frontiers | Frontiers in Forests and Global Change

TYPE Original Research
PUBLISHED 17 January 2025
DOI 10.3389/ffgc.2024.1450098



OPEN ACCESS

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RECEIVED 16 June 2024
ACCEPTED 31 December 2024
PUBLISHED 17 January 2025

CITATION
Maleknia R, Elena Enescu R and Salehi T (2025) Climate change and urban forests: generational differences in women's perceptions and willingness to participate in conservation efforts.
*Front. For. Glob. Change* 7:1450098.
doi: 10.3389/ffgc.2024.1450098



# Climate change and urban forests: generational differences in women's perceptions and willingness to participate in conservation efforts

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**Introduction:** Climate change represents one of the most pressing challenges confronting contemporary societies. Despite occupying a relatively small proportion of the Earth's surface, cities contribute disproportionately to greenhouse gas emissions. Urban forests, as a vital form of natural infrastructure, play a critical role in mitigating the adverse impacts of climate change. Effective management and conservation of these resources necessitate active engagement from diverse stakeholder groups, with women being a particularly important demographic. However, generational differences in women's perceptions of climate change and their willingness to participate in urban forest conservation have received limited investigation. This study seeks to address this gap by comparing the perceptions and conservation participation intentions of two groups of women: those belonging to Generation Z and women from earlier generations.

**Methods:** The sample comprised 401 women from Generation Z and 395 women from other generations. Data for the study were collected using a questionnaire administered through a multi-stage cluster sampling method. The collected data encompassed participants' awareness of climate change, its causes, the dual impacts of climate change and urban forests, their willingness to engage in urban forest management, and their demographic characteristics such as age, educational level, family size, family income, highest education in family, and educational levels of fathers and mothers. The analysis was conducted using both descriptive and inferential statistical methods.

**Results:** The results revealed significant generational differences in understanding climate change, recognizing the role of forests in mitigating its effects, and demonstrating willingness to engage in urban forest conservation. Across all measures, Generation Z exhibited higher levels of awareness and willingness compared to older generations. Furthermore, increased awareness of these issues in both groups was positively associated with a greater willingness to participate in urban forest management. Socio-economic factors also influenced willingness differently between the two generational groups, highlighting the nuanced effects of these variables on participation intentions.

**Discussion:** The results showed althought differences in awareness were observed between the two groups, increased awareness consistently led to a heightened willingness among both groups to participate in urban forest conservation. These findings underscore the importance of adopting intergenerational perspectives

on climate change, emphasizing that educational and promotional programs must be tailored to account for generational differences to effectively maximize engagement and foster widespread participation in urban forest conservation efforts.

KEYWORDS

climate change, urban greenspace, female participant, generational differences, Generation Z

## 1 Introduction

Cities occupy small areas yet are major greenhouse gas contributors (Beckmann-Wübbelt et al., 2023; Sturiale et al., 2023). This global climate crisis poses significant risks to the well-being and livelihoods of communities across the world (Jones et al., 2024; Zhan et al., 2023). In this context, urban forests have emerged as a crucial nature-based solution to mitigate the adverse effects of global warming (Hutt-Taylor et al., 2022; Muluneh and Worku, 2022; Yang et al., 2024). As natural carbon sinks and providers of essential ecosystem services (Hoshyari et al., 2020; Maleknia, 2024), these verdant green spaces within urban environments can play a vital role in climate change adaptation and resilience (Jones et al., 2024). The management and conservation of these forests is a necessary and important action to address climate change. Given that the management and conservation of these forests is dependent on government organizations, and these organizations are unable to fulfill this duty on their own due to a lack of financial resources and human capital, public participation is essential (Azizipor et al., 2024; Mohammadi et al., 2024). Therefore, the long-term conservation and sustainable management of urban forests often necessitates the active participation and collaborative stewardship of community members from all genders and ages (Maleknia and ChamCham, 2024a). Engaging citizens in the decision-making processes in urban forests management can help ensure the equitable distribution of the manifold benefits of these natural assets (Galati et al., 2023).

women play a vital role in addressing climate change impacts (Maleknia and Salehi, 2024; Rainard et al., 2023). Women exhibit a heightened vulnerability (Md et al., 2022) and concern regarding the impacts of climate change (Acheampong et al., 2023). The findings of studies indicate that women, compared to men, exhibit a greater intention and behavior toward environmental issues (Le et al., 2024), particularly those related to addressing climate change (McCall et al., 2019). Therefore, to effectively mitigate climate change, it is essential to emphasize the role of women across all age groups (Devonald et al., 2024). The behavior of women in mitigating climate change is influenced by various factors, such as formal education, age, risk perception and psychological variables (Li et al., 2024; Maleknia and Salehi, 2024; Walker et al., 2022). In this regard, the factor of age is an important variable due to the generational differences and the variation in attitudes and behaviors among individuals (Ágoston et al., 2024; Maleknia et al., 2024b). The results of studies have shown that generational differences are one of the determinants of individuals' environmental behaviors, and the behaviors of people in different age groups vary (Akbarizadeh et al., 2021; Grønhøj and Thøgersen, 2009; Maleknia et al., 2024b). As individuals of different age groups possess distinct perspectives and life experiences (Lorenzini et al., 2021; Ogiemwonyi, 2022), their behavioral intention and actual behavior can vary. In regards to climate change, research indicated that younger female exhibit higher beliefs and risk perception compared to older groups (Lorenzini et al., 2021; Poortinga et al., 2023). Understanding these age-related differences is crucial in developing targeted strategies and initiatives to engage female of all generations to mitigate climate change.

