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Reciprocal Relations Between Urban Vegetation and Human Perception in Urban Green Landscapes

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Abstract

This study investigates men's perceptions and preferences toward native, semi-native, and non-native plant species in the urban parks of Tabriz, Iran. It examines how cognitive recognition of plant types shape preferences for trees, shrubs, bushes, and flowers. A visual questionnaire containing 72 images of plant species was administered to 200 male park users in Tabriz. The instrument gathered demographic data, assessed respondents' recognition of plant origins, and measured preferences using a five-point Likert scale. Data were analyzed using descriptive statistics, Pearson correlation, and reliability assessment via Cronbach's alpha. Participants showed the strongest preference for flowers, followed by trees, shrubs, and bushes. Native and semi-native species were generally more preferred than non-native ones. The most favored species included the red maple, Indian chestnut, cluster jasmine, paper flower shrub, pomegranate bush, and lilies. Non-native shrubs were the least preferred group. A significant positive correlation was found between plant recognition and preference across all plant categories, indicating that familiarity strongly enhances visual preference. Men's landscape preferences in Tabriz are closely linked to their cognitive recognition of plant species, with native and semi-native vegetation perceived as more appealing and suitable for urban parks. Incorporating these species—especially flowers—can enhance park attractiveness and user satisfaction. The findings highlight the importance of integrating public perceptual and cognitive factors into urban planting design to improve ecological, aesthetic, and social value in urban green spaces.

Introduction

Urbanization continues to accelerate globally, with the share of the world's population living in cities projected to rise from one-half in 2010 to nearly two-thirds by 2045 (UN, 2014). This rapid growth often results in increased urban density, intensifying pressure on cities to balance development needs with the provision of adequate green infrastructure. In this context, assessing the role of urban green spaces in supporting human well-being has become increasingly vital.

A growing body of empirical research demonstrates that contact with nature delivers a diverse array of measurable benefits for individuals. As Samadi-Todar et al. (2025) emphasize, understanding these benefits is essential for sustaining and enhancing human well-being in an urbanizing world. Urban green spaces also support biodiversity and provide key ecosystem services (Paudel and States, 2023). Experiences in parks have been shown to reduce stress (Jang et al., 2024; Ulrich, 1981), foster mindfulness, restore mental vitality, and evoke feelings of calm and serenity (Hami and Tarashkar, 2018; Kaplan, 1983). Furthermore, such spaces facilitate social cohesion by promoting neighborly interaction (Qi etal., 2024; Samadi-Todar et al., 2024). Beyond psychological, social, and aesthetic advantages, they also generate economic value for communities—for instance, by mitigating costs associated with air pollution (Aslanoğlu et al., 2025; Hami et al., 2025a).

Samadi-Todar and Hami, (2025) concludes that urban parks play a critical role in promoting physical activity and mental well-being among older men, particularly through their esthetic and amenity-related

features and instead, beautiful landscapes and supportive amenities are more influential in shaping positive mental outcomes.

Contemporary green spaces typically include a broad range of plant species, yet their design often proceeds without fully accounting for public perceptions and preferences regarding vegetation. This stands in contrast to the European Landscape Convention (ELC), which identifies people's perceptions as a central element in landscape evaluation and planning (Kühne and Jenal, 2025). Consequently, understanding user preferences for plant species in urban parks is becoming an essential consideration for effective landscape design and management.

Perception psychology offers valuable insights into landscape aesthetics, as perceptual processes determine how individuals identify and evaluate environmental attributes relevant to their goals. while the degree of landscape recognition also plays a significant role in shaping these preferences (Nguyen-Dinh and Zhang, 2025). Ultimately, individuals' landscape preferences are formed through their perceptual abilities and their familiarity with specific environments (Kaplan et al., 1998; Wartmann et al., 2021).

Recent study shows that pepole prefer outdoor spaces that are comfortable, accessible, safe, and supportive of social and physical activities and They favor visually appealing landscapes with openness and some mystery, and their preferences (Hami et al., 2025a,b).

Preference is conceptualized as a cognitive representation formed through visual perception, reflecting individuals' motivations, emotions, and affective responses (Yang et al., 2024). Preference has also been described as the extent to which a person favors the visual character of one setting over another (Holvoet et al., 2018; Pazhouhanfar and Kamal, 2014), while visual preference specifically denotes the aesthetic judgment individuals make when evaluating landscapes (Wartmann et al., 2021).

To date, research addressing men's attitudes toward plant species is scarce or virtually nonexistent, even though aligning green space characteristics with men's interests is a necessary component of contemporary park planning. Accordingly, the present study aims to integrate men's plant-species preferences into strategies for urban planting design.

Moreover, rapid urbanization in middle-income countries such as Iran has increased city populations by nearly 300 percent in recent decades (United Nations, 2014). This rapid expansion has often contributed to urban densification, intensifying pressure on urban and peri-urban areas. Under such conditions, urban green spaces become vital, as many key functions associated with sustainable development are dependent on their presence.

Today, urban parks and green spaces are recognized as fundamental components of healthy urban living. Among the key environmental variables that shape individuals' visual and emotional responses to the urban environment, vegetation plays a central role (Brunner et al., 2025). Green infrastructures such as parks and green roofs provide extensive ecosystem services that enhance physical (Samadi-Todar et

al., 2025), mental (Samadi-Todar and Hami, 2025; Hami et al. 2025b), and overall well-being while contributing to the ecological resilience of cities. These environments improve urban quality of life by mitigating noise pollution, enhancing air quality, replenishing groundwater, regulating microclimates, and creating opportunities for residents to interact with nature (Hami et al., 2025c; Pandey and Ghosh, 2023).

A growing body of research indicates that proximity and access to parks foster physical activity, elevate mood, increase self-esteem, and lower the risk of chronic illnesses. Additionally, the aesthetic quality of park landscapes can further motivate individuals to engage in outdoor activities. Nevertheless, under certain conditions—such as when parks are situated near areas with heavy traffic—green spaces may inadvertently increase exposure to pollutants or reduce perceived safety, potentially creating health concerns.

