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Aesthetics of Native Ornamental Trees in Urban Green Spaces of Northern Iran: The Case of Rasht City

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Abstract

Native tree species can be a good candidate for growing in urban green spaces as per the climate of each region due to their high adaptation, high resistance to environmental stresses, low maintenance costs, and low water requirement owing to reliance on rainfall. This research aimed to explore the aesthetic aspect of native ornamental trees in the city of Rasht, Iran. So, the aesthetic traits and characteristics of 14 native tree species were recorded by observing them in nature. After 11 aesthetic parameters were determined, an opinion poll was conducted among experts with a questionnaire designed by information collected. The trees were evaluated by theanalytic hierarchy process (AHP) and the results were analyzed by the Expert Choice software package. Based on the findings, the three species of *Zelkova carpinifolia*, *Parrotia persica*, and *Acer cappadecicum* were the most suitable and the three species of *Populus caspica* Bornm., *Gleditsia-caspica*, and *Juniperus foetidissima* were the least suitable from an aesthetic viewpoint. It is also concluded that from an aesthetic perspective, deciduous broadleaf tree species are more beautiful in different seasons than evergreen narrow-leaf species in the study site, so they are more capable of being used in urban green spaces.

Keywords: Aesthetics, Green space, Native trees, Ornamental, Rasht.

INTRODUCTION

Green spaces are representative of nature in towns and cities and an integrated and necessary element of their architecture with a key role to play in their metabolism so that their shortage can disrupt the lives of cities (Mohammadi Hamidi and Akbari, 2020). Green spaces are so important in urban areas that they constitute one of the main five urban land-uses. Unlike the common perception that portrays green spaces as places with some trees and benches, they are symbols of cultural and social thoughts of the community and a major factor in urban space, which are always considered by the public from social, cultural, and psychological aspects and play an essential role in urban planning (Razavi and Kazemi, 2012). All three conceptual, functional, and aesthetic aspects have been taken care of in Iranian gardens, and this is the key to their persistence over time. It can also be stated that Iranian gardens are wise and perfectionist aesthetically in which water and plants are so arranged that they can satisfy both the physical needs from functional and aesthetic aspects and spiritual needs from a conceptual aspect (Okhovat, 2015). Native plants include trees, shrubs, cover plants, flowering plants, and so on, which have supplied food, shelter, and landscape for different animal species and humans for long years (Karimian, 2016).

Bravo-Bello *et al.* (2020) used the analytic hierarchy process (AHP) to select appropriate native tree species in Mexico City. They used library research to select criteria for the selection and listing of the evaluated trees. Then, a panel of forestry experts assigned specific weights to the criteria using a matrix of pairwise comparison. They finally ranked 15 tree species for Mexico City.Vaz *et al*. (2018) assessed the effects of non-native tree species versus native species on several green space services including cultural, entertainment, ecotourism, and aesthetic services. They adopted a meta-analysis method for data assessment. The results showed that people had significantly different opinions on the aesthetics of the native and non-native trees. In a review paper on native plants in an urban landscape, Karimian (2016) states that climatic conditions and the unsustainability of different resources will make urban managers use native species in green space and landscape designing. Native plants are good options to construct a sustainable green space due to their high adaptation to local climate and consequently, their low maintenance costs. When using local species in urban landscapes, it is vital to use suitable planting patterns and observe landscape designing principles in order to create a beautiful green space applauded by citizens.

Accordingly, the present study aimed to assess and explore aesthetic and botanical factors of native ornamental trees, group the target trees based on their habitat conditions and ideal aesthetic criteria, develop sustainable tree planting using native ornamental trees based on the Comprehensive Plan of Tree Planting in Urban Passages of Rasht, reduce maintenance costs of urban trees, and increase visual appeal by planting the studied native ornamental trees in the green spaces of Rasht City.