The environmental behaviors of Generation Z are increasingly being recognized as a significant focus in research as a target group of study (D'Arco et al., 2023; Juma-Michilena et al., 2024; Masserini et al., 2024). Generation Z, individuals born roughly between 1997 and 2012 (D'Arco et al., 2023) with share of 32% of the population of word consists the largest generation. This generation considered as a significant part of society which will face with environmental challenges in future and have significant impact on environmental behavior as world next leaders (Parzonko and Bali, 2021; Review et al., 2023). The perspectives and behaviors of Generation Z regarding climate change are of critical importance, as this generation is coming of age during a pivotal time in the global climate crisis (Juma-Michilena et al., 2024). The findings of the study reveal that Generation Z demonstrates a heightened awareness of carbon emissions and climate change, which significantly influences their lifestyle choices (Aktan and Kethüda, 2024; Salguero et al., 2024). However, as emphasized, addressing climate change requires the active participation of all generations. The literature indicates that divergent generational cohorts may display markedly distinct pro-environmental behaviors, attributable to disparate perceptions regarding the differential impacts of climate change across age demographics (Satinover and Holt, 2023; Swim et al., 2022). Consequently, age, understood as a generational variable, can act as a strong predictor of individuals' behavioral responses to the challenges posed by climate change (Syropoulos and Markowitz, 2024). The divergence in the experience and understanding of climate change between different generations can have varying impacts on them (Swim et al., 2022). This can be seen in the varying degrees of engagement and participation in efforts to mitigate climate change, which stem from these generational differences in perceiving the effects of climate change (Jürkenbeck et al., 2021). The findings of Ágoston et al. (2024) indicated that there is no statistically significant difference between generations in terms of environmental behavior scores. However, the nature of their environmental behaviors differs. The younger generation exhibits a greater intention towards green purchasing and the utilization of public transportation. In contrast, the older generation demonstrates a stronger proclivity for recycling and reducing meat consumption as environmental behaviors.

Research on climate change and generational differences has predominantly focused on topics such as green purchasing, eco-friendly product consumption, and responsible travel as strategies to combat climate change. However, a significant research gap exists

in exploring the intersection of generational differences, urban forests, and climate change. This research aims to fill this gap. This study aims to: (1) examine the awareness of Generation Z and older generations regarding climate change, its causes, the role of urban forests in its mitigation, and their willingness to participate in urban forest management; (2) analyze the influence of awareness levels in these two groups on their willingness to engage in urban forest management; and (3) investigate the role of individuals' socio-economic factors in shaping their willingness to participate in the management of urban forests. The findings of this research can offer valuable insights for designing strategies to combat climate change. By assessing the awareness levels of individuals across different generations and their willingness to participate, it becomes possible to understand the current state and utilize this knowledge for planning collaborative actions through urban forests. Furthermore, identifying the factors influencing individuals' willingness to engage provides a deeper understanding of the determinants shaping their intentions. This understanding is instrumental in identifying target groups for participatory initiatives and addressing the barriers that hinder participation. By recognizing these factors, strategies can be developed to enhance public engagement in climate change mitigation through the management of urban forests.

## 1.1 Theoretical framework

This study adopts a theoretical framework comprising multiple concepts, including theory of generation and behavioral theories. Generational differences are considered a key determinant of individuals' awareness regarding various environmental issues (Jürkenbeck et al., 2021; Nikolić et al., 2022; Tavárez et al., 2024). Individuals' awareness environmental issues has been identified in various studies as a strong predictor of behavioral intentions, can ultimately translate into actual behavior (García-salirrosas et al., 2024; Moody-Marshall, 2023). Additionally, socio-demographic variables are recognized as significant determinants of individuals' willingness to participate in urban forest management initiatives to combat climate change. The influence of these variables on individuals' awareness of behavior has been also confirmed in environmental-related research (Botha and Wiese, 2024; Meet et al., 2024; Sousa et al., 2024). This framework can provide a foundation for understanding the differences in generational willingness to participate in urban forest management for mitigating climate change.

Theory of generations as conceptualized by Mannheim in 1952 and expanded by Strauss and Howe in 1991, postulates that individuals belonging to the same generational cohort share common values, beliefs, and behaviors due to the shared sociopolitical and cultural contexts during their formative years (Bristow, 2024; Pilcher, 1994). These shared experiences create generational identities that influence how cohorts perceive and address societal issues. According to generational classifications, Generation Z comprises individuals born between 1997 and 2012 (D'Arco et al., 2023). This cohort has grown up during an era of rapid technological and communicative advancements and has been more directly exposed to issues related to climate change compared to previous generations (Imjai et al., 2024; Salguero et al., 2024). Generation Z has grown up in a highly digitized world, with access to extensive environmental education and global climate change discourse through social media and other modern communication platforms (Dragolea et al., 2023). This generation is likely to exhibit a stronger inclination toward climate awareness and environmental responsibility (Masserini et al., 2024; Swim et al., 2022). Age-group older than Generation Z, shaped by different historical and technological contexts, may demonstrate varying degrees of awareness and engagement with environmental issues, relying more on traditional media and community-based knowledge sources (Maleknia et al., 2025; Stout et al., 2020).

The study also draws on the principle that environmental awareness is a precursor to pro-environmental behavior. Research suggests that higher awareness of environmental issues leads to greater concern and a stronger willingness to engage in conservation actions (Milfont and Schultz, 2016). Differences in knowledge and understanding between the generational cohorts regarding the reciprocal relationship between climate change and urban forests is vital factor to design participatory plans. Studies show that younger generations demonstrate stronger emotional responses to climate change, including feelings of fear, guilt, and anxiety. This emotional engagement is more pronounced than differences in cognitive beliefs about climate change itself (Poortinga et al., 2023). Younger activists are at the forefront of climate change discussions, significantly influencing public perception and policy debates. Figures like Greta Thunberg symbolize this generational activism, which contrasts sharply with the more cautious approaches often seen in older demographics. A study conducted in the UK highlights that younger generations exhibit higher emotional engagement with climate change than older ones (Poortinga et al., 2023). Intergenerational differences in environmental concerns can also be attributed to varying worldviews shaped by distinct life experiences. For instance, a study from China found significant differences in ecological worldviews between generations but noted that local environmental issue concerns did not vary significantly. This suggests that while younger generations may have broader ecological concerns influenced by modern values and media exposure, their focus on local issues might not differ greatly from older generations (Wang and Wu, 2024). The conceptual model of this study posits that individuals' awareness of climate change, and the role of urban forests can significantly influence their willingness to participate in the management of these resources. Additionally, it is hypothesized that socio-economic factors play a critical role in shaping this willingness. These hypotheses are tested within the context of generational comparisons, with a particular focus on Generation Z, to gain a deeper understanding of how this generation differs from older generations in their perspectives and behaviors. By applying Generational Theory, the study contextualizes the observed differences in perceptions of climate change and urban forest conservation, linking them to the broader sociocultural influences specific to each generational cohort.

