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Sustainable Urban Forest Conservation: Assessing Public Attitudes towards Urban Forests in Nairobi City

Mirera Raphael Binyanya[1]*, Njuguna Bernard Mugwima[1], Dennis Karanja[2], Stella Mbiti[2]

[1]Centre for Urban Studies, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya
[2]Department of Landscape Architecture, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya
Email: *raphael.mirera@jkuat.ac.ke

Abstract

Nairobi city's rapid development has caused urban tree cover loss despite evidence of demand, and values attached to these forests by the residents. This paper investigated these values through an analysis of the residents' attitudes towards the urban forests. Data on urban forest characteristics, composition, problems, causes, and proposed solutions were collected through open ended questions and attitudinal values using a 7-point Likert psychometric scale questionnaire with 40 attitude statements. The findings on urban forest character, problems, causes, and solutions were ranked in order of popularity while attitudes were subjected to a Relative Importance Index (RII) analysis which ranked them in order of importance. The factor "Trees make the city beautiful" ranked as the most important variable (RII = 0.9457), followed by "Urban forests protect the city against climate change effects" (RII = 0.9228). The variable "Forests in the city should be cleared to provide more land for housing" factor was ranked as the lowest (RII = 0.2069). The study recommends that Nairobi's urban forest conservation strategies recognize and prioritize resident's values through participatory conservation strategies. In addition, adoption of the identified proposals, improvements and suggestions in the order tabulated in this paper will promote forest conservation.

Keywords

Attitudes, Conservation, Urban Conservation, Urban Forest, Values

1. Introduction

Urban forests and other urban public spaces need to be managed and utilised sustainably to support the city with ecosystem services (Han & Yeo-Chang, 2021;

Berglihn & Gómez-Baggethun, 2021). Most importantly, urbanisation's negative effect on the biodiversity of urban areas calls for protective action (Izquierdo et al., 2011; Liu et al., 2019; Romero et al., 2018). There is also an urgent need to provide guidelines for the utilisation, protection, and improvement of the city's forest for posterity (Moraes Amaral et al., 2021). These guidelines should aim at providing planning strategies (Pregitzer et al., 2019) that can be adopted to mitigate against loss and threats to the city's forests. In addition, they should provide a framework for future ecologically sensitive developments that respect urban forests (Ordóñez et al., 2020).

Ecological studies and ecological city principles recognize the role played by the presence of nature in the urban environment (Berglihn & Gómez-Baggethun, 2021; Lamhamedi et al., 2021). An urban forest plays a fundamental role in shaping an ecological city (Berglihn & Gómez-Baggethun, 2021). This is due to the role of improving environmental quality and the aesthetic benefit of the urban landscape. Urban forests are used by urban residents for recreation, enjoyment, leisure and for other outdoor activities (Levandovska et al., 2020). This is in addition to the ecosystem services (Berglihn & Gómez-Baggethun, 2021) that urban forests provide to urban areas. Urban forests further provide habitats for flora and fauna which contribute to general biodiversity in the city (Enedino et al., 2018; Tee et al., 2018). This illustrates that urban forestry and urban forests can be used to achieve and promote sustainable urban areas.

Urban forests are for people (Zhao et al., 2020) and their conservation, planning, design, utilisation, and enjoyment must focus on the residents. Residents of a particular urban setting have specific feelings, attitudes and values attached to urban trees and landscapes (Lamhamedi et al., 2021). According to (Barron et al., 2021), local preferences and priorities for urban forests provide a clear framework for their conservation. These preferences (Barron et al., 2021) sometimes contradict expert opinions on urban forests preferences and opinions on design and planning as noted by Barron et al. (2021). Another study conducted by Cai et al. (2021) examined the residents' spatial preferences for urban park routes during physical activities and established that routes through the forest are preferred for physical activities. These studies illustrate the need to focus on the residents or users of a particular urban forest in generation conservation and planning strategies.

Urban forests also have a variety of positive benefits beyond the recreational and aesthetic (Agbelade & Onyekwelu, 2020; Hemmelgarn & Munsell, 2021; Herwanti et al., 2021; Lamhamedi et al., 2021) benefits that are easily identified and acknowledged by residents (Han & Yeo-Chang, 2021; Macháč et al., 2022). However, residents sometimes do not have a clear understanding of these benefits. This can be attributed to the fact that these benefits are sometimes not physically identifiable or visible to the untrained eye. Studies have identified some of the benefits that may not be recognised by residents to include microclimate regulation and water retention (Kong et al., 2021; Macháč et al., 2022), ecosystem ser-

vices (Young & Bauer, 2022), psychological benefits (Young & Bauer, 2022) and air quality benefits (Nowak et al., 2014). This lack of recognition calls for intervention from the experts, planners, and forest managers (Ordóñez et al., 2020) who are aware of these benefits to educate the residents, plan for them and protect the urban forest ecosystems on behalf of the residents (Moraes Amaral et al., 2021). This process must also involve the residents and communities through participatory relationships in local urban governance (Butt et al., 2021). Most importantly, the preferences of the residents (Arnberger & Eder, 2015) ought to provide planning guidelines and conservation strategies for sustainable urban forests.

2. Methods

Similar past studies have successfully adopted questionnaires to assess user preference, attitudes, and values (Cheung & Hui, 2018; Huang, 2014; Hunter, 2001; Kleiber, 2001; Wang et al., 2019). This study employed a standard questionnaire for assessing user attitudes towards urban forests in Nairobi Arboretum Forest. This data collection tool comprised of open-ended questions on the general understanding of urban forest composition, characteristics, problems, their causes, and suggestions on solutions. It also had 40 attitudinal statements (Maitland, 2009a) designed to capture the user's perception of the forest environment and provide an understanding of their values based on the Likert scale (Joshi et al., 2015). These Likert scale statements broadly examined six different parameters under likelihood, frequency, likability, importance, agreement, and accessibility. For example, the likability parameter was rated in degree of preference on a 7-point Likert scale ranging from: 1. strongly disliked, 2. mildly disliked, 3. disliked, 4. neutral, 5. liked, 6. mildly liked and 7. strongly liked (Maitland, 2009b).

The specific factors in the Likert scale adopted on the study included accessibility, comfort, urban forest benefits, security, safety, participation, walkability, flora, fauna, biodiversity, conservation, management, urban development, climate change and training. These factors were presented in the form of the 40 attitude questions that were ranked in the Likert scale. The questionnaire also included a section for collecting data on the opinions and suggestions of the respondents on urban forest matters and another section for capturing the respondent's biophysical data.

