

Article

Perceptions and Use of Urban Green Spaces, Leading Pathways to Urban Resilience

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Abstract

This study examined residents' perceptions, preferences, and experiences of urban green spaces in four regional units of the Region of Attica—West Athens, Central Athens, South Athens, and Piraeus—demonstrating how demographic diversity, urban morphology, and external stressors—such as extreme heat and the COVID-19 pandemic—shape green space use. The results show that, while green spaces are essential for health, well-being, and social cohesion, their distribution is uneven, which limits their availability (27.3%) and access (21.8%) to residents. Main concerns expressed by residents when visiting green spaces and open green spaces are poor maintenance (50.7%), lack of security (36.7%), and socially irresponsible behaviour (e.g., littering, vandalism) (32.8%). Extreme heat emerged as a major constraint on outdoor activities, particularly affecting women and the elderly. Household-associated outdoor areas (balconies, courtyards, and verandas) were highly valued (59.8%), highlighting the role of private green spaces in dense urban environments. Major metropolitan parks were the most visited and valued by residents for providing contact with nature (23.0%) and benefiting from stress relief (54.0%) while practicing their favourite activity, though their use was limited during heatwaves (30.3% of the residents do not visit). Most activities during and after the COVID-19 pandemic were reported unchanged, though reported increases in walking (34.3%) and park visits (28.3%) demonstrate the importance of green spaces in fostering urban resilience. However, the reported lack of engagement in gardening (48.0%), indoor plant care (41.2%) and bird/wildlife watching (58.3%) suggest missed opportunities for ecological and cultural enrichment. Overall, the study underscores the urgent need for integrated planning strategies to improve accessibility, maintenance, and equity in green space provision. By aligning with the sustainable development goals, the four regional units of the Region of Attica can transform its green infrastructure into an inclusive, resilient system that supports public health, social inclusion, and climate adaptation.

Keywords: urban green spaces; Region of Attica; inclusiveness; urban resilience; private outdoor spaces; green space use; accessibility



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1. Introduction

Urban dwellers constitute more than half of the global population [1,2], while urban areas, although occupying only 3% of the Earth's land surface [3], account for 60–80% of the global energy consumption and 75% of the global carbon emissions [4]. The United Nation's

(UN) 11th sustainable development goal (SDG 11) highlights the provision for access to safe, inclusive, and accessible, green and public spaces, especially for women and children, the elderly, and persons with disabilities [5]. It also advocates for integrated urban policies that support inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and their development and implementation in accordance with the Sendai Framework for Disaster Risk Reduction 2015–2030 [6]. Complementing this is the 2016 New Urban Agenda, which outlines the framework for the planning, construction, development, management, and improvement of urban areas, serving as a catalyst for SDG 11 [7]. The UN-Habitat recommends that 45% of the urban land constitute public spaces, of which 30% be allocated to streets and sidewalks, and 15% to open spaces, green spaces, and public facilities [8]. In 2020, a global study of 911 cities across 114 countries showed that public spaces constituted approximately 16% less than the UN-Habitat threshold [9]. Additionally, a study of 120 cities across the world showed that pervious surfaces ranged between 30–50% of the metropolitan areas [9]. The UN's SDG11 and New Urban Agenda highlight the importance of green and public spaces within urban areas to develop sustainable and resilient urban areas.

Public urban green spaces (e.g., parks, public squares, gardens, playgrounds, small woodlands, copses, urban forests, groves, natural reserves, road islands, etc.) are integral components of cities, offering urban dwellers opportunities for recreation, social interaction, and a connection to nature and the provision of numerous benefits (i.e., improved mental and physical health, enhanced social cohesion, and environmental advantages such as air purification and temperature regulation) [10,11]. The benefits of high-quality green space on people's physical and mental health and well-being, and children's development, are increasingly recognised [12]. During the COVID-19 pandemic, more than 90% of the reported cases occurred in urban areas [13]. In addition, public spaces served as safe spaces for social interaction under distancing restrictions and for emergency infrastructure, such as temporary hospitals, COVID test centres, and other facilities, highlighting their significance in contributing to human health and well-being during the COVID-19 pandemic [14]. The need to expand non-motorised transit networks that provide safe urban transportation was also highlighted during the pandemic, as public transportation in many urban areas around the world was challenged by the need to maintain the hygiene standards required to curtail COVID-19 by wearing masks and upholding social distancing restrictions [14]. In this context, in 2021, Cecil Konijnendijk proposed the “3-30-300” rule for developing greener, more resilient, and healthier cities, towns, and neighbourhoods, stating that every resident needs to see three trees from every home, school, and place of work; that every neighbourhood should have at least 30% tree canopy cover; and that every citizen should have a large public green space approximately 300 m (5 min walking distance), from their home [15,16]. As the design of cities varies across the world, the implementation of the 3-30-300 rule or other such voluntary guidelines would depend on the local context.

Considering the local context of cities, the size, number and types (parks, squares, historical gardens, botanical gardens, playgrounds, woodlands, etc.) of public urban green spaces vary as well as their spatial distribution and usage. Researchers argue that, although large in size, urban green spaces may exist in cities, though not all of them can be effectively used by urban dwellers [17]. It has been found that the presence of commercial facilities around urban green spaces is an important external factor influencing the spatial distribution of visitors in urban green spaces, followed in descending order by population density and transportation, emphasizing the need for the development of new green spaces in areas of high utilization, such as recreational business districts and also the improvement of the quality of low visited public green spaces, to increase their usage [17–19]. On the other hand, the spatial inequity of public urban green spaces within cities has been associated with socially vulnerable groups (i.e., the elderly, individuals with

limited education or unemployed), highlighting the need to eliminate inequities in public green space provision [19,20].

Within cities, trees (the planting of which forms one of the most effective strategies to mitigate the effect of extreme heat) [21] and shrubs should be the primary vegetation category due to the essential ecosystem services and benefits they provide in relation to other vegetation types, though occasionally other types of vegetation (herbs, including ground cover vegetation) may be more appropriate [16]. The environmental quality of urban green spaces, which reflects their attractiveness, is enhanced by the presence of a variety of plants and animals, as well as natural elements such as water bodies [22]. Furthermore, urban green spaces offering shade and cooling effects are appreciated particularly during hot weather. It is important to note that the cooling effect of urban green spaces is mainly affected by their tree species composition and associated leaf traits, crown dimensions and age distribution [21].

The availability of various features and amenities and the overall functionality of urban green spaces are positively associated with increased urban green space satisfaction and usage [11,23,24]. On the other hand, the presence of antisocial behaviour (such as litter, vandalism) may discourage people from using urban green spaces. Within urban green spaces, floating population settlement spaces have a negative effect on their usage, though they are often found in low-cost locations where urban green spaces are poorly maintained or of poor quality, rendering difficulties in meeting the recreational needs of visitors [22].

Urban green spaces that facilitate social interactions and community activities (such as those that are environmental, historical and cultural) foster a sense of belonging, encouraging regular visits [10,11]. Within urban green spaces, historical and cultural facilities (such as historical and cultural sites, memorials, museums, art galleries, temples, ruins, memorial statues, etc.) enhance visitors' interest to participate in activities [22]. Green spaces that meet the cultural values and needs of the local community are likely to be utilised more effectively.

Urban green space poor maintenance is negatively associated with visitation [25]. Well-maintained urban green spaces (regular cleanliness, repair of facilities) as well as observable safety measures (particularly during nighttime) enhance the visitors' perception of safety, encouraging visitation [11,22]. However, dense vegetation does not facilitate the recognition of possible threats in the surroundings, increasing the sense of danger. Open spaces, on the other hand, are safer for activities in urban green spaces, particularly at night [22].

Urban dwellers show a preference for larger urban green spaces over neighbourhood greens; however, they are willing to trade proximity to urban green spaces for size [25,26]. Accessibility and proximity to urban green spaces are key factors in determining regular visitation; urban dwellers are more likely to visit urban green spaces that are conveniently located and accessible [10,17,25]. Another important determinant of green space visits is the socio-demographics [25]. Different age groups and genders respond differently to various stressors such as extreme heat due to physiological differences amongst them that can limit their accessibility to green spaces, as well as their use [27,28]. Furthermore, different age groups and genders have shown to have different preferences in the use of green spaces as well as in the practiced activities [27,28].

Understanding the factors that influence the use of urban green spaces in cities is essential for landscape architects, urban planners, and policymakers when designing inclusive and effective green areas that cater to diverse urban populations, promoting human health and well-being [22]. Most of the research on urban green space use has concentrated on the internal environmental factors of urban green spaces (urban green space features and amenities, ecological quality, maintenance, social interaction and community activities, etc.) or external urban form factors (accessibility and proximity, safety, social, etc.) [22]. On the other hand, studies related to urban green space usage with an aim to enhance their design and usage are limited [10,22].

The current research addresses the latter gap in the literature and examines urban green space use within a densely built area of a Mediterranean city, as the four selected regional units of the Athens Metropolitan Area (Athens Western Sector, Athens Central Sector, Athens Southern Sector, Piraeus). More specifically, it investigates residents' local preferences of urban green spaces, accessibility and proximity to urban green spaces, preferred activities practiced within the urban green spaces, and motives for their visitation. The results would contribute to advance the knowledge of the utilisation of urban green spaces in relation to socio-spatial factors and urban form, while informing on the strategies necessary to enhance urban green space design and usage within the Metropolitan area of Athens so as to concomitantly build urban resilience.

2. Materials and Methods

2.1. Study Area

Athens is the capital city and the largest city, in terms of population, of Greece. It is in close proximity (12 km) to its port city Piraeus, which hosts one of Europe's largest passenger and container ports. Both Athens and Piraeus occupy the Metropolitan Area of Athens, which spreads across 5 of the 8 regional units of the Region of Attica (West Athens, Central Athens, South Athens, North Athens, Piraeus) (Figure 1). The Metropolitan Area of Athens is located within the Attica basin, enclosed by five mountains (Egaleo and Poikilo to the west, Parnitha to the northwest, Penteli to the northeast and Hymettus to the east) and reaching the Saronic gulf (to the south). The geomorphology of the Attica basin, subjected to temperature inversion phenomena, combined with the emission of pollutants, can frequently reach unsafe air quality levels. Furthermore, the centre of Athens is densely built, with relatively narrow streets, creating urban canyons with a height/width ratio greater than 2 [29]. The current research examines urban green space use within four selected regional units of the Athens Metropolitan Area (West Athens, Central Athens, South Athens, Piraeus), which are characterised by greater building density and a lesser amount of green spaces than the remaining Athens Metropolitan Area.



Figure 1. Satellite image depicting the regional units that were selected for study, from the Region of Attica (West Athens, Central Athens, South Athens, and Piraeus) and the Municipality of Athens, located within Central Athens (source: satellite image of Attica, Google Earth, 2020, <https://earth.google.com/web/>; image landsat/Copernicus, modified by authors).

In particular, West Athens (population 478,883, 68.177 km²; [30]) comprises 7 municipalities (Agia Varvara, Agioi Anargyroi-Kamatero, Egaleo, Ilion, Peristeri, Petroupoli, Chaidari); Central Athens (population 1,002,212, 82.571 km²; [30]) comprises 8 municipalities (Athens, Vyronas, Galatsi, Dafni-Hymettus, Zografou, Ilioupoli, Kaisariani, Filadelfia-Chalkidona), of which the Municipality of Athens is populated with more than half of the sector's population (643,452, 37.912 km²; [30]); South Athens (population 529,455, 70.125 km²; [30]) comprises 7 municipalities (Agios Dimitrios, Alimos, Glyfada, Elliniko-Argyroupoli, Kallithea, Moschato-Tavros, Nea Smyrni, Palaio Faliro); and Piraeus (population 448,051, 52.144 km²; [30]) comprises 5 municipalities (Piraeus, Keratsini-Drapetsona, Korydallos, Nikaia-Agios Ioannis Rentis, Perama).

2.2. Questionnaire Survey Content and Conduct

A questionnaire survey was conducted in early September 2024, following a hot summer, addressing people living within the West Athens, Central Athens, South Athens, and Piraeus regional units of the Athens Metropolitan Area. The questionnaire survey constitutes part of a broader study that investigates the effect of urban heat in relation to green spaces within the aforementioned regional units of the Athens Metropolitan Area (funded by the Green Fund).

The questionnaire was designed to investigate the residents of the aforementioned area of study, in relation to the use, accessibility and proximity to urban green spaces, practiced activities within the urban green spaces, and motives for their visitation. Its structure and content were informed by previous questionnaire surveys on green space use [23,31,32], adapted to the current research aim and Athenian urban landscape context. To ensure the validity of the questionnaire survey, the original draft of the questionnaire was reviewed by three academics/researchers, with experience in conducting questionnaire surveys, for clarity, relevance and consistency with the research objectives and aims. Following the initial review, revisions were undertaken in relation to the wording and structure of the questionnaire. Furthermore, a pilot study was undertaken with 20 participants to evaluate the comprehension of the questions and calculate the average time required to complete the questionnaire. Minor modifications were made to the questionnaire based on the feedback obtained from the pilot study. On completion of the validation process, the final version of the questionnaire was ready to be administered after obtaining permission from the Committee of Ethics and Deontology of Research of the Agricultural University of Athens.