This empirical approach strengthens the theoretical framework by linking observed generational differences to measurable factors such as media consumption patterns, educational levels, and household dynamics. The theoretical framework provides a comprehensive lens for understanding the generational gap in urban forest conservation. By situating the findings within these theoretical constructs, the study contributes to the literature on intergenerational engagement in climate change mitigation and offers practical insights for designing targeted outreach and education programs to enhance participation in urban forest conservation.

# 2 Materials and methods

## 2.1 Study area

This study was conducted in the urban forests of Khorramabad, the capital city of Lorestan Province, Iran (Figure 1). Khorramabad is located between the geographical coordinates of 48°2′ E and 49°0′ E longitude, and 33°53' N and 33°27' N latitude. The city has an area of approximately 60,000 hectares, and its population, according to the latest national census conducted by the Statistical Center of Iran in 2016, is approximately 506,000 people. Khorramabad is divided into three urban zones and 23 urban neighborhoods based on the latest administrative divisions. The first urban zone contains two neighborhood-level parks and three zone-level parks, collectively covering an area of 229,941 square meters. The second urban zone has three neighborhood-level parks and three zone-level parks, occupying a total area of 146,262 square meters. The third urban zone includes eight neighborhood-level parks and seven zone-level parks, spanning an area of 442,897 square meters. The city of Khorramabad was selected as the study area due to its significant social transformations in recent years. This city, characterized by a traditional culture, exhibits notable differences between its younger generation and older generations, particularly in terms of education and life experiences.

## 2.2 Study population and sampling method

The statistical population of this research study consisted of two distinct groups. Since the primary objective of the research was to investigate the difference in climate change and urban forest awareness between Generation Z individuals and other generational cohorts, the statistical population was composed of two groups. In this study, the first group consisted of female high school students from Generation Z, a demographic that has been relatively underrepresented in research on climate change and urban forestry. According to official statistics, this population group constituted approximately seven thousand individuals. The other group consisted of women from age groups outside of Generation Z, older than 30 years, henceforth referred to as the "older Generation group" in tables and text. To better differentiate between the two groups, women above the age of 30 who were visitors to the urban forests were selected to represent this older age cohort. The sample size was determined using the Krejcie and Morgan (1970) table. Based on this table, the maximum sample size for each group was set at 386 individuals. For greater precision, a higher number of samples was considered, and after eliminating incomplete or flawed questionnaires, 401 questionnaires for the Generation Z group and 395 questionnaires for the older Generation group were used in the analysis. Multistage cluster sampling with proportional allocation was employed for the sampling process. For sampling the older population, urban districts were selected as the clusters. Subsequently, three parks were chosen from zones 1 and 2, and four parks from zone 3. Within each park, the samples were randomly selected. The number of samples in each cluster was determined proportional to the population of the respective area. The sampling procedure for the student group followed the same approach, with schools considering as the clusters in the second stage of the clustering process.

## 2.3 Data gathering

The research utilized a self-constructed questionnaire to collect data for this study. The questionnaire consisted of three distinct sections. The first section gathered demographic information about the research participants. For the mother population, this included age, household income, highest level of household education, spouse's education, and household size. For the student population, the collected data encompassed household income, highest level of household education, parental education, and household size. The second section of the questionnaire contained questions about the

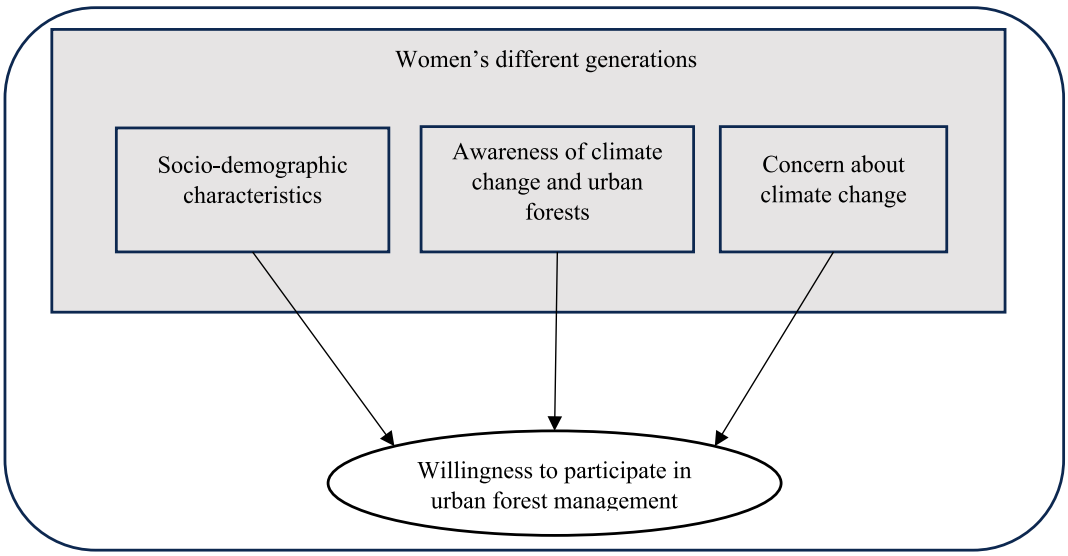


FIGURE 1
Theorical framework of study.

participants' level of awareness regarding climate change, their concerns about the consequences of climate change (three items), and their awareness of the role of urban forests and trees (three items) in mitigating climate change. The third section of the questionnaire included items related to the participants' willingness to engage in urban forest conservation programs. This section employed four items to assess the individuals' propensity to participate in the protection of urban forests to combat climate change. The cumulative scores on these items were used as a metric to gauge the participants' willingness towards participating in urban forest conservation. A five-point Likert scale was utilized to respond to the questions in the second and third sections of the questionnaire.