The Statistical Package for Social Sciences (SPSS) software was used to analyse demographic data, descriptive statistics of minimum, maximum, mean, and standard deviation. It was also applied to compute the Relative Importance Indices and measure the properties of the measurement scale through reliability analysis.

The reliability analysis established the internal consistency of the data collection tool. The value used to establish internal consistency is Cronbach's alpha. Based on the findings, the tool recorded a Cronbach value of 0.785. The value suggests that the tool attained the required level of consistency. Thus, the items

in measurement are reliable and can be adopted. The item-total statistic table provides the consistency that would behave if one of the items in the tool was removed. Based on the results, deleting the item "Forests in the city pose a security risk" would improve the value of Cronbach's alpha to 0.794. The suggestion of deleting the item is supported by the ranking based on the relative importance index, which places the variable among the lowest (37) ranked variable. Thus, deleting the item would improve the reliability of the tool. This finding supports the general positive attitude towards and need for conservation of urban forests.

3. Study Area

In Nairobi city, recent public campaigns, and outcry about the destruction of urban forests in favour of infrastructure and road expansion undertaken by the government further justify the need for action to protect Nairobi's forests. The current development trend in Nairobi is not sustainable socially, ecologically, environmentally, and economically. There are recent studies on Nairobi's urban forests (Furukawa et al., 2016; Manji, 2017; Moreka et al., 2018; Njeru, 2010, 2013; Nyawira Muchane, 2019; Oloo et al., 2021) investigating challenges, biodiversity loss among other problems. This study however sought to examine the residents' perspective on these forests in the form of attitudes which may help predict protection against the threats in these studies.

The study area was Nairobi Arboretum Forest which is one of the gazetted urban forests in Nairobi (Oloo et al., 2021). It was founded in 1907 by Mr. Batiscombe as a trial plot for new fast growing forestry trees that would supply the high demand of fuel wood for the Kenya-Uganda railway line and in turn save Kenya's indigenous forests. Most of its trees are therefore exotic. It was later gazetted as a national reserve in 1932 by the government of Kenya and is now under the management of the Kenya Forest Service with the help of Friends of Nairobi Arboretum. It is home to over 350 tree species and over 100 resident and migrant birds among other animal species. As one of the few well preserved and maintained urban forests, it provides an ideal space for picnics, jogging, walking or just relaxing and unwinding. It is also easily accessible on foot or by car from the city centre.

4. Results

The target population for the study were all the visitors to Nairobi Arboretum Forest on the three days of the study. The data collection tool was randomly issued to visitors who were willing to participate, and 50 respondents (n = 50) successfully participated. This sample size was adopted as a pilot for a comprehensive study that will be conducted in all the five urban forests in Nairobi city. The distribution of respondents by gender was 48% female and 52% male. The distribution of respondents by age group shows that the majority (44%) of the respondents were between 18 to 24 years Thirty-eight percent (38%) of the respondents were between 25 and 34 years, while 10% were between 35 to 44 years.

Respondents aged 45 to 55 years were 4%, while 2% were between 55 and 64 as shown in Figure 1.

The findings show that most (36%) of the respondents have lived in their current residence for more than 20 years. Twenty-four percent (24%) of the respondent have lived in their current location for a period between 10 to 20 years. Respondents who lived in their current places for a period between 5 to 10 years were 14%. Respondents living in their current places for a period between 1 to 5 years were 16%. Respondents living in their current residence for less than one year were only 10%. The study further established that 82% of the respondents were of African Traditional religion, while 10% were Christian. Islam comprised 8% of the total respondents. The distribution of respondents by residence shows that the Majority (18%) of the respondents resided in Nairobi. Other localities comprised 2% of each of the total respondents as shown in Figure 2.

Data on urban forest composition and the respective contribution to the general character was collected and tabulated as shown in Figure 3 & Figure 4 below. Notably, trees contribute 60% followed by birds and animals at 18% and 14% respectively. Insects and grass were noted to have the least contribution at 5% and 3% respectively. The respondents also ranked the components that least contribute to the urban forest character (see Figure 4). Insects were notably least considered at 55% followed by animals and birds at 26% and 15% respectively. This ranked juxtaposing of the most and least important components confirms the key components that give the urban forest its character to be trees.

The respondents were also tasked to give information on the problems that the forest experienced and the data collected show that lack of water was the most common problem at 20% of the respondents (see Figure 8). Waste disposal,
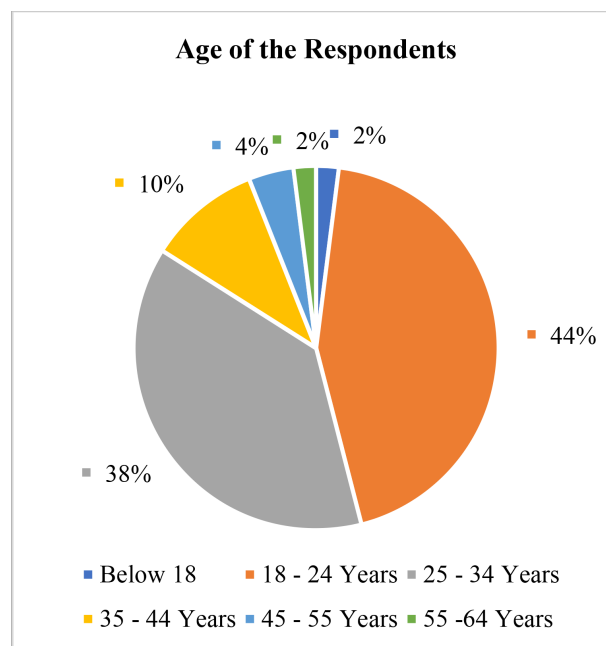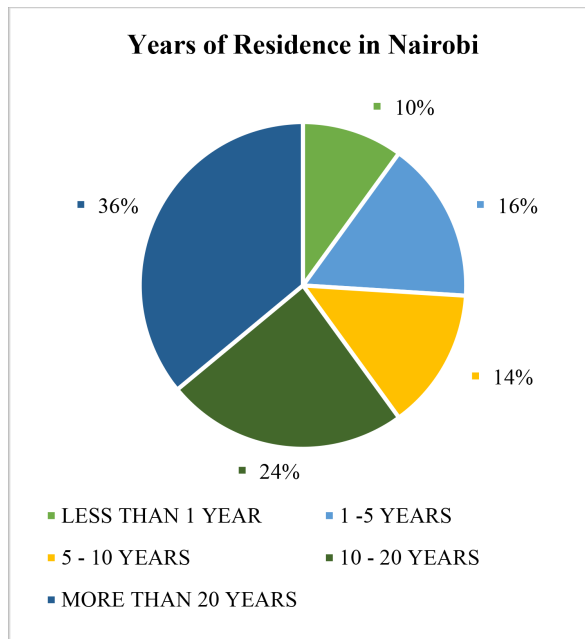

Figure 1. Age of respondents.

