-forest visual character and urban-forest visual quality.

In conclusion, another issue to consider is how to apply our framework to a variety of urban forests, as the differences in physical appearance among urban forests can make it challenging to establish a universal framework for estimating the aesthetics of urban forests. The application of a framework for assessing the aesthetics of urban forests based on a local urban forest’s character and public opinion is needed. Results from the aesthetic assessment framework can be useful for planning tools and sustainable management strategies that promote the protection of beautiful areas or improve areas with low aesthetics.

5. Limitations and Future Studies

Despite the findings of this study, this study has several limitations. Firstly, there is a restriction on the number of keywords that were used; future initiatives considering more keywords such as “criteria” and “indicators” could reveal another dimension of urban forestry aesthetics that is not discussed in this review. Secondly, this study discusses significant aspects of the aesthetic assessment of urban forests; however, a quantitative analysis is not included, and future research initiatives are encouraged to further investigate the quantitative aspects of the published research studies within the subject matter. Thirdly, the scope of this study is confined to identifying the variables and factors influencing the aesthetics of urban forest areas, providing thorough definitions of each variable and an understanding of how to assess and validate it; this is still an active field of research. Therefore, we recommend future studies to further investigate in order to provide both theoretical and practical definitions for each of the seven major variables used to assess the visual aesthetic quality of urban forest areas.

6. Conclusions

By analyzing 81 published studies concerning aesthetic quality in urban and natural forest areas, we found out that the urban forest’s aesthetics is highly influenced by visual composition, visual sense, and visual conditions. Aesthetics has been proven to be an important part of forest functions and values because of its many benefits, especially in urban areas. Aesthetics should be viewed as a valuable resource and a significant motivator to protect urban forests. To further preserve urban-forest aesthetics, there is a need to establish unique assessment systems that reflect local needs. The considered studies have also recognized the aesthetic benefits of urban forests towards economy, human well-being, and ecological protection. Protecting urban-forest aesthetics is, therefore, viewed as both a public-interest responsibility and a benefit.

Following a review of all studies to determine the factors and variables of urban-forest aesthetic quality assessment, we discovered that most of these studies were conceptually centered on physical and psychological assessments. This study shows that visual concepts would provide a more comprehensive approach to aesthetic quality assessment by combining both “expert-based” and “perception-based” approaches. The results from this review also highlight the importance of establishing an integrated framework that can be used to assess the aesthetic quality of urban forest areas. In this study, the urban-forest aesthetic is defined by urban-forest visual character, measured by urban-forest visual qualities, and

assessed by experts and public preferences. Besides, there is also a need to understand how to evaluate and validate the importance of each variable. Nonetheless, we believe that these findings establish the fundamental principles that could guide researchers, forest managers, and decision makers in highlighting the meaning and assessment of the aesthetic quality of urban forest areas.

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Appendix A

Table A1. Summary table of all 81 documents.

No.	Document	First Author	Year	Journal	Method	Research Scope
1	Research	Diechuan Yang	2020	<i>Landscape and Urban Planning</i>	Hierarchical identification of landscape character	Landscape character in national park.
2	Research	Bingqian Ma	2020	<i>Forests</i>	Questionnaire survey	Landscape visual aesthetic quality in urban area.
3	Research	Natalia Fumagalli	2020	<i>Sustainability</i>	Questionnaire survey	Landscape visual aesthetic quality in rural greenways.
4	Research	Sadegh Fathi	2020	<i>International Journal of Environmental Research and Public Health</i>	Questionnaire and analytical network process (ANP)	Landscape visual aesthetic quality to improve the physical health of citizens in urban spaces.
5	Research	Foltête Jean-Christophe	2020	<i>Landscape and Urban Planning</i>	Coupling of crowd-sourced imagery and visibility modeling.	Landscape aesthetic dimension.
6	Research	Jiaying Shi	2020	<i>Sustainability</i>	Questionnaire survey	Landscape aesthetic preference and landscape cognition for different land covers (parks, waters, structures, and forests).
7	Research	Oleksandr Karasov	2020	<i>Ecological Indicators</i>	GIS-based mapping	Landscape-aesthetic GIS analysis in national park.
8	Research	Hayk Khachatryan	2020	<i>Land Use Policy</i>	Eye-tracking	Landscape aesthetics and landscape care knowledge.
9	Research	Dmitry A. Ruban	2020	<i>Geosciences</i>	Field investigation	Landscape aesthetic value of colluvial blocks.
10	Research	Zi Wang	2020	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Scenic beauty in national forest park.
11	Research	W.L. Zijlema	2020	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Landscape aesthetic ratings in four urban cities.
12	Research	Youngeun Kang	2019	<i>Sustainability</i>	Eye-tracking	Landscape visual aesthetics of urban areas.
13	Research	James F. Palmer	2019	<i>Landscape and Urban Planning</i>	GIS-based mapping	Landscape assessment model for visual impact assessment.
14	Research	Szu-Hsien Peng	2019	<i>Sustainability</i>	Expert survey / analytic hierarchy process (AHP) and analytic network process (ANP)	Landscape aesthetic assessment of watershed.
15	Research	Joanna Badach	2019	<i>Sustainability</i>	Case studies	Landscape visual, ecological, and structural quality of urban riverside.
16	Research	Luca Battisti	2019	<i>Sustainability</i>	Participatory approach (interviews, questionnaires, and participatory mapping)	Landscape aesthetic perception of the park.