Prior to the commencement of the research, the questionnaire was reviewed by a team of 10 experts from diverse backgrounds, including forestry, environmental science, extension and development, educational sciences, and individuals with research experience in the domains of women and students. With feedback received from the expert team, the questionnaire was revised and subsequently approved by the team members. In the next phase, a pretest was conducted with 30 participants from each group, and the results confirmed the reliability of the questionnaire through Cronbach's alpha. The results indicated that the alpha coefficient for all constructs exceeded 0.82, which is above the acceptable level for this statistic. The finalized version of the questionnaire was then used for data collection.

Data were collected through face-to-face interviews. At the beginning of each interview, participants were provided with detailed explanations about the purpose of the study and the procedure for responding to the questions. They were assured that the information would be used exclusively for this research and would not be shared with any other entity. Written consent was obtained from older participants to participate in the study, while legal guardians of student participants also provided their consent for the research. For individuals requiring assistance, efforts were made to support them in completing the questionnaire while ensuring that the responses reflected their personal views. Interviewers only assisted in clarifying and documenting answers when necessary. A significant challenge during data collection arose with the older age group, as fewer individuals were willing to participate. Consequently, additional time was required to complete the necessary number of questionnaires for this group. The research data were collected between September and November of 2023, based on two statistical populations. The average time required to complete the questionnaire was 23 min for the older generation group and 16 min for the Generation Z group.

## 2.4 Data analysis

The research data underwent a thorough analysis using both descriptive and inferential statistical methods, each selected to align with the nature of the data and the study's objectives. Descriptive analysis was employed to summarize the demographic and individual characteristics of the participants, providing a comprehensive overview of the sample composition. This step was essential for understanding the population's structure and forming the foundation for subsequent inferential analyses. Inferential statistical methods were utilized to examine relationships and differences between variables, ensuring that the study's hypotheses were rigorously tested. The Mann–Whitney U test was chosen for mean comparisons due to the ordinal nature of the data, as it is a robust non-parametric test that does not require the assumption of normality, making it suitable for analyzing ranked data. This approach ensured that the comparison between groups was statistically valid and unbiased by the data's distribution. For correlation analyses, both Spearman's rank-order correlation and Pearson's correlation coefficient were employed. Spearman's method was applied to ordinal variables. In contrast, Pearson's correlation coefficient was used for ratio-scale data, as this method is well-suited for detecting linear relationships in continuous data. Together, these methods provided a comprehensive assessment of the associations between variables, tailored to their measurement scales. The use of $SPSS_{24}$ software facilitated accurate and reliable data analysis, ensuring that the chosen statistical tests were implemented correctly (see Figure 2).

# 3 Results

## 3.1 Demographic characteristics

The results of demographic characteristics of older generation indicate, the 30–40 age group (39%) had the highest frequency. This was followed by the 40–50 (28%), 50–60 (18%), and over 60 (15%) age groups. Single women comprised 49% and married women 51% of the research participants. The Z Generation participants were in the 14–18 age range. This group exhibited homogeneity in terms of age, education, marital status, and employment. Therefore, detailed demographic information has been omitted.

The sources of awareness for individuals from two groups are illustrated in Figure 3. As shown, social media was the main awareness source for participants from Generation Z followed by friends and formal media including TV and radio. For older generation, the formal media such as TV and radio were the main sources of information and awareness about climate change and the relationship between urban forests and climate change. Social media, family, friends, and extension programs were the next important sources, respectively.

## 3.2 Results of comparison test

The results of the Mann–Whitney U test for comparing the awareness of the two groups regarding climate change and the role of urban forests in addressing it, are presented in Table 1. As the table indicates, the Generation Z had significantly greater awareness of climate change ($z = -10.86$, $p = 0.000$), understanding of its causes ($z = -4.6$, $p = 0.000$), concern about its consequences ($z = -2.85$, $p = 0.021$), and the role of urban forests in mitigating climate change ($z = -3.13$, $p = 0.003$). The Generation Z also showed significantly higher willingness to participate in the conservation of urban forests to mitigate climate change compared to non- Generation Z ($z = -8.5$, $p = 0.000$). However, there was no significant difference between the two groups in their awareness of the impact of climate change on urban trees ($z = -0.65$, $p = 0.48$).

The influencing factors on the willingness of the two groups to participate in the conservation of urban forests were examined in two categories: variables related to individuals' awareness of climate change and its relationship to urban forests, and socioeconomic