MATERIALS AND METHODS

The city of Rasht is one of the megacities of Iran and is the biggest and most populated city in the North of Iran. It is mostly resided by Gilaks on the Southern coasts of the Caspian Sea (Fig. 1-2). Rasht has a humid and temperate climate with an annual precipitation rate of 1359 mm (Fig. 3**)** so that it has the highest precipitation rate among all province centers of Iran and is even known as the City of Rain. The total effective urban green space area (including public and private ones) is 618 ha and the public green space area is 169 ha. The city presently has 64 active parks, some of which have historical value, such as Park-e Shahr and SabzeMeydan. Out of all parks in this city, 17 parks are located in urban district 1, 9 parks in urban district 2, 13 parks in urban district 3, 14 in urban district 4, and 11 in urban district 5. Presently, the per capita green space of Rasht amounts to 5.2 m^2, which is lower than Iran's mean and standard level. Some important reasons for the shortage of per capita green space in Rasht include the lack of land, high

land prices, and the mayoralty's financial constraints to purchase urban gardens and lands with green space land-use. The present study investigated 14 native tree species including the Caucasian elm (*Zelkova carpinifolia*), the chestnut-leaved oak (*Quercus castaneifolia*), the field elm (*Ulmus minor*), *Populus caspica*, the Caucasian wingnut (*Pterocarya fraxinifolia*), the Caspian locust (*Gleditschia caspica*), the ash (*Fraxinus excelsior*), the Persian ironwood (*Parrotia persica*), the Cappadocian maple (*Acer cappadocicum*), the common box (*Buxus sempervirens*), *Thuja*, the Mediterranean cypress (*Cupressus sempervirens* var. Horizontalis), foetid juniper (*Juniperus foetidissima*), and the Arizona cypress (*Cupressus arizonica*).

Fig. 1 The map of Iran and Guilan province.

Fig. 2. Ansatellite image of Rasht.

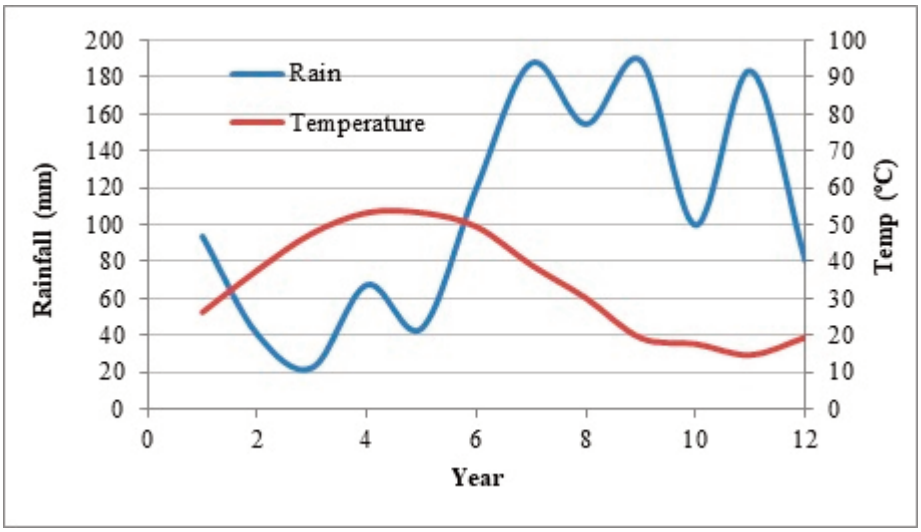

Fig. 3. The ambrothermic diagram of Rasht (2016-2021).

Data collection, questionnaire development, and software used for analysis

At first, 14 tree species that were native to Rasht were selected for the study by using the available resources, e.g., books, papers, and brochures, a field study, and face-to-face interviews with experts. Then, their aesthetic dimensions were investigated, and finally, 11 aesthetic parameters were assessed on the studied trees including (1) shade creation, (2) trunk beauty, (3) branching pattern beauty, (4) leaf beauty (color, shape, and size), (5) view in spring, (6) view in summer, (7), view in autumn, (8) view in winter, (9) canopy shape and cover, (10) plant scale, and (11) prunability. At the next step, questionnaires were developed in two sections including general and expertise questions. The reliability and validity of the questionnaires were assessed by Cronbach's alpha, and the coefficient of inconsistency was employed to measure the consistency of the experts' responses to assessments and pairwise comparisons. The inconsistency rate of <0.1 reflects the reliability and consistency of responses. Also, the AHP was employed to calculate the weight of the underlying factors by pairwise comparisons and to group the trees based on the opinions of 15 experts. The statistical analyses were performed in the Expert Choice software package.