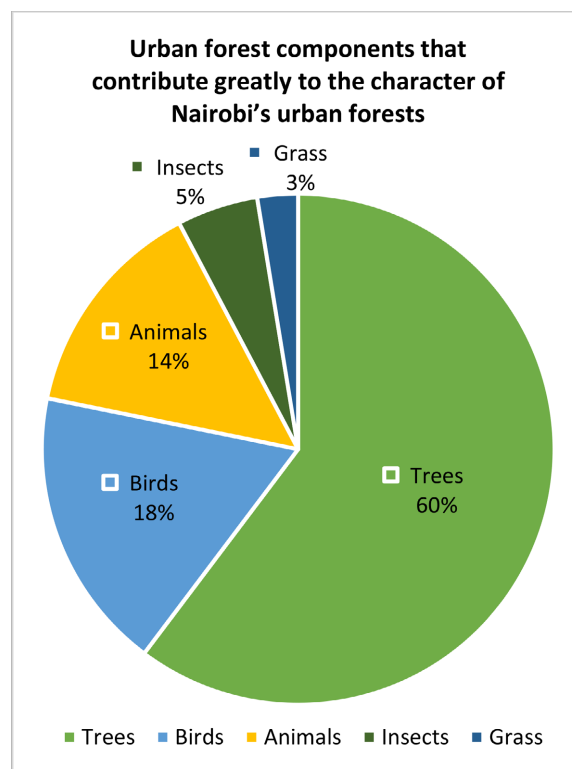**Figure 2.** Years of respondents' residence in the city of Nairobi.

Figure 3. Urban Forest components that contribute greatly to the character of Nairobi's urban forests.

encroachment, deforestation, security, and ease of access problems were noted by 16%, 14%, 13%, 10%, 8% and 7% respectively. The respondents further proposed solutions to these problems (see **Figure 5**). It emerged that 21% of the re-

spondents proposed proper maintenance, 15% improved waste management and 15% tree planting as the top priority solutions. These were followed by enactment of proper conservation laws at 11% and inclusion of water vendors at 10%. Other solutions proposed include strict enforcement of laws, police patrol,
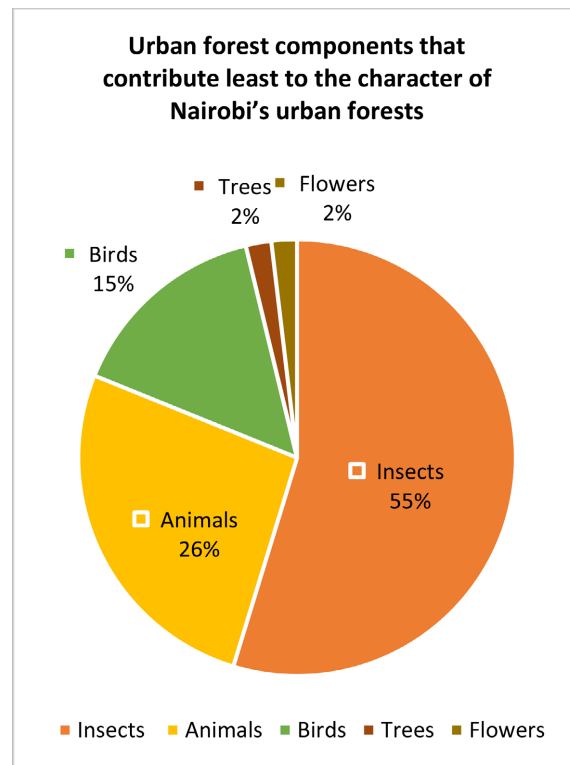
**Figure 4.** Urban Forest components that contribute least to the character of Nairobi's urban forests.
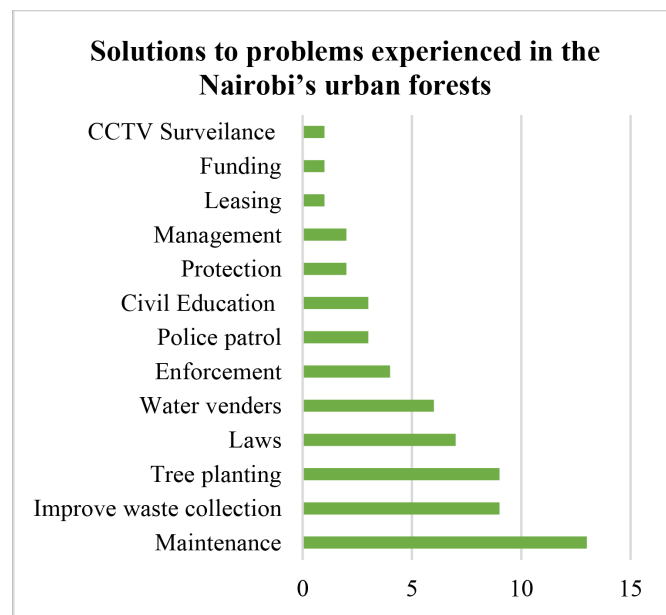
Figure 5. Solutions to problems experienced in the Nairobi's urban forests.

civic education, and general protection at 6%, 5%, 5%, and 3% respectively. Proper management, leasing, more funding, and CCTV surveillance were the least popular solutions at 2% each.