Given that parks host diverse vegetation and serve as key social gathering spaces, their design must maximize functionality and encourage greater visitation. Landscape enhancement therefore becomes essential, with plant species selection being a critical dimension of landscape quality. Beyond expert knowledge, understanding user preferences is necessary for informed plant selection. Identifying which plant species visitors find most appealing enables designers to align planting schemes with public tastes.

Against this backdrop, the present study aims to explore men's attitudes toward plant diversity in urban landscapes, investigate how their socio-demographic background shapes their plant species preferences, and examine the relationship between plant diversity preferences and cognitive theory. To address these aims, the study poses the following research questions: What are men's preferences regarding diverse plant species in urban parks? And is there a significant relationship between cognitive factors and preferences for diverse vegetation in these environments?

Theoretical foundations

The concept of landscape recognition. Recognition of landscape types has been identified as an important factor influencing visual preferences. Cultural contexts shape how individuals perceive their surrounding environment, and this perceptual recognition in turn affects their preferences (Kaplan & Kaplan, 1989). In earlier work, Kaplan and Kaplan (1982) conceptualized recognition as a product of repeated encounters with a particular environment, arguing that familiarity with places and objects not only enhances functional and social capabilities but also evokes emotional responses such as comfort and a sense of predictability. Similarly, Huebert et al. (2025) defined recognition as a feeling of prior familiarity with specific conditions or elements, even in the absence of detailed recall. Kaplan and Kaplan (1989) further emphasized that recognition emerges through accumulated experience, such that individuals with differing environmental backgrounds display distinct preferences. Supporting this view, Gobster et al. (2007) demonstrated that recognition can play a decisive role in shaping perceptions and preferences. Moreover, the perception of relationships among landscape elements is strengthened through cognitive processes when these elements are viewed as an integrated whole (Shao et al., 2024;

Fu et al., 2024). In this study, the notion of cognition refers specifically to how individuals with diverse backgrounds perceive the variety of plant species present in urban landscapes.

The concept of landscape quality. The quality of an environment is understood as its capacity for rapid restoration and its potential to return to a healthy ecological state (Gann et al, 2019). Nasar (1988) conceptualizes quality as an affective assessment rooted in individuals' subjective evaluations and emotional responses. According to Zhang, (2025), landscape quality emerges from the dynamic interactions between the characteristics of a landscape and their perceptual impacts on people. A key dimension of landscape quality for users is their ability to recognize, interpret, and navigate the environment across space and time (Daneil, 2001). Furthermore, the quality of a particular landscape is shaped by the way social institutions arrange and manage its elements in alignment with collective values and societal expectations (Council of Europe, 2000). In this context, designing landscapes informed by public preferences becomes essential for achieving a landscape quality that resonates with users and supports shared environmental ideals.

The concept of landscape perception. Environmental perception is strongly shaped by individuals' familiarity with their surroundings. Pedersen (1978) argues that such familiarity influences perception through the development of conceptual meanings based on experience, selective attention to functionally relevant features, and the perceptual depth formed through long-term interaction with the environment. Landscape perception research often distinguishes between spatial configuration and detailed landscape elements (Kaplan & Kaplan, 1989). Spatial configuration concerns the arrangement, depth, and breadth of natural components (Tarashkar et al., 2020), while the perception of specific elements relates to distinctive features and fine visual details (Gurtner et al., 2021).

Kaplan et al. (1998) propose an information-based framework that explains how people interpret natural environments through two- and three-dimensional processing. The arrangement of landscape elements supports either understanding—enhanced in coherent and legible settings—or exploration, which is more associated with complexity and mystery (Tarashkar, 2018). The four informational predictors of landscape preference—coherence, legibility, complexity, and mystery—are central to this model.

Urban landscape quality is commonly assessed through the interaction between physical characteristics and public perception (Polat and Akay, 2015). Stated preferences offer important insights into how landscapes contribute to well-being and social sustainability (Albaladejo-García et al., 2023; Chiesura, 2004). As visual cues dominate human perceptual processing (Kaplan & Kaplan, 1989), visual quality has become a key consideration in landscape planning.

Theoretical explanations for landscape preferences generally fall into evolutionary and cultural categories (Wartmann et al., 2021; Fry et al., 2009). Evolutionary approaches argue for innate, phylogenetically rooted tendencies to prefer environments offering survival advantages, often described as landscape beauty. Two influential functionalist theories—Kaplan and Kaplan's (1982) information-processing model and Appleton's (1996) prospect–refuge theory—emphasize environmental qualities that support safety, effective information use, and engagement. These perspectives highlight the

importance of coherent, stimulating landscapes that allow individuals to observe without being exposed (Kaplan & Kaplan, 1989).

The concept of landscape preference

In environmental psychology, *preference* is understood as an intuitive and low-effort evaluative process that reflects basic human needs and supports effective functioning within an environment (Kaplan and Talbot, 1988; Kaplan & Kaplan, 1989). Preferences are shaped by perceptual cues, environmental content, and spatial organization rather than formal training or explicit standards. Research highlights that individuals tend to favor landscapes that provide *meaning*—a sense of understanding and coherence—and *engagement*, the opportunity for exploration and stimulation (Kaplan, 1977). As quality of life has become a key concern in urban societies, effective management of urban landscapes and the creation of visually appealing environments have gained increasing importance (Mouratidis, 2021). Landscape preference studies typically rely on visual assessment methods, which have been shown to be more reliable than verbal techniques (Kang and Liu, 2020). Insights from these studies assist designers and decision-makers in developing urban landscapes that better align with user expectations, improve environmental quality, and enhance overall wellbeing.

Landscape Perception and Preference

Landscape Content Quality. Previous research has examined individuals' perceptions and preferences regarding landscape elements. For instance, Dramstad et al. (2006) reported that certain characteristics, such as the presence of specific plant species, significantly affect preferences for agricultural landscapes. Similarly, Todorova et al. (2006) observed that people tend to favor urban streets with tree-lined avenues over other types of streets. In a study conducted in England, Hoyle et al. (2017) evaluated public perceptions of plant species through a semi-natural vegetation design and questionnaire, revealing that the majority of respondents expressed a preference for including non-native plants in public spaces. Furthermore, Polat and Akay (2015) demonstrated that the absence of shrubs in planting arrangements negatively influenced the perceived visual quality of landscapes.