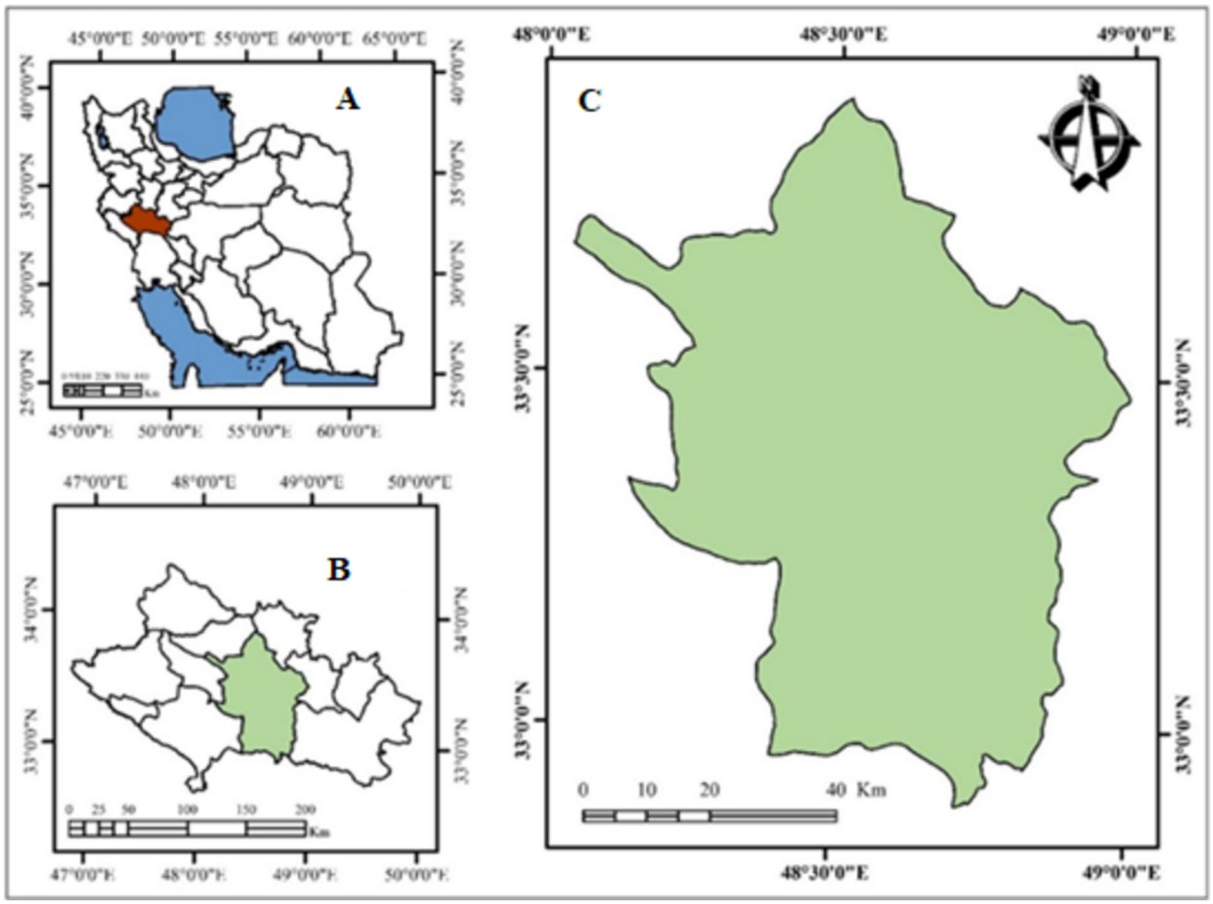


FIGURE 2
Study area location (produced by authors).

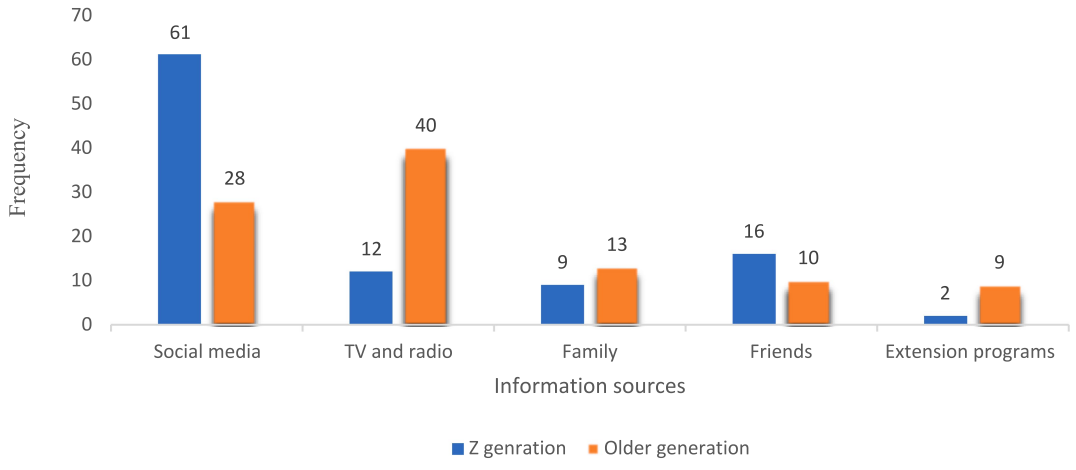


FIGURE 3
The sources of awareness of individuals regarding to climate change.

variables of the individuals. Table 2 presents the results of the Spearman's correlation test for examining the relationship between the two groups' awareness and their willingness to participate in the conservation of urban forests. The results showed that all the variables used in the study, including awareness of climate change, understanding of its causes, concern about its effects, perception of its impact on urban forests, and recognition of the role of urban forests in mitigating climate change, had positive and significant relationship

TABLE 1 Results of the Mann–Whitney U test for comparing the awareness of the two groups.

| Variables | Generations | Mean Rank | z-values | *p*-values |
|---|---|---|---|---|
| Awareness about climate change | Older G. | 295.59 | −10.86 | 0.000** |
| | Z G. | 461.82 | | |
| Climate change causes | Older G. | 345.99 | −4.6 | 0.000** |
| | Z G. | 414.13 | | |
| Concern about climate change | Older G. | 384.14 | −2.85 | 0.021** |
| | Z G. | 435.15 | | |
| Effect of climate change on urban forests | Older G. | 345.53 | −0.65 | 0.480$^{ns}$ |
| | Z G. | 360.19 | | |
| Role of urban forests on climate change mitigation | Older G. | 351.84 | −3.13 | 0.003** |
| | Z G. | 410.18 | | |
| Willingness to participate in urban forests management | Older G. | 361.62 | −8.50 | 0.000** |
| | Z G. | 450.37 | | |

**, Significant at 0.01 level, ns: not significant, Older G. = older generation; Z G. = Generation Z.

with the willingness to participate in the protection of urban forests in both groups. Therefore, as individuals' knowledge and understanding in these areas increase, their willingness to participate in the protection of urban forests also increases.

Table 3 presents the results of a correlation analysis examining the relationship between the participants' willingness to engage and their socioeconomic characteristics. For the ordinal data, Spearman's correlation test was used, while Pearson's correlation test was applied to the ratio-scale data. The findings suggested that certain socioeconomic factors have differential impacts on the two study groups. The results indicated that household income does not have a significant influence on the willingness to participate in both groups. This result indicated that individuals' willingness to participate in urban forest management is not influenced by household income. The study revealed a contrasting effect of household size on the two groups. While household size had a significant negative impact on the willingness of individuals from older generation, it has a positive and significant effect on the willingness of the Generation Z to participate in urban forest conservation. The findings revealed that in the older generation, an increase in household size acts as a deterrent to participation, whereas in Generation Z, this factor enhances individuals' willingness to engage in urban forest management. The findings also showed that age has a significant negative impact on the willingness of individuals from older generation to participate. This suggests that as age increases, the willingness of these individuals to engage in urban forest conservation decreases. Furthermore, the highest level of household education had a significant positive effect on the willingness to participate in urban forest conservation for both groups. For the older generations, the education level of the spouse does not have a significant impact on their willingness to participate, but their own educational attainment positively and significantly influences their willingness to engage in urban forest conservation. Regarding the Generation Z, the analysis reveals that while the father's education does not significantly affect their willingness to participate, the mother's education has a positive and significant impact on their willingness to engage in urban forest conservation.