The study also sought to examine whether the respondents understood the causes of the problems identified. The causes of these problems in **Figure 6** above were identified by the respondents as shown in **Figure 7**. Poor forest management was identified by 27% of the respondents followed by rapid urbanization, human behaviour, and lack of funds by 16%, 16%, 11% and 9% of the respondents respectively. Unemployment, encroachment, poor planning, and culture were noted to have the least causality at 7%, 4%, 4% and 2% respectively.
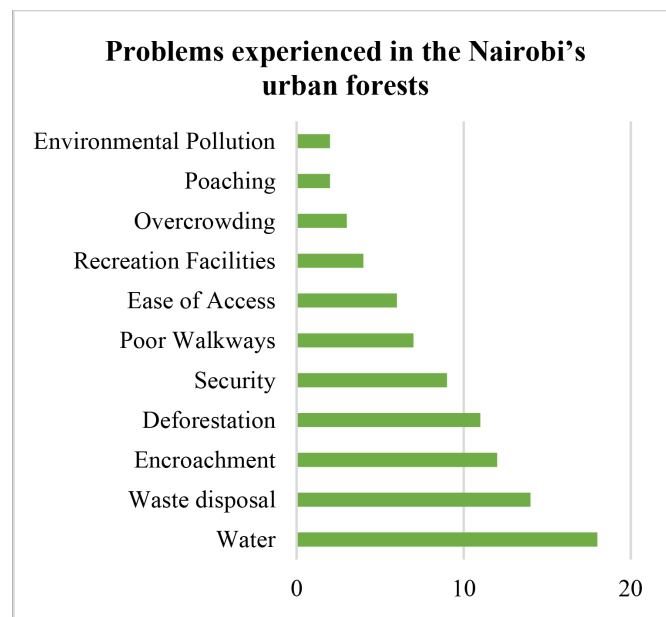
Figure 6. Problems experienced in the Nairobi's urban forests.
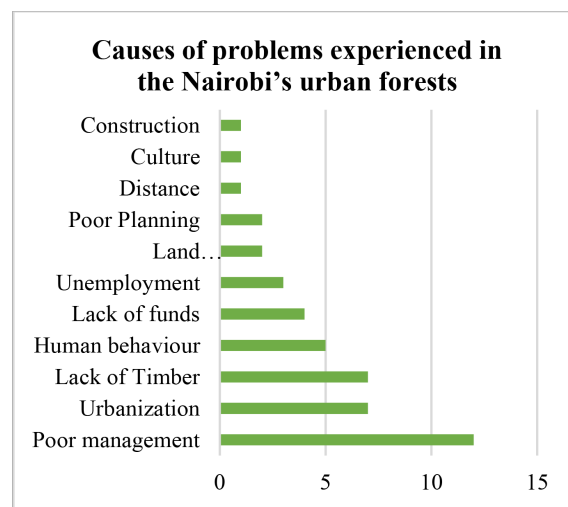
Figure 7. Causes of problems experienced in the Nairobi's urban forests.

The study also sought to establish whether the respondents have ideas and suggestions of conservation and specific actionable improvements to the forest environment. In addition, the respondents provided tangible improvements to the forest as shown in Figure 8. Waste recycling, afforestation and maintenance were identified as the most popular by 15% 11% and 10% respondents respectively.

More specific actions and suggestions are shown in Figure 9 and Figure 10
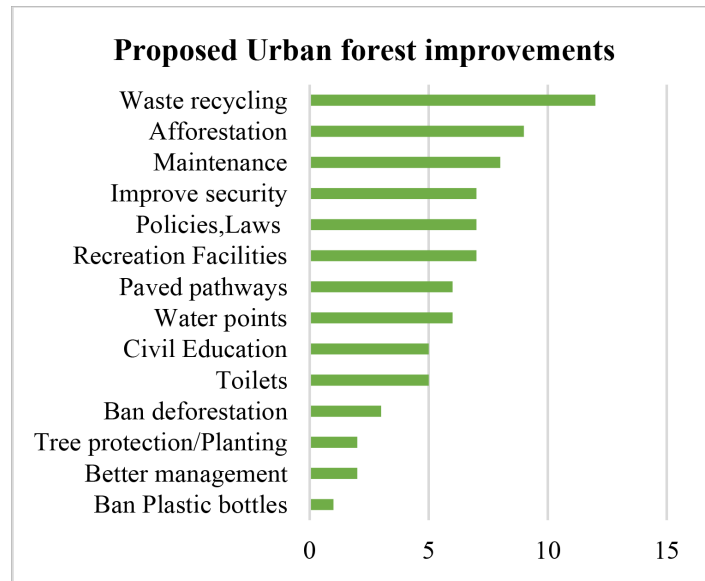
Figure 8. Proposed Urban Forest improvements.
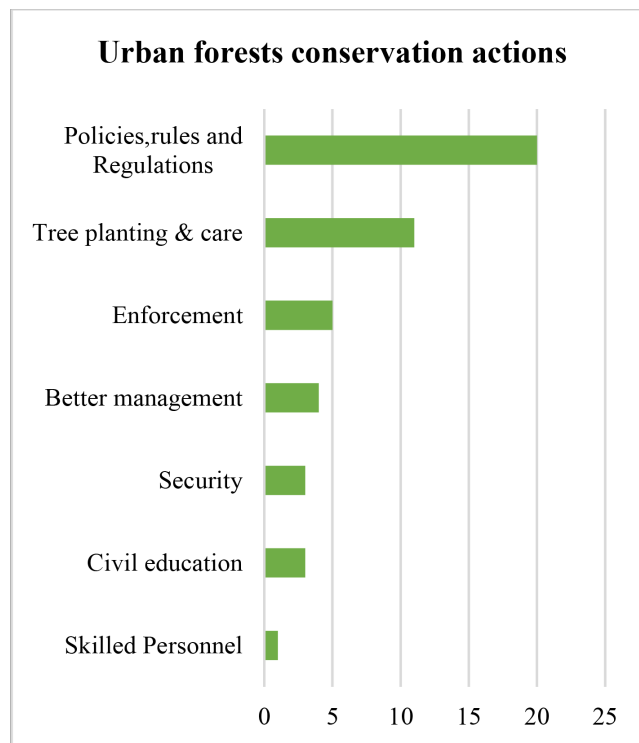
Figure 9. Urban forests conservation actions.

Suggestions on Forest conservation
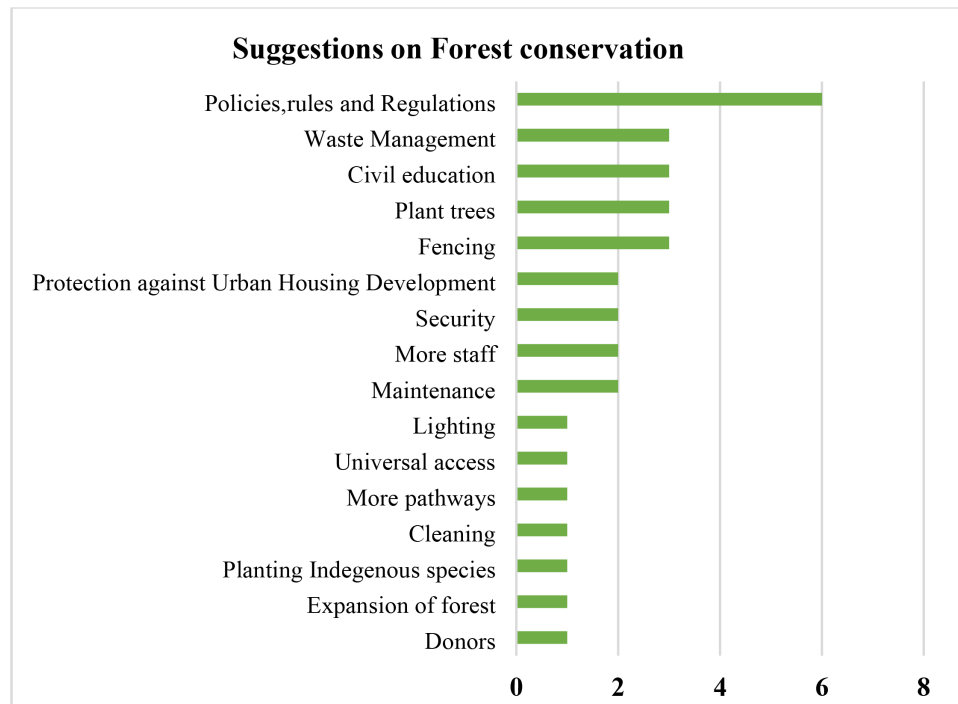
Figure 10. Suggestions on Forest conservation.

