Journal of Ornamental Plants
https://sanad.iau.ir/en/Journal/jornamental
ISSN (Print): 2821-0093 ISSN (Online): 2783-5219

Research Article
Volume 14, Number 4: 259-274, December, 2024
https://doi.org/10.71645/jop.2024.140301041105690

Exploring Citizens' Aesthetic Perception in Urban Green Space Design: A Study of Ornamental Trees and Shrubs Distribution in Bushehr, Iran

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Received: 23 March 2024 **Accepted:** 29 May 2024

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Abstract

Expanding and restoring urban green spaces represent a growing social demand among citizens in developing countries. However, in Iran, these efforts face significant challenges due to the country›s arid regions and the heightened expectations of people regarding visual and environmental quality. The selection of tree species in urban landscape design plays a crucial role in shaping the aesthetic, emotional, and environmental aspects of urban areas. To evaluate the impact of ornamental trees and shrubs in Bushehr›s urban space, a questionnaire-based survey was conducted with a statistical sample of 200 Bushehri citizens, focusing on five species: *Bougainvillea* sp., *Ficus elastica*, *Conocarpus erectus*, *Clerodendrum inerme*, and *Dodonea viscosa*. Analysis revealed that «emotional feeling» and «perceived environmental beauty» constituted 70.9 % of society's aesthetic perception variance. Additionally, Friedman's nonparametric test highlighted significant differences in society's aesthetic perception of the studied trees, with respondents noting higher perceived cognitive beauty in *Bougainvillea* sp. and *F. elastica*. Effective selection of plant species for urban green spaces not only enhances visual appeal but also positively impacts people's emotional well-being. This requires a thorough consideration of environmental factors and emotional responses. By integrating these concepts into the design, along with raising awareness of arid region species, satisfaction with urban spaces can be partially increased.

Keywords: Aesthetics, Shrubs, Trees, Urban green space.

INTRODUCTION

Population growth and urbanization are undeniable realities of the modern world. As urban areas expand, there is a growing demand for appealing landscapes. However, concurrently, the availability of spaces conducive to enhancing landscape beauty both quantitatively and qualitatively is diminishing (Ma, 2005). In recent years, the traditional spatial-based approach to landscape performance has evolved towards multifunctional paradigms. This shift is driven by the belief that landscapes become more practical and effective when they serve ecological, economic, sociocultural, historical, and aesthetic purposes simultaneously. Therefore, when planning and constructing landscapes and green spaces in climatically unique regions, such as arid and semi-arid areas, it becomes crucial to prioritize multipurpose functionality. This includes addressing climate change-related challenges, notably the water crisis and its socioeconomic implications, alongside considerations for aesthetic dimensions.

In developing countries, there is a burgeoning social and civic demand for the expansion and revitalization of urban green spaces. However, this aspiration faces significant challenges, particularly in arid regions, due to population growth and the scarcity of sustainable water resources. Simultaneously, community expectations regarding the visual appeal of green spaces add to the complexity. Addressing this requires the localization and introduction of alternative drought-resistant species. This strategy offers a partial solution to mitigate dissatisfaction in dry climates (Karimian, 2019).

The term 'aesthetic' finds its roots in the Greek word 'aisthēta,' which translates to perceptible things. Beauty, as described by Lothian (1999), is a natural delight derived from experiencing natural landscapes, whether observed physically or perceived mentally as an intrinsic quality of the environment within human consciousness. Gobster *et al.* (2007) further elaborate on aesthetics, defining it as the sensation of joy evoked by perceptible features within landscape patterns, observable directly and temporarily from the landscape itself. Thus, the aesthetic perception of a landscape arises from diverse stimuli and the amalgamation of various senses in perceiving it, with particular emphasis placed on visual beauty (Karimian, 2019). Cultural-based aesthetic theories, as proposed by Bourassa (1990), acknowledge factors such as social, religious, racial, and historical influences in shaping people's aesthetic responses. These theories underscore the intricate interplay between culture and aesthetics in shaping individuals' perceptions of beauty. Plants hold significant symbolism in Iranian culture, representing freshness and beauty (Aminzadeh, 2001). One of the most notable Persian concepts related to green spaces is the term "Pardis", which has influenced numerous words in other languages (Barati, 2003).

The concept of humans as the creators and primary influencers of urban environments emerged in the 15th century, leading to the development of attractive squares, green spaces, landscapes, and intersections within cities (Shokouie, 2017). Scholars unanimously recognize the vital role of urban green spaces in fostering sustainable cities (Seiferling *et al*., 2017). These spaces offer a multitude of benefits, including enhancing urban aesthetics, promoting public health, and increasing land value (Pandit *et al*., 2013; Roy, 2017). Additionally, they contribute to green views, provide shade, support biodiversity (Cowett and Bassuk, 2014; Li *et al*., 2018; Subburayalu and Sydnor, 2012), mitigate air pollution (Harris and Manning, 2010), combat heat island effects (Lanza and Stone, 2016), and influence microclimates (Sanusi *et al*., 2017). Street trees, a prominent feature of urban green spaces, thrive in close proximity to people's daily lives (Plant and Sipe, 2016). While much research on street trees has focused on their functional benefits, such as data collection and policy development, attention to species diversity is crucial (Vogt *et al*., 2017; Berland and Lange, 2017; Buijs *et al*., 2019; Foo, 2018; Galenieks, 2017).

Studies emphasize the importance of selecting street tree species capable of withstanding harsh environmental conditions, ensuring they provide optimal benefits and endure challenging growth conditions (Mullaney *et al*., 2015; Jim, 2003; Sjöman and Nielsen, 2010; Chen, 2017). The growth environment of street trees differs significantly from trees cultivated in other parts of cities, impacting citizens' perception (Mullaney *et al*., 2015; Yang *et al.*, 2012; Escobedo and Chacalo, 2008). Integrating citizens' perceptions and preferences into existing selection criteria is expected to enhance their satisfaction (Kim *et al*., 2021). Trees in urban areas serve four main functions: Ecological: They provide habitats for wild species (MacGregor-Fors *et al.*, 2011). Temperature: Trees and their density help reduce urban heat island effects (Grimm *et al.*, 2008). Economic: Their shade can lower maintenance costs for urban infrastructure (Conway and Urbani, 2007; Sanesi and Chiarello, 2006). Social: Trees contribute to stress reduction and are commonly used for stress mitigation.