RESULTS AND DISCUSSION

Ranking of criteria

The pairwise comparison of aesthetic indices and criteria by the AHP (Fig.4) showed that the criteria of leaf beauty, prunability, and trunk beauty had the highest and the criteria of view in autumn, view in winter, and plant scale had the lowest ranks among the studied criteria, respectively.

Leaf beauty

According to the experts, leaf beauty with a weight of 0.304 was ranked first among all studied indices (Fig.4). Among the trees, *Z. carpinifolia*, *P. persica*, and *A. cappadocicum* obtained the highest ranks in this index. Leaves are very diverse in color, shape, and size, and each plays a significant role in selecting tree species for a beautiful landscape in urban green spaces. Leaves draw green space designers' attention due to their color spectrum in different seasons, as well as their different shapes and sizes. Experts and designers always try to grow trees in green spaces that are highly beautiful in addition to being adapted to the urban environment (Zhao *et al*., 2017).

Prunability

The experts assigned a weight of 0.187 to this index, putting it in the second rank among all indices (Fig. 4). Among the studied trees, *Z. carpinifolia*, *P. persica*, and *A. cappadocicum* were ranked first to third, respectively. Prunability is a significant criterion in selecting trees for green spaces because a goal that green space designers pursue is to give a certain form and shape to trees in order to create a beautiful landscape in the city (Karimian *et al*., 2016).

Trunk beauty

Based on the opinions collected from the experts, trunk beauty was ranked the third important index with a weight of 0.167 (Fig. 4). It was found that *Z. carpinifolia*, *P. persica*, and *A. cappadocicum* had the first to third most beautiful trunks. Trees have different trunk colors, tissues, and shapes. The trunks of most trees are blurred and dark in appearance. But, some have unique trunk colors (light and opposite color) with high attractiveness, especially in winter and autumn (Jahandideh, 2017).

View in autumn

View in autumn is one of the lowest ranks with a weight of 0.033 by the experts (Fig. 4). Among the studied tree species, the first to third ranks were assigned to *Z. carpinifolia*, *P. persica*, and *A. cappadocicum*, respectively. Zhao *et al*. (2017), who studied the visual preference of trees and the effect of tree traits and seasons on their aesthetics, reported that although there were no significant differences in preference in four seasons, the tree with a higher rank in spring or summer was more likely to represent severe fluctuations in priority among four seasons.

View in winter

This index was ranked low with a weight of 0.035 by the experts (Fig. 4). The highest ranks were assigned to *Z. carpinifolia*, *Q. castaneifolia*, and *A. cappadocicum*, respectively. According to Zhao *et al*. (2017), most tree species with preferred traits should be used not only for aesthetic attractiveness but also for their ecological benefits. To achieve contrast in aesthetic quality in different seasons, trees that are more preferred in spring or summer should be planted.

Plant scale index

This index was weighted 0.029 by the experts, which is very low (Fig. 4). *Z. carpinifolia*,

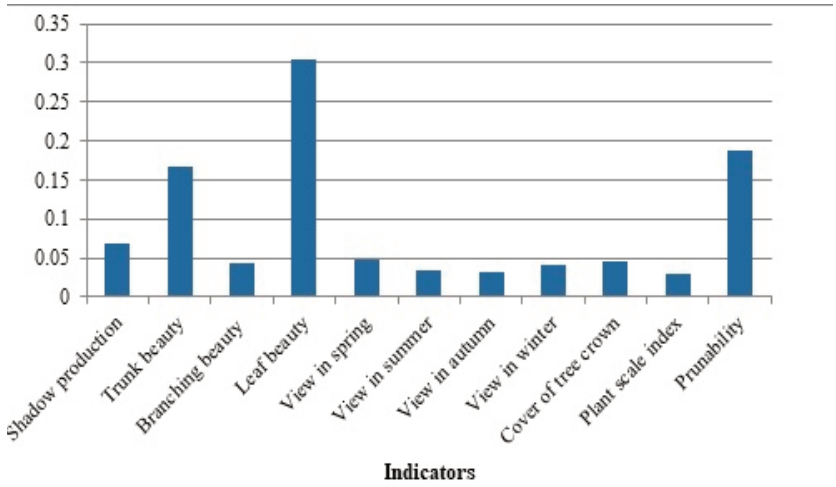

Fig. 4.The ranking of the indices.