respectively where proper conservation policies, rules, and regulations (see **Figure 9**) was the most popular conservation action proposed by 43% of the respondents. Tree planting and care, enforcement and better management follow at 23%, 11% and 9% respectively. Security, civic education, and skilled personnel were least popular at 6%, 6% and 2% respectively. Specific suggestions provided (see **Figure 10**) rank policies and regulations top with 18% of the respondents followed by waste management, civic education, tree planting and fencing at 9% of the respondents each.

Relative Importance Index

A Relative Importance Index (RII) has been used in similar previous studies to rank attitudes (Huang, 2014; Hunter, 2001; Johnson & LeBreton, 2004; Kleiber, 2001; Rooshdi et al., 2018). The assessment of the attitudinal importance to which the n = 50 sample of the respondents had towards the urban forest environment and the 40 statement items being the variables of focus, the need to classify them in order of importance was key. The Relative Importance Index (RII) was therefore employed to rank factors based on their importance. Based on the points in the Likert scale, the weighting is given based on the frequency attained by each factor. The computation of the index was calculated using the formula below.

$$\text{Relative Importance Index} = \frac{7n_7 + 6n_6 + 5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{A \times N}$$

where: n_i represents the frequency in each of the 7-point scale; A is the highest

value in the scale. In this case A is 7. *N* is the total frequency for each of the factor.

From the computations of the data, the factor "Trees make the city beautiful" was identified as the most important variable of the study (RII = 0.9457), followed by "Urban forests protect the city against climate change effects" (RII = 0.9228). "The variable Forests in the city should be cleared to provide more land for housing" factor was ranked as the lowest (RII = 0.2069), suggesting that it was less important in the study. The ranking of the factors is shown in Table 1 below.

5. Discussion

The relative importance index rank in Table 1 provides a framework for analysis of the data as the statements can be categorised into four broad themes based on the rank. These include benefits of urban forests, conservation measures, access to urban forests, and urban forests management.

5.1. Benefits of Urban Forests

The role of urban forests in contributing to the city's beauty and aesthetics ranked as the most important statement (RII = 0.9457). This is closely followed by the role of protection against impacts of climate change and the benefits accrued through walking in the forest such as bird and animal watching (RII = 0.9228). These results confirm the universally accepted affinity towards nature and the growing demand for more greenery in the city. Similar findings were reported by a study conducted by Macháč et al. (2022) which explored people's preferences for natural spaces in the city of Liberec. Other studies by Huang (2014) and Hunter (2001) further record similar findings. This further provides a basis and justification for the protection and improvement of the urban forests. People's recognition of the benefits accrued from urban forests and their desire to have urban forests is a further justification for conservation.

5.2. Conservation Measures

Conservation strategies and successes reported in past studies highlight the importance of values attached to the subject to be protected (Arnberger & Eder, 2015; Cai et al., 2021; Endreny et al., 2017; Lamhamedi et al., 2021; Levandovska et al., 2020; Massawe et al., 2021; Wajchman-Świtalska et al., 2021) meaning, people protect what they value. The rank for conservation measures and efforts in this study can be attributed to the recognition of the benefits of urban forests outlined in the first theme above. The willingness to participate in tree planting and training on conservation initiatives that ranked 7 and 8 respectively emphasize the value attached to efforts of urban forest protection. In addition, the personal willingness of respondents to voluntarily participate in forest conservation efforts is a good indicator of the projected conservation strategies. Lastly, the users' acceptance of conservation initiatives (19) can be used to predict the success of general urban forest conservation.

Table 1. Relative Importance Index rank of the 40 attitude statements.

Rank/Statement	Strongly Agree (7)	Agree (6)	Mildly Agree (5)	Neutral (4)	Mildly Disagree (3)	Disagree (2)	Strongly Disagree (1)	N	Total	A*N	Relative Importance Index (RII)
1. Trees make the city beautiful	36	12	1			1		50	331	350	0.945714
2. Urban forests protect the city against climate change effects	29	16	4	1				50	323	350	0.922857
3. More trees should be planted in the forest	31	14	2		1		2	50	316	350	0.902857
4. I enjoy watching animals and birds in the forest	32	11	1	3	1	2		50	314	350	0.897143
5. Natural forests are better than artificial landscapes	30	11	1	6	1	1		50	310	350	0.885714
6. I prefer walking in the forest to city streets	26	17	2	1	1		2	49	303	343	0.883382
7. I am willing to plant a tree as a conservation initiative	22	18	5	2	1	1		49	300	343	0.874636
8. I am willing to be trained in ways to conserve the forest	17	25	3	3	1		1	50	300	350	0.857143
9. Walking in the forest is beneficial	21	19	2	3	1	2	1	49	291	343	0.848397
10. It is comfortable walking in the forest	13	23	6	5	1			48	282	336	0.839286
11. Entrance fees to access the forest is affordable	14	20	8	4	3	1		50	285	350	0.814286
12. Birds should be part of the city	19	8	4	7	4	2		44	245	308	0.795455
13. People cause pollution in the forest.	13	20	8	3	1	2	2	49	272	343	0.793003
14. More animals should be introduced in the forest	13	17	8	7		4		49	269	343	0.784257
15. We value real estate development more that urban forests	16	18	2	4	1	1	7	49	258	343	0.752187
16. I feel secure in the forest	12	13	7	13	1	3	1	50	259	350	0.74
17. More access points to the forests should be provided	9	19	6	5	2	8		49	249	343	0.725948
18. We attach little value to the protection of urban forests	8	17	8	5	8	3		49	248	343	0.723032
19. I am willing to volunteer in activities to improve the forest	9	18	6	7	3	3	3	49	247	343	0.720117
20. We should provide space for animals in the city	10	15	8	9	2	3	3	50	251	350	0.717143
21. All parts of the forest are easily accessible	9	14	8	11	4	3	1	50	250	350	0.714286
22. New road developments in Nairobi are a threat to urban forests	11	18	4	3	2	9	2	49	243	343	0.708455
23. Commercial activities in the forest are a threat to the forest	10	15	6	7	2	5	3	48	237	336	0.705357
24. Animals should be part of the city	11	12	7	6	7	6	1	50	242	350	0.691429
25. I am saddened by the rate of development around forests in Nairobi	11	10	4	12	3	7	1	48	229	336	0.681548
26. High-rise buildings are a threat to urban forests	8	18	4	8		8	4	50	236	350	0.674286
27. Urban forests in Nairobi are easily accessible	5	15	9	8	5	8		50	233	350	0.665714
28. Waste management in the forest is adequate	5	14	8	10	4	8	1	50	228	350	0.651429