Iran, a country where approximately two-thirds of its land area lies in arid and semi-arid regions, faces challenges in maintaining sustainable water resources due to their limited availability (Karimian, 2019). Consequently, there is a necessity to transition towards water-sensitive urban designs, xeriscaping, and altered planting patterns. Climatic classifications indicate that precipitation ranges from 100 to 250 mm in arid regions and 250 to 490 mm in semi-arid regions, with Iran being considered arid given its average precipitation of about 200 mm. Moreover, approximately 120 million hectares of Iran's total land area of 165 million hectares have arid desert climates (Khosroushahi, 2012). Designing landscapes and green spaces in arid regions presents unique challenges due to harsh climatic conditions, including limited precipitation, acute water scarcity, high temperatures, intense solar radiation, persistent winds, significant fluctuations in day and night temperatures, and low humidity levels. Despite the acknowledged importance of trees in urban areas and contemporary urbanization strategies (Ezcurra, 1990), tree cover remains predominantly sparse. While the role of urban trees in supporting wildlife has been extensively studied (Chace and Walsh, 2006; Hamer and McDonnell, 2008), there has been limited investigation into people's perceptions of trees (MacGregor-Fors *et al.*, 2011). Therefore, addressing the issues of green space and aesthetics in urban areas is crucial.

Ode *et al.* (2008) delineated nine visual concepts, collectively shaping the notion of visual aesthetics in landscapes. These concepts encompass complexity, coherence, stewardship, disturbance, visual scale, image ability, naturalness, historicity, and ephemera. Dulebenets *et al.* (2018) highlighted essential contradictions in organizing aesthetic elements, such as equipment and facility inadequacies, disordered lighting, asymmetric coloring, and unbalanced spacing. Celik and Aciksoz (2017) evaluated the natural, cultural, economic, and structural features contributing to urban green space aesthetics, examining their ties to globalization and seeking sustainability solutions in Bartin, Turkey. Natural elements, labeled as "natural tranquilizers," are deemed beneficial for urban areas, offering respite from the stress prevalent in daily life (Othman *et al.*, 2015). Barrett *et al.* (2009) underscored that global population growth manifests concerns across various domains, including landscape aesthetics, disease ecology, energy resource management, environmental literacy, food production, genetic diversity, and landscape vitality. Veinberga *et al.* (2019) explored human perception of ecological qualities and landscape aesthetics, assessing four types of plantings in urban green spaces across six ecological and beauty characteristics in four Latvian cities. Tork (2011) advocated for leveraging natural ground to enhance aesthetic perception and quality of life, emphasizing the significance of natural elements and criteria in shaping human existence.

This study aims to discern and examine the aesthetic impacts of ornamental trees and shrubs in urban green space design within Bushehr.

MATERIALS AND METHODS

Species selection and study site

Out of the 90 street tree species planted in Bushehr, five primary species were selected for the research based on their prevalence in main streets and their ability to absorb pollutants. The research comprised two phases. During the first phase, ecological indices of the trees were identified. A comprehensive list of ornamental plants was obtained from the Organization of Urban Parks and Green Spaces of Bushehr, encompassing 123 species of plants, shrubs, and trees with their phenology. From this list, ten superior species were chosen based on various criteria, including growth parameters, regional adaptability, suitability for the urban environment, aesthetic appeal, architectural qualities, and unique characteristics within the city (Asgharpour, 2009).

To make these selections, consultations were held with organizations such as the Organization of Urban Parks and Green Spaces, the Department of Environment, as well as experts in horticulture, green space management, and urban architecture. The selected species included buttonwood (*Conocarpus erectus*), sacred fig (*Ficus religiosa*), great bougainvillea (*Bougainvillea* sp.), sorcerers bush (*Clerodendrum inerme*), palm (*Phoenix* sp.), neem (*Azadirachta indica*), jambolan (*Syzygium cumini*), rubber fig (*Ficus elastica*), royal poinciana (*Delonix regia*), and sticky hop bush (*Dodonaea viscosa*) grown in Bushehr. Inductively coupled plasma mass spectrometry (ICP-MS) was used to measure the concentration of heavy metals (Amareh *et al*., 2024). Based on the results of heavy metal uptake, five ornamental flowers of *Bougainvillea* sp., *C. erectus*, *C. inerme*, *D. viscosa*, and *F. elastica* were finally chosen as they had the highest rate of heavy metal uptake (Fig. 1).

In the second phase, the focus shifted to assessing the aesthetic effects of the selected tree species within the urban space of Bushehr. To accomplish this, the research team compiled and refined evaluation criteria based on an extensive literature review (Todorova *et al*., 2004; Lampinen *et al*., 2021; Camacho-Cervantes *et al*., 2014; Kim *et al.*, 2021). These criteria were then transformed into an initial questionnaire. Subsequently, the questionnaire was subjected to validation by 10 experts specializing in art, horticulture, and landscape design to ensure its aesthetic validity. Their feedback and insights were instrumental in refining the questionnaire to ensure its effectiveness in assessing the aesthetic aspects of the target tree species.

Based on the content validity index (CVI), respondents were asked to rate each item on the questionnaire as irrelevant, needing major revision, relevant but needing minor revision, or completely relevant. This process aimed to assess how well the selected questions satisfied all criteria required for inclusion in the final instrument and whether the domains chosen for forming the final instrument adequately reflected all aspects of the studied construct (Polit and Beck, 2006; Grant and Davis, 1997; Rubio *et al*., 2003; Abdollahpour *et al*., 2010).

Content validity is considered a crucial step in questionnaire design and is the primary type of validity to ensure when creating an instrument (Grant and Davis, 1997; Rubio *et al*., 2003; Abdollahpour *et al.*, 2010). To evaluate content validity, the questionnaire was distributed to 10 experts in horticulture, landscape design, and art. They were asked to provide their opinions on the 19 items of the questionnaire using the four criteria mentioned above.