The Relationship Between Cognition and Landscape Preference. Preferences for landscapes vary considerably, reflecting both individual differences and underlying cognitive processes. Cognition, shaped by experience—including place of residence, travel, education, and cultural norms—plays a central role in these variations, though it does not straightforwardly predict preferences (Kaplan & Kaplan, 1989). The relationship between individuals and their environment significantly influences visual landscape preferences, as these are affected by both perceptual ability and familiarity with the landscape (Kaplan & Kaplan, 1998). Familiarity with specific plant biomes also impacts preferences (Cai et al., 2022), although studies show mixed effects, with some reporting negative or unclear correlations between familiarity and preference (Kaplan & Kaplan, 1989). Overall, familiarity tends to enhance preference, often measured by the landscape type and population size of respondents' birth or residence area.

Kaplan and Kaplan (1982) link familiarity to information theory, suggesting it enhances sensory processing and increases appeal. Novelty and familiarity interact to shape aesthetic evaluation from early perceptual stages (Leder et al., 2004). Aesthetic preference is also influenced by processing fluency, with more easily processed stimuli generally rated more positively (Samadi-Todar and Hami, 2025).

Method

Study Area

Tabriz, one of Iran's major metropolitan centers, is situated in the northwest of the country at 38.15°N and 46.17°E, forming the core of East Azerbaijan Province (Tarashkar et al. 2020) (Fig. 1). The study area is characterized by a semi-arid ecosystem, with its climatic conditions shaped largely by the surrounding steppes. Owing to the city's elevated plain, winters are typically long and cold, while summers remain relatively mild. Mean annual precipitation ranges from 250 to 300 mm. In the mountainous areas adjacent to the city—such as Mount Sahand—winds blow persistently throughout the year, and seasonal wind patterns in Tabriz generally consist of easterly and westerly flows. The lowest average temperature, recorded in January, is around − 7°C, whereas the warmest period, spanning July and August, typically reaches average temperatures of about 18°C. Based on the 2016 national census, Tabriz had a population of 1,558,693 residents (Tarashkar et al. 2020). For the purposes of this research, El Goli Park and Baghmisheh Forest Park—two of the city's most prominent urban green spaces—were selected as representative sites for evaluating the relevant study variables, with subsequent generalization of the findings to the broader network of parks across Tabriz. Given that landscape photographs constitute an effective means of assessing public preferences for natural environments and are widely applied in studies examining landscape perception and preference (Tarashkar, 2018), this research employed a visual-based questionnaire as the most appropriate tool for eliciting participants' landscape preferences.

Questionnaire structure

Demographic and general questions

The first section of the questionnaire focuses on collecting respondents' demographic information. In this section, participants are asked to provide details about their marital status, age, educational attainment, occupation, monthly income, as well as their place of residence and birthplace. The age variable is categorized into five groups (20–30, 30–40, 40–50, 50–60, and above 60 years). Educational level is classified into five categories (below diploma, diploma, bachelor's, master's, and doctoral degrees). Occupation is presented with six options (governmental, private-sector, self-employed, student, retired, and unemployed), while monthly income is divided into five ranges (less than 200 $, 200–400 $, 400–700 $, 700–1000 $, and more than 1000 $). The second section comprises general questions that respondents are required to complete prior to answering the specialized items of the questionnaire.

Specialized Questions

The third section of the questionnaire incorporates visual stimuli to evaluate the dependent variables, which pertain to participants' background characteristics, cognitive processes, and landscape preferences. According to Kaplan and Kaplan (1989), preference formation is closely tied to cognition, such that individuals' evaluations of landscape quality can be anticipated based on their cognitive frameworks (Nakarmi et al., 2023). Given that vegetation and green elements enhance the visual appeal of urban environments (Borst et al., 2008), the present study explores how personal background factors relate to the perception of plant species in urban parks, with particular attention to cognitive theory.

Images serve as effective communicative tools due to their capacity to convey complex information and improve comprehension (Reynolds & Johnson, 2011). Therefore, following a review of prior research and to ensure clearer understanding and more accurate responses from participants, visual materials were employed as the primary means of assessing the variables in this section. A set of images depicting diverse plant species—including native, semi-native, and non-native species commonly found in Tabriz—was used to measure preference levels. Respondents evaluated these images using a five-point Likert scale.

Image preparation

A visual questionnaire was developed to investigate how individuals' backgrounds, in conjunction with cognitive theory, influence their perception of plant species in urban landscapes. To this end, seventy-two images representing native, semi-native, and non-native species were sourced from electronic databases and incorporated into this section of the instrument. Given Iran's vast geographical extent (1,648,195 km²) and the consequent impracticality of accessing all national vegetation zones, electronic resources constituted the only feasible means for obtaining photographs of diverse plant species (Fig. 2).

The selected species were organized into four main categories: (a) trees, (b) shrubs, (c) bushes, and (d) flowers. Each category comprised six native, six semi-native, and six non-native species. The selection process aimed to include the most ecologically significant species from Iran's major phytogeographic regions to ensure comprehensive representation within the questionnaire.

In the tree category, the native species included *Ulmus spp, Platanus orientalis, Fraxinus excelsior, Elaeagnus angustifolia, Acer spp, and Populus nigra 'Italica*; the semi-native group comprised *Melia azedarach, Ailanthus altissima, Paulownia tomentosa, Maclura pomifera, Taxus baccata, and Picea abies*; and the non-native group included *Zelkova carpinifolia, Ziziphus spina-christi, Magnolia spp, Picea pungens, Aesculus hippocastanum, and Acer palmatum*.

For shrubs, native species consisted of *Spiraea crentata, Sambucus nigra variegata, Cotinus coggygria, Viburnum spp, Syringa vulgaris, and Tamarix spp;* semi-native species included *Lagerstroemia indica,*

Deutzia spp, Nerium oleander, Laurus nobilis, Amorpha fruticosa, and Bougainvillea spp; while non-native species were *Prosopis koelziana Burkil, Acacia ehrenbergiana, Calligonum comosum, Vaccinium spp., DODONAEA VISCOSA, HALOXYLON AMMODENDRON*.