P. persica, and *A. cappadocicum* were ranked first to third in this index, respectively. Hekmati and Seifi (2014) state that dwarf trees whose height is lower than the observer's eye provide an intimate atmosphere while those with a height higher than the observer's eye encircle and fill the space.

Ranking of three superior species in individual indices

According to Fig. 5, *Z. carpinifolia*, *A. cappadocicum*, and *P. persica* were among the best three species in all indices and only *P. persica* was not superior in two indices of view in winter and general tree shape. Instead, *Q. castaneifolia* was among the superior species in the index of view in winter and *B. sempervirens* was among the superior species in the index of general tree shape. According to the experts, *Z. carpinifolia*, *A. cappadocicum*, and *P. persica* are most suitable to create visual beauty in the urban landscape.

Ranking of three superior indices for each species

According to Fig. 6, the superior indices for each species showed that among superior evergreen species including *C. sempervirens*, *Thuja*, *C. arizonica*, and *B. sempervirens*, the indices of general tree shape, view in winter, and plant scale had the highest ranks and among the superior deciduous broadleaf species including *Z. carpinifolia*, *P. persica*, and *A. cappadocicum*, the indices of shade creation, leaf beauty, and prunability had the highest ranks from the perspective of the experts.

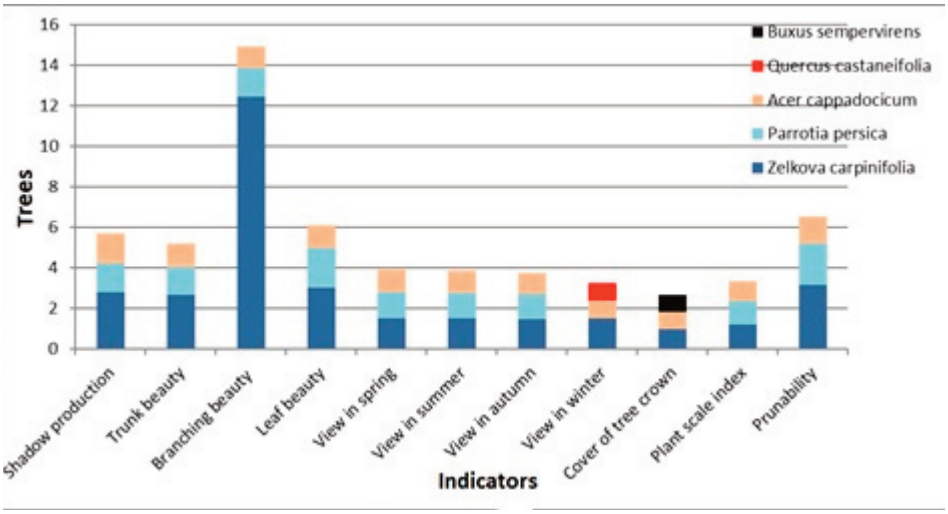

Fig. 5. Three superior species in each index.