The CVI score was calculated by determining the total agreement scores for each item that received scores of 3 and 4 (the highest scores), divided by the total number of voters. Items with a CVI score of >0.79 were considered acceptable. The analysis revealed that all items achieved CVI scores >0.79, except for items 6, 7, 9, 14, and 19, which were deemed suitable for evaluation (Table 1).

Table 1. The content validity index.

	Features	Content validity index					
		Irrelevant	Needing major revision	Relevant but needing minor revision	Completely relevant	Standard value	Sum of columns 4 + 3
2	I feel good when I see this tree amidst the greenery.			40	60	62	100
12	This tree is compatible with the weather conditions of the city.			10	90	62	100
17	Proper grooming and pruning make it more beautiful.			22.2	77.8	78	100
1	This tree beautifies urban green spaces.			11.1	88.9	78	100
4	This tree gives a pleasant color and scent to the green space.		10	30	60	62	90
13	It creates a natural atmosphere in the street.		10	10	80	62	90
16	They cool the air on hot days.		11.1	22.2	66.7	78	88.9
5	This tree gives a warm and friendly feeling to the environment.		20	30	50	62	80
8	This tree is attractive.		20	60	20	62	80
11	I feel happy when I see this tree.	20		50	30	62	80
3	This tree can be a symbol of the green space in the region.	22.2		55.6	22.2	78	77.8
10	It is a unique tree.	11.1	11.1	33.3	44.4	78	77.7
14*	It keeps us aware of the seasonal changes of nature.	11.1	11.1	33.3	44.4	78	77.7
7*	This tree creates a sense of security in the street.	20	10	50	20	62	70
15	It provides a suitable place for the local residents to gather.	10	20	50	20	62	70
18	When it dries, it creates an unpleasant scene in the environment.	20	10	10	60	62	70
6*	This is a lovely tree.		40	30	30	62	60
19*	Houses in the vicinity of green space created by these trees are in a better position for buying and selling.	22.2	33.3	33.3	11.1	78	44.4
9*	It creates a sense of liberation in me.	40	20	30	10	62	40

After scoring, items that did not meet the minimum required score were discarded, while those with borderline scores were revised to enhance their validity. Following confirmation of validity, a pilot test was conducted to evaluate the instrument's reliability. Cronbach's alpha was calculated to be 0.91, confirming the instrument's reliability.

The questionnaire comprised two sections. The first section gathered demographic information (educational level and age), while the second section focused on assessing aesthetic perception and tree features within the urban environment. These included aspects such as urban space beauty, evoking positive feelings, symbolizing green spaces, adding freshness and scent, creating a warm and friendly atmosphere, attractiveness, uniqueness, providing delight, adapting to climatic conditions, creating natural surroundings, offering a gathering place, cooling the air, and enhancing beauty through grooming and pruning.

Respondents were presented with images of each studied species separately and asked to rate their agreement with the questionnaire items for each species on a scale from 1 to 10 (1 = very weak agreement, 10 = very strong agreement). Data were collected during the winter of 2022 and analyzed using nonparametric tests such as the Kruskal-Wallis and Friedman tests, as well as exploratory factor analysis R. Additionally, Bartlett's test and the Kaiser-Meyer-Olkin (KMO) measure were employed to ensure sample size adequacy and the sphericity of variables before conducting factor analysis.

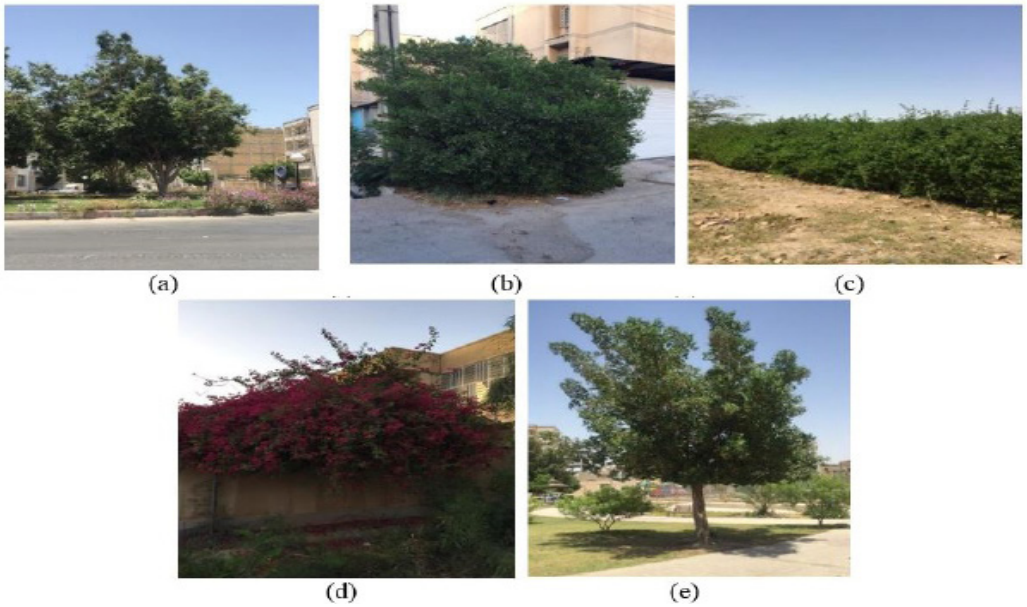

Fig. 1. (a) *Ficus elastica*; (b) *Dodonea viscosa*; (c) *Clerodendrum inerme*; (d) *Bougainvillea* sp.; and (e) *Conocarpus erectus*.

RESULTS

The findings revealed that the majority of respondents fell within the age brackets of 30-40 years (33.7%) and 40-50 years (30.2%). Regarding educational attainment, the highest frequency was observed among individuals holding a bachelor's degree (45.8%), while the lowest frequency was recorded among those with an under-high school diploma (4.9%) (Table 2).

Table 2. The respondents' age and educational level characteristics.