## 4 Discussion

This study was conducted to investigate the awareness of Z and older female generations regarding climate change, its reciprocal impact with urban forests, and the willingness to participate in the conservation of urban forests. The study results on the generational differences in awareness about climate change and urban forests, dual influence of climate change and urban forests, and concerns about the effects of climate change, revealed that student of Generation Z had significantly greater awareness in all cases compared to individuals from older generation. Consequently, Generation Z expressed higher levels of concern about the impacts of climate change. Previous studies have also shown that Generation Z has high levels of concern regarding the effects of climate change (Parzonko and Bali, 2021; Salguero et al., 2024). Other research has indicated that the understanding and awareness of young people regarding climate change is significantly higher compared to older individuals (Milfont et al., 2021; Poortinga et al., 2023), which the current study also confirms. This difference can be attributed to the novelty of the climate change issue and the role of forests in mitigating its effects. The Z generation, due to the recent introduction of these topics in textbooks and other information sources, is more familiar with the related concepts compared to previous generations. Additionally, the younger generation's access to digital tools, which is a hallmark of Generation Z (Salguero et al., 2024), has further enhanced their understanding of these issues (Vrselja et al., 2024). The findings of this study suggest that older generations require targeted programs to enhance their awareness of climate change, its causes, and its connection to urban forests. Such initiatives can help increase their understanding and engagement with these critical issues. The results also showed that, contrary to the different understanding of the two groups on other aspects, their knowledge about the impact of climate change on urban trees did not differ significantly. This lack of difference can be attributed to the tangible effects of climate change on trees and urban forests, such as early leaf shedding or pests and diseases, which are observable to all individuals. This result indicates that individuals may primarily recognize only the tangible and noticeable signs of climate change. It is essential to raise public awareness about the

TABLE 2 The results of correlation test for two groups' awareness and their willingness to participate.

| Dependent variable | Independent variables | Generations | r | *t*-values |
|---|---|---|---|---|
| Willingness to participate in urban forests management | Awareness about climate change | Older G. | 0.444 | 0.000** |
| | | Z G. | 0.335 | 0.000** |
| | Climate change causes | Older G. | 0.173 | 0.001** |
| | | Z G. | 0.159 | 0.002** |
| | Concern about climate change | Older G. | 0.476 | 0.000** |
| | | Z G. | 0.220 | 0.000** |
| | Effect of climate change on urban forests | Older G. | 0.426 | 0.000** |
| | | Z G. | 0.323 | 0.000** |
| | Role of urban forests on climate change mitigation | Older G. | 0.412 | 0.000** |
| | | Z G. | 0.385 | 0.000** |

**, Significant at 0.01 level, older G = older generation, Z G. = Generation Z.

TABLE 3 Relationship between the willingness to participate and socioeconomic characteristics.

| Dependent variable | Independent variables | Generations | r | *t*-values |
|---|---|---|---|---|
| Willingness to participate in urban forests management | Family income | Older G. | 0.054 | $0.080^{ns}$ |
| | | Z G. | 0.038 | $0.075^{ns}$ |
| | Family size | Older G. | −0.115 | 0.001** |
| | | Z G. | 0.220 | 0.002** |
| | Highest education of family | Older G. | 0.198 | 0.012** |
| | | Z G. | 0.255 | 0.000** |
| | Age | Older G. | −0.172 | 0.012** |
| | Husband education | Older G. | 0.087 | $0.325^{ns}$ |
| | Educational levels | Older G. | 0.269 | 0.000** |
| | Mother education | Z G. | 0.248 | 0.000** |
| | Father education | Z G. | 0.074 | $0.214^{ns}$ |

**, Significant at 0.01 level, ns: not significant, older G = older generation, Z G. = Generation Z.

hidden and long-term impacts of climate change on various aspects, including the environment.

The results of the study showed that Z generation, compared to individuals from older generation, received more of their awareness from social media. In contrast, other generations relied more on official media such as television and radio, as well as their families. This difference is due to intergenerational differences. Generation Z consists of individuals from digital age, who have greater knowledge and access to modern communication technology and the internet (Imjai et al., 2024; Salguero et al., 2024), and therefore obtain their information from these sources. Studies have demonstrated that media plays a crucial role in shaping individuals' awareness, perceptions, and behaviors (Chamcham et al., 2024; Maleknia et al., 2025). However, the results indicate that individuals from different generations have different information sources regarding climate change and urban forests. Therefore, in designing awareness-raising programs, it is necessary to consider various sources, including official media and social media, to increase the awareness of different generations of society in this regard (Maulana et al., 2024). Based on the research results, this awareness-raising can create a basis for increasing individuals to participate in actions to address climate change, such as the conservation of urban forests.

The results indicated that the willingness to participate in urban forest conservation was significantly higher among Generation Z participants compared to older group. Studies have shown that younger age groups exhibit a high willingness to engage in forest conservation (Ávalos-Hernández et al., 2024; Moody-Marshall, 2023), even if this willingness does not always translate into actual participatory behavior (Maleknia et al., 2024a). Therefore, this finding can be utilized in planning participatory programs for the management and conservation of urban forests. This finding is noteworthy for two main reasons. Firstly, individuals from Generation Z, as the future custodians and managers of urban forest conservation and climate change mitigation, show a strong willingness to participate in these efforts. Thus, it is essential to devise plans to harness this potential. Providing necessary education to raise their awareness and promoting participatory programs can be effective strategies to achieve this goal. Secondly, the weaker willingness of older individuals to participate is also noteworthy. Urban managers should plan to engage this demographic to leverage the full potential of all individuals in combating climate change.