Continued

29. Advertisement billboards are a threat to street trees	6	15	6	7	4	8	4	50	222	350	0.634286
30. The forest staff are adequate in managing the forest	4	11	10	9	6	5	4	49	212	343	0.618076
31. Management of urban forests in Nairobi is adequate	2	11	10	9	3	12	2	49	201	343	0.586006
32. The Nairobi city county should manage Nairobi's forests	11	9	1	7	3	4	13	48	194	336	0.577381
33. Forest access should be free for the public	8	9	3	6	5	11	7	49	193	343	0.562682
34. Ablution facilities in the forest are adequate.	3	6	8	8	8	12	5	50	182	350	0.52
35. Importance attached to urban forests is adequate	3	5	9	6	9	13	5	50	178	350	0.508571
36. We do enough to protect urban forests	3	4	8	9	7	9	10	50	170	350	0.485714
37. Forests in the city pose a security risk		5	7	13	3	9	12	49	156	343	0.45481
38. Recreation facilities in the forest are sufficient	1	7	3	5	7	13	13	49	144	343	0.419825
39. Entry fees should be increased to provide more money for improvement of the forest		5		2	9	19	12	47	115	329	0.349544
40. Forests in the city should be cleared to provide more land for housing			2	1	1	9	36	49	71	343	0.206997

5.3. Access to Urban Forests

Access to urban forests is vital in promoting the utilisation of the resources in the forest environment as reported by Arnberger & Eder, 2015; Cai et al., 2021; Macháč et al., 2022. Attitude statements on affordability of access and the need to increase access points that ranked 11 and 17 respectively provide a good indicator of the role of accessibility in forest conservation. Users can only enjoy the benefits in the first theme when there is guaranteed, easy and affordable access. The theme of urban conservation therefore gets further justification through access. In other words, urban forests need to be accessible if their benefits are to be utilised. Lastly, the respondents feeling towards increasing access fees ranked low (39) thus confirming the need for cheaper or affordable access to urban forests.

5.4. Urban Forests Management

The management of urban forests and related resources is vital in the overall conservation and management activities, just like policies and planning, ought to be based on detailed resource inventories and monitoring (Butt et al., 2021; Endreny et al., 2017; Ordóñez et al., 2020; Pregitzer et al., 2019). In addition, management tools highlighted by Moraes Amaral et al. (2021) provide essential guidelines to the management of urban forests. These must provide basic information about the trees (species, age, height), and about vitality, special characteristics, and their place in a wider urban forest context, not least related to the demands of urban dwellers.

The attitude statements on urban forest management were ranked low (28, 30, 31 and 32). This can be attributed to the following factors. First, the forests in Nairobi are managed by different entities that range from the county govern-

ment to non-government organisations. There is an almost equal split in respondents on the adequacy on management of the forests and the need to have the county government manage urban forests. However, the need for participatory approaches in management is notably acknowledged by the respondents.

5.5. Recommendations

The data and their analysis above reveal the need to urgently provide tangible actionable recommendations that will ensure Nairobi's urban forests are conserved and utilized in a sustainable way. It is also paramount to provide a raft of solutions to help in shaping the urban forest environments in Nairobi and beyond.

The summarised interpretation of the users' attitudes is that there is a universal appreciation of the role and benefits of urban forests. There is also a great appetite for these benefits as illustrated by the quest for universal access and general improvement of the forest's environment. The first recommendation is to have an integrated participatory management system that involves the users and the city administration. This will ensure a multidisciplinary approach that is centred in public participation. This should also be incorporated in the city's policy framework.

Secondly, the city's financial policies should incorporate a cyclic revenue management system that ensures funds generated from forest resources are re-invested in the conservation of these forests. In addition, other revenue streams like donations, grants and sponsorships should be provided for in the legal frameworks to foster accountability. This will tap into the willingness of the users to contribute, participate, and donate to forest conservation initiatives. These unique approaches represent new ways of accomplishing the management of urban forests under the challenges of reduced city funding. The approaches are corporate sponsorship of trees along boulevards and in city parks, community tree planting programs, non-government organization management of large urban parks, and master arborist programs.

The third recommendation deals with the need to protect the existing urban forest while expanding and increasing its quality, biodiversity, and habitat richness. This translates to controlling urban developments that threaten urban forests like road expansions and residential development. The city's policy frameworks must outline what is allowed as development in the forest precincts. This must further outline measures to replace and improve the threatened species habitat as brought about by the inevitable urbanisation and densification.

The fourth intervention from this study addresses the urban planning problem which is the primary source of the main threats to urban forests in Nairobi. Threats of encroachment, tree loss, competing land uses and pollution challenges have been attributed to lack of or poor urban planning. Zoning regulations in Nairobi and specifically around the study area have been abused resulting in unregulated densification of residential development. This has the effect of habitat

fragmentation, pollution and overcrowding in and around the forest. The solution therefore must emanate from sound urban planning principles with robust zoning guidelines that must be followed and enforced. Consequently, the city's management and enforcement departments must be robust to ensure compliance to protect the fragile forest ecosystems.

6. Conclusion

In conclusion, available scientific literature, evidence, and numerous policy instruments have emphasized the importance of urban green spaces in urban social-ecological systems to mitigate several problems of urban dwellers in the last two decades. This study has further brought out the attitudes that users of Nairobi's Arboretum Forest have towards its environment. These attitudes summarise the values attached to the natural environment and its presence in the city. These values provide a basis for protection since it is generally accepted that a society cannot protect what it does not value.

The study has also exposed Nairobi's residents desire to have more opportunities for urban forests access. This desire, which is also recorded by other studies done globally (Arnberger & Eder, 2015; Barron et al., 2021; Cai et al., 2021; Han & Yeo-Chang, 2021) confirms the universal human affinity to nature. Interestingly, the residents further expressed willingness to participate in conservation activities of these spaces. This therefore calls for a framework to accommodate and coordinate conservation and utilisation of urban forests.