Variable	Levels	Frequency	%
Age	<20 years	24	11.7
	20-30 years	26	12.7
	30-40 years	69	33.7
	40-50 years	62	30.2
	50-60 years	18	8.8
	> 60 years	6	2.9
Educational level	Under diploma	10	4.9
	Diploma	19	9.4
	Associate degree	11	5.4
	Bachelor's degree	93	45.8
	Postgraduate degree	70	34.5

Regarding the respondents' aesthetic perception of *Bougainvillea* sp., the highest scores were observed in various aspects, with the most notable being the stimulation of a good feeling (9.33), symbolizing the green space (8.76), creating pleasant color and scent (8.38), provoking a warm and friendly feeling (8.86), attractiveness (9.09), uniqueness (8.41), creating a sense of delight (8.95), adaptation to climatic conditions (9.39), creating a natural space (8.97), creating a suitable place for gathering (8.33), and enhancing beauty with proper grooming and pruning (8.48). Conversely, the highest scores for creating an unpleasant scene due to drying (7.21) and cooling the air on hot days (7.92) were associated with F. elastica (Table 3).

Additionally, the lowest averages for aesthetic perception features were observed in various aspects, notably:

Creating an urban green space (5.28), inducing a good sense (5.06), symbolizing the green space (4.41), creating pleasant color and scent (3.72), inducing a warm and friendly feeling (4.66), attractiveness (4.67), uniqueness (4.46), creating a sense of delight (4.12), creating a natural space (5.95), creating a suitable place for gathering (5.29) and enhancing beauty with proper grooming and pruning (7.39). These lowest averages were associated with *C. erectus*. Additionally, the lowest averages for adaptation to climatic conditions (7.17) and cooling the air on hot days (6.17) were related to *D. viscosa* (Table 3).

In general, the respondents' highest mean aesthetic perception was associated with *Bougainvillea* sp. (8.64), while the lowest was observed for *C. erectus* (5.41) (Fig. 2).

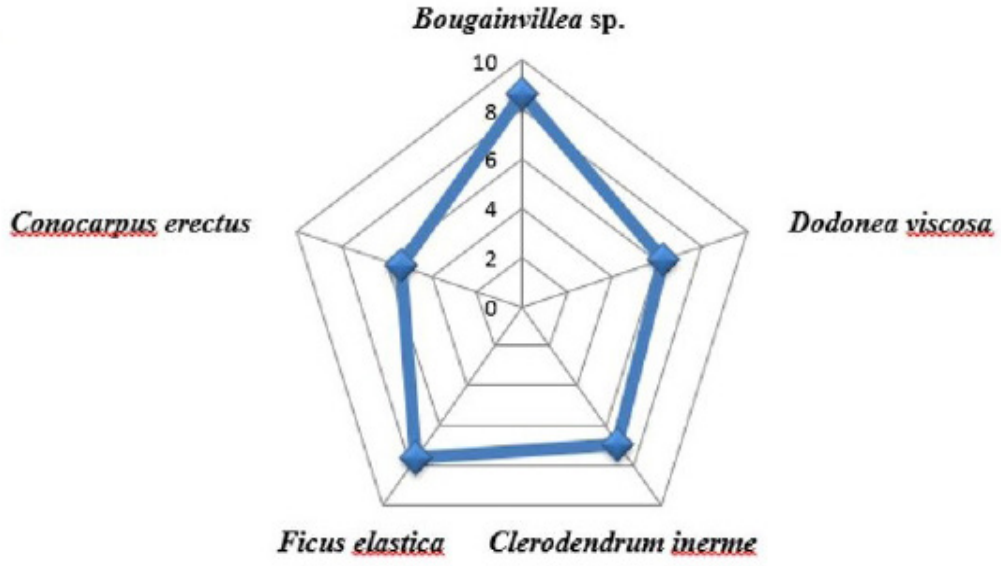

Fig. 2. The average aesthetic perception of the ornamental trees in Bushehr's urban green space.

The Kruskal-Wallis test examining the effect of education on aesthetic perception of the landscape trees indicated no significant difference among the education groups. However, when studying the difference in aesthetic perception of common trees in urban landscape design among different age groups, the test revealed significant differences in the aesthetic perception of *F. elastica* (Chi2 = 3.404, $P < 0.05$). Further comparison of the mean ranks showed a significant difference only between the age groups of <20 years and 30-40 years regarding aesthetic perception of *F. elastica*, while the age groups did not significantly differ in aesthetic perception of the other plants (Table 4).

Table 3. The aesthetic characteristics of the trees.

Characteristic	*Bougainvillea sp.*		*Conocarpus erectus*		*Ficus elastica*		*Clerodendrum inerme*		*Dodonea viscosa*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
This tree beautifies urban green spaces.	9.26	1.416	5.28	3.495	7.95	2.037	7.50	2.351	6.56	2.500
I feel good when I see this tree in the green.	9.33	1.454	5.06	3.538	7.76	2.157	7.10	2.261	6.08	2.566
This tree can be a symbol of the green space in the region.	8.76	1.915	4.41	3.694	7.23	2.632	6.24	2.652	5.59	2.940
This tree gives a pleasant color and scent to the green space.	8.38	2.269	3.74	3.565	7.17	2.585	6.50	2.539	5.84	2.671
This tree gives a warm and friendly feeling to the environment.	8.86	1.756	4.66	3.460	7.43	2.493	6.64	2.382	5.84	2.657
This tree is attractive.	9.09	1.684	4.67	3.455	7.54	2.689	6.80	2.628	5.83	2.562
It is a unique tree.	8.41	2.031	4.46	3.539	7.23	2.664	6.13	2.888	5.56	2.753
I feel happy when I see this tree.	8.95	1.803	4.12	3.437	7.23	2.476	6.38	2.751	5.77	2.733
This tree is compatible with the weather conditions of the city.	9.39	1.337	7.31	3.168	8.10	2.142	8.00	2.250	7.17	2.705
It creates a natural atmosphere in the street.	8.97	1.670	5.95	3.349	8.01	2.098	7.07	2.573	6.79	2.701
It creates a proper place for local residents' gatherings.	8.33	2.323	5.29	3.526	7.70	2.392	5.97	3.046	5.66	2.900
It cools the air on hot days.	7.21	2.639	6.67	3.384	7.92	2.355	6.62	2.902	6.17	2.734
Proper grooming and pruning make it more beautiful.	8.48	2.357	7.36	3.199	8.05	2.260	8.33	2.191	7.68	02.538
When it dries, it creates an unpleasant scene in the environment.	7.50	3.019	6.78	3.299	7.54	2.696	7.26	2.875	7.01	2.863
Total			75.7		106.8		96.5		87.5	

Table 4. The difference among educational groups and age groups in their aesthetic perception of the ornamental trees in Bushehr.