Table A1. Cont.

No.	Document	First Author	Year	Journal	Method	Research Scope
17	Research	Mikel Subiza-Pérez	2019	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Landscape-aesthetic-quality scale evaluation of green–blue spaces.
18	Research	Anthony Kerebel	2019	<i>Landscape and Urban Planning</i>	Artificial Intelligence for Ecosystem Services (ARIES) modeling	Landscape aesthetic paradigm.
19	Research	Ronghua Wang	2019	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Landscape aesthetic preference in urban green spaces.
20	Review	Paul H. Gobster	2019	<i>Landscape and Urban Planning</i>	/	Landscape visual quality assessment.
21	Research	Kwang Youn Lee	2019	<i>Sustainability</i>	Viewshed and spatial aesthetic analysis	Visual and spatial aesthetics of the forest in mountain scenery.
22	Research	Mei Liu	2019	<i>Sustainability</i>	Questionnaire survey	Landscape aesthetic preference assessment of urban parks.
23	Research	Uta Schirpke	2019	<i>Landscape and Urban Planning</i>	Spatial modeling	Landscape aesthetic assessment of mountain regions.
24	Research	Hadi Beygi Heidarlou	2019	<i>Land Use Policy</i>	mapping and accuracy assessment	Landscape character
25	Research	Belén Martín	2018	<i>Ecological Indicators</i>	Describes two landscape scenarios	Landscape visual character.
26	Research	Ruth D. Swetnam	2018	<i>Land Use Policy</i>	Transferring metrics	Landscape aesthetic quality metrics.
27	Research	Johannes Hermes	2018	<i>Ecosystem Services</i>	Mapping and assessment of LAQ	Landscape aesthetic quality assessment.
28	Research	Ramesh Paudyal	2018	<i>Forests</i>	Questionnaire survey	Scenic beauty of forest area.
29	Research	David J. Nowak	2018	<i>Urban Forestry and Urban Greening</i>	Simulations	Urban-forest benefits.
30	Research	Guo Li	2017	<i>Landscape and Urban Planning</i>	Identification and description of landscape character	Landscape character types.
31	Research	Ronghua Wang	2017	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Urban-forest aesthetic quality.
32	Research	K. Tessa Hegetschweiler	2017	<i>Landscape and Urban Planning</i>	Questionnaire survey	Urban-forest aesthetic quality.
33	Research	Yun Hye Hwang	2017	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Unprotected secondary urban forests.
34	Research	Heather M. Kiley	2017	<i>Science of The Total Environment</i>	Questionnaire survey	Preference, scenic attractiveness, and conservation value.
35	Research	Macario Rodríguez-Entrena	2017	<i>Land Use Policy</i>	Experiment method	Landscape visual aesthetic quality of olive groves.
36	Review	Iryna Dronova	2017	<i>Landscape and Urban Planning</i>	/	Landscape complexity of visual aesthetic quality.
37	Research	R.D. Swetnam	2017	<i>Ecosystem Services</i>	GIS-based mapping	Landscape visual aesthetic quality of rural area.
38	Review	Nigel Cooper	2016	<i>Ecosystem Services</i>	/	Aesthetic cultural values associated with ecosystems.
39	Research	Yohan Sahraoui	2016	<i>Journal of Environmental Management</i>	Questionnaire survey	Spatial modeling of landscape aesthetics of urban-rural areas.
40	Research	GACHad D. Pierskalla	2016	<i>Urban Forestry and Urban Greening</i>	Moment-to-moment data and GIS	Landscape aesthetics of urban area.
41	Research	Ronghua Wang	2016	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Landscape visual aesthetic quality of urban, urban green space, farm, and forest areas.
42	Research	Meryem Atik	2016	<i>Journal of Environmental Management</i>	Landscape character assessment (LCA) tool for characterization	Landscape characters with terminology (aesthetics).
43	Review	Andrew Butler	2016	<i>Landscape Research</i>	/	Landscape character assessment.
44	Proceeding	Jamilah Othman	2015	<i>Procedia Environmental Sciences</i>	Questionnaire survey	Scenic beauty assessment of forest, hill, waterfall and lake.
45	Research	Xenia Junge	2015	<i>Landscape and Urban Planning</i>	Questionnaire survey	Landscape aesthetic quality of agricultural area.
46	Research	Sang Seop Lim	2015	<i>Journal of Environmental Management</i>	Questionnaire survey	Forest aesthetic value.
47	Proceeding	Noriah Othman	2015	<i>Procedia—Social and Behavioral Sciences</i>	Questionnaire survey	Landscape aesthetic values of national garden.
48	Research	Kaisa Hauru	2014	<i>Landscape and Urban Planning</i>	Questionnaire survey	Urban forest aesthetic appreciation.