The questionnaire survey was implemented online through computer-assisted web interviewing (CAWI), via the online panel of the company Prorata S.A., which specialises in conducting quantitative and qualitative research. A quota sampling approach was employed to ensure proportional representation of respondents across gender, age groups, and the four regional units of the Region of Attica, based on population distributions from the 2021 Hellenic Statistical Authority Census. Participants of the survey responded to questions shown on a website or via a web application. Although the survey was distributed using a computer-assisted web interviewing (CAWI) platform, respondents were not required to have advanced digital skills. Data collection was supported by trained personnel from Prorata S.A., who provided guidance to participants during survey completion when needed (e.g., elderly respondents), ensuring that individuals with limited internet access or technological literacy were not excluded from participation. The application of the CAWI model offers, in short time, wide reach surveys of flexibly designed questionnaires (introducing geospatial data), with real-time data collection, automated accuracy checks, anonymity and privacy of respondents, and easy output of data [33,34].

The questionnaire consisted of 34 questions divided into 4 subject areas: "Participant details" (e.g., socio-demographic characteristics), "General green spaces," "Particular green

space,” and “Effect of COVID-19 on the use of green spaces” (Table 1). Nearly all questions in the survey were closed-ended, and included multiple choice (with one or multiple answers per question), polar or binary, and Likert scale questions, which were used to facilitate participants, as well as data coding and analysis [35]. The responses to the open-ended questions were analysed based on Oppenheim’s [35] interpretation of qualitative survey data. Initially, all responses were read multiple times to familiarise with the data. Each response was carefully reviewed to generate systematically across the dataset codes that captured the meaning of the responses. Thereafter, each coded response was grouped into thematic categories that reflect shared meanings. This categorisation process aimed to identify common perceptions amongst participants that would complement the quantitative findings. The questionnaire took 7–9 min to complete and 600 people responded from the regional units of the Athens Metropolitan Area (N = 600) that were selected for study. All the questionnaires completed were valid.

Table 1. Questionnaire survey content addressed to online participants.

Questions	Response Options
Participant Details	
1. Participant’s residential neighbourhood located within the urban area of Attica’s basin; 2. Location of participant’s residence; 3. Complete your address or a nearby location (e.g., junction); 4. Age; 5. Gender; 6. Nationality; 7. Educational level; 8. Occupation; 9. Access to garden or yard; 10. Ownership of means of transport; 11. Number of children; 12. Number of pets	1. yes—continue survey, no—exit survey; 2. West Athens (Agia Varvara, Agioi Anargyroi-Kamatero, Egaleo, Ilion, Peristeri, Petroupoli, Chaidari), Central Athens (Athens, Vyronas, Galatsi, Dafni-Hymettus, Zografou, Ilioupoli, Kaisariani, Filadelfia-Chalkidona), South Athens (Agios Dimitrios, Alimos, Glyfada, Elliniko-Argyroupoli, Kallithea, Moschato-Tavros, Nea Smyrni, Palaio Faliro), Piraeus (Piraeus, Keratsini-Drapetsona, Korydallos, Nikaia-Agios Ioannis Rentis, Perama); 3. open-ended; 4. years; 5. male, female, other, no answer; 6. Hellenic, other EC country, non-EC European country, non-European country, no answer; 7. primary, secondary, tertiary, other _____, no answer; 8. civil worker, employee, freelancer, pensioner, pupil, student, other _____, no answer; 9. yes, no, no answer; 10. yes, no, no answer; 11. none, one, two, three, four, five or more, no answer; 12. none, one, two, three or more, no answer.
General green spaces	
13. Have you stayed in an urban area of Attica’s basin during a period of extreme heat?	yes, no, no answer.
14. Have you stayed in an urban area of Attica’s basin during a curfew period due to measures against the spread of COVID-19?	yes, no, no answer.
15. Select up to three activities that the extreme heat makes it difficult for you to do in public spaces.	1. walk; 2. exercise; 3. cycle; 4. walk the dog; 5. family play (children’s playground); 6. socialize—coffee-walk with friends; 7. cultural events; 8. work—going to work; 9. shopping; 10. other _____; 11. no answer.
16. Which outdoor spaces do you currently feel you have easy and safe access to? (Select all that apply.)	1. parks or small woodlands; 2. municipal or communal garden; 3. urban squares; 4. private yard or garden belonging to my household; 5. courtyard, veranda, balcony belonging to my household; 6. communal courtyard, garden or terrace; 7. sidewalk; 8. roads appropriately designed for 2-m social distancing measures; 9. cycle path; 10. natural area, e.g., forest area; 11. beach; 12. other _____; 13. nowhere; 14. no answer.
17. The last time you were in an open green space, how was your mood affected?	1. significantly improved; 2. slightly improved; 3. no effect; 4. slightly worsened; 5. significantly worsened; 6. unsure; 7. no answer
18. The last time you visited an open green space, how did it affect your stress levels?	1. significantly improved; 2. slightly improved; 3. no effect; 4. slightly worsened; 5. significantly worsened; 6. unsure; 7. no answer.
19. What concerns you lately, or not, when visiting parks and open green spaces? (Select all that apply.)	1. I don’t have easy access; 2. I feel uncomfortable from the heat; 3. it’s crowded; 4. it doesn’t meet my needs; 5. it’s not maintained; 6. visitors don’t follow hygiene and safety measures; 7. it’s not child-friendly; 8. it’s not open at the times I want and can go; 9. it doesn’t have sufficient lighting; 10. the use of chemicals for weed control; 11. it is under-staffed; 12. there is excessive police presence; 13. there is lack of security; 14. I don’t feel safe; 15. other _____; 16. none; 17. no answer.

Table 1. Cont.

Questions	Response Options
20. Do you have any additional safety concerns beyond those you selected in the previous question?	open-ended.
21. What factors limit your visit to parks and open green spaces?	open-ended.
Particular green space	
By the term “green spaces” we mean public or free and open to the public outdoor green spaces. For example, parks, urban and suburban forests, sports areas, playgrounds, green schoolyards or smaller spaces such as a vacant plot of land in the neighbourhood, a planted road island, a stream, a lake, a ravine, a seaside location, or anything else.	
22. Please now bring to mind your favourite green space that you visit often. Then note down some information about it so that we can understand exactly which place you are referring to.	1. Name of the location _____ [required]. 2. Street and number or nearest known point to the place _____ [required]. 3. Municipality _____. 4. Neighbourhood/district _____. 5. Other useful information/description _____
23. Select the value/function with the greatest importance for the place you mentioned.	1. aesthetic value (e.g., view); 2. cultural value; 3. activities (e.g., sports); 4. health and well-being; 5. significant flora and fauna; 6. social value; 7. contact with nature; 8. refuge of coolness during extreme heat; 9. no answer.
24. Do you visit this particular place on days with intense and prolonged extreme heat? Answer using the following scale where 1 means not at all and 5 means very much.	Scale (1 = not at all, 5 = very much); no answer.
25. Select the most meaningful-to-you activity.	1. walking; 2. running; 3. cycling; 4. sport without equipment; 5. sport requiring equipment; 6. walking the dog; 7. supervising children; 8. nature observation; 9. water activities; 10. relaxing; 11. social activities; 12. reading a book; 13. drinking coffee; 14. other _____; 15. no answer.
26. What are the greatest benefits of this activity? Select up to 3 answers.	1. I enjoy nature; 2. I study nature; 3. I exercise; 4. I do something creative; 5. I decrease in stress; 6. I avoid crowds; 7. I communicate with my family; 8. I spend time with friends; 9. I think; 10. I rest and calm down; 11. I concentrate better; 12. I spend time outside the house; 13. other _____; 14. no answer.
27. How often do you usually engage in this activity in the particular place? Select only 1 answer.	1. daily; 2. weekly; 3. monthly; 4. every six months; 5. annually; 6. never, proceed to question 30; 7. no answer, proceed to question 30.
28. What is the usual duration of this activity in the particular place? Select only 1 answer.	1. approximately 15 min; 2. approximately 30 min; 3. approximately 1 h; 4. from 1 to 3 h; 5. from 3 to 6 h; 6. more than 6 h; 7. no answer.
29. What season do you mainly do this activity in the particular place? Select only 1 answer.	1. all; 2. summer; 3. winter; 4. autumn; 5. spring; 6. no answer.
30. When was the last time you visited the particular place? Select only one answer.	1. today; 2. last week; 3. last month; 4. last 6 months; 5. last year; 6. no answer.
31. How much time does it take to reach the particular place?	1. < 5'; 2. 5–10'; 3. 11–20'; 4. 21–30'; 5. 31–45'; 6. >45'; 7. no answer.
32. How long did you stay at this particular place the last time you visited it?	1. < 5'; 2. 5–10'; 3. 11–20'; 4. 21–30'; 5. 31–45'; 6. >45'; 7. no answer.
33. How do you usually reach this particular place?	1. car, motorbike or taxi; 2. train or metro; 3. bus or tram; 4. cycle; 5. walk; 6. other _____; 7. no answer.
Effect of COVID-19 on the use of green spaces	
34. Since the start of the COVID-19 crisis, how have your habits regarding the following activities changed, compared with what you did before? (select one answer per activity.)	
	I do not participate in this activity. Started during the COVID-19 crisis. Increased during the COVID-19 crisis. No change. Decreased during the COVID-19 crisis. Stopped during the COVID-19 crisis. No answer.

Table 1. Cont.

Questions	Response Options
visit parks or woodlands;	
use shared open space (e.g., urban square, playground);	
walking;	
outdoor recreation (hiking, swimming, boating, cycling, etc.);	
outdoor exercise (e.g., running, etc.);	
walking the dog;	
gardening;	
bird and wildlife watching;	
looking after indoor plants;	
observing nature from the window.	

2.3. Statistical Analysis

The collected data were subjected to statistical analysis using SPSS Statistical Software v.17.0 (SPSS Inc., Chicago, IL, USA). A descriptive statistical approach was selected given the exploratory nature of the study and its aim to identify patterns in perceptions and use of urban green spaces rather than to build predictive models. Hence, for this study, in each question, the percentage frequency of the participants' responses was calculated to determine the most frequent responses. In addition, inferential statistics through one-way analysis of variance (ANOVA) and *t*-test were utilized. Specifically, one-way ANOVA was used to examine group differences by age and gender (Q15, Q16, Q17, Q18, Q19, Q23, Q25, Q26–Q33), in line with previous perception-based urban environmental studies [36]. A significance threshold of $p < 0.05$ was adopted to test for statistically significant differences. In cases where significant effects were determined ($p < 0.05$), Tukey's HSD post hoc statistical test was used at the 5% significance level to identify specific differences among age categories and Student's *t*-test at $p < 0.05$ was used to identify differences between genders; the identified significant differences among the age categories or genders are presented. Future stages of the research will incorporate multivariate analyses (e.g., logistic regression and factor analysis) to further explore associations between socio-demographic factors and behavioural outcomes.

3. Results

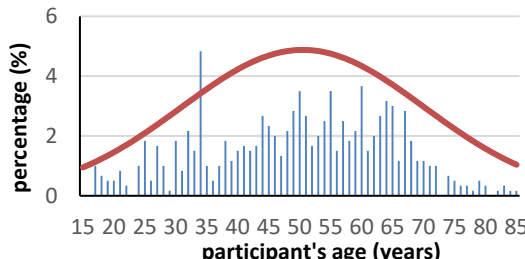
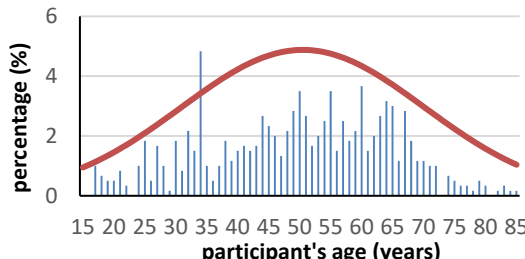
The results are presented in accordance with the subject areas of the questionnaire survey (i.e., "Participant details", "General green spaces", "Particular green space", "Effect of COVID-19 on the use of green spaces") as well as the sequence of the questions and corresponding responses (e.g., multiple choice, polar or binary, and Likert scale answers).