Species	Age group		Educational level	
	Chi-square	p-value	Chi-square	p-value
Bougainvillea sp.	2.696	0.747	7.131	0.129
Conocarpus erectus	3.403	0.638	5.037	0.283
Ficus elastica	14.923	0.011	1.372	0.849
Clerodendrum inerme	4.364	0.498	2.241	0.692
Dodonea viscosa	0.624	0.987	1.969	0.742

Also, the results of the nonparametric Friedman test showed statistically significant differences in the aesthetic perception of the studied ornamental trees in the green space of Bushehr (Chi2 = 325.4; P < 0.01) (Table 5).

Table 5. The comparison of the ornamental trees in the urban green space of Bushehr.

Tree	Mean rank
Bougainvillea sp.	4.43
Conocarpus erectus	1.99
Ficus elastica	3.48
Clerodendrum inerme	2.84
Dodonea viscosa	2.26
P < 0.01; Chi-square = 325.4	

Table 6. Identification of aesthetic perception components of urban residents in Bushehr.

Item	Component	
	Emotional feeling	Environmental beauty
It is a unique tree.	0.872	
This tree can be a symbol of the green space in the region.	0.855	
I feel happy when I see this tree.	0.833	
This tree is attractive.	0.828	
This tree gives a warm and friendly feeling to the environment.	0.822	
I feel good when I see this tree in the green.	0.774	
This tree gives a pleasant color and scent to the green space.	0.732	
It creates a proper place for local residents' gatherings.	0.720	
This tree beautifies urban green spaces.	0.648	
This tree is compatible with the weather conditions of the city.		0.850
Proper grooming and pruning make it more beautiful.		0.791
It cools the air on hot days.		0.637
When it dries, it creates an unpleasant scene in the environment.		-0.632
It creates a natural atmosphere in the street.		0.583
Percent of variance	62.115	8.676
Eigenvalue	8.696	1.227

To assess the community's overall aesthetic perspective, an exploratory factor analysis (R type) was conducted to categorize the general aesthetic items. Total scores of the items were calculated separately for all five trees. Bartlett's test and the Kaiser-Meyer-Olkin (KMO) measure were then utilized to assess the feasibility of factor analysis through principal component analysis, with the results confirming its feasibility (KMO test = 0.943; < 0.01).

The data were divided into two factors based on eigenvalues of >1, which collectively accounted for 70.9 percent of the total variance in the data. The results revealed that people's aesthetic perception comprised two general components: emotional feeling (including uniqueness, symbolism of the green space, creating a sense of delight, attractiveness, a warm and friendly ambiance, inducing a positive feeling, providing pleasant colors and scents, offering a suitable place for social gatherings, and enhancing the beauty of the urban green space) and perceived environmental beauty (encompassing adaptation to climatic conditions, enhancing beauty through proper grooming and pruning, cooling the air on hot days, creating an unpleasant scene when drying, and providing a natural atmosphere to the street) (Table 6).

DISCUSSION

Trees offer numerous benefits in urban environments, playing a pivotal role in upholding sustainability (Li *et al.*, 2018; Park *et al*., 2017). Street trees, found abundantly in urban green spaces, serve as accessible natural elements for residents (Plant and Sipe, 2016) and must endure water scarcity and adverse conditions (Chen *et al*., 2017). Hence, considering the functional role of street trees is crucial when selecting species (Li *et al*., 2018; Buijs *et al*., 2019). A well-designed urban green space not only enhances aesthetics but also contributes to physical and mental well-being. Emphasizing the aesthetic aspect is fundamental in plant selection for green spaces. Urban green spaces, integral to urban ecosystems, are integrated into parks, green belts, roadsides, residential areas, and other locations.

To excel in green space management, it's crucial to utilize trees and shrubs that are well-suited for the specific region, as they can withstand potential stresses and adapt to local conditions. Moreover, when considering aesthetic aspects, it's essential to take into consideration the opinions of both experts and the general public regarding the plants present in green spaces. Therefore, to investigate the aesthetic and ecological impacts of ornamental trees and shrubs in the design of urban green spaces in Bushehr, this study gathered input from citizens, horticulturists, and aesthetic experts. As a result, the five best trees (*Bougainvillea* sp., *F. elastica, C. erectus, D. viscosa,* and *C. inerme*) were selected based on the ecological and aesthetic parameters.

In terms of educational attainment among respondents, the highest frequency was observed for those with a bachelor's degree, while the lowest frequency was noted for individuals with an under-diploma degree. Additionally, the analysis revealed no significant differences among the studied groups regarding their perception of aesthetic components.

Regarding age distribution, the highest frequency was observed in the 30-40 and 40-50 age groups, while the lowest frequency was found in the >60 age group. Analysis of differences in aesthetic perception among age groups concerning the commonly planted trees in Bushehr's landscape showed significant variation only for *F. elastica* between the <20 years and 30-40 years age groups. No significant differences were observed for other age groups.

Overall, the highest average aesthetic perception was observed for *Bougainvillea* sp. and *F. elastica,* while the lowest was recorded for *C. erectus* and *D. viscosa* (Fig. 1). This suggests that citizens in Bushehr have a stronger aesthetic appreciation for *Bougainvillea* sp. and *F. elastica*. The preference for flowering plants and trees in the city aligns with findings by Iwamura and Yokohari (2001) and Todorova *et al*. (2004), indicating a general attraction towards flowers.