Within the bushes/sub-shrubs classification, native species comprised *Pyracantha, Cynanchum acutum, Berberis thunbergii, Achillea millefolium, Clematis spp, and Buxus sempervirens*; semi-native species included *Hedera helix, Lavandula angustifolia, Origanum majorana, Ipomoea, Wisteria sinensis, and Hyssopus officinalis*; and non-native species consisted of *Teucrium polium, Vitex agnus-castus, Pergularia tomentosa, Withania coagulans, Zhumeria majdae*. *Passiflora caerulea*.

In the flower group, native species included *Petroselinum crispum, Matthiola incana, hrysanthemum spp, Flowering cabbage, Viola × wittrockiana, and Fritillaria spp;* semi-native species comprised *Cycas revoluta, Iris spp, Argyranthemum frutescens, Zinnia, Lilium spp, and Yucca spp*; while the non-native category included *Convallaria majalis, Tropaeolum majus, Hoya carnosa, Plumeria spp, Iberis sempervirens, and Limonium sinuatum*. All species were classified based on their degree of ecological compatibility with the climate conditions of Tabriz.

Population and Statistical Sample of the Study

The target population in this research consists of men over 20 years old who frequent the parks of Tabriz and possess a basic level of environmental awareness. Since accurate data on the total number of male visitors to the city's major parks is unavailable, an appropriate sampling strategy was required to ensure the generalizability of the results. Given the indeterminate size of the visitor population, the sample size was determined using the Mitra–Lankford method (Mitra & Lankford, 1999). This method effectively minimizes potential bias by reducing sampling error, enhancing the confidence level, and limiting non-sampling errors.

$e = \sqrt{[(P)(1-P)]/n} \rightarrow \%3.74 = \sqrt{[(\%50)(1-\%50)]/n} \rightarrow n = 178$

In this formula, e denotes the sampling error. In the present study, by assuming a value of 3.74 for e—interpreted as the standard deviation—the calculated sample size was 178 participants. The parameter P, representing the probability of the occurrence of a particular attribute or condition, is conventionally set at 0.50. Based on this equation, the required sample size for the study was determined to be 178 male users of Tabriz urban parks. To enhance the reliability and adequacy of the sample, this number was increased to 200 participants.

In May and July 2024, 200 men were carefully selected to complete a questionnaire. The questionnaire was distributed using this brochure. Participants from Park were selected using systematic sampling to represent park visitors in multiples of 10. For example, the questionnaires were presented in parts of 10 and numbered 1, 11, 21, 31, 41 (Hami and Tarashkar, 2018). The survey was carried out by three people simultaneously between 10 a.m. and 2 p.m. and 4 p.m. and 8 p.m. for five weeks, as the parks in Tabriz are most visited at this time (Hami et al., 2014). Samadi-Todar et al. (2025) claims that the systematic

sampling method used in the sample selection process reflects the characteristics of the target group. Participants were presented with tasks with a completion time of 20 minutes after they confirmed that they were willing to complete the questionnaire. The current study was conducted from the individualized perspective of older men.

Data Analysis Method

The Statistical Package for the Social Sciences (SPSS) is used to predict the future trend of the data (Devi et al. 2013). A software package called (SPSS) is used to manipulate, analyze and present data (Meraj et al. 2022; Sinha et al. 2022); The social and behavioral sciences use the package extensively. The Statistical Package for Social Science (SPSS), No. 26 was used to analyze the data. The results are listed below. First, the categorical questions—marital status, age groups, education level, and income categories—were described using frequency analysis. The next step was to group the indices by internal similarity into indices that represented comparable reasons for rejection. In addition, the descriptive analysis yielded the statistical mean of the variables, which was then used to interpret the highest and lowest levels of agreement and disagreement on the variable questions based on the spectrum. A reliability analysis was used to check the internal factor consistency of the grouped elements. Finally, the Pearson correlation test was applied between the independent and dependent indicators.

Results

Demographic Analysis Result

Table 1 presents the demographic profile of the respondents, including marital status, age categories, education level, occupation, monthly income, and place of birth. As shown, the study sample consisted of 200 male participants from Tabriz. The proportion of single respondents was higher than married ones, comprising 54.5% of the total sample. The largest age cohort was 20–30 years, representing 111 individuals (55.5%), while participants aged over 60 accounted for the smallest share at only 2%.

In terms of educational attainment, most respondents held a bachelor’s degree (108 individuals), whereas those with a doctoral degree formed the smallest group with seven participants. Regarding employment status, self-employed individuals constituted the largest category (73 respondents, 36.5%), followed by those working in the private sector (31.5%) and the public sector (12%). Retired individuals represented the smallest group, accounting for only 4% (8 participants).

Monthly income distribution indicated that individuals earning less than 5 million tomans formed the largest income group (36.5%, 73 respondents), while those earning 15–20 million tomans constituted the smallest segment (3%, 6 respondents). Additionally, the majority of participants (89%) were urban-born, with the remaining respondents originating from rural areas.

Table 1
Descriptive statistics

Individual-level variables	**n**	**%**
Marital status	**109**	**54.5**
Single	**91**	**45.5**
Married		
Age	**111**	**55.5**
20–30	**47**	**23.5**
30–40	**28**	**14**
40–50	**10**	**5**
50–60	**4**	**2**
> 60		
Monthly income	73	36.5
< $200	70	35
$200 - $400	39	19.5
$400 - $700	6	3
$700-$1000	12	6
> $1000		
Education level	12	6
Below diploma	41	20.5
Diploma	108	54
Bachelor	32	16
Master	7	3.5
Ph.D. or higher		

Job	24	12
Government	63	31.5
Private	73	36.5
Freelance	20	10
Student	8	4
Retired	12	6
Unemployed		
Total	200	100

Respondents' preferences for plants

Ranking trees based on respondents' preferences

As illustrated in Fig. 3, male participants exhibited the strongest preference for images 5, 17, and 18 compared to the other species. Image 18—depicting the red maple—received the highest mean rating (4.07, SD = 1.105), indicating it as the most favored species for urban landscapes. This preference pattern is followed by image 17 (mean = 4.02, SD = 1.075), representing the Indian chestnut, and image 5 (mean = 3.98, SD = 0.992), which corresponds to the Tabrizi chestnut.