The results of influencing factors on the individuals' willingness indicated a significant positive relationship between individuals' awareness about climate change and urban forests, and their willingness to participate in urban forest conservation. This result

aligns with other studies that emphasize the impact of individuals' understanding and awareness of climate change (Beckmann-Wübbelt et al., 2023) or environmental concerns (Khedrizadeh et al., 2017; Tatari et al., 2019) on their intention to address these issues. Various studies have confirmed awareness as a significant determinant of individuals' attitudes and behavioral intentions (Badawi et al., 2024; Maleknia and ChamCham, 2024a; Tavárez et al., 2024). Knowledge about environmental issues, including climate change, and awareness of the functions of forests can enhance individuals' participation in conservation programs (Akbarizadeh et al., 2021). Conducting educational courses is a strategy that can raise individuals' awareness and positively influence their environmental behaviors, such as forest conservation.

The study's findings on demographic factors revealed that household income did not significantly affect the willingness to participate in urban forest conservation in either group. While some studies have confirmed a positive and significant effect of income on participatory behavior (Akbarizadeh et al., 2021; Barabadi et al., 2020), others have not found a significant impact (Maleknia and ChamCham, 2024b; Panyavaranant et al., 2023). This discrepancy could be attributed to the varying conditions of the different study areas and the influence of other factors. Individuals' willingness to participate may stem from factors other than income, or income may have an indirect effect on their willingness. A better understanding of income's impact requires comprehensive studies to explore its direct and indirect effects on individuals' knowledge and attitudes. The results indicated a different impact of household size on the two groups. While household size significantly and negatively affected the willingness of individuals from Older Generation, it had a positive and significant impact on Generation Z's willingness to participate in urban forest conservation. While Azizipor et al. (2024), reported a negative and significant effect of household size on individuals' participation in urban forests, Mohammed et al. (2017) confirmed the positive effect of household size on individual willingness to participate in forest management. This result might be linked to the potential role of older generations within the family. Many of these individuals are married with children or are employed, which increases their responsibilities and reduces their available time for social or environmental activities, such as participating in urban forest conservation. However, with a larger household size, responsibilities related to individuals from Generation Z may be shared, giving them more time to engage in social and environmental programs.

While some studies suggest a positive and significant effect of age on participation (Elton et al., 2023), the present study, consistent with some other studies (Barabadi et al., 2020; Maleknia and ChamCham, 2024b; Panyavaranant et al., 2023), found that age negatively and significantly impacts the willingness of generations other than Generation Z to participate. The findings reveal that the older generation demonstrated lower willingness to participate compared to Generation Z. Moreover, within the older generation itself, willingness to engage decreased with age, potentially due to limited free time caused by professional or personal responsibilities or physical limitations. In the studied community, increased age might indirectly negatively affect attitudes and knowledge about climate change, leading to a reduced willingness to participate. It is recommended to conduct studies among individuals from age groups outside Generation Z to identify the primary reasons for this decline in willingness. Understanding these factors can inform the design of participatory programs, allowing for targeted strategies to address and mitigate these barriers effectively.

The highest level of household education significantly increased the willingness of both groups to participate in urban forest conservation. Higher household education levels can indirectly enhance other family members' awareness (Akbarizadeh et al., 2021). Since individuals' awareness is directly related to their willingness to participate, increased education levels among household members can indirectly strengthen the willingness of other members to participate (Ugulu et al., 2013). Among Older Generation, the spouse's education did not significantly impact their willingness to participate, but their willingness was positively and significantly influenced by their education. Other studies also indicate the impact of education level on individuals' participation rates (Akbarizadeh et al., 2021; Barabadi et al., 2020). With higher education levels, the potential for increased awareness about environmental issues, such as climate change and the role of urban forests, rises, thereby increasing their willingness to participate in urban forest conservation. Examining the influence of parental education on Generation Z's willingness to participate showed that the father's education did not have a significant impact, but the mother's education positively and significantly influenced their willingness. This finding offers managerial insights for promoting participatory actions. As the study indicates, mothers have a significant impact on the willingness of Generation Z family members to participate compared to fathers. Therefore, raising mothers' awareness about climate change, the role of forests in this context, and promoting participatory conservation of urban forests can also influence their children and help engage them in conservation programs to combat climate change. Given the degradation and land-use change of the country's forests (Khosravi et al., 2014; Parma et al., 2017; Savadroodbari et al., 2017), and the importance of forests in carbon sequestration and climate change mitigation (Delpasand et al., 2022), it is essential to consider generational differences to foster their participation in forest conservation efforts to address climate change.

## 4.1 Limitations and suggestion for future research

This study has certain limitations that should be acknowledged. First, the research was conducted within a specific geographic area and focused solely on the urban forests of Khorramabad, Iran. As a result, the findings may not be generalizable to other regions with different socio-cultural, environmental, or economic contexts. Second, the study exclusively examined women, focusing on generational differences without considering male perspectives. This limits the broader applicability of the findings and restricts a comprehensive understanding of gender dynamics in urban forest conservation. Third, the research primarily relied on self-reported data collected through questionnaires, which may be subject to social desirability bias or inaccuracies in participants' responses. Additionally, while the study provided valuable insights into the role of awareness and socio-economic variables in influencing conservation behaviors, it did not explore other potential factors such as psychological motivations, cultural norms, or institutional barriers that might impact participation. Lastly, the cross-sectional design of the study limits the ability to draw causal inferences or examine changes in perceptions

and behaviors over time. Based on these limitations and findings of research, the following suggestions are provided for future research.

Future studies should replicate this research in diverse geographic and socio-cultural contexts to examine whether the observed generational differences hold across different regions. Comparative analyses across countries or cities with varying urban forest management practices could provide more comprehensive insights. To achieve a holistic understanding of generational and gender dynamics in urban forest conservation, future research should include both male and female participants. Additionally, studies could compare gender-specific attitudes and behaviors across generations. Conducting longitudinal studies would allow researchers to investigate changes in awareness, attitudes, and behaviors over time, particularly as societal and environmental conditions evolve. Future research could explore psychological, cultural, and institutional factors influencing urban forest conservation behaviors. Variables such as environmental values, social norms, trust in institutions, and perceived barriers could offer deeper insights into participation dynamics. Future research should evaluate how the integration of generational perspectives can inform urban forest management policies and participatory strategies, ensuring equitable and effective engagement across all age groups.