Bougainvillea sp., a native flower commonly used for indoor decoration, boasts a delicate appearance with thin, dark green leaves resembling an umbrella crown. It thrives in low-light indoor environments and contributes to air purification by absorbing pollutants. Similarly, *F. elastica*, with its large, vibrant leaves, imparts a sense of abundance and beauty to indoor spaces, effectively filtering the air and creating a conducive environment for gatherings.

The perception of these plants by citizens aligns with their role in enhancing urban spaces, fostering warmth, friendliness, uniqueness, and delightfulness, while also providing suitable venues for social interactions. These findings are consistent with previous research highlighting the pivotal role of trees in enhancing the aesthetic appeal of street landscapes. Studies by Schroeder and Cannon (1983), Sommer *et al.* (1990, 1992), Wolf (2003), Kim *et al.* (2021), and Todorova *et al.* (2004) have all underscored the importance of trees in shaping the visual appeal and ambiance of urban environments. Additionally, these findings emphasize the significance of the space beneath trees, corroborating the observations made by Kim *et al.* (2021) and Todorova *et al*. (2004).

Bougainvillea sp. stands out as a vibrant and visually striking plant that holds significant potential for enhancing the urban green spaces of Bushehr. Its suitability for planting in urban environments stems from its ability to thrive in hot and humid climates, tolerate varying levels of sunlight, and exhibit relative resistance to pests and diseases. These characteristics make it well-suited to Bushehr's climate conditions. Furthermore, its trailing growth habit makes it an ideal choice for adorning the entrances and walls of buildings, adding a touch of natural beauty to urban landscapes.

Considering the preferences of the residents of Bushehr, *Bougainvillea* sp. can be effectively integrated into urban settings, including parks, pavilions, and gateways. Its diverse range of colors further enhances its potential for creating visually appealing urban landscapes. Moreover, the plant's ability to bloom throughout most seasons adds an element of diversity and vitality to the urban environment, contributing to the overall aesthetic appeal of the cityscape. Therefore, *Bougainvillea* sp. emerges as a promising option for incorporating environmental aesthetics into the urban fabric of Bushehr.

Ficus elastica, the second preferred choice among the people of Bushehr, offers both aesthetic and environmental benefits, making it an excellent option for cultivation in urban green spaces. Its variegated and visually appealing leaves enhance the aesthetic appeal of urban landscapes, while its ability to thrive in adverse conditions makes it a resilient choice for urban environments. This plant can tolerate varying levels of sunlight, including shade and semi-shade, making it adaptable to the climatic conditions of Bushehr.

Additionally, *Ficus elastica* exhibits a relatively high level of resistance to pests and diseases, further enhancing its suitability for cultivation in Bushehr's green spaces. Its malleable nature allows it to be shaped and cultivated to fit the desired aesthetic preferences of urban planners and landscape designers. Moreover, *Ficus elastica* is known for its air-purifying properties, contributing to improved air quality and reduced noise pollution in urban areas.

Given its ability to provide ample shade, *Ficus elastica* is particularly well-suited for semi-tropical cities like Bushehr, where intense sunlight is prevalent. The respondents' high scores for items such as "creating a suitable space for friendly gatherings" and "matching Bushehr's urban space" reflect their recognition of these beneficial attributes of *Ficus elastica,* further emphasizing its suitability for urban green spaces in the city.

Clerodendrum inerme is, a resilient evergreen shrub, presents an excellent option for enhancing the green spaces of Bushehr. Its adaptability to hot and humid climates, along with its capacity to thrive in both shade and semi-shade conditions, makes it well-suited for the city's

environmental requirements. Additionally, its relative resistance to pests and diseases, coupled with its malleability, allows for easy cultivation and shaping to fit various urban landscapes. *Clerodendrum inermis* is particularly recommended for street sides and parks due to its aesthetic appeal, including its evergreen foliage, high prunability, and form-ability. Its presence adds to the beauty of urban spaces while also serving practical purposes such as noise reduction. By absorbing noise, *Clerodendrum inermis* contributes to mitigating noise pollution, making it an ideal choice for areas between streets and sidewalks.

The outcomes of this study hold significant implications for forthcoming street tree selection endeavors in Bushehr, encompassing extensive programs aimed at enhancing parks and green spaces. Through the integration of citizens' preferences and perceptions, these methodologies offer a pathway to crafting urban green areas that resonate with the community's values and needs. Consequently, this approach is poised to elevate citizen engagement and participation levels within the realm of urban planning and development initiatives.

The process of selecting plant species for urban decoration presents a multifaceted challenge. Beyond mere visual aesthetics, the strategic distribution of ornamental trees and shrubs throughout Bushehr's urban green spaces holds the power to evoke emotional responses in individuals. Thus, the selection of suitable plant species demands a comprehensive examination of both environmental and emotional factors. Natural landscapes and flowering species not only enhance the visual appeal but also have a profound impact on individuals' mental and emotional well-being, fostering feelings of serenity, freshness, and connection with nature. In this context, *Bougainvillea* sp. emerges as a particularly suitable candidate for Bushehr's urban landscape. This species exhibits remarkable adaptability to the local environmental conditions, thriving in the city's temperate and humid climate. Its ability to withstand high levels of moisture and sunlight renders it well-suited for the region. By incorporating *Bougainvillea* sp. into urban green spaces, planners can simultaneously address both environmental and emotional considerations. This strategic selection not only enhances landscape beauty but also contributes to citizen satisfaction, fosters a deeper connection with nature, and reinforces Bushehr's environmental authenticity.

CONCLUSION

The study revealed that the aesthetic perception of the studied trees was significantly influenced by two key components: "Emotional feeling" and "perceived environmental beauty." Citizens viewed *Bougainvillea* sp. and *F. elastica* as having higher perceived cognitive beauty, indicating that these species align more closely with public preferences and hold greater value. This underscores the importance of incorporating citizens' preferences into urban park designs to ensure their success. Future research avenues could explore the development of modern artificial intelligence-based approaches to incorporate public opinions into the selection of plant species for urban green spaces. However, it's crucial to consider climate as a critical criterion in this process, particularly in urban areas, to ensure the suitability and sustainability of the chosen plants.