As illustrated in Fig. 4, male participants showed the lowest preference for images 14, 4, and 13, which correspond to the trees of the side, the elder, and the free, respectively. Among these, image 14 exhibited the lowest mean preference (M = 3.15, SD = 1.223), followed closely by image 4 (M = 3.17, SD = 1.261) and image 13 (M = 3.24, SD = 1.299). Notably, images 13 and 14 feature non-native tree species, while only one native species appears within this set of least-preferred images.

The ranking of shrubs based on male respondents’ preferences is presented in Fig. 5. Among the shrubs, images 12, 5, and 7 received the highest preference scores. Image 12, representing the paper flower shrub, was the most favored with a mean score of 4.28 (SD = 0.916), followed closely by image 5, depicting the cluster jasmine shrub, with a mean of 4.24 (SD = 1.028), and image 7, illustrating the lace shrub, with a mean of 3.97 (SD = 1.00). Notably, image 5 corresponds to a native shrub, whereas images 7 and 12 are classified as semi-native. Non-native shrubs did not feature among the most preferred selections by male respondents.

According to Fig. 6, images 13, 14, and 16 are considered the least preferred shrubs among men in Tabriz city, representing the shrubs of Mahor, Eskabil, and Natark, respectively. Image 13 (mean: 2.56 - standard deviation: 1.243) has the lowest preference, and this trend continues with image 14 (mean: 2.59 - standard deviation: 1.265) and image 16 (mean: 3.03 - standard deviation: 1.307). All images are of non-native plants, and there is no image of native or semi-native plants.

Ranking of shrubs and bushes based on respondents' preferences

As can be seen in Fig. 7, images 11, 4 and 6 are the most preferred shrubs and bushes among men. Image 6 (mean: 4.22 - standard deviation: 0.993) represents pomegranate shrub and has the highest preference. Image 4 (mean: 4.05 - standard deviation: 1.076) and image 11 (mean: 3.91 - standard deviation: 1.087), representing honeysuckle and glycine respectively, have the highest preference after image 6. Images 4 and 6 are native shrubs and image 11 is in the semi-native shrub category.

As shown in Fig. 8, images 17, 14, and 13 have the least preference for shrubs and bushes among men. Image 17 (mean: 3.02 - standard deviation: 1.244) has the least preference, and this trend continues with image 14 (mean: 3.18 - standard deviation: 1.250) and image 13 (mean: 3.28 - standard deviation: 1.216). The Morkhosh, Helpe, and Panyerbad bushes represent images 13, 14, and 17, respectively, all of which are considered non-native shrubs.

Ranking of Flowers Based on Respondents' Preferences

According to Fig. 9, images 10, 8, and 11 have the highest preference among men. Image 11 (mean: 4.14 - standard deviation: 0.988) which is a lily flower is the most preferred flower, and this pattern continues with image 8 (mean: 4.12 - standard deviation: 0.993) which is a rose lily flower and image 10 (mean: 4.10 - standard deviation: 0.926) which is a hyacinth flower. All 3 images are semi-native flowers.

As can be seen in Fig. 10, images 13, 1, and 4 have the lowest preference. Image 13 (mean: 3.55 - standard deviation: 1.172), which represents snowdrops, has the lowest preference, and this trend continues with image 1 (mean: 3.68 - standard deviation: 1.325), marigolds, and image 4 (mean: 3.73 - standard deviation: 1.175), ornamental cabbage. Image 13 belongs to non-native flowers, and images 1 and 4 belong to native flowers.

Respondents' Preferences for Plant Classifications

The results presented in Table 2 show the mean analysis based on men's preferences for landscape plant classifications. According to the table, men prefer semi-native flowers (mean: 3.99, standard deviation: 0.805), native flowers (mean: 3.89, standard deviation: 0.894), non-native flowers (mean: 3.78, standard deviation: 0.844), and native shrubs and bushes (mean: 3.76, standard deviation: 0.761), respectively. Non-native shrubs (mean: 2.93, standard deviation: 1.02) and non-native shrubs and bushes (mean: 3.32, standard deviation: 0.974) are the least preferred by men, respectively. The closer the alpha coefficient is to 1, the greater the reliability of that group. All values are above 0.7, thus they have high reliability.

Table 2
Description of Mean male preferences towards plant classification

Group	Origin	Mean	S.d	Cronbach's alpha
Tree	Native	3.58	0.804	0.728
	Semi-native	3.66	0.757	0.743
	Non-native	3.70	0.874	0.832
Surb	Native	3.75	0.883	0.816
	Semi-native	3.66	0.757	0.775
	Non-native	2.93	1.02	0.899
screw and bush	Native	3.76	0.761	0.764
	Semi-native	3.65	0.732	0.783
	Non-native	3.32	0.974	0.836
Flower	Native	3.89	0.894	0.844
	Semi-native	3.99	0.805	0.829
	Non-native	3.78	0.844	0.804

Respondents' overall preferences for plant groupings

Results of mean analysis using descriptive statistics show that, overall, men prefer flowers (mean: 3.89, standard deviation: 0.723) more, and this trend continues with trees (mean: 3.65, standard deviation: 0.669), shrubs (mean: 3.58, standard deviation: 0.667), and shrubs (mean: 3.44, standard deviation: 0.686), respectively (Table 3).

Table 3
Description of the average overall preferences of respondents towards plant groupings

Group	Mean	S.d
Tree	3.65	0.669
Shrub	3.44	0.686
screw and bush	3.58	0.667
Flower	3.89	0.723

Relationship between landscape knowledge level and landscape content quality

Pearson correlation test was used to evaluate the correlation between participants' knowledge level and their preference for landscape plants. The research findings show a significant correlation between the level of plant knowledge and their preference. According to the information in Table 4, there is a strong correlation between knowledge of native plants and preference for trees, shrubs, vines, and flowers. In addition, there is a strong correlation between knowledge of semi-native plants and preference for all species. Therefore, there is a significant direct relationship between knowledge of native and semi-native plants and preference for trees, shrubs, vines, and flowers. Also, there is a moderate correlation (correlation coefficient = 0.678, significance = 0.000) between knowledge of non-native plants and preference for non-native flowers.