3.1. Participant Details

In the current study, participants ($N = 600$) were representative of both genders (52.5% male, 47.5% female), and their age ranged between 17 and 85 years, with a median of 51 years and a mean of 49.62 years ($SD = 14.79$) (Table 2). Most participants live in Central Athens (42.0%), while the lowest proportion of participants live in Piraeus (17.5%) (Table 2). Concerning the type of occupation, participants were mostly employees (37.8%), followed by pensioners (20.0%), civil workers (15.8%), freelancers (14.3%), and others (7%) (Table 2). The majority of participants have children (53.8%). More than a quarter of participants own pets (28.7%), and nearly all participants are Hellenes (99.2%) (Table 2).

Table 2. Socio-demographic participant details of questionnaire survey (N = 600) (Questions 1–2, 5–12) addressed to residents of four regional units of the Region of Attica (West Athens, Central Athens, South Athens, and Piraeus).

Location of Residence (Q1–2)			Percentage	Participants' Educational Level (Q7)		Number	Percentage	
Residence based on Regional Units/ Municipality	Piraeus	Total	17.5	Primary	4	0.7		
		Keratsini-Drapetsona	2.5	Secondary	132	22.0		
		Korydallos	2.0	Tertiary	436	72.7		
		Nikaia-Agios Ioannis Rentis	2.2	Other	19	3.2		
		Piraeus	10.5	No answer	9	1.5		
		Perama	0.3					
	South Athens	Total	22.3	Participants' Occupation (Q8)			Number	Percentage
		Agios Dimitrios	1.8	Civil worker	95	15.8		
		Alimos	2.3	Employee	227	37.8		
		Glyfada	3.0	Freelancer	86	14.3		
		Elliniko-Argyroupoli	1.5	Pensioner	120	20.0		
		Kallithea	4.5	Pupil	6	1.0		
		Moschato-Tavros	0.5	Student	4	0.7		
		Nea Smyrni	5.2	Other (unemployed)	11	1.8		
	West Athens	Palaio Faliro	3.5	Other (household maintenance)	4	0.7		
		Total	18.2	Other (not specified)	17	2.8		
		Agia Varvara	0.3	No answer	32	5.3		
		Agioi Anargyroi-Kamatero	2.8	Participants' Access to Garden or Yard (Q9)			Number	Percentage
		Egaleo	1.8	Yes	276	46.0		
		Ilion	3.3	No	324	54.0		
	Central Athens	Peristeri	4.5	Participants' Owned Means of Transport (Q10)			Number	Percentage
Petroupoli		1.2	Yes	438	73.0			
Chaidari		4.2	No	162	27.0			
Total		42.0						
Athens		29.8						
Vyronas		1.5						
Galatsi		1.7						
Dafni-Hymettus		1.3						
Zografou		2.3						
Ilioupoli	3.2							
Kaisariani	0.7							
Filadelphia-Chalkidona	1.5							
			0	20	40	60	80	100
			percentage (%)					

Participants' Age (Q4)		Percentage	Participants' Number of Children (Q11)		Number	Percentage		
	percentage (%)		0	274	45.7			
			1	134	22.3			
			2	152	25.3			
			3	28	4.7			
			4	5	0.8			
			No answer	7	1.2			

3.2. General Green Spaces

Nearly all participants have resided in an urban area within Attica during both a period of extreme heat (97.8%) and a curfew period due to measures against the spread of COVID-19 (96.8%) (Figure 2).

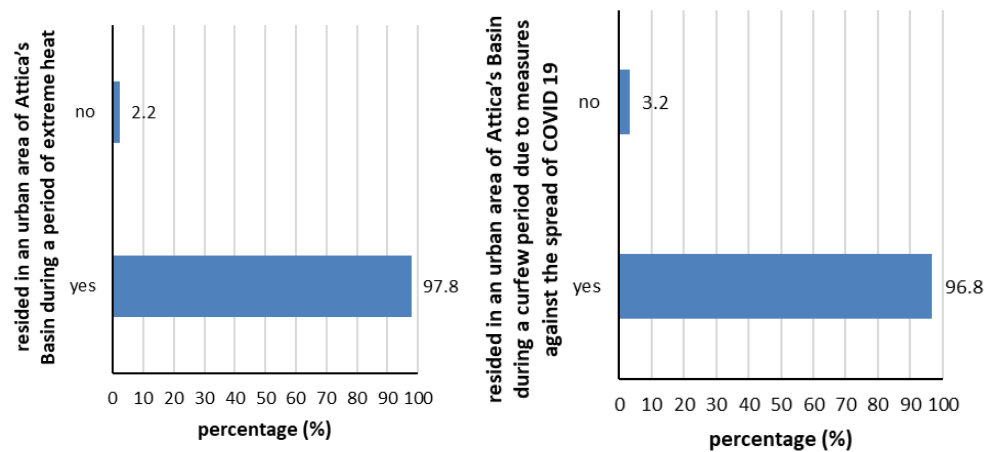


Figure 2. Percentage of participants that have resided in an urban area within Attica during a period of extreme heat (Q13, **left**) and a curfew period due to measures against the spread of COVID-19 (Q14, **right**) (N = 600).

During extreme heat, the main activities identified by participants as difficult to implement in public spaces are to walk (71.7%), work or commute to work (51.0%), and shop (40.7%) (Figure 3). Moreover, approximately a quarter of the participants also stated that exercising (24.3%) and walking the dog (21.3%) are difficult to implement during extreme heat (Figure 3).

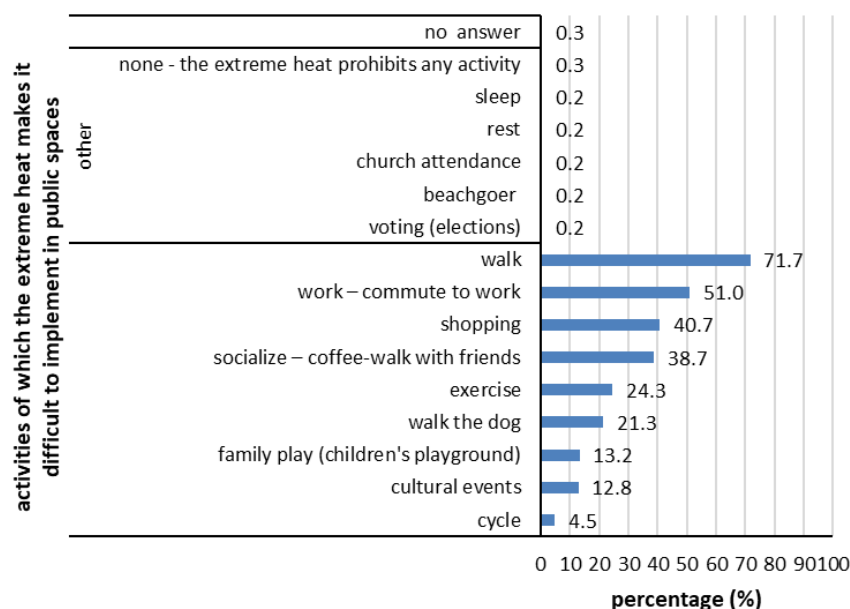


Figure 3. Activities identified as difficult to implement in public spaces during extreme heat expressed as percentage (%) of participant responses (N = 600) (Q15).

Significant differences ($p < 0.05$) amongst the different age groups and genders were denoted in some of the activities identified as difficult to implement in public spaces during extreme heat (Tables 3 and 4). Generally, participants >65 years show more difficulties in shopping, socialising (coffee, walk with friends) than the other age groups, while

young adult participants (15–24 years) show more difficulties in exercising and family play (25–44 years) (Table 3). Additionally, participants >65 years show less difficulties in working or going to work than the other age groups (Table 3). Concerning different genders, male participants present more difficulties in exercising, while female participants present more difficulties in walking the dog and shopping (Table 4).

Table 3. Mean number ($\pm$ S.E.) of participants' responses (N = 600) to the activities identified as difficult to implement in public spaces during extreme heat (Q15), expressed in relation to different age groups. Different letters (a, b) within columns denote differences between means according to Tukey's HSD test at $p < 0.05$.

Age Groups	Activities				
	Walk	Exercise	Cycle	Walk the Dog	Family Play (Children's Playground)
15–24 yrs	0.55 $\pm$ 0.094	0.41 $\pm$ 0.093 a	0.14 $\pm$ 0.065	0.19 $\pm$ 0.090	0.07 $\pm$ 0.048 ab
25–44 yrs	0.72 $\pm$ 0.033	0.32 $\pm$ 0.034 ab	0.05 $\pm$ 0.016	0.24 $\pm$ 0.027	0.19 $\pm$ 0.029 a
45–64 yrs	0.71 $\pm$ 0.027	0.21 $\pm$ 0.024 b	0.04 $\pm$ 0.012	0.16 $\pm$ 0.025	0.13 $\pm$ 0.020 ab
>65 yrs	0.78 $\pm$ 0.041	0.16 $\pm$ 0.037 b	0.02 $\pm$ 0.014	0.34 $\pm$ 0.039	0.04 $\pm$ 0.020 b
F/p value	2.045/0.106 ns	5.553/0.001 ***	2.492/0.059 ns	2.570/0.053 ns	4.693/0.003 **
	Socialize— Coffee, Walk with Friends	Cultural Events	Work— Going to Work	Shopping	
15–24 yrs	0.38 $\pm$ 0.092 ab	0.07 $\pm$ 0.048	0.48 $\pm$ 0.094 a	0.28 $\pm$ 0.084 b	
25–44 yrs	0.33 $\pm$ 0.035 b	0.11 $\pm$ 0.023	0.55 $\pm$ 0.037 a	0.31 $\pm$ 0.034 b	
45–64 yrs	0.37 $\pm$ 0.029 ab	0.14 $\pm$ 0.020	0.58 $\pm$ 0.029 a	0.42 $\pm$ 0.029 ab	
>65 yrs	0.54 $\pm$ 0.050 a	0.15 $\pm$ 0.036	0.27 $\pm$ 0.044 b	0.56 $\pm$ 0.050 a	
F/p value	4.591/0.003 **	0.607/0.610 ns	10.356/<0.001 ***	6.672/<0.001 ***	

where ** and *** denote significance at $p < 0.01$ and $p < 0.001$, respectively; ns: non significance.

Table 4. Mean number ($\pm$ S.E.) of participants' responses (N = 600) to the activities identified as difficult to implement in public spaces during extreme heat (Q15), expressed in relation to different genders. Different letters (a, b) within columns denote differences between means according to Student's *t*-test at $p < 0.05$.

Gender	Activities				
	Walk	Exercise	Cycle	Walk the Dog	Family Play (Children's Playground)
Male	0.72 $\pm$ 0.025	0.31 $\pm$ 0.026 a	0.05 $\pm$ 0.012	0.16 $\pm$ 0.020 b	0.13 $\pm$ 0.019
Female	0.72 $\pm$ 0.027	0.17 $\pm$ 0.022 b	0.04 $\pm$ 0.012	0.28 $\pm$ 0.027 a	0.14 $\pm$ 0.020
F/p value	0.008/0.964 ns	65.430/<0.001 ***	0.423/0.745 ns	55.009/<0.001 ***	0.507/0.722 ns
	Socialize—Coffee, Walk with Friends	Cultural Events	Work— Going to Work	Shopping	
Male	0.38 $\pm$ 0.027	0.12 $\pm$ 0.018	0.53 $\pm$ 0.028	0.35 $\pm$ 0.027 b	
Female	0.39 $\pm$ 0.029	0.14 $\pm$ 0.021	0.49 $\pm$ 0.030	0.47 $\pm$ 0.030 a	
F/p value	0.361/0.763 ns	2.799/0.403 ns	0.606/0.382 ns	25.261/0.003 **	

where ** and *** denote significance at $p < 0.01$ and $p < 0.001$, respectively; ns: non significance.

Household outdoor spaces (e.g., courtyards, verandas, balconies) are identified as the easiest and safest to access outdoor spaces (59.8%) followed by urban parks and parks or woodlands (each at 55.2%) (Figure 4).