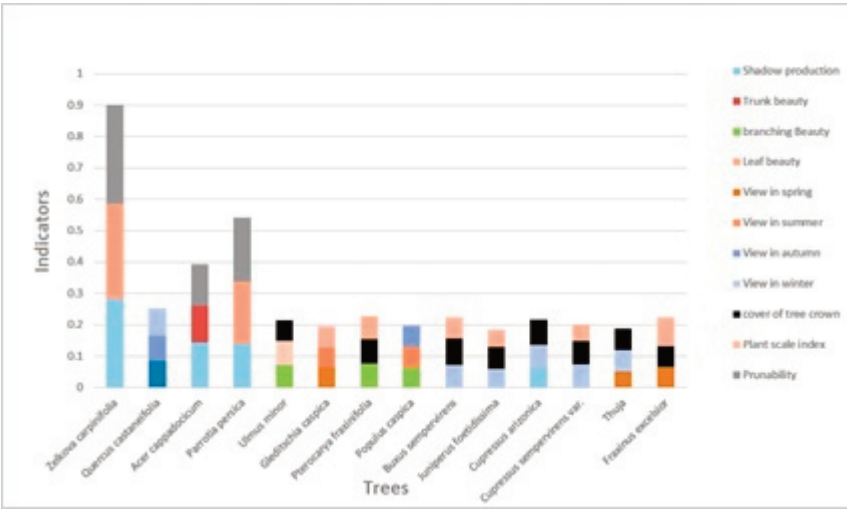

Fig. 6. Three superior indices in each species.

Ranking of 14 native tree species

The results as to the assessment of 14 studied native plant species based on aesthetic indices (Fig. 7) showed that *Z. carpinifolia*, *P. persica*, and *A. cappadocicum* were the most and *P. caspica*, *G. caspica*, and *J. foetidissima* were the least suitable species, respectively.

Zelkova carpinifolia

According to the results, *Z. carpinifolia* was ranked first among the studied tree species with a weight of 0.223 (Fig. 7). Among the indices, the indices of prunability, leaf beauty, and shade creation were ranked the highest. *Z. carpinifolia* trees are attractive because of their beautiful leaves and livid smooth trunks. Furthermore, its lushness in growing seasons has high value in terms of view in autumn and winter, which relates to its regular branching and bark color. Presently, this beautiful old tree species can be found in Park-e Shahr, Mafakher, SalarMoshkat, and Bagh-e Zarbafi parks in Rasht.

Parrotia persica

According to the experts, the second rank was assigned to *P. persica* with a weight of 0.144 (Fig. 7). Prunability, leaf beauty, and shade creation were found to be the most important indices. *P. persica* trees have red and purple leaves in autumn so that they present their most appealing view in autumn. Leaves with diverse colors create breathtaking perspectives in nature. In addition to the fact that this tree species flowers before the emergence of leaves in late winter and early spring so that its flowers are most beautiful in late winter and early spring, its leaves are so attractive during spring and summer.

Acer cappadocicum

The experts ranked *A. cappadocicum* third among the studied trees with a weight of 0.111 (Fig. 4). The highest ranks among the indices were assigned to shade creation, prunability, and trunk beauty. Maple trees provide a balanced beauty all around the year. *A. cappadocicum* can create a good canopy cover and shade due to its extensive canopy. The tree has big claw-shaped reciprocal leaves in lime green. All maple trees have spectacular beauty in the eyes of viewers both in the growing season and in the dormancy season.

Juniperus foetidissima, Gleditschia caspica, and Populus caspica

The results showed that *J. foetidissima*, *G. caspica*, and *P. caspica* (with the weights of 0.044, 0.043, and 0.043, respectively) did not gain good scores in the aesthetic features of different organs and beautiful views in different seasons. These tree species do not provide viewers with an appealing view.

Final results of the assessment of trees and aesthetic features

According to Fig. 7, the experts ranked the deciduous broadleaf species including *Z. carpinifolia*, *P. persica*, and *A. cappadocicum* highest and *J. foetidissima*, *G. caspica*, and *P. caspica* lowest among the trees assessed by aesthetic indices. Among the indices too, leaf beauty, prunability, and trunk beauty were ranked the highest and view in autumn, view in winter, and plant scale were ranked the lowest.

CONCLUSION

Native tree species can be appropriate candidates in the selection of the best species for urban green spaces due to their high adaptation, high resistance to environmental stress, lower maintenance costs, and lower water requirement owing to their reliance on rainfall. In this study,