Table 4
Relationship between landscape knowledge level and landscape content quality

Landscape recognition			Preference			
			Tree	Shrub	screw and bush	Flower
	Native	Pearson Cor.	0.838**	0.787**	0.773**	0.774**
		significance	0.000	0.000	0.000	0.000
	Semi-native	Pearson Cor.	0.849**	0.745**	0.758**	0.767**
		significance	0.000	0.000	0.000	0.000
	Non-native	Pearson Cor.	0.782**	0.824**	0.796**	0.678**
		significance	0.000	0.000	0.000	0.000

Spearman correlation coefficient: < 0.3 negligible correlation, 0.3–0.5 weak correlation, 0.5–0.7 moderately strong correlation, 0.7–0.9 strong correlation, 0.9 < very strong correlation.

Discussion

Urban landscape management strategies have often been developed without adequately considering men's perceptions and preferences regarding plant origin and diversity. A major challenge in this domain is the lack of information about men's needs and desires. The present study aimed to investigate men's preferences and perceptions while taking into account their level of knowledge. The study framework was derived from the existing literature, which suggests that familiarity with landscape types can significantly influence visual preferences (Häfner et al., 2018; Wartmann et al., 2021). Additionally, knowledge has been identified as a key factor in shaping perception (Gobster et al., 2007). Consequently, this study focused on examining the influence of knowledge level on preferences for plant species of varying origins.

To collect the necessary data, a structured questionnaire incorporating both textual and visual components was employed. Initially, the questionnaire gathered demographic and general information. Subsequently, specialized questions were presented in a closed-ended format, using a five-point Likert scale. Data were collected through simple random sampling from 200 male residents of Tabriz who were familiar with local parks and their conditions. The collected responses were analyzed using SPSS software, version 26. Results indicate that higher levels of knowledge are associated with stronger preferences. Notably, men exhibited a greater preference for flowers. Native plants were generally more favored than semi-native and non-native species and were perceived as more influential in shaping their ideal landscape. The key findings of this study are discussed in detail below.

Respondents' Preferences Regarding the Level of Recognition of Landscape Species

The analysis of mean preference scores for different plant species revealed that, as anticipated, men generally favored native and semi-native species over non-native ones. Among the native species assessed, the Tabrizi tree, cluster jasmine shrub, pomegranate vines, and honeysuckle emerged as the most preferred. Svobodova et al. (2010) demonstrated that respondents' evaluations of landscapes are influenced by their familiarity with the landscape and their attachment to the place of birth or residence. Accordingly, the impact of birthplace and current residence on men's preferences and their landscape recognition appears justified. In contrast, Russo et al. (2025) reported no significant relationship between preference and native plant species. It should be noted, however, that in the UK study, only 40% of participants were male, suggesting that the observed differences may reflect cultural or regional variations between England and Iran.

Regarding semi-native species, respondents most frequently favored the paper flower shrub, lilies, and irises. These results align with prior research. Aldopold (2017) emphasized that aesthetic evaluations are shaped by an individual's environmental recognition of a landscape. Thus, the higher preference for visually appealing semi-native species, such as the paper flower, which is commonly planted and familiar within Tabriz, can be attributed to this recognition.

Correlation analysis further indicated a positive relationship between plant recognition and landscape preference. This suggests that as familiarity with a landscape increases, so does the preference for its constituent species. These findings are consistent with earlier studies; for instance, Gerson et al. (1977) concluded that landscape preferences are largely influenced by individuals' recognition of the environment. Similarly, Kaplan et al. (1989) highlighted the critical role of cognitive processes in shaping preferences. Research also underscores that considering the level of cognition is essential both for assessing people's landscape preferences and for predicting them (Keane, 1990). Consequently, urban park planting designs in Tabriz should be informed by the observed correlation between plant preference and cognitive recognition of the landscape.

Relationship Between Respondents' Preferences and the Attractiveness of Landscape Plants

The analysis of men's average preferences toward various plant species indicates that the aesthetic qualities of plants play a significant role in shaping their preferences. In the overall assessment of plant groups, flowers emerged as the most preferred by male respondents. This can be attributed to the prominent role of flower gardens in the design of urban landscapes—such as public squares and street-side green spaces—where men are more frequently engaged. Consequently, familiarity with these spaces may enhance recognition and preference for flowers. These findings align with Komossa et al. (2018), who reported that direct experience and knowledge of a site strongly influence individual preferences.

Among non-native species, red maple and Indian chestnut trees were particularly favored, likely due to the visual appeal of their foliage and other aesthetic attributes. Previous research highlights the influence of foliage color on preference formation, noting that vibrant and colorful vegetation tends to be preferred over uniformly green types (Hao et al., 2024). Furthermore, studies suggest that people's preferences for specific landscapes are closely linked to their perceived attractiveness and beauty (Samadi-Todar and Hami, 2025). Hami et al. (2025a,b) similarly found a positive correlation between aesthetic appeal and preference, indicating that visually appealing characteristics enhance the desirability of landscape types. The results of the present study corroborate this positive relationship between attractiveness and preference.

Research applications

Urban parks serve as vital leisure spaces, yet limited research exists on local user preferences compared to Western contexts. This study examines men's preferences and the influence of demographic factors—age, education, income, and occupation—on sustainable park design from a social sustainability perspective. Understanding these characteristics is essential for aligning park design with environmental, social, cultural, and urban planning objectives.

Findings indicate that men prefer native and semi-native flowers, shrubs, and flowering vines, highlighting a direct relationship between plant recognition and preference. Familiar, locally compatible species enhance user satisfaction and park efficiency, emphasizing the importance of integrating user preferences with professional landscape design. Tailoring plantings and park feature to demographic profiles ensures greater usability, sustainability, and appeal of urban green spaces.