ACKNOWLEDGMENT

The authors would like to thank Islamic Azad University, Rasht Branch for its support towards this project.

Literature Cited

Abdollahpour, I., Nedjat, S., Noroozian, M., Golestan, B. and Majdzadeh, R. 2010. Development of a caregiver burden questionnaire for the patients with dementia in Iran. International Journal of Preventive Medicine, 1(4): 233-241.

Amareh, R., Kaviani, B., Sedaghathoor, S. and Allahyari, M.S. 2024. Antioxidant defense strategies of urban ornamental plants in southern Iran against heavy metals. Bioremediation Journal, 28 (4): 1-19. https://doi.org/10.1080/10889868.2024.2303007

Aminzadeh, B. 2001. Philosophy of environmental interaction in Muslim cities. Soffeh, 10 (31): 40-53. (In Persian)

Asgharpour, M. J. 2009. Multiple criteria decision making. Tehran University Press, 400 pages.

Barati, N. 2003. An innovative view to the concept of garden and green space in Persian language. Journal of Environmental Studies, 29 (Special Issue), 1-12. (In Persian)

Barrett, T.L., Farina, A. and Barrett, G.W. 2009. Aesthetic landscapes: An emergent component in sustaining societies. Landscape Ecology, 24: 1029-1035. https://doi.org/10.1007/s10980-009-9354-8

Berland, A. and Lange, D.A. 2017. Google street view shows promise for virtual street tree surveys. Urban Forestry and Urban Greening, 21: 11-15.

Bourassa Steven, C. 1990. A paradigm for landscape aesthetics. Environment and Behavior, 22 (6): 787-812.

Buijs, A., Hansen, R., van der Jagt, S., Ambrose-Oji, B., Elands, B., Rall, E.L., Mattijssen, T., Pauleit, S., Bunhaar, H. and Olafsson, A.S. 2019. Mosaic governance for urban green infrastructure: Upscaling active citizenship from a local government perspective. Urban Forestry and Urban Greening, 40: 53-62.

Camacho-Cervantes, M., Schondube, J. E., Castillo, A. and MacGregor-Fors, I. 2014. How do people perceive urban trees? Assessing likes and dislikes about the trees of a city. Urban Ecosystems, 17: 761-773.

Celik, D. and Aciksoz, S. 2017. Urban aesthetic and urban landscape design guides: A case study of Bartin-Turkey. Journal of Environmental Biology, 38(5): 893-900.

Chace, J.F. and Walsh, J.J. 2006. Urban effects on native avifauna: A review. Landscape Urban Planing, 74: 46-69.

Chen, Y., Wang, X., Jiang, B., Wen, Z., Yang, N. and Li, L. 2017. Tree survival and growth are impacted by increased surface temperature on paved land. Landscape Urban Planning, 162: 68-79.

Conway, T.M. and Urbani, L. 2007. Variations in municipal urban forestry policies: A case study of Toronto, Canada. Urban Forestry and Urban Greening, 6: 181-192.

Cowett, F.D. and Bassuk, N.L. 2014. Statewide assessment of street trees in New York State, USA. Urban Forestry and Urban Greening, 13: 213-220.

Dulebenets, N., Ozguven, E. and Moses, R. 2018. The highway beautification act: Towards improving efficiency of the federal outdoor advertising control program. Transportation Research, 110: 88-106.

Escobedo, F. and Chacalo, A. 2008. Descontaminación atmosférica por el arbolado urbano de la Ciudad de México (Reduction in atmosphere pollution due to the urban trees in Mexico City). Interciencia, 33: 29-33.

Ezcurra, E. 1990. De las chinampas a la megalópolis (From chinampas to the big city). Fondo de Cultura Económica, México.

Foo, K. 2018. Examining the role of NGOs in urban environmental governance. Cities, 77: 67-72.

Galenieks, A. 2017. Importance of urban street tree policies: A comparison of neighboring southern California cities. Urban Forestry and Urban Greening, 22: 105-110.

Gobster, P.H., Nassauer, J.I., Daniel, T.C. and Fry, G. 2007. The shared landscape: What does aesthetics have to do with ecology? Landscape Ecology, 22: 959-972.

Grant, J.S. and Davis, L.L. 1997. Selection and use of content experts for instrument development. Research in Nursing and Health, 20: 269-274.

Grimm, N.B., Faeth, S.H., Golubiewski, N.E., Redman, C.L., Wu, J.G., Bai, X.M. and Briggs, J.M. 2008. Global change and the ecology of cities. Science, 319: 756-760.

Hamer, A.J. and McDonnell, M.J. 2008. Amphibian ecology and conservation in the urbanizing world: A review. Biology Conservation, 141: 2432-2449.

Harris, T.B. and Manning, W.J. 2010. Nitrogen dioxide and ozone levels in urban tree canopies. Environmental Pollution, 158: 2384-2386.

Iwamura, T. and Yokohari, M. 2001. Review and future perspectives of park maintenance and management by local communities in Kobe City, Hyogo prefecture. Journal of the Japanese Institute of Landscape Architecture, 64 (5): 671-674. (In Japanese with English summary)

Jim, C.Y. 2003. Protection of urban trees from trenching damage in compact city environments. Cities, 20: 87-94.

Karimian, Z. 2019. The conflict of landscape aesthetic preferences with sustainable green space in arid regions. Flower and Ornamental Plants, 4 (1): 1-12. (In Persian)

Khosroushahi, M. 2012. The compare of geomorphoclimatological deserts domain of Iran. Watershed Management Researches (Pajouhesh-Va-Sazandegi), 94: 10-18. (In Persian)

Kim, S.S., Lee, J.S., Lee, D.H. and Choi, Y. 2021. Citizens' preference and perception of street trees of main boulevards in Bussan, South Korea. Sustainability, 13 (6): 3141.

Lampinen, J., Tuomi, M., Fischer, L.K., Neuenkamp, L., Alday, J.G., Bucharova, A. and Klaus, V.H. 2021. Acceptance of near-natural green space management relates to ecological and socio-cultural assigned values among European urbanites. Basic and Applied Ecology, 50: 119-131.