Lastly, another promising finding from the study reveals that most of the visitors to the forest (44%) were aged between 18 and 24 years old. This is positive sustainability indicator as the youthful generation's appreciation of urban forests points to a bright future as far as conservation and utilization of urban forests in a rapidly urbanising world. This further indicates a projected growth in demand for access and utilization of urban forests. It may also provide a basis for rethinking the planning strategies in the global urban context.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Agbelade, A. D., & Onyekwelu, J. C. (2020). Tree Species Diversity, Volume Yield, Biomass, and Carbon Sequestration in Urban Forests in Two Nigerian Cities. *Urban Ecosystems, 23,* 957-970. https://doi.org/10.1007/s11252-020-00994-4

Arnberger, A., & Eder, R. (2015). Are Urban Visitors' General Preferences for Green-Spaces Similar to Their Preferences When Seeking Stress Relief? *Urban Forestry & Urban Greening, 14,* 872-882. https://doi.org/10.1016/j.ufug.2015.07.005

Barron, S., Sheppard, S., Kozak, R., Dunster, K., Dave, K., Sun, D., & Rayner, J. (2021a). What Do They Like about Trees? Adding Local Voices to Urban Forest Design and Planning. *Trees, Forests and People, 5,* Article ID: 100116.

https://doi.org/10.1016/j.tfp.2021.100116

Berglihn, E. C., & Gómez-Baggethun, E. (2021). Ecosystem Services from Urban Forests: The Case of Oslomarka, Norway. *Ecosystem Services, 51,* Article ID: 101358. https://doi.org/10.1016/j.ecoser.2021.101358

Butt, S., Smith, S. M., Moola, F., & Conway, T. M. (2021). The Relationship between Knowledge and Community Engagement in Local Urban Forest Governance: A Case Study Examining the Role of Resident Association Members in Mississauga, Canada. *Urban Forestry and Urban Greening, 60,* Article ID: 127054. https://doi.org/10.1016/j.ufug.2021.127054

Cai, M., Cui, C., Lin, L., Di, S., Zhao, Z., & Wang, Y. (2021). Residents' Spatial Preference for Urban Forest Park Route during Physical Activities. *International Journal of Environmental Research and Public Health*, 18, Article No. 11756. https://doi.org/10.3390/ijerph182211756

Cheung, L. T. O., & Hui, D. L. H. (2018). Influence of Residents' Place Attachment on Heritage Forest Conservation Awareness in a Peri-Urban Area of Guangzhou, China. *Urban Forestry and Urban Greening, 33,* 37-45. https://doi.org/10.1016/j.ufug.2018.05.004

Endreny, T., Santagata, R., Perna, A., Stefano, C. de, Rallo, R. F., & Ulgiati, S. (2017). Implementing and Managing Urban Forests: A Much Needed Conservation Strategy to Increase Ecosystem Services and Urban Wellbeing. *Ecological Modelling, 360,* 328-335. https://doi.org/10.1016/j.ecolmodel.2017.07.016

Enedino, T. R., Loures-Ribeiro, A., & Santos, B. A. (2018). Protecting Biodiversity in Urbanizing Regions: The Role of Urban Reserves for the Conservation of Brazilian Atlantic Forest Birds. *Perspectives in Ecology and Conservation, 16,* 17-23. https://doi.org/10.1016/j.pecon.2017.11.001

Furukawa, T., Kiboi, S. K., Mutiso, P. B. C., & Fujiwara, K. (2016). Multiple Use Patterns of Medicinal Trees in an Urban Forest in Nairobi, Kenya. *Urban Forestry and Urban Greening, 18,* 34-40. https://doi.org/10.1016/j.ufug.2016.05.003

Han, Z.-Y., & Yeo-Chang, Y. (2021). Beijing Resident's Preferences of Ecosystem Services of Urban Forests. *Forests, 12,* Article No. 14. https://doi.org/10.3390/f12010014

Hemmelgarn, H. L., & Munsell, J. F. (2021). Exploring "Beyond-Food" Opportunities for Biocultural Conservation in Urban Forest Gardens. *Urban Agriculture and Regional Food Systems, 6,* e20009. https://doi.org/10.1002/uar2.20009

Herwanti, S., Febryano, I. G., Yuwono, S. B., Khotimah, K., Banuwa, I. S., Harianto, S. P., Tsani, M. K., Surnayanti, Damayanti, I., Prasetia, H., Rusita, & Fitriana, Y. R. (2021). Tourism Economic Value of Bukit Pangonan Urban Forest, Lampung, Indonesia. *International Journal of Design and Nature and Ecodynamics, 16,* 543-549. https://doi.org/10.18280/ijdne.160508

Huang, S. C. L. (2014). Park User Preferences for Establishing a Sustainable Forest Park in Taipei, Taiwan. *Urban Forestry and Urban Greening, 13,* 839-845. https://doi.org/10.1016/j.ufug.2014.10.002

Hunter, I. R. (2001). What Do People Want from Urban Forestry?—The European Experience. *Urban Ecosystems, 5,* 277-284. https://doi.org/10.1023/A:1025691812497

Izquierdo, A. E., Grau, H. R., & Aide, T. M. (2011). Implications of Rural-Urban Migration for Conservation of the Atlantic Forest and Urban Growth in Misiones, Argentina (1970-2030). *Ambio, 40,* 298-309. https://doi.org/10.1007/s13280-010-0095-3

Johnson, J. W., & LeBreton, J. M. (2004). History and Use of Relative Importance Indices in Organizational Research. *Organizational Research Methods, 7,* 326-340.

https://doi.org/10.1177/1094428104266510

Joshi, A., Kale, S., Chandel, S., & Pal, D. (2015). Likert Scale: Explored and Explained. *British Journal of Applied Science & Technology, 7,* 396-403. https://doi.org/10.9734/BJAST/2015/14975

Kleiber, O. (2001). Valuation of Recreational Benefits and Visitor Conflicts in an Urban Forest. In *Fifth International Conference of the International Society for Ecological Economics (ISEE). "Ecological Economic Management and Planning in Regional and Urban Systems."* (p. 5, 7, 12). International Society for Ecological Economics (ISEE).