Conclusion

The findings highlight the significant role of native plant species in the urban parks of Tabriz. Given men's higher recognition of native plant images, integrating species such as the Tabrizi tree, cluster jasmine shrub, pomegranate vines, and honeysuckle into park landscapes appears advantageous. Semi-

native species ranked next in terms of recognition and preference, with paper flower shrubs, lilium, and lily-of-the-valley emerging as the most familiar and favored among male respondents. The study provides clear evidence of a positive and meaningful association between plant recognition and men's preferences: as recognition increases or decreases, preference levels shift accordingly. Correlation analyses further indicate that men show interest in viewing native and semi-native trees, as well as non-native shrubs, within urban environments. Moreover, overall recognition across the four plant groups suggests that flowers are the most identifiable category for male participants. Consequently, an optimal planting strategy for urban landscapes would include a blend of native and semi-native trees, non-native shrubs, and a diverse assortment of flowers. Broadly, the results demonstrate that men possess the capacity to recognize the plant species characteristic of their environment. Considering the growing emphasis on incorporating perceptual and preference-based insights into urban park design, greater attention to demographic factors will be essential in shaping future park planning and development.

Limitations

As with many scientific investigations, this study faced several inherent limitations that offer direction for future research. To begin with, only a subset of the native, semi-native, and non-native plant species in Tabriz was included, making it impossible to assess all existing species. Additionally, the findings are specific to parks within Tabriz and should not be generalized to parks in other cities without careful consideration and contextual understanding. The limited participation of men aged over 60 further constrained sampling in this demographic group. Moreover, insufficient collaboration and support from relevant institutions—particularly the Parks and Green Space Organization—restricted the study's breadth to some extent.

Declarations

Ethics approval and consent to participate

Ethics approval and consent to participate

The requirement for ethical approval for this study was formally waived by the Ethics Committee of the Faculty of Agriculture, University of Tabriz, Tabriz, Iran (No. D/123/7812), in accordance with the ethical principles of the World Medical Association Declaration of Helsinki (1964) and its subsequent amendments. The study was conducted in accordance with the ethical standards of the World Medical Association Declaration of Helsinki and the research ethics regulations of the University of Tabriz. The research involved a voluntary and anonymous questionnaire survey of adult participants and did not include clinical intervention, collection of sensitive personal data, or procedures posing more than minimal risk to participants. Prior to participation, all respondents were informed about the purpose of the study, the voluntary nature of participation, the anonymity and confidentiality of their responses, and their right to withdraw from the study at any time without consequence. Informed consent was obtained from all participants before data collection.

Consent to publish statement

Informed consent was obtained from all the individual participants for publication

Availability of data and material

The author confirms that the data supporting the findings of this study are available within the article and its supplementary material. Raw data that support the findings of this study are available from the corresponding author, upon reasonable request.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Clinical Trial Number

Clinical trial number: not applicable.

Consent to Participate Statement

Informed consent was obtained from all the individual participants for participation in this study.