Table A1. Cont.

No.	Document	First Author	Year	Journal	Method	Research Scope
49	Proceeding	Muhamad Solehin Fitry Rosley	2014	<i>Procedia—Social and Behavioral Sciences</i>	Questionnaire survey	Landscape aesthetic quality assessment.
50	Research	Gonzalo de la Fuente de Val	2014	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Landscape visual quality appreciation.
51	Research	Ksenia Kirillova	2014	<i>Tourism Management</i>	Interview	Tourist aesthetic judgment of nature and urban tourist destinations.
52	Research	Ondrej Kalivoda	2014	<i>Journal of Environmental Management</i>	Perception-based investigation (interview)	Landscape visual aesthetic quality.
53	Research	Sadasivam Karuppannan	2014	<i>Journal of Sustainable Development</i>	Case study	Urban green space.
54	Research	Jelena Vukomanovic	2014	<i>Land</i>	Visual quality metrics, viewshed analysis	Landscape aesthetics and pull factors.
55	Research	Isabelle D. Wolf	2014	<i>Landscape and Urban Planning</i>	questionnaire survey and GPS	Benefits of public green space.
56	Book Chapter	Jess Vogt	2020	<i>Snowball Method Encyclopedia of the World's Biomes</i>	/	Urban forests: features and benefits.
57	Conference	Robert G. Sullivan	2016	<i>National Association of Environmental Professionals Annual Conference</i>	/	Visual resource inventory of national park.
58	Conference	Ahmet Tuğrul Polat	2015	<i>19th International Academic Conference</i>	/	Landscape visual quality assessment.
59	Thesis	Marina Golivets	2011	<i>Swedish University of Agricultural Sciences</i>	Questionnaire survey	Forest aesthetic value.
60	Research	Allen Carlson	2010	<i>Environmental Values</i>	Suggestion and examination of positions	Aesthetic appreciation for the protection of nature.
61	Research	Mari Sundli Tveit	2009	<i>Journal of Environmental Management</i>	Questionnaire survey	Landscape aesthetic quality of agricultural area.
62	Review	T. Panagopoulos	2009	<i>Ecological Economics</i>	/	Forest aesthetic quality assessment.
63	Review	G. Fry	2009	<i>Ecological Indicators</i>	/	Landscape ecology visual quality.
64	Review	Angeline D. Gough	2008	<i>Ecological Indicators</i>	/	Sustainable forest management.
65	Review	Åsa Ode	2008	<i>Landscape Research</i>	/	Landscape aesthetic theory and landscape visual character.
66	Review	M.D. Velarde	2007	<i>Urban Forestry and Urban Greening</i>	/	Landscape aesthetics' health and well-being effects.
67	Review	M. Tveit	2006	<i>Landscape Research</i>	/	Landscape visual quality assessment and landscape visual character.
68	Research	Robert G. Ribe	2006	<i>Journal of Environmental Psychology</i>	Questionnaire survey	Scenic beauty of forest conservation.
69	Research	Gonzalo de la Fuente de Val	2006	<i>Landscape and Urban Planning</i>	Questionnaire survey	Landscape spatial pattern and the rating of visual aesthetic quality.
70	Book Chapter	Liisa Tyrväinen	2005	<i>Urban Forests and Trees</i>	/	Benefits of urban forests
71	Research	Robert G. Ribe	2005	<i>Landscape and Urban Planning</i>	Questionnaire survey	Scenic beauty and design of forest.
72	Research	Assenna Todorova	2004	<i>Landscape and Urban Planning</i>	Questionnaire survey	Landscape aesthetic preferences.
73	Review	G.T. McDonald	2004	<i>Forest Policy and Economics</i>	/	Sustainable forest management.
74	Research	Gary R. Clay	2004	<i>Landscape and Urban Planning</i>	Questionnaire survey	Landscape scenic quality assessment along roads.
75	Research	K.F. Akbar	2003	<i>Landscape and Urban Planning</i>	Questionnaire survey	Landscape scenic quality assessment along roads.
76	Research	Liisa Tyrväinen	2003	<i>Urban Forestry and Urban Greening</i>	Questionnaire survey	Urban-forest aesthetic value.
77	Review	Colin Price	2003	<i>Urban Forestry and Urban Greening</i>	/	Urban-forest aesthetic benefits.
78	Book Chapter	Carys Swanwick	2002	<i>The Countryside Agency, and Scottish Natural Heritage</i>	/	Landscape character assessment.
79	Review	James F. Palmer	2001	<i>Landscape and Urban Planning</i>	/	Landscape visual quality assessment.