Kong, X., Zhang, X., Xu, C., & Hauer, R. J. (2021). Review on Urban Forests and Trees as Nature-Based Solutions over 5 Years. *Forests, 12,* Article No. 1453. https://doi.org/10.3390/f12111453

Lamhamedi, H., Lizin, S., Witters, N., Malina, R., & Baguare, A. (2021). The Recreational Value of a Peri-Urban Forest in Morocco. *Urban Forestry and Urban Greening, 65,* Article ID: 127339. https://doi.org/10.1016/j.ufug.2021.127339

Levandovska, N., Kolejka, J., Šera, B., & Zarnovičan, H. (2020). The Recreational Potential of Urban Forests—An Application of the Assessment Method. *Sumarski List, 1-2,* 53-63. https://doi.org/10.31298/sl.144.1-2.6

Liu, N., Zhao, S., Shao, Q., & Feng, K. (2019). Impact of Regional Human Capital and Urban Sprawl on Forest-Based on a Forest Conservation Model. *High Technology Letters, 25.*

Macháč, J., Brabec, J., & Arnberger, A. (2022). Exploring Public Preferences and Preference Heterogeneity for Green and Blue Infrastructure in Urban Green Spaces. *Urban Forestry and Urban Greening, 75,* Article ID: 127695. https://doi.org/10.1016/j.ufug.2022.127695

Maitland, A. (2009a). How Many Scale Points Should I Include for Attitudinal Questions? *Survey Practice, 2,* 1-4. https://doi.org/10.29115/SP-2009-0023

Maitland, A. (2009b). Should I Label All Scale Points or Just the End Points for Attitudinal Questions? *Survey Practice, 2,* 1-4. https://doi.org/10.29115/SP-2009-0014

Manji, A. (2017). Property, Conservation, and Enclosure in Karura Forest, Nairobi. *African Affairs, 116,* 186-205. https://doi.org/10.1093/afraf/adx006

Massawe, G. P., Marealle, W. N., Liseki, S. D., & Camerini, G. (2021). Conservation of Urban Forest in Tanzania: Community Attitudes towards Njiro Forest, Arusha. *East African Journal of Forestry and Agroforestry, 4,* 1-12. https://doi.org/10.37284/eajfa.1.1.28

Moraes Amaral, R. D. de A., Morato, R. G., Mariano, R. S., & Ferreira, J. M. R. (2021). Urban Forest Management Tools. *Revista de Gestao Ambiental e Sustentabilidade, 10,* e18131. https://doi.org/10.5585/geas.v10i1.18131

Moreka, B., Kiboi, S., & Gichuk, N. (2018). Ecology of Small Mammals in Oloolua Forest in Nairobi, Kenya. *International Journal of Zoology and Applied Biosciences, 3,* 294-301.

Njeru, J. (2010). "Defying" Democratization and Environmental Protection in Kenya: The Case of Karura Forest Reserve in Nairobi. *Political Geography, 29,* 333-342. https://doi.org/10.1016/j.polgeo.2010.07.003

Njeru, J. (2013). "Donor-Driven" Neoliberal Reform Processes and Urban Environmental Change in Kenya: The Case of Karura Forest in Nairobi. *Progress in Development Studies, 13,* 63-78. https://doi.org/10.1177/146499341201300105

Nowak, D. J., Hirabayashi, S., Bodine, A., & Greenfield, E. (2014). Tree and Forest Effects on Air Quality and Human Health in the United States. *Environmental Pollution, 193,*

119-129. https://doi.org/10.1016/j.envpol.2014.05.028

Nyawira Muchane, M. (2019). Population Status, Distribution Patterns and Conservation Needs of Endangered *Croton alienus* Pax in Kenya. *International Journal of Natural Resource Ecology and Management, 4,* 120-128. https://doi.org/10.11648/j.ijnrem.20190405.13

Oloo, F., Murithi, G., & Jepkosgei, C. (2021). Quantifying Tree Cover Loss in Urban Forests within Nairobi City Metropolitan Area from Earth Observation Data. In *1st International Electronic Conference on Forests—Forests for a Better Future: Sustainability, Innovation, Interdisciplinarity* (pp. 1-15). MDPI. https://doi.org/10.3390/IECF2020-07952

Ordóñez, C., Threlfall, C. G., Livesley, S. J., Kendal, D., Fuller, R. A., Davern, M., van der Ree, R., & Hochuli, D. F. (2020). Decision-Making of Municipal Urban Forest Managers through the Lens of Governance. *Environmental Science and Policy, 104,* 136-147. https://doi.org/10.1016/j.envsci.2019.11.008

Pregitzer, C. C., Ashton, M. S., Charlop-Powers, S., D'Amato, A. W., Frey, B. R., Gunther, B., Hallett, R. A., Pregitzer, K. S., Woodall, C. W., & Bradford, M. A. (2019). Defining and Assessing Urban Forests to Inform Management and Policy. *Environmental Research Letters, 14,* Article ID: 085002. https://doi.org/10.1088/1748-9326/ab2552

Romero, A. C., Issii, T. M., Pereira-Silva, E. F. L., & Hardt, E. (2018). Effects of Urban Sprawl on Forest Conservation in a Metropolitan Water Source Area. *Revista Arvore, 42,* e420114. https://doi.org/10.1590/1806-90882018000100014

Rooshdi, R. R. R. M., Majid, M. Z. A., Sahamir, S. R., & Ismail, N. A. A. (2018). Relative Importance Index of Sustainable Design and Construction Activities Criteria for Green Highway. *Chemical Engineering Transactions, 63,* 151-156.

Tee, S. L., Samantha, L. D., Kamarudin, N., Akbar, Z., Lechner, A. M., Ashton-Butt, A., & Azhar, B. (2018). Urban Forest Fragmentation Impoverishes Native Mammalian Biodiversity in the Tropics. *Ecology and Evolution, 8,* 12506-12521. https://doi.org/10.1002/ece3.4632

Wajchman-Świtalska, S., Zajadacz, A., & Lubarska, A. (2021). Recreation and Therapy in Urban Forests—The Potential Use of Sensory Garden Solutions. *Forests, 12,* Article No. 1402. https://doi.org/10.3390/f12101402

Wang, Y., Kotze, D. J., Vierikko, K., & Niemelä, J. (2019). What Makes Urban Greenspace Unique—Relationships between Citizens' Perceptions on Unique Urban Nature, Biodiversity, and Environmental Factors. *Urban Forestry and Urban Greening, 42,* 1-9. https://doi.org/10.1016/j.ufug.2019.04.005

Young, C., & Bauer, N. (2022). Eviction from Paradise: Lived Experience, Psycho-Social and Health Effects of Allotment Garden Loss. *Urban Forestry and Urban Greening, 75,* Article ID: 127708. https://doi.org/10.1016/j.ufug.2022.127708

Zhao, Z., Ren, J., & Wen, Y. (2020). Spatial Perception of Urban Forests by Citizens Based on Semantic Differences and Cognitive Maps. *Forests, 11,* Article No. 64. https://doi.org/10.3390/f11010064