Lanza, K. and Stone, B. 2016. Climate adaptation in cities: What trees are suitable for urban heat management? Landscape and Urban Planning, 153: 74-82.

Li, X., Ratti, C. and Seiferling, I. 2018. Quantifying the shade provision of street trees in urban landscape: A case study in Boston, USA, using google street view. Landscape and Urban Planning, 169: 81-91.

Lothian, A. 1999. Landscape and the philosophy of aesthetics: Is landscape quality inherent in the landscape or in the eye of the beholder? Landscape and Urban Planning, 44: 177-198.

Ma, H. 2005. Molecular genetic analyses of microsporogenesis and microgametogenesis in flowering plants. Annual Review in Plant Biology, 56: 393-434.

MacGregor-Fors, I., Morales-Perez, L. and Schondube, J.E. 2011. Does size really matter? Species-area relationships in human settlements. Divers Distribution, 17: 112-121.

Mullaney, J., Lucke, T. and Trueman, S.J. 2015. A review of benefits and challenges in growing street trees in paved urban environments. Landscape and Urban Planning, 134: 157-166.

Ode, A., Tveit, M.S. and Fry, G. 2008. Capturing landscape visual character using indicators: Touching base with landscape aesthetic theory. Landscape Research, 33 (1): 89-117.

Othman, N., Noralizawati, M. and Mohd Hisham, A. 2015. Landscape aesthetic values and visiting performance in natural outdoor. Environment, Social and Behavioral Sciences, 202: 330-339.

Pandit, R., Polyakov, M., Tapsuwan, S. and Moran, T. 2013. The effect of street trees on property value in Perth, Western Australia. Landscape and Urban Planning, 110: 134-142.

Park, J., Kim, J., Lee, D.K., Park, C.Y. and Jeong, S.G. 2017. The influence of small green space type and structure at the street level on urban heat island mitigation. Urban Forestry and Urban Greening, 21: 203-212.

Plant, L. and Sipe, N. 2016. Adapting and applying evidence gathering techniques for planning and investment in street trees: A case study from Brisbane, Australia. Urban Forestry and Urban Greening, 19: 79-87.

Polit, D.F. and Beck, C.T. 2006. The content validity index: Are you sure you know what's being reported? Critique and recommendations. Research in Nursing & Health, 29: 489-497.

Roy, S. 2017. Anomalies in Australian municipal tree managers' street-tree planting and species selection principles. Urban Forestry and Urban Greening, 24: 125-133.

Rubio, D.M.G., Berg-Weger, M., Tebb, S.S., Lee, E.S. and Rauch, Sh. 2003. Objectifying content validity: Conducting a content validity study in social work research. Social Work Research, 27 (2): 94-104.

Sanesi, G. and Chiarello, F. 2006. Residents and urban green spaces: The case of Bari. Urban Forestry and Urban Greening, 4: 125-134

Sanusi, R., Johnstone, D., May, P. and Livesley, S.J. 2017. Microclimate benefits that different street tree species provide to sidewalk pedestrians relate to differences in plant area index. Landscape and Urban Planning, 157: 502-511.

Schroeder, H.W. and Cannon Jr., W.N. 1983. The esthetic contribution of trees to residential streets in Ohio towns. Journal of Arboriculture, 9 (9): 237-243.

Seiferling, I., Naik, N., Ratti, C. and Proulx, R. 2017. Green streets—quantifying and mapping urban trees with street-level imagery and computer vision. Landscape and Urban Planning, 165: 93-101.

Shokouie, H. 2017. New perspectives on urban geography. 1, 18, Samt, Tehran, Iran. (In Persian)

Sjöman, H. and Nielsen, A.B. 2010. Selecting trees for urban paved sites in Scandinavia—A review of information on stress tolerance and its relation to the requirements of tree planners. Urban Forestry and Urban Greening, 9: 281-293.

Sommer, R., Guenther, H. and Barker, Ph.A. 1990. Surveying householder response to street trees. Landscape Journal, 9: 79-85.

Sommer, R., Guenther, H. and Cecchettini, Ch.L. 1992. A user-based method for rating street trees. Landscape Research, 17 (3): 100-107.

Subburayalu, S. and Sydnor, T.D. 2012. Assessing street tree diversity in four Ohio communities using the weighted Simpson index. Landscape and Urban Planning, 106: 44-50.

Todorova, A., Asakawa, S. and Aikoh, T. 2004. Preferences for and attitudes towards street flowers and trees in Sapporo, Japan. Landscape and Urban Planning, 69 (4): 403-416.

Tork, H. 2011. Landscape architecture and urban perspective: A case study of Abbasabad Hill in Hamedan. M.Sc. Thesis, Beheshti University, Tehran, Iran. (In Persian)

Veinberga, M., Skujāne, D. and Rivža, P. 2019. The impact of landscape aesthetic and ecological

qualities on public preference of planting types in urban green spaces. Scientific Journal of Latvia University of Life Sciences and Technologies Landscape Architecture and Art, 14 (14): 7-17.

Vogt, J., Gillner, S., Hofmann, M., Tharang, A., Dettmann, S., Gerstenberg, T., Schmidt, C., Gebauer, H., van de Riet, K. and Berger, U. 2017. Citree: A database supporting tree selection for urban areas in temperate climate. Landscape and Urban Planning, 157: 14-25.

Wolf, K. 2003. Freeway roadside management: The urban forest beyond the white line. Journal of Arboriculture, 29 (3): 127-135.

Yang, J., Zhou, J., Ke, Y. and Xiao, J. 2012. Assessing the structure and stability of street in Lhasa, China. Urban Forestry and Urban Greening, 11: 432-438.

How to cite this article:

Amareh, R., Kaviani, B., Sedaghathoor, SH. & Allahyari, M.S. (2024). Exploring Citizens' Aesthetic Perception in Urban Green Space Design: A Study of Ornamental Trees and Shrubs Distribution in Bushehr, Iran. Journal of Ornamental Plants, 14(4), 259-274.

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