Table A1. Cont.

No.	Document	First Author	Year	Journal	Method	Research Scope
80	Review	Terry C. Daniel	2001	<i>Landscape and Urban Planning</i>	/	Landscape visual quality assessment.
81	Review	Andrew Lothian	1999	<i>Landscape and Urban Planning</i>	/	Landscape aesthetic philosophy.

Table A2. Total number of publications from all 81 documents.

Categories		Number of Publications
A	Document	
	Research papers	57
	Review papers	15
	Proceeding papers	3
	Book chapters	3
	Conference papers	2
	Thesis	1
		81
B	Year	
	2020	12
	2019	13
	2018	5
	2017	8
	2016	7
	2015	5
	2014	8
	2011	1
	2010	1
	2009	3
	2008	2
	2007	1
	2006	3
	2005	2
	2004	3
	2003	3
	2002	1
	2001	2
	1999	1
		81
C	Journal	
	<i>Landscape and Urban Planning</i>	20
	<i>Urban Forestry and Urban Greening</i>	13
	<i>Sustainability</i>	8
	<i>Journal of Environmental Management</i>	5
	<i>Ecological Indicators</i>	4
	<i>Forests</i>	2
	<i>Landscape Research</i>	3
	<i>Land Use Policy</i>	4
	<i>Ecosystem Services</i>	3
	<i>Land</i>	1
	<i>Forest Policy and Economics</i>	1
	<i>Ecological Economics</i>	1
	<i>Science of The Total Environment</i>	1
	<i>Journal of Environmental Psychology</i>	1
	<i>Tourism Management</i>	1
	<i>Environmental Values</i>	1
	<i>Journal of Sustainable Development</i>	1
	<i>International Journal of Environmental Research and Public Health</i>	1
	Other	10
		81

Table A2. Cont.

	Categories	Number of Publications
D	Method	
	Questionnaire survey method	35
	Experiment method	7
	Modeling method	5
	GIS-mapping method	6
	Landscape character identification method	3
	Technique method	3
	Interview method	2
	Review method	20
		81
E	Research scope	
	Landscape visual aesthetic quality assessment	27
	Forest and urban-forest aesthetics	20
	Landscape aesthetics	17
	Landscape aesthetic preference	5
	Landscape aesthetic philosophy and judgment	5
	Landscape character	5
	Urban green space	2
		81

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