## 4.2 Implications

### 4.2.1 Theorical implications

This study contributes to the existing body of knowledge by offering a nuanced understanding of how generational differences shape awareness and concern related to climate change and urban forest conservation. Grounded in generational theory, the research underscores that generational identity significantly influences environmental awareness and pro-environmental willingness. The findings reveal that Generation Z exhibits higher levels of awareness and a stronger willingness to engage in urban forest conservation compared to older generations. This adds a valuable perspective to the theoretical discourse on age-related environmental issues, emphasizing the role of shared sociocultural and technological contexts in shaping generational willingness toward climate action. The study highlights the pivotal role of environmental awareness in fostering conservation intentions. By demonstrating a positive relationship between awareness and willingness to participate in urban forest management across generational cohorts, it reinforces the theoretical linkage between knowledge acquisition and pro-environmental actions. Moreover, the analysis of socio-economic variables—such as education, household size, and income—adds depth to our understanding of how these factors interact with generational differences to shape conservation intentions. These findings enrich existing theoretical frameworks by integrating generational and socio-economic dimensions into models of environmental behavior.

By focusing specifically on women, this research advances the intersectional understanding of gender and generational influences on environmental engagement. It emphasizes the critical role of women in climate change mitigation, particularly highlighting how maternal education significantly impacts the pro-environmental behaviors of younger generations. This insight contributes to gender-focused theoretical discussions and positions women as influential agents of environmental change within their families and communities. Additionally, the study extends theoretical applications of generational theory to the urban ecological context, bridging gaps between environmental psychology, urban forestry, and climate change research. It highlights the importance of considering generational perspectives when designing participatory conservation programs, thus providing a theoretical foundation for future research on intergenerational collaboration in addressing global environmental challenges.

### 4.2.2 Practical and policy implications

The findings of this study provide valuable empirical insights into the generational dynamics of urban forest conservation and climate change mitigation. The significant generational differences observed in awareness, concern, and willingness to participate highlight the importance of targeting specific demographic cohorts with tailored approaches. For instance, Generation Z demonstrated higher levels of awareness about climate change and its relationship with urban forests, alongside a stronger willingness to engage in conservation activities. These findings suggest that this group is particularly receptive to participatory programs and could serve as a primary focus for urban forest management initiatives. The study also identified distinct patterns in socio-economic factors influencing willingness to participate. Household size, for example, had contrasting effects across generations, with a positive impact on Generation Z and a negative influence on older cohorts. Additionally, maternal education emerged as a critical determinant for the younger generation's engagement, whereas personal education levels were more significant for older participants. These nuanced relationships highlight the need to consider socio-economic contexts when designing interventions aimed at fostering conservation behaviors. The study also underscores the role of environmental awareness as a driving factor for participation across generations. This reinforces the empirical validity of awareness-raising campaigns as a mechanism to enhance conservation behaviors, particularly among less engaged demographics such as older women.

The results of this study also provide actionable guidance for policymakers and urban forest managers. First, the strong engagement potential of Generation Z suggests that participatory programs should prioritize this demographic through targeted outreach strategies, such as leveraging social media platforms and digital tools, which are the primary sources of information for this cohort. By aligning conservation initiatives with the communication preferences of younger generations, policymakers can effectively harness their enthusiasm and willingness to participate. Second, the findings regarding older generations indicate the need for policies that address barriers to participation, such as time constraints or lack of access to information. Tailored educational programs delivered through traditional media and community-based channels can help bridge the awareness gap for these groups and foster their engagement in conservation efforts. The study also emphasizes the influence of maternal education on Generation Z's conservation behaviors, suggesting a need for family-oriented interventions. Policies aimed at raising environmental awareness among mothers could indirectly enhance participation rates among younger generations. Lastly, the identified generational differences in the socio-economic factors influencing participation point to the importance of adopting

context-sensitive approaches. Policymakers should consider household dynamics, education levels, and economic contexts when designing conservation programs to ensure they resonate with the unique needs and motivations of each demographic group. By tailoring policies to reflect these empirical insights, urban forest management strategies can achieve broader and more effective community engagement in addressing climate change.

## 5 Conclusion

This study explored generational differences in women's awareness of climate change, their understanding of urban forests' role in mitigating its impacts, and their willingness to participate in urban forest conservation. By comparing Generation Z and older cohorts, the research provided a nuanced perspective on how generational identity and socio-economic factors shape environmental attitudes and behaviors. The findings revealed that Generation Z demonstrated significantly higher levels of awareness, concern, and willingness to engage in conservation efforts compared to their older counterparts. Additionally, the study highlighted the critical role of environmental awareness in fostering pro-environmental behaviors across generations, emphasizing the importance of targeted educational initiatives to enhance participation.

The influence of socio-economic factors on conservation willingness further enriched the findings. While household size positively impacted Generation Z's willingness, it had a negative effect on older generations, underscoring the importance of context-specific approaches in conservation planning. Maternal education emerged as a significant determinant of Generation Z's engagement, highlighting the intergenerational transmission of environmental values and the potential of family-oriented strategies in participatory programs. These findings underscore the necessity of incorporating generational perspectives into urban forest management strategies. Policymakers and urban planners must leverage the strong engagement potential of Generation Z while addressing the barriers faced by older generations to foster inclusive and equitable participation. By tailoring awareness campaigns and conservation programs to the unique characteristics and preferences of each generation, urban forest management can be positioned as a critical tool for climate change mitigation. This research contributes to the broader discourse on generational dynamics in environmental behavior and offers practical insights for designing targeted strategies to enhance community engagement in urban forest conservation. Future studies are encouraged to expand this work by exploring additional demographic groups, geographic contexts, and the longitudinal impacts of awareness and education initiatives.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by Research Ethics committees of Lorestan University of Medical Sciences. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

## Author contributions

RM: Conceptualization, Methodology, Project administration, Software, Writing – original draft. RE: Conceptualization, Writing – review & editing. TS: Data curation, Writing – review & editing.

## Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. The publication fee was funded by Transilvania University of Brașov.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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