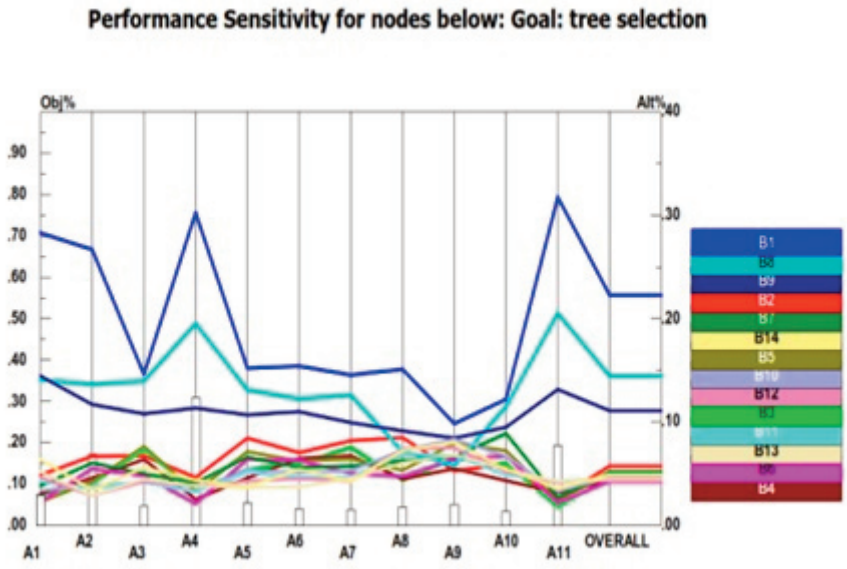

Fig. 7. Final results on the assessment of trees and aesthetic indices.

data were collected by field observation of the green spaces in Rasht and interviews with 15 experts and scholars of green spaces and experts of Urban View, Landscape, and Green Space Organization, Urbanization Organization, and the Organization of Natural Resources and Forestry using a questionnaire in order to assess 14 native tree species based on some aesthetic indices by the AHP. It is concluded that the three species of *Z. carpinifolia*, *P. persica*, and *A. cappadocicum* are the most suitable and the three species of *P. caspica*, *G. caspica*, and *J. foetidissima* are the least suitable based on the aesthetic indices, respectively. It can be inferred from the results that deciduous broadleaf trees are aesthetically preferred to native evergreen trees in Rasht so that they are more appealing in different seasons, so they can potentially be used in designing urban green spaces.

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Literature Cited

Bravo-Bello, J.C., Martínez-Trinidad, T., Romero-Sanchez, M.E., Valdez-Lazalde, J.R. and Benavides-Meza, H. 2020. The analytic hierarchy process for selection of suitable trees for Mexico City. iForest - Biogeosciences and Forestry, 13 (6): 541-547. doi:10.3832/ifor3481-013.

Hekmati, J. and Seifi, M.R. 2014. Design of the garden and park: Engineering field of natural resources. University of Payam Noor, 296.

Jahandideh, A. 2017. Aesthetic study of some native trees under the hyrcanian basin in urban green space (Case study: Rasht county). Master Thesis.

Karimian, Z. 2016. Native plants in urban landscape. Flower and Ornamental Plants, 1 (1): 78-86. http://flowerjournal.ir/article-1-108-fa.html

Mohammadi Hamidi, S., Nazmfar, H. andAkbari, M. 2020. Spatial analysis of parks and urban green spaces by using copras models and GIS (Case study: 22 regions of Tehran). Human Geography Research, 52 (2): 437-455. doi: 10.22059/jhgr.2018.248988.1007610

Okhovat, H. 2015. Conceptual, functional and aesthetic analysis of the environmental elements of

water and plant with emphasis on the physical aspect of persian gardens. Journal of Environmental Science and Technology, 16 (1): 487-500.

Razavi, M.S. and Kazmi, M. 2012. Evaluation of urban green space and its location using fuzzy criteria decision making (Case study: Three Hills of Mashhad). Geographic Space Quarterly, 15 (39): 1-17.

Vaz, A.S., Pilar, C.D., Oscar, G., Álvaro, A., Montserrat, V., Asunción, S., Hélia, M., Álvaro, B., Joaquim, S., Silva, J.S, Vicente, J. and Honrado, J. 2018. An indicator-based approach to analyse the effects of non-native tree species on multiple cultural ecosystem services. Ecological Indicators, 85: 48-56.

Zhao, J., Xu, W. and Li, R.2017. Visual preference of trees: The effects of tree attributes and seasons. Urban Forestry andUrban Greening, 25: 19-25.

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