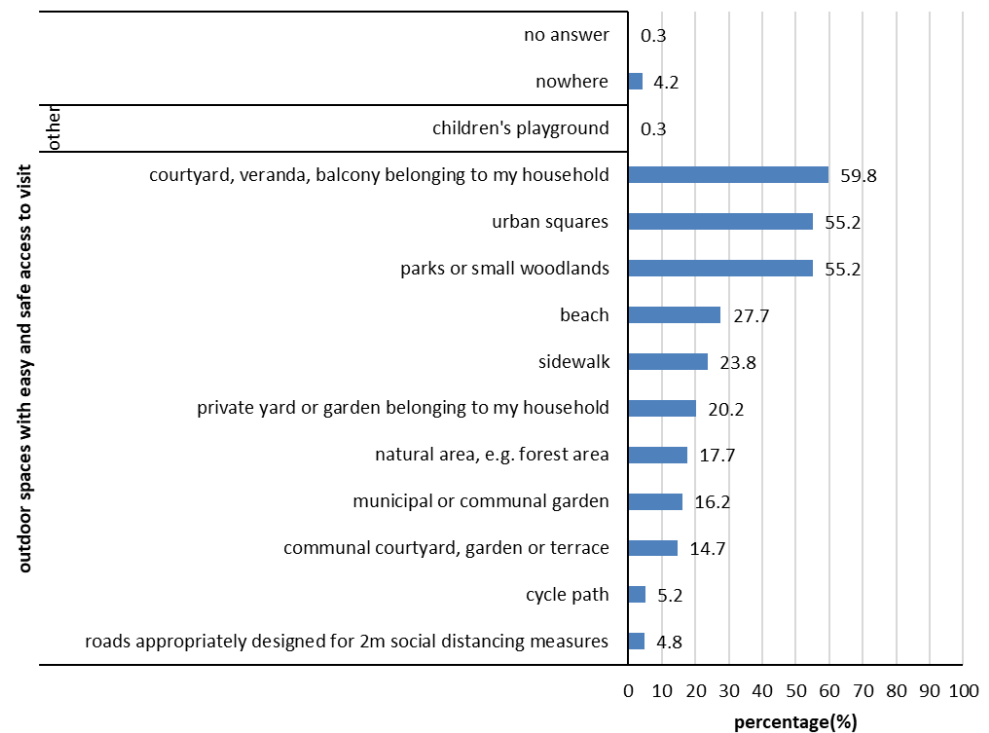


Figure 4. Outdoor spaces considered as easy and safe to visit expressed as percentage (%) of participant responses (N = 600) (Q16).

Significant differences ($p < 0.05$) in the outdoor spaces considered as easy and safe to visit were shown amongst the different age groups and genders (Tables 5 and 6). Generally, urban squares, sidewalks and natural areas (e.g., forests) are given more consideration by the young adult participants (15–24 years) as easy and safe to visit than the other age groups, and parks/small woodlands, communal courtyards, gardens or terraces and roads appropriately designed for 2 m social distancing measures are given less consideration by the elderly participants (>65 years) as easy and safe to visit than the other age groups (Table 5). On the other hand, male participants gave more consideration than the female participants to urban squares and cycle paths as being easy and safe to visit (Table 6).

Table 5. Mean number ($\pm$ S.E.) of participants' responses ($N = 600$) to outdoor spaces considered as easy and safe to visit (Q16), expressed in relation to different age groups. Different letters (a, b) within columns denote differences between means according to Tukey's HSD test at $p < 0.05$.

Age Groups	Outdoor Spaces					
	Parks/ Small Woodlands	Municipal or Communal Gardens	Urban Squares	Household Private Yard or Garden	Household Courtyard, Veranda, Balcony	Communal Courtyard, Garden or Terrace
15–24 yrs	0.45 $\pm$ 0.094 ab	0.31 $\pm$ 0.087	0.79 $\pm$ 0.077 a	0.21 $\pm$ 0.077	0.76 $\pm$ 0.081	0.24 $\pm$ 0.081 a
25–44 yrs	0.65 $\pm$ 0.035 a	0.18 $\pm$ 0.029	0.56 $\pm$ 0.037 b	0.18 $\pm$ 0.029	0.58 $\pm$ 0.036	0.21 $\pm$ 0.030 ab
45–64 yrs	0.53 $\pm$ 0.030 ab	0.14 $\pm$ 0.029	0.54 $\pm$ 0.030 b	0.22 $\pm$ 0.024	0.58 $\pm$ 0.029	0.13 $\pm$ 0.020 ab
>65 yrs	0.47 $\pm$ 0.050 b	0.15 $\pm$ 0.036	0.50 $\pm$ 0.050 b	0.19 $\pm$ 0.039	0.64 $\pm$ 0.048	0.07 $\pm$ 0.025 b
F/p value	4.013/0.008 **	2.285/0.078 ns	2.706/0.045 *	0.310/0.818 ns	1.573/0.195 ns	4.383/0.005 **
	Sidewalk	Roads Appropriately Designed for 2 m Social Distancing Measures	Cycle Path	Natural Area, e.g., Forest Area	Beach	
15–24 yrs	0.45 $\pm$ 0.094 a	0.14 $\pm$ 0.065 a	0.10 $\pm$ 0.058	0.41 $\pm$ 0.093 a	0.21 $\pm$ 0.077	
25–44 yrs	0.24 $\pm$ 0.032 b	0.06 $\pm$ 0.018 ab	0.06 $\pm$ 0.017	0.21 $\pm$ 0.030 b	0.25 $\pm$ 0.032	
45–64 yrs	0.23 $\pm$ 0.025 b	0.03 $\pm$ 0.010 b	0.05 $\pm$ 0.013	0.15 $\pm$ 0.021 b	0.29 $\pm$ 0.027	
>65 yrs	0.20 $\pm$ 0.040 b	0.04 $\pm$ 0.020 b	0.03 $\pm$ 0.017	0.13 $\pm$ 0.033 b	0.31 $\pm$ 0.046	
1-7 F/p value	2.731/0.043 **	2.707/0.044 **	0.948/0.417 ns	5.433/0.001 **	0.603/0.614 ns	

where *, and ** denote significance at $p < 0.05$, and $p < 0.01$, respectively; ns: non significance.

Table 6. Mean number ($\pm$ S.E.) of participants' responses ($N = 600$) to outdoor spaces considered as easy and safe to visit (Q16), expressed in relation to different genders. Different letters (a, b) within columns denote differences between means according to Student's t -test at $p < 0.05$.

Gender	Outdoor Spaces					
	Parks/ Small Woodlands	Municipal or Communal Gardens	Urban Squares	Household Private Yard or Garden	Household Courtyard, Veranda, Balcony	Communal Courtyard, Garden or Terrace
Male	0.57 $\pm$ 0.028	0.16 $\pm$ 0.021	0.59 $\pm$ 0.028 a	0.21 $\pm$ 0.023	0.58 $\pm$ 0.028	0.14 $\pm$ 0.019
Female	0.53 $\pm$ 0.030	0.16 $\pm$ 0.022	0.51 $\pm$ 0.030 b	0.19 $\pm$ 0.023	0.61 $\pm$ 0.029	0.16 $\pm$ 0.022
F/p value	2.566/0.391 ns	0.168/0.838 ns	10.232/0.03 *	2.012/0.480 ns	2.213/0.456 ns	2.181/0.460 ns
	Sidewalk	Roads Appropriately Designed for 2 m Social Distancing Measures	Cycle Path	Natural Area, e.g., Forest Area	Beach	
Male	0.26 $\pm$ 0.025	0.05 $\pm$ 0.013	0.07 $\pm$ 0.14 a	0.17 $\pm$ 0.021	0.29 $\pm$ 0.026	
Female	0.22 $\pm$ 0.024	0.04 $\pm$ 0.012	0.03 $\pm$ 0.10 b	0.18 $\pm$ 0.023	0.26 $\pm$ 0.026	
F/p value	5.219/0.256 ns	1.834/0.499 ns	1.987/0.483 ns	0.077/0.889 ns	0.603/0.614 ns	

where * denotes significance at $p < 0.05$; ns: non significance.

Open green spaces significantly improved both the mood and stress levels of participants (71.2% and 56.7% respectively) (Figure 5).

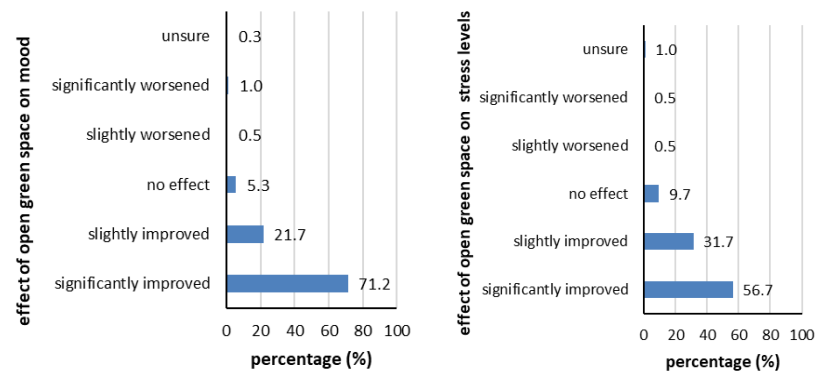


Figure 5. Effect of open green space visits on participants' mood (Q17, left) and stress levels (Q18, right) expressed as percentage (%) of participant responses (N = 600).

The main concerns expressed when visiting parks and open green spaces are poor maintenance (50.7%), lack of security (36.7%), and the fact that visitors do not follow hygiene and safety measures (32.8%) (Figure 6). Crowdedness (22.0%) and the lack of the sense of safety (20.8%) were expressed by nearly a quarter of the participants (Figure 6). Additional concerns when visiting parks and open green spaces (Q20) were not expressed by the majority of participants (79.3%). The remaining 20.7% commented on issues related to the poor maintenance of the planting, infrastructure and cleanliness of the green spaces, irresponsibility or lack of training of the personnel involved in the maintenance and management of the green spaces, insufficient infrastructure (e.g., seating, lighting), poor behaviour of fellow humans and irresponsibility of dog owners, presence of illegal immigrants, floating population and drug addicts, criminality (battery and robbery), lack of security and sense of safety, fire risk, and, in some cases, unsustainable design of green spaces. It is noted that some participants commented on feeling safe with the presence of police in green space, while others commented on feeling unsafe.

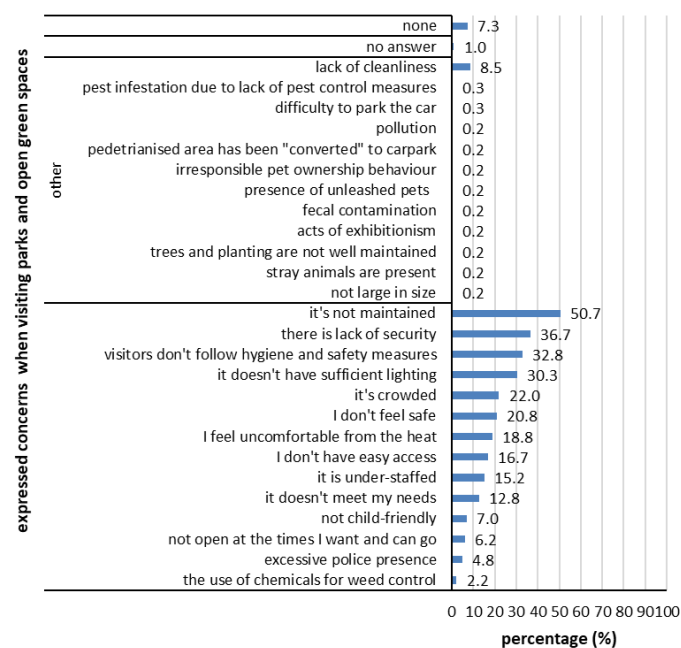


Figure 6. Concerns when visiting parks and open green spaces expressed as percentage (%) of participant responses (N = 600) (Q19).

The concerns in visiting parks and open green spaces were mostly non-significantly different ($p < 0.05$) amongst the different age groups and genders (Tables 7 and 8). Generally, the young adult participants (15–24 years) are more concerned that the parks and open green spaces they visit are understaffed and do not meet their personal needs compared with the other age groups (Table 7). Furthermore, female participants are more concerned than male participants about feeling uncomfortable due to the heat in the parks and open green spaces they visit, as well as at the use of chemicals for weed control (Table 8).

Table 7. Mean number ($\pm$ S.E.) of participants' responses ($N = 600$) to concerns present when visiting parks and open green spaces (Q19), expressed in relation to different age groups. Different letters (a, b) within columns denote differences between means according to Tukey's HSD test at $p < 0.05$.