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Figures

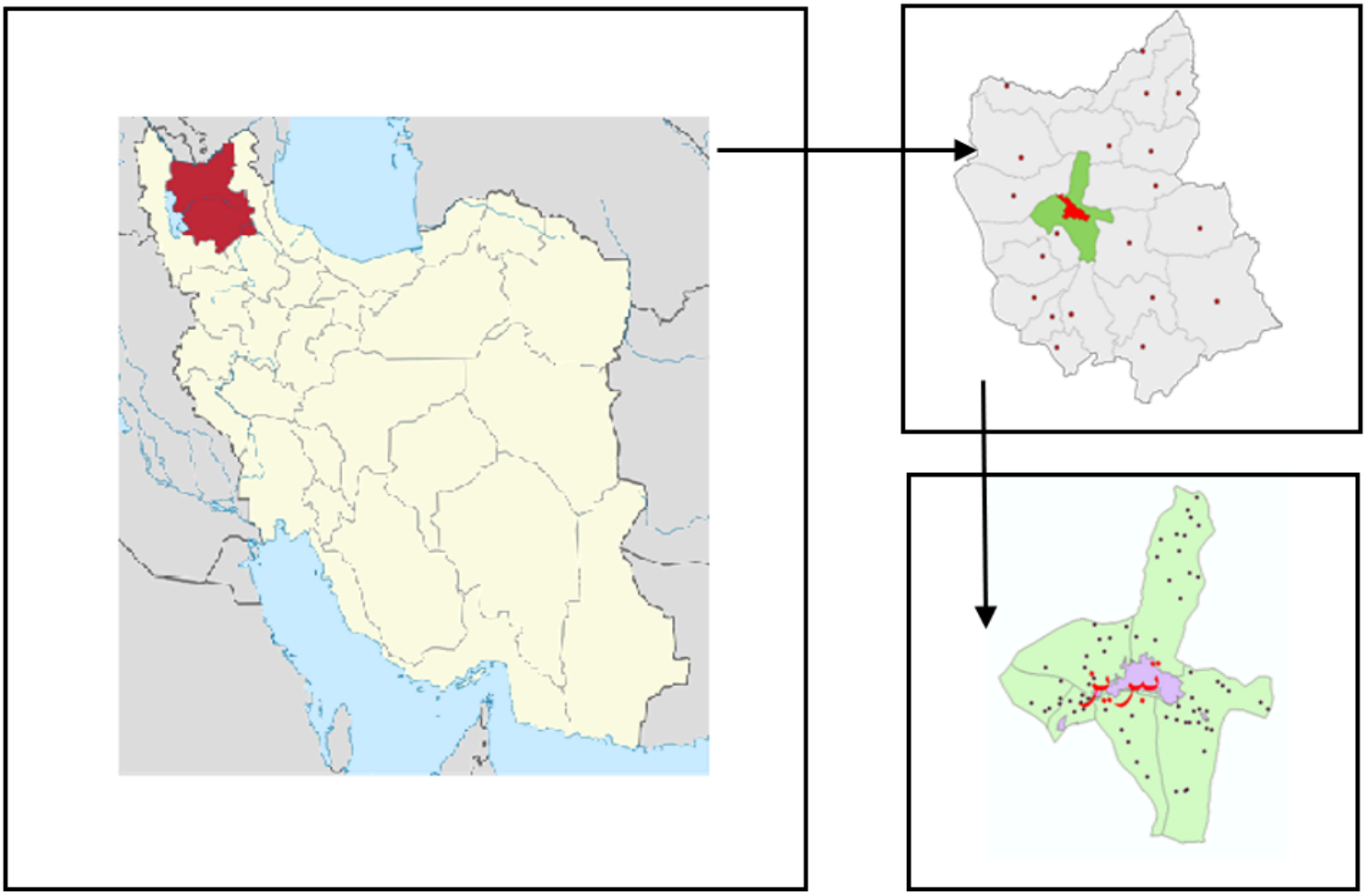

Figure 1

Tabriz City and the Study Cases

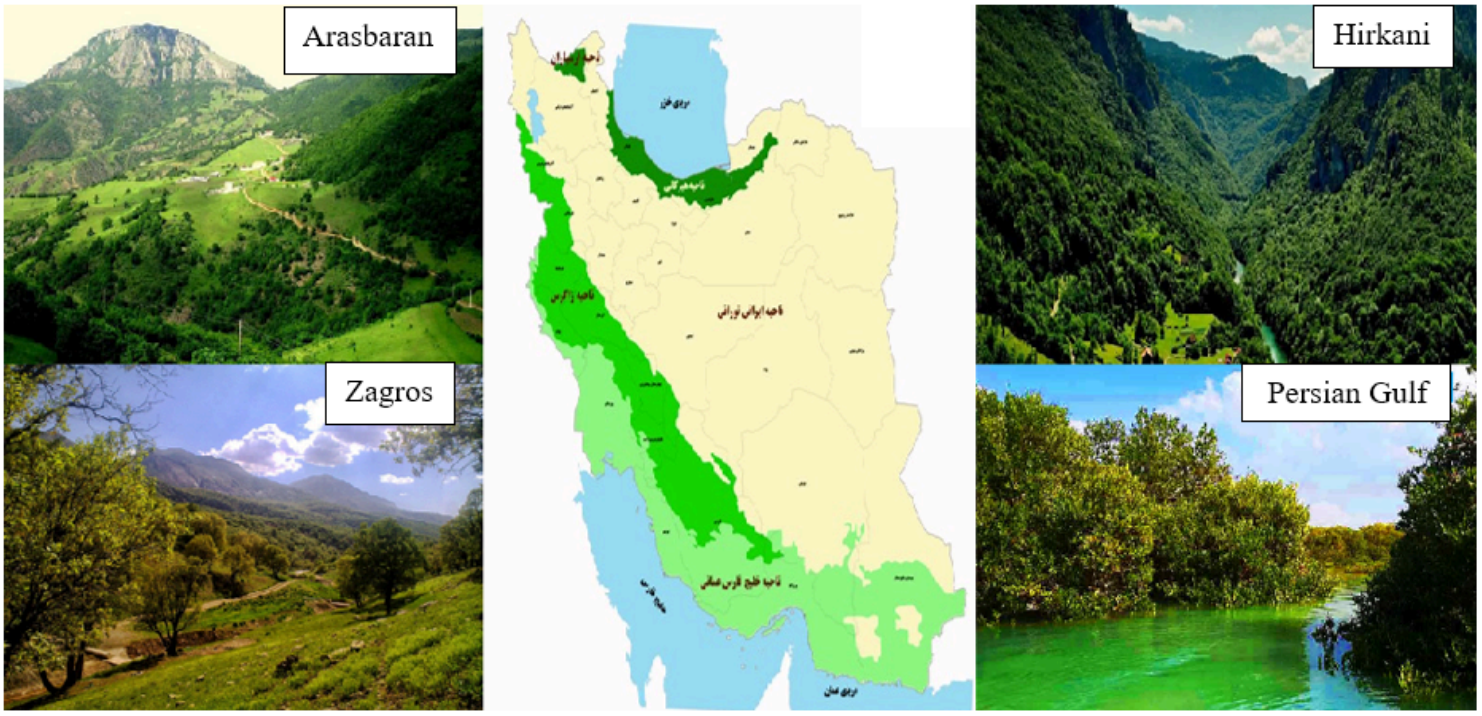

Figure 2

Vegetation regions of Iran

5	17	18
		
Mean: 3.98; S.d: 0.992	Mean: 4.02; S.d: 1.075	Mean: 4.07; S.d: 1.105

Figure 3

Ranking of trees based on the highest preference

14	4	13
		
Mean: 3.15; S.d: 1.223	Mean: 3.17; S.d: 1.261	Mean: 3.24; S.d: 1.299

Figure 4

Ranking of trees based on the lowest preference

7	5	12
		
Mean: 3.97; S.d: 1.000	Mean: 4.24; S.d: 1.028	Mean: 4.28; S.d: 0.916

Figure 5

Ranking of shrubs based on highest preference

16	14	13
		
Mean: 3.03; S.d: 1.307	Mean: 2.59; S.d: 1.26	Mean: 2.56; S.d: 1.243

Figure 6

Ranking of shrubs based on lowest preference

6	4	11
		
Mean: 4.22; S.d: 0.993	Mean: 4.05; S.d: 1.076	Mean: 3.91; S.d: 1.087

Figure 7

Ranking of screws and bushes based on the highest level of preference

13	14	17
		
Mean: 3.28; S.d: 1.216	Mean: 3.18; S.d: 1.250	Mean: 3.02; S.d: 1.244

Figure 8

Ranking of screws and bushes based on the lowest level of preference

11	8	10
		
Mean: 4.14; S.d: 0.998	Mean: 4.12; S.d: 0.993	Mean: 4.10; S.d: 0.926

Figure 9

Ranking of flowers based on highest preference

11	8	10
		
Mean: 3.73; S.d: 1.175	Mean: 3.68; S.d: 1.325	Mean: 3.55; S.d: 1.172

Figure 10

Ranking of flowers based on lowest preference