Age Groups	Concerns						
	I do not have easy access	I feel uncomfortable from the heat	It is crowded	It does not meet my needs	It is not maintained	Visitors do not follow hygiene and safety measures	It is not child-friendly
15–24 yrs	0.14 $\pm$ 0.065	0.17 $\pm$ 0.071	0.21 $\pm$ 0.077	0.31 $\pm$ 0.087 a	0.59 $\pm$ 0.093	0.48 $\pm$ 0.094	0.10 $\pm$ 0.058
25–44 yrs	0.14 $\pm$ 0.025	0.18 $\pm$ 0.029	0.25 $\pm$ 0.032	0.10 $\pm$ 0.022 b	0.50 $\pm$ 0.037	0.30 $\pm$ 0.034	0.09 $\pm$ 0.021
45–64 yrs	0.20 $\pm$ 0.024	0.20 $\pm$ 0.024	0.21 $\pm$ 0.024	0.13 $\pm$ 0.020 b	0.52 $\pm$ 0.030	0.33 $\pm$ 0.028	0.06 $\pm$ 0.014
>65 yrs	0.15 $\pm$ 0.036	0.16 $\pm$ 0.037	0.18 $\pm$ 0.038	0.12 $\pm$ 0.032 b	0.47 $\pm$ 0.050	0.33 $\pm$ 0.047	0.04 $\pm$ 0.020
F/p value	1.186/0.314 ns	0.363/0.780 ns	0.786/0.502 ns	3.479/0.016 *	0.556/0.645 ns	1.230/0.298 ns	1.165/0.322 ns
	It is not open at the times I want and can go	It does not have sufficient lighting	The use of chemicals for weed control	It is under-staffed	There is excessive police presence	There is lack of security	I do not feel safe
15–24 yrs	0.10 $\pm$ 0.058	0.34 $\pm$ 0.090	0.07 $\pm$ 0.048	0.34 $\pm$ 0.090 a	0.07 $\pm$ 0.048	0.41 $\pm$ 0.093	0.24 $\pm$ 0.081
25–44 yrs	0.05 $\pm$ 0.017	0.36 $\pm$ 0.035	0.01 $\pm$ 0.008	0.18 $\pm$ 0.029 b	0.05 $\pm$ 0.016	0.30 $\pm$ 0.034	0.17 $\pm$ 0.028
45–64 yrs	0.07 $\pm$ 0.015	0.29 $\pm$ 0.027	0.03 $\pm$ 0.010	0.13 $\pm$ 0.020 b	0.04 $\pm$ 0.012	0.41 $\pm$ 0.029	0.25 $\pm$ 0.026
>65 yrs	0.05 $\pm$ 0.022	0.21 $\pm$ 0.041	0.01 $\pm$ 0.010	0.10 $\pm$ 0.030 b	0.06 $\pm$ 0.024	0.35 $\pm$ 0.048	0.17 $\pm$ 0.037
F/p value	0.478/0.697 ns	2.588/0.052 ns	1.771/0.152 ns	4.443/0.004 **	0.258/0.856 ns	2.359/0.071 ns	1.817/0.143 ns

where * and ** denote significance at $p < 0.05$ and $p < 0.01$, respectively; ns: non significance.

Table 8. Mean number ($\pm$ S.E.) of participants' responses ($N = 600$) to concerns present when visiting parks and open green spaces (Q19), expressed in relation to different genders. Different letters (a, b) within columns denote differences between means according to Student's t -test at $p < 0.05$.

Gender	Concerns						
	I do not have easy access	I feel uncomfortable from the heat	It is crowded	It does not meet my needs	It is not maintained	Visitors do not follow hygiene and safety measures	It is not child-friendly
Male	0.15 $\pm$ 0.020	0.15 $\pm$ 0.020 b	0.21 $\pm$ 0.023	0.15 $\pm$ 0.020	0.51 $\pm$ 0.028	0.31 $\pm$ 0.026	0.08 $\pm$ 0.015
Female	0.19 $\pm$ 0.023	0.23 $\pm$ 0.025 a	0.23 $\pm$ 0.025	0.11 $\pm$ 0.018	0.50 $\pm$ 0.030	0.35 $\pm$ 0.028	0.06 $\pm$ 0.014
F/p value	5.824/0.228 ns	27.148/0.010 *	0.820/0.651 ns	7.538/0.174 ns	0.130/0.819 ns	3.505/0.346 ns	1.563/0.533 ns
	It is not open at the times I want and can go	It does not have sufficient lighting	The use of chemicals for weed control	It is under-staffed	There is excessive police presence	There is lack of security	I do not feel safe
Male	0.06 $\pm$ 0.014	0.28 $\pm$ 0.025	0.01 $\pm$ 0.005 b	0.16 $\pm$ 0.020	0.04 $\pm$ 0.011	0.37 $\pm$ 0.027	0.19 $\pm$ 0.022
Female	0.06 $\pm$ 0.014	0.33 $\pm$ 0.028	0.04 $\pm$ 0.011 a	0.15 $\pm$ 0.021	0.06 $\pm$ 0.014	0.37 $\pm$ 0.029	0.23 $\pm$ 0.025
F/p value	0.152/0.845 ns	9.066/0.129 ns	0.311/0.032 *	2.879/0.781 ns	0.029/0.397 ns	7.101/0.933 ns	2.138/0.183 ns

where * denotes significance at $p < 0.05$; ns: non significance.

The main factors that limit participants from visiting parks and open green spaces are related to their availability (27.3%) (e.g., long distance, lack and insufficient number of green spaces) and access (21.8%) (e.g., unavailability or inconvenient public transport, poor condition or inhibited pedestrian access routes, illegal car parking) (Figure 7).

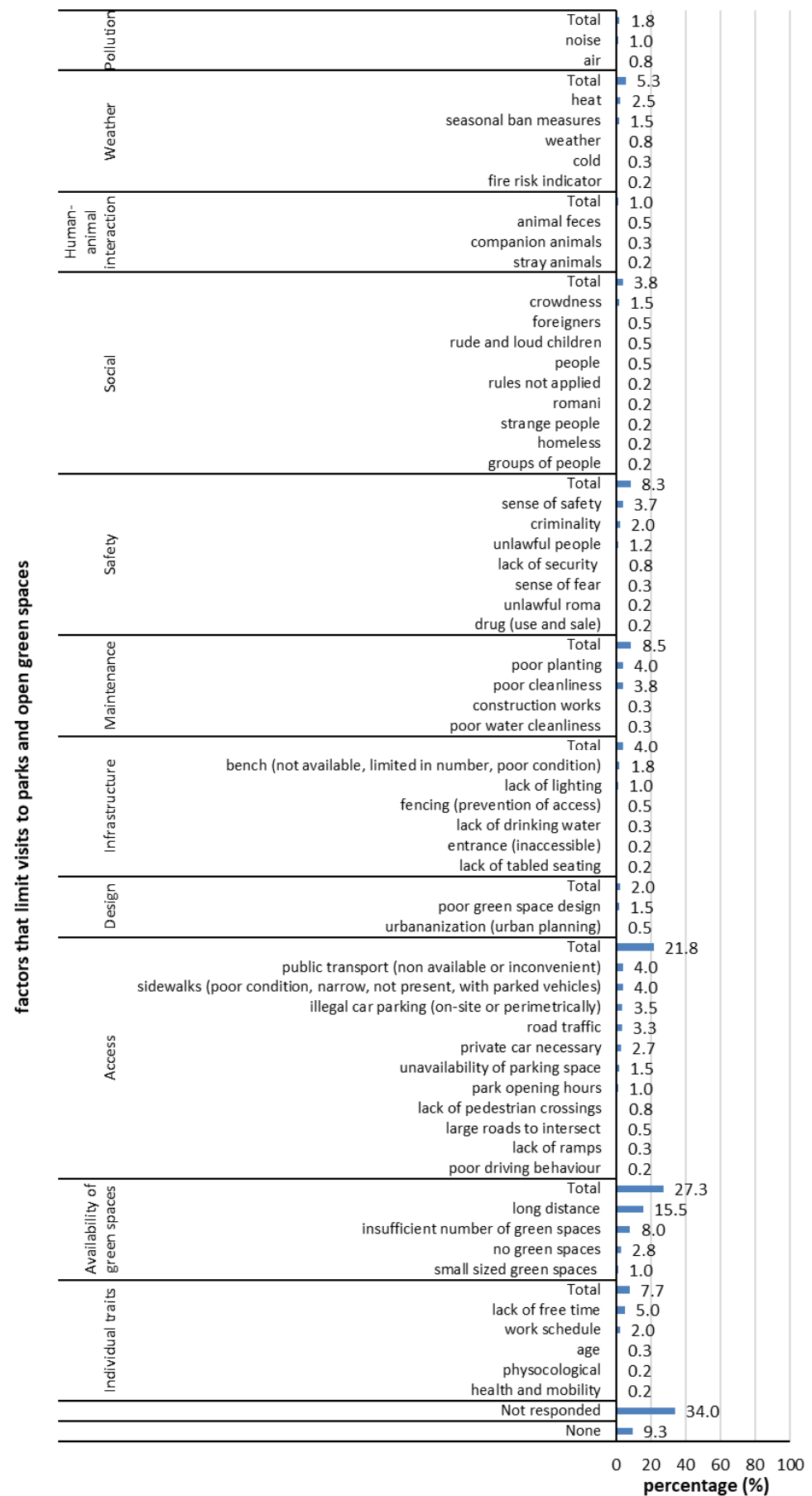


Figure 7. Factors that limit visits to parks and open green spaces expressed as percentage (%) of participant responses (N = 600) (Q21).

3.3. Particular Green Space

The distribution of the favourite most often visited green spaces identified by participants within the studied areas appears uneven, as most identified locations are collected in a circular arc-shaped area around the borders of the four studied regional units, though less in the western and Pireaus regional units (Figure 8). The most popular green spaces identified by participants as the favourite most often visited are the Metropolitan Park “Antonis Tritsis,” Pedion Areos, and Stavros Niarchos Park (Figure 9).

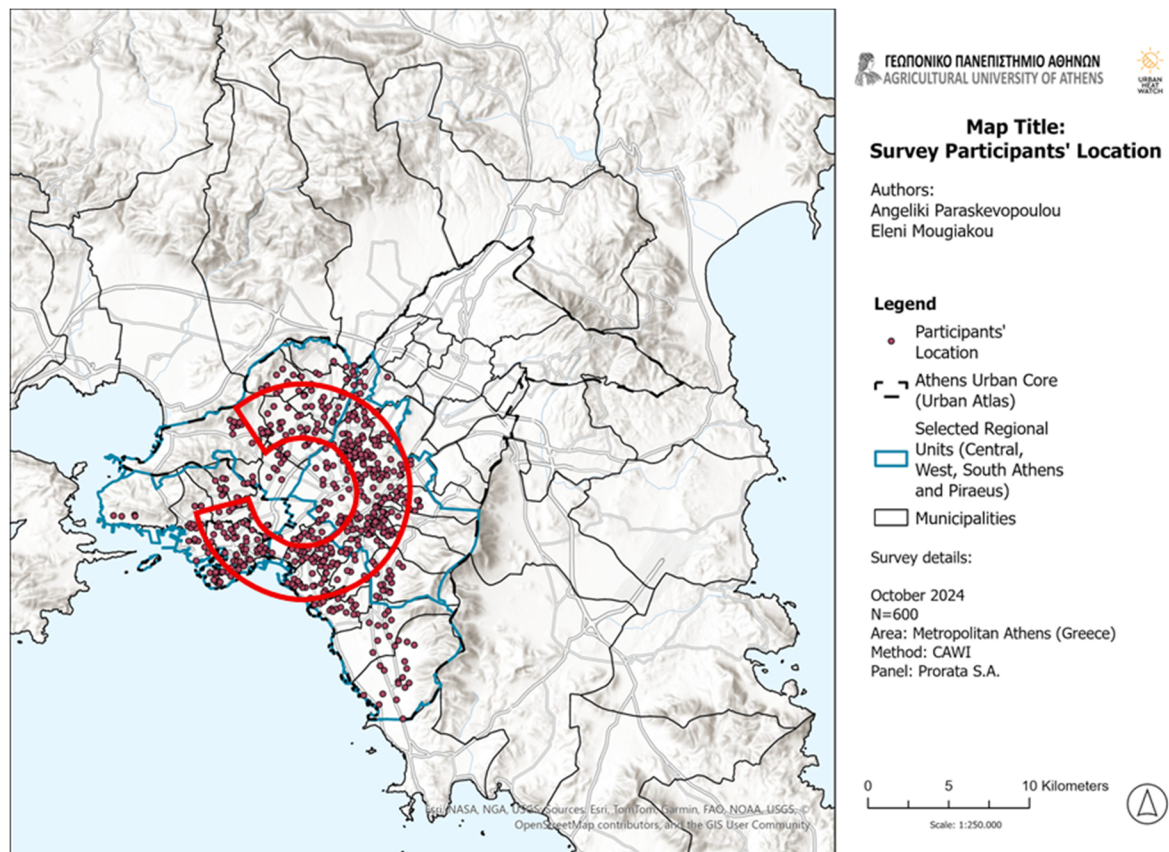


Figure 8. Distribution of the location of various green spaces identified by participants as their favourite most often visited green spaces in relation to participants' location of residence (Q3 & Q22 combined). The dots denote participants' location of residence and the red outline denotes the area with a higher density of favourite most often visited green spaces within the regional units of the Region of Attica (West Athens, Central Athens, South Athens, and Piraeus) (N = 600).



Figure 9. Favourite most often visited green spaces expressed as percentage (%) of participant responses (N = 600) (Q22).

Most participants stated the value or function of greatest importance at their favourite and most often visited green space is “contact with nature” (Figure 10). However, most participants do not visit or visit little their favourite green space on days with intense and prolonged extreme heat (Figure 10).

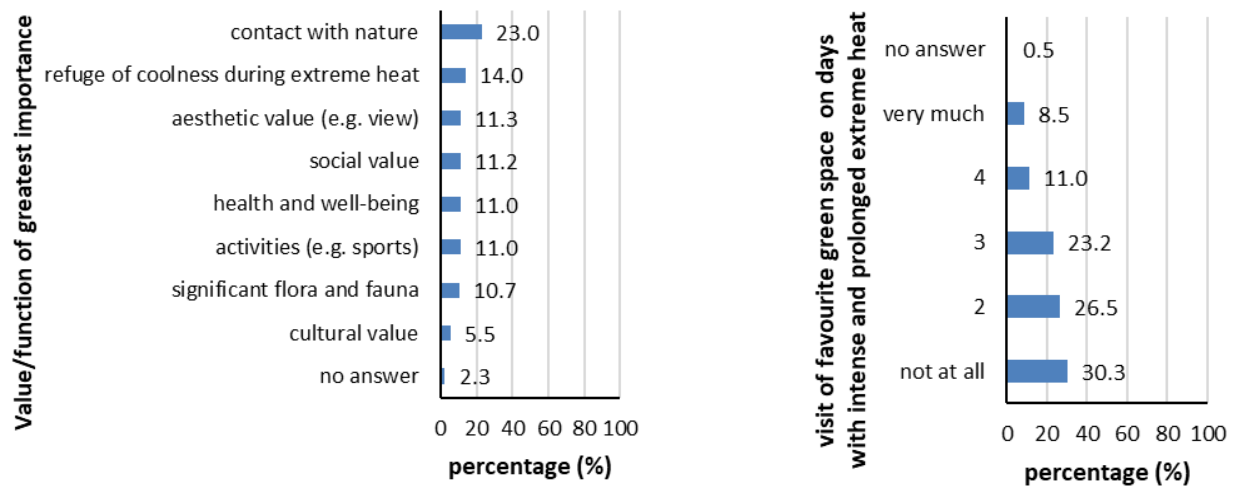


Figure 10. Value/function of greatest importance (Q23, left) and visits on days with intense and prolonged extreme heat (Q24, right) at the “favourite most visited green space” expressed as percentage (%) of participant responses (N = 600).

Walking is the most meaningful activity for most participants (50.5%) (Figure 11). The main benefits from practicing the most meaningful activity are reduced stress (54.0%), sense of calmness (42.3%), enjoyment of nature (41.8%), the ability to exercise (29.8%) and spending time outdoors (24.2%) (Figure 11).

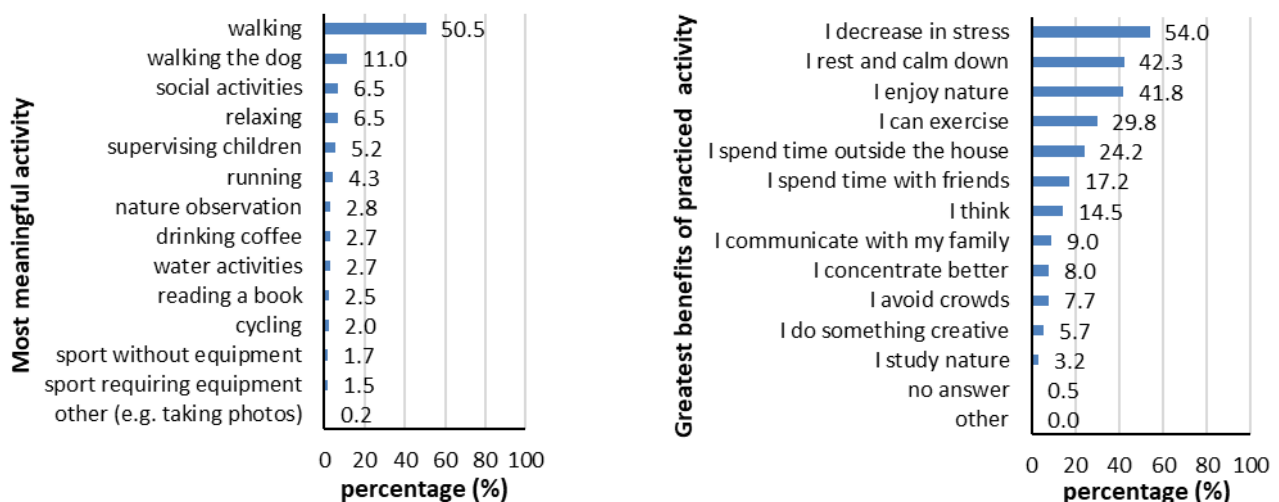


Figure 11. The most meaningful activity (Q25, left) and the greatest benefits of practiced activity (Q26, right) at the “favourite most visited green space” expressed as percentage (%) of participant responses (N = 600).

Significant differences ($p < 0.05$) in the greatest benefits of the most meaningful activity practiced at the “favourite most visited green space” were shown amongst the different age groups but not amongst the different genders (Tables 9 and 10). Generally, the younger participants (15–24 years) consider being creative, spending time and communicating with their family significantly more than participants >65 years as the greatest benefits of the most meaningful activity practiced at the “favourite most visited green space” (Table 9).

Different genders showed non-significant differences ($p < 0.05$) in the greatest benefits of the most meaningful activity practiced at the “favourite most visited green space”.

Table 9. Mean number ($\pm$ S.E.) of participants’ responses ($N = 600$) to the greatest benefits of the most meaningful activity practiced at the “favourite most visited green space” (Q26), expressed in relation to different age groups. Different letters (a, b) within columns denote differences between means according to Tukey’s HSD test at $p < 0.05$.

Age Groups	Greatest Benefits					
	I enjoy nature	I study nature	I can exercise	I do something creative	I decrease in stress	I avoid crowds
15–24 yrs	0.31 $\pm$ 0.087	0.03 $\pm$ 0.034	0.31 $\pm$ 0.087	0.17 $\pm$ 0.071 a	0.52 $\pm$ 0.094	0.00 $\pm$ 0.000
25–44 yrs	0.38 $\pm$ 0.036	0.03 $\pm$ 0.012	0.28 $\pm$ 0.033	0.05 $\pm$ 0.017 b	0.55 $\pm$ 0.037	0.05 $\pm$ 0.016
45–64 yrs	0.46 $\pm$ 0.030	0.04 $\pm$ 0.011	0.31 $\pm$ 0.027	0.06 $\pm$ 0.014 b	0.56 $\pm$ 0.029	0.09 $\pm$ 0.017
>65 yrs	0.42 $\pm$ 0.049	0.02 $\pm$ 0.014	0.30 $\pm$ 0.046	0.01 $\pm$ 0.010 b	0.46 $\pm$ 0.050	0.11 $\pm$ 0.031
F/p value	1.427/0.234 ns	0.347/0.791 ns	0.143/0.934 ns	3.933/0.009 **	1.258/0.288 ns	2.276/0.079 ns
	I communicate with my family	I spend time with friends	I think	I rest and calm down	I concentrate better	I spend time outside the house
15–24 yrs	0.07 $\pm$ 0.048 a	0.38 $\pm$ 0.092 a	0.03 $\pm$ 0.034	0.41 $\pm$ 0.093	0.07 $\pm$ 0.048	0.38 $\pm$ 0.092
25–44 yrs	0.15 $\pm$ 0.026 ab	0.24 $\pm$ 0.032 ab	0.11 $\pm$ 0.023	0.39 $\pm$ 0.036	0.05 $\pm$ 0.016	0.25 $\pm$ 0.032
45–64 yrs	0.08 $\pm$ 0.016 ab	0.12 $\pm$ 0.019 b	0.18 $\pm$ 0.023	0.44 $\pm$ 0.029	0.10 $\pm$ 0.018	0.21 $\pm$ 0.024
>65 yrs	0.01 $\pm$ 0.010 b	0.12 $\pm$ 0.032 b	0.16 $\pm$ 0.037	0.43 $\pm$ 0.049	0.08 $\pm$ 0.027	0.28 $\pm$ 0.045
F/p value	5.748/0.001 **	7.643/<0.001 ***	2.401/0.067 ns	0.348/0.790 ns	1.452/0.227 ns	1.911/0.127 ns

where ** and *** denote significance at $p < 0.01$ and $p < 0.001$, respectively; ns: non significance.

Table 10. Mean number ($\pm$ S.E.) of participants’ responses ($N = 600$) to the greatest benefits of the most meaningful activity practiced at the “favourite most visited green space” (Q26), expressed in relation to different genders. Comparisons between means were conducted according to Student’s t -test at $p < 0.05$.

Gender	Greatest Benefits					
	I enjoy nature	I study nature	I can exercise	I do something creative	I decrease in stress	I avoid crowds
Male	0.41 $\pm$ 0.028	0.03 $\pm$ 0.009	0.33 $\pm$ 0.027	0.06 $\pm$ 0.013	0.56 $\pm$ 0.028	0.07 $\pm$ 0.014
Female	0.43 $\pm$ 0.029	0.04 $\pm$ 0.011	0.26 $\pm$ 0.026	0.05 $\pm$ 0.013	0.52 $\pm$ 0.030	0.09 $\pm$ 0.017
F/p value	0.825/0.646 ns	3.408/0.357 ns	13.002/0.073 ns	0.661/0.685 ns	2.877/0.334 ns	3.752/0.334 ns
	I communicate with my family	I spend time with friends	I think	I rest and calm down	I concentrate better	I spend time outside the house
Male	0.09 $\pm$ 0.016	0.16 $\pm$ 0.021	0.15 $\pm$ 0.020	0.40 $\pm$ 0.028	0.06 $\pm$ 0.014	0.24 $\pm$ 0.024
Female	0.09 $\pm$ 0.017	0.18 $\pm$ 0.023	0.14 $\pm$ 0.021	0.45 $\pm$ 0.030	0.10 $\pm$ 0.018	0.24 $\pm$ 0.025
F/p value	0.040/0.921 ns	1.771/0.506 ns	0.023/0.940 ns	6.571/0.168 ns	9.934/0.118 ns	0.002/0.981 ns

where ns: non significance.

The most meaningful activity of participants is practiced weekly (51.5%), for approximately 1 h or between 1–3 h (36.9% and 36.0%, respectively) throughout the year (56.3%) (Figure 12).

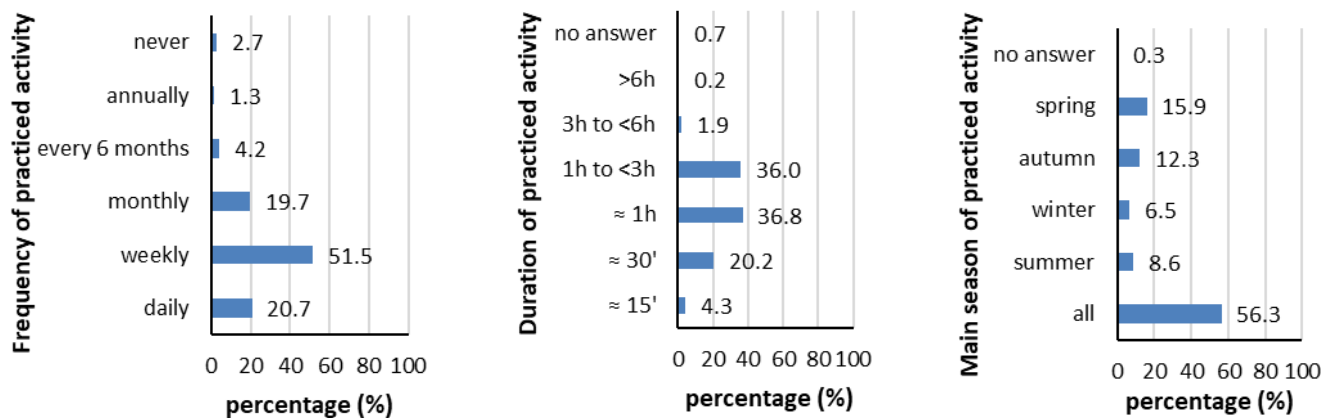


Figure 12. Frequency (Q27, left), duration (Q28, middle) and season of the year (Q29, right) of the most meaningful activity practiced at the “favourite most visited green space” expressed as percentage (%) of participant responses (N = 600).

Significant differences ($p < 0.05$) in the frequency of the most meaningful activity practiced at the “favourite most visited green space” are shown amongst the different age groups, though not amongst the different genders (Table 11). Generally, the most meaningful activity at the “favourite most visited green space” is practised more frequently by the elderly participants (>65 years) than the young adult participants (15–24 years) (Table 11).

Table 11. Mean frequency ($\pm$ S.E.) of the most meaningful activity practised at the “favourite most visited green space” (Q27), expressed in relation to different age groups and genders of participants (N = 600). Different letters (a, b) within columns denote differences between age group means according to Tukey’s HSD test at $p < 0.05$. Comparisons between gender means were conducted according to Student’s t test at $p < 0.05$.

Age Groups	Frequency ¹	Gender	Frequency ¹
15–24 yrs	2.10 $\pm$ 0.194 a	Male	2.15 $\pm$ 0.054
25–44 yrs	2.49 $\pm$ 0.081 ab	Female	2.30 $\pm$ 0.066
45–64 yrs	2.16 $\pm$ 0.056 ab		
>65 yrs	1.94 $\pm$ 0.104 b		
F/p value	7.233/<0.001 ***	F/p value	11.922/0.078 ns

¹ frequency values: 1. daily; 2. weekly; 3. monthly; 4. every six months; 5. annually; 6. never. Where *** denotes significance at $p < 0.001$, ns: non significance.

The time of the last visitation to their “favourite most visited green space” for most participants was one week (49.5%) (Figure 13). Most participants take 5–10' to reach their favourite green space (32.7%), though approximately a quarter of the participants take 11–20' (Figure 13). Participants mostly walk (53.2%) to reach their favourite green space; however, a relatively large number of participants reach their favourite green space by car, motorbike or taxi (25.8%) (Figure 13). Additionally, most participants spend more than 45' at their favourite green space (55.7%); however, approximately half of the participants spend less than 45' (Figure 13).

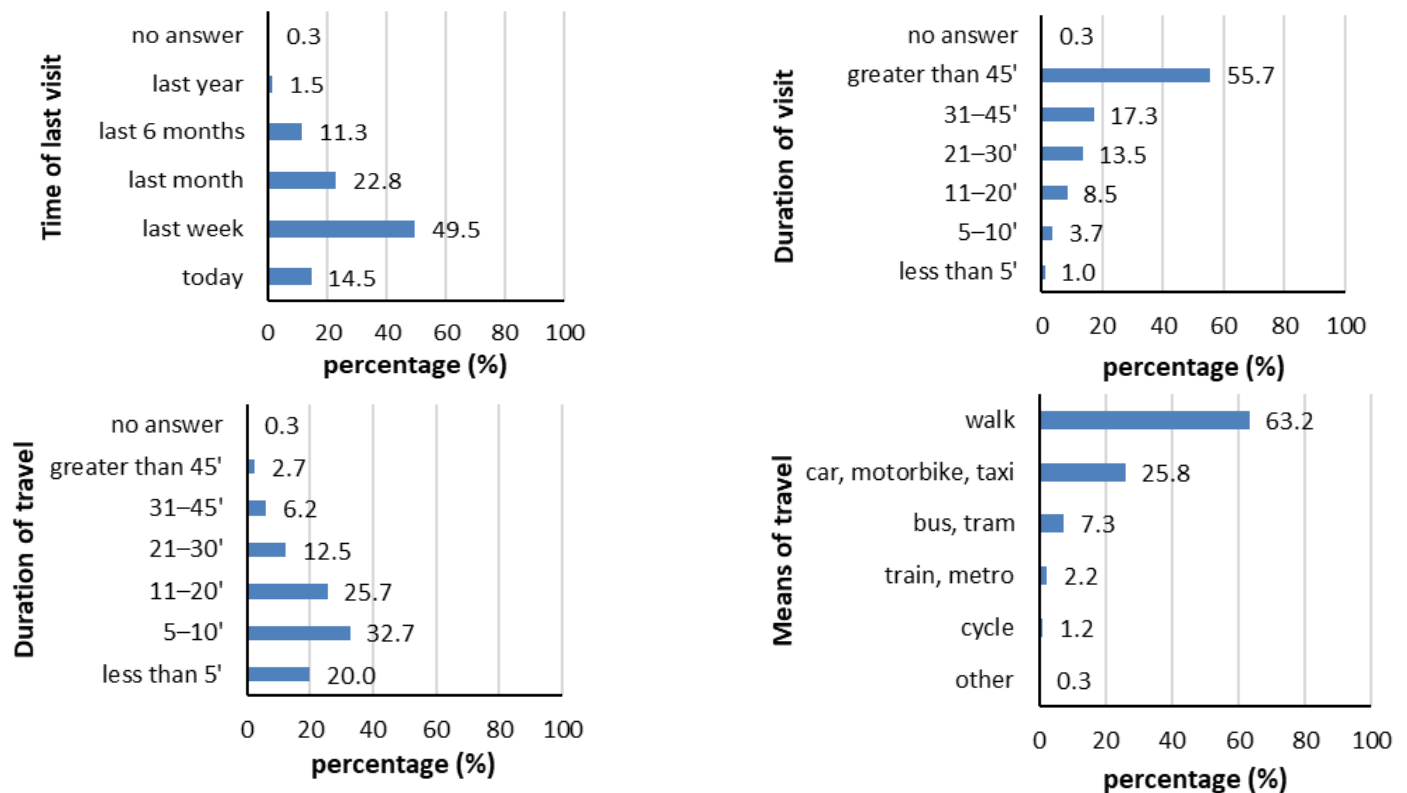


Figure 13. Time of last visit (Q30, **top left**), duration of travel (Q31, **top right**), duration of visit (Q32, **bottom left**) and means of travel (Q33, **bottom right**) to the “favourite most visited green space” expressed as percentage (%) of participant responses (N = 600).

3.4. Effect of COVID-19 on the Use of Green Spaces

Most participants stated no changes in their habits for most of the activities practiced in green spaces due to COVID-19, though a relatively large number of participants stated to have increased their walking (34.3%) and visits to the parks or woodlands (28.3%) since COVID-19 (Figure 14). It is noteworthy to mention that most participants expressed not engaging in bird and wildlife watching (58.3%), gardening (48.0%), looking after indoor plants (41.2%), or walking the dog (53.5%) (Figure 14).

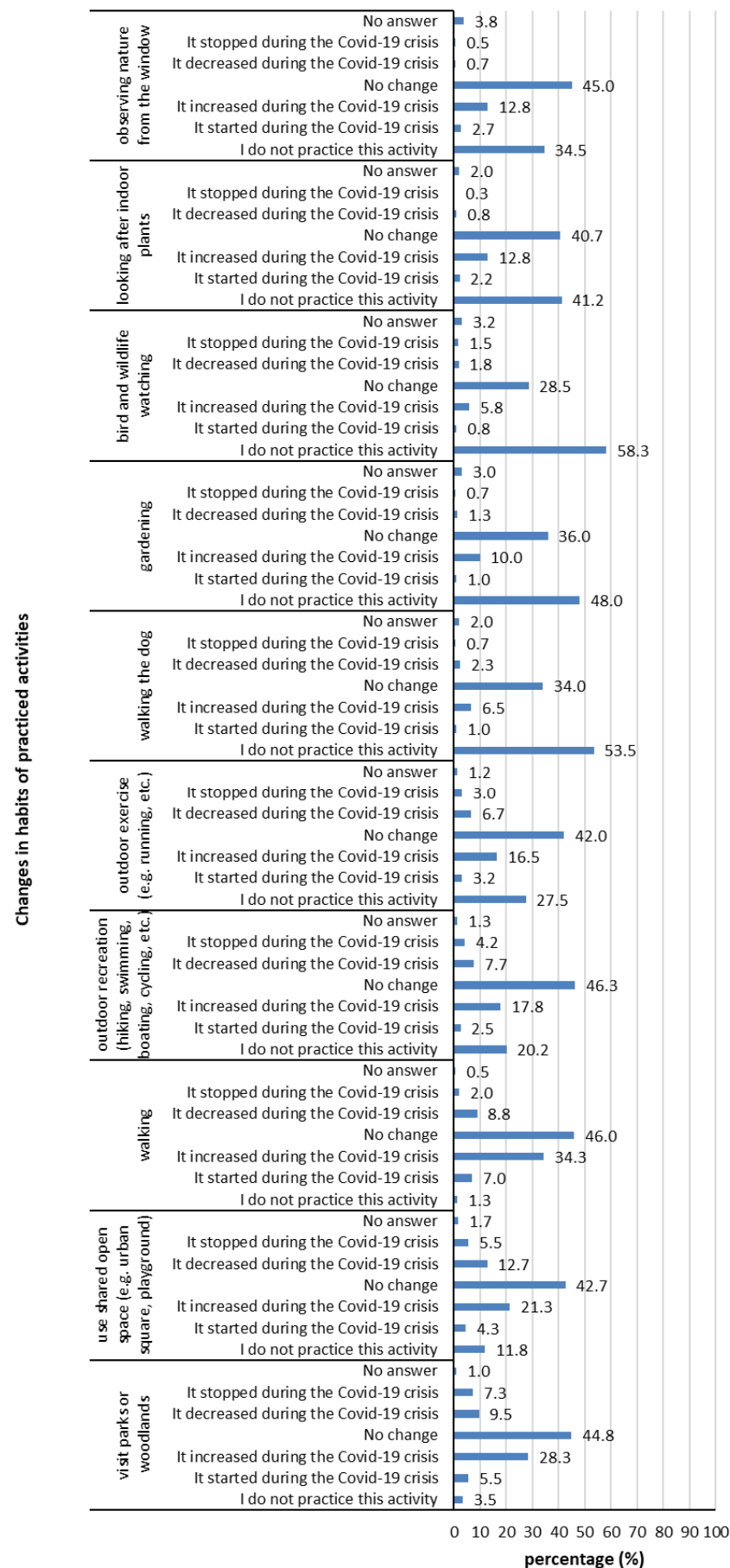


Figure 14. Potential changes in the habits of practiced activities in green spaces since COVID-19, expressed as percentage (%) of participant responses (N = 600) (Q34).

4. Discussion

The discussion follows the structure of the results section and is in accordance with the subject areas of the questionnaire survey (i.e., “Participant details”, “General green spaces”, “Particular green space”, “Effect of COVID-19 on the use of green spaces”).

4.1. Participant Details

Overall, people of both genders, different ages, levels of education, occupation, and parental and dog owner status participated in the survey. The distribution of the location of residence of participants within the four regional units of the Region of Attica (West Athens, Central Athens, South Athens, and Piraeus) is representative of the corresponding population recorded in the 2021 Census [30]. The population of the four studied regional units constitutes 64.5% of the population of Attica (i.e., 2,458,603 studied residents/3,814,065 all Attica residents, 2021 Census) [30]. The dominant morphological building type in the studied area is compact mid-rise (typically 5–7 stories) [37]. Furthermore, more than a quarter of the population of Attica (26.3%) lives in Central Athens, which is characterised by a low density of green spaces and a high concentration of buildings, forming deep urban canyons with an aspect ratio >2 [30,38]. These urban typologies contrast with the recommendations/guidelines of SDG 11 [7] and UN-Habitat [8] and underscore the necessity to transform the existing urban system of Athens to absorb and adapt to challenges (e.g., extreme heat events, pandemic, etc.). Hence, this study provides representative information on the locals’ preferences of urban green spaces, accessibility and proximity of urban green spaces, preferred activities, and motives of visitation living within such urban typologies. This information can help inform strategies aimed at improving the design and use of urban green spaces within the metropolitan area of Athens. In doing so, the study contributes to broader efforts to strengthen urban resilience.

4.2. General Green Spaces

Nearly all participants experienced a period of extreme heat as well as a curfew period due to measures against the spread of COVID-19 while residing in an urban area of Attica’s Basin, confirming that the participants’ responses to the survey’s questions are based on these experiences. Overall, walking, working, or commuting to work and shopping are daily or regular activities that participants state are difficult to undertake in public spaces during extreme heat. Other less popular regular activities, such as exercising, walking the dog, as well as family play and participating in cultural events, are also expressed by participants as difficult to implement in public spaces during extreme heat. Most of the above-mentioned activities take place in urban streets. However, many people often overlook the significance of urban streets as public space [39]. Urban streets constitute a fundamental type of public space hosting various activities (e.g., daily walking, commuting, recreation and exercise) [39]. Though urban streets account for 20–30% of urban areas, they constitute 80% of the total public spaces, while the remaining public spaces are allocated to parks, squares and other public spaces [39,40]. Streets are composed mainly of roads, building facades, pavements, vegetation (e.g., trees, hedges, flower beds, etc.), street furniture (e.g., lighting, traffic lights, bollards, etc.) and built structures (e.g., planters, road islands, etc.). The thermal properties of hardscape materials (e.g., low albedo and storage of heat) contribute to elevated air temperatures due to the thermal radiation emitted from their surfaces into the atmosphere [39,41]. The air temperature is further elevated by the heat emitted from human activities (e.g., air conditioning systems, pollution) [39,41]. Tree planting is one of the most effective strategies by which to mitigate the effects of extreme heat [21]. As already presented, the studied area is characterised by deep urban canyons and the lack of greenery; therefore, possibly, during periods of extreme heat, the

emission of heat from both hardscape materials and human activities further aggravates the street thermal environments, increasing street heat exposure to participants and making it difficult for them to conduct the aforementioned daily or regular activities in public spaces.

Overall, amongst the various activities, shopping and socialising were shown to be more difficult to undertake in public spaces during extreme heat for elderly participants (>65 yrs) than for young adult participants. However, working or going to work, exercising and family play were shown to be more difficult to undertake in public spaces during extreme heat for participants aged between 15–64 yrs than elderly participants (>65 yrs). This is expected as elderly participants (>65 yrs) are usually pensioners, therefore they no longer work or go to work and have adult children (>18 yrs) and no longer need to take their children to the playground. Additionally, it is possible that older participants avoid exercising outdoors during extreme heat, as the elderly (>65 years) are more prone to heat stress and mortality risk than younger people [28]. During extreme heat events, the Ministry of Health issues measures, advising vulnerable groups such as the elderly to avoid unnecessary outdoor activities. Researchers have found a strong correlation between age, temperature increases and mortality risk [42]; the mortality rate of the elderly (>65 years) increases at temperatures that are 4.32 °C lower than those that younger people experience [42].

It is interesting that, amongst the various activities, walking the dog and shopping were shown to be more difficult to implement in public spaces during extreme heat by female participants than by male participants, while exercise was shown to be the opposite. Researchers have shown that women are less likely to engage in moderate-to-vigorous physical activity (exercise) in parks than men, a finding which agrees with those of the current study [27]. On-leash dog walking at a regular walking speed is classified as moderate intensity exercise [43]. Furthermore, women are often viewed as more active in shopping than men, whether it is to interact with the family, for utilitarian purposes (e.g., shopping at the supermarket, etc. to cater for the daily needs) or for pleasure [44]. Women family caregivers experience worse mental outcomes than men in balancing work (career development) and caregiving [45]. Caregiving tasks include mainly personal care, meal preparation, house chores, care for children and/or elderly parents [45], while elderly parent caregiving by daughters (i.e., women) is twice as much as that undertaken by sons (i.e., men) [46]. Considering that men and women differ physiologically in how they regulate their body temperature, women are more vulnerable than men to extreme heat events as they are more sensitive and less adaptable to heat extremes [47–49]. This study is among the first to highlight extreme heat as an additional challenge, compounding the disproportionate burden of unpaid informal family caregiving responsibilities borne by women. Note that the question asking to “identify the activities that are difficult to implement in public spaces during extreme heat” would not include activities that participants do not perform but possibly would otherwise be performed if other factors such as poor maintenance of green spaces or poor accessibility to them, did not hinder their performance (see below).

The outdoor spaces (e.g., courtyards, verandas, balconies) of participants' households are the easiest and safest accessed outdoor spaces, followed by urban parks and parks or woodlands. Indeed, private outdoor spaces such as courtyards, verandas and balconies provide residents access to safe green spaces and constitute important spaces for supporting human well-being [50,51]. Researchers prioritise, amongst other interventions, the purposeful design of balconies in apartment housing design so as to promote healthy and restorative living environments [52]. In densely built urban areas such as the studied area, balconies can alleviate some of the negative effects associated with high-density living by providing a “mini garden” to which residents can retreat, contributing to their well-

being [53]. Furthermore, placing plants on the balcony rails, which is characteristic of some buildings in the studied area, can improve the visual appearance of the city as they can be seen from the streets below and the opposite buildings [54] and can potentially improve the microclimate [55]. Courtyards, on the other hand, depending on the aspect ratio and orientation, can play a vital role in managing the microclimate by reducing solar radiation and increasing ventilation; hence, increasing residents' thermal comfort [56]. The current study did not examine the visual impact and benefits of the presence of plants on balconies or the factors of courtyards that influence their microclimate; however, additional studies are proposed to research their potential to constitute a core component of a resilience strategy for the studied area.

Participants' perceptions on the ease and safety of visiting outdoor spaces vary amongst different age groups. Amongst the various outdoor spaces, urban squares, sidewalks and natural areas (e.g., forests) are considered as easy and safe to visit more by the young adult participants (15–24 years) than the other age groups. Both the physical and social environments of outdoor spaces are important in understanding their influence on the usage and practice of physical activities [57]. People choose a green space to practice a particular activity to experience multiple psychological outcomes; it has been found that young adults are motivated to visit green spaces to escape from their daily routine, experience fun outdoors, and/or reflect on themselves, while elderly people are motivated to visit nearby green spaces for social interaction and do things alone without any fear [58]. Urban squares and sidewalks are active spaces, and can be motivating to visit, particularly when there are events, so as to allow one to escape from the daily routine, while the quietude and sensory input of natural areas foster self-reflection.

On the other hand, the use of open green spaces is also influenced by physical barriers [59]. A study by Wu and Song [59] showed that safety, accessibility, and maintenance are important factors for elderly visitors to urban parks. In the current study, parks/small woodlands, communal courtyards, gardens or terraces and roads appropriately designed for 2 m social distancing measures are considered less by the older participants (>65 years) as easy and safe to visit than the other age groups. Possibly, the availability of the aforementioned types of green spaces is reduced in the older age groups than in the other age groups, particularly as all participants already live in areas that are characterised by dense building density and therefore offer parks/small woodlands; households with communal courtyards, gardens or terraces; and roads that allow for 2 m social distancing measures that are limited in number and size. Other researchers confirm that neighbourhoods with fewer green spaces result in residents facing more barriers to using green spaces, such as lack of maintenance and poor accessibility [60]. Furthermore, the studied area is characterised by high building density and often neighbourhoods have one- or two-way roads with parked cars on either side, obstructing access to cross over, and narrow sidewalks, often with broken slabs or lined with trees and which also obstruct access, making accessibility challenging, particularly for the elderly with mobility problems, and even more so for disabled people. It is possible that the elderly participants are challenged by mobility difficulties and accessibility issues (e.g., obstructed entrances, road junctions, etc.) that constitute barriers for them to visit as often as the young adult participants of the current study. More detailed research would provide more information on why the elderly participants visit their "favourite most visited green space" less frequently. The current study did not focus on disabled people; however, they need to be researched and addressed to make green spaces inclusive to all. As implemented in other Mediterranean cities (e.g., Valencia's superblocks), urban planners, traffic engineers and landscape architects need to redesign the neighbourhoods within Athens so as to facilitate and provide safe access to green spaces, so that no person is left behind according to the UN's SDGs.

Participants' perceptions of easy and safe to visit outdoor spaces vary amongst the genders as well; urban squares and cycle paths are considered to be easy and safe to visit more by male participants than female participants. Urban squares of the studied area are often characterised by human-made infrastructures that contain a relatively large paved area, where crowds participate in various activities, usually in groups (e.g., outdoor play, skating, conversations, cycling, transversing, etc.) that can willingly or unwillingly intercept one-another, or where various events take place (e.g., concerts, shows, etc.), and are embellished with one or more focal points in the form of, for example, a prominent building, statue, fountain, planting bed, etc. Although these urban squares contain planting, they are less natural green spaces than parks. The above results agree with the findings of other researchers, showing that males visit green spaces characterised by human-made infrastructure more than females, while females visit green spaces characterised by naturalness more than males [61].

Regarding cycle paths, the results of the current study also agree with the findings of other researchers showing that males cycle more than females [62,63]. The most common and, for some, the safest way to enhance cycling within cities is to develop infrastructure exclusive to cycling [64]. However, very few cities in Europe possess such an infrastructure, and most of the cities that do possess it have recently developed it. In Athens, exclusive cycle paths are limited to a few kilometres, due to their cost or street geometry [64]. The cycling infrastructure network of Greece is limited and of poor quality, and the cycling rate is low [63]. Hence, the perceived safety of cyclists in Greece is low [63].

Open green spaces were found to be associated with an improvement in both the mood and stress levels of participants. In contrast to the built environment, these results indicate that visits to natural spaces, such as urban parks and urban woodland, have a favourable impact on perceived stress alleviation. Indeed, Kondo et al. [65] demonstrated that urban green spaces have a favourable correlation with mood and physical activity and a negative correlation with mortality, heart rate, and violence. Other researchers have also shown that 30' visits to green areas have positive effects on stress relief and cardiac response compared with the urban street environment [66]. Understanding the use and effect of green spaces on human health could inform on the strategies necessary to enhance urban green space design and usage.

Poor maintenance (50.7%), lack of security (36.7%), and visitors' disregard for safety and hygienic precautions (32.8%) are the main complaints made by the participants when visiting parks and open green spaces (Figure 6). Roughly one quarter of the participants reported feeling crowded (22.0%) and unsafe (20.8%). Visitors' complaints for poor maintenance of urban parks and open spaces [67], and the disposal of waste by visitors in parks and green spaces, particularly during events [68], are highlighted in several studies. The maintenance condition of urban green spaces affects people's perception of safety [57,69]; regular maintenance (cleanliness and facility upkeep) enhances visitors' sense of safety and encourages their continued use [11,12]. In contrast, poorly maintained green spaces may discourage general usage but encourage usage by those who commit minor infractions, which may then escalate into more serious crimes [21,23,57]. Hence, unsafe or poorly maintained green spaces may deter people from visiting them even if they are located within walking distance from their homes. Fallen plant biomass (leaves/flowers/fruits) and branches, damage to plants, roots breaking pavements/walls, and hiding spaces for unlawful activities are identified as negative effects of nature in urban green spaces [57,70]. Furthermore, visitors' sense of safety can be influenced by the presence of dense planting and open spaces that can be reduced or increased, respectively, especially during nighttime [21].

Overall, young adult participants (15–24 years) are more concerned that the parks and open green spaces they visit are understaffed and do not meet their personal needs

compared with the other age groups. Open green spaces often fail to meet the needs of visitors due to poor maintenance, which in many cases is related, as identified in the current study, to limited staff resources [60,71]. Furthermore, poorly maintained open green spaces are deterrents to young adults seeking to practice their activities, hence failing to meet their needs as determined above [72]. Indeed, researchers have found that urban green spaces were not utilised by young adults if they believed that they were unsafe or uninspiring in terms of quality or facilities [73]. As already mentioned above, young adults are motivated to visit green spaces to escape from their daily routine, experience fun outdoors and/or reflect on themselves.

Moreover, female participants are more concerned than male participants about feeling uncomfortable due to the heat in the parks and open green spaces they visit, as well as about the use of chemicals for weed control. The former results agree with the results already mentioned above that women are more vulnerable than men against extreme heat events as they are more sensitive and less adaptable to heat extremes [47–49]. Considering the latter, overall environmental exposure to agrochemicals (e.g., herbicides, pesticides, fertilisers) will have the same effects on the health of both men and women, although not always [73,74]. Research on the effects on human health of some agrochemicals, such as glyphosate-based herbicides (a widely used herbicide), suggests potential clinical implications on women's reproductive health, including polycystic ovarian syndrome (PCOS), endometriosis, infertility, and adverse pregnancy outcomes [75]. Therefore, in the current study, women are possibly generally aware of the potential risks related to the environmental exposure to chemicals such as herbicides, particularly if they are "vulnerable" (i.e., pregnant, menstruating or ovulating) and feel uncomfortable with the use of chemicals for weed control.

The results of the current study confirm that availability (e.g., long distance, lack and insufficient number of green spaces) and access (e.g., unavailability or inconvenient public transportation, poor condition or inhibited pedestrian access routes, illegal car parking) are the primary factors that restrict participants from visiting parks and open green spaces. Addressing these spatial inequities in public green space provision constitutes a core component in building an urban resilience strategy for the studied area. Additionally, the above results highlight significant differences in the perceptions and use of outdoor spaces among different age groups and genders. These differences warrant further exploration in relation to socio-cultural, economic, or physical factors that are beyond the scope of this study. The impact of the interactions amongst the economic, social, ecological, and infrastructure factors of resilience is greater than the impact of their independent effects [76]. Understanding such factors could provide valuable insights into how these differences influence green space use and help ensure the provision of more inclusive green spaces.

4.3. Particular Green Space

The majority of the locations that participants chose as their favourite most often visited green spaces are mainly accumulated in an arc-shaped pattern around the borders of the four regional units under study, with fewer locations found in the western and Pireaus regional units, illustrating that the distribution of the green spaces within the examined area is uneven. The studied area was selected as it is characterised by high building density and limited green spaces, hence it was anticipated that some inequalities may arise from the current research. This research highlighted the areas with greater inequalities in the distribution, and in other words, the access to green spaces. Although not examined specifically, the inequalities in the distribution of green spaces seem to illustrate that the studied area does not meet the 3-30-300 rule [15,16]. The fact that most participants stated the value or function of greatest importance at their favourite and most

often visited green space is “contact with nature” and that walking is the most meaningful activity, emphasises the need to address the inequalities in green space access.

Research has shown that, to improve access to green spaces, it is not only necessary to provide good-quality green spaces but also connectivity with green spaces (walkability) and social cohesion (socio-demographics and inclusiveness) [10,11,25,57,61,77]. “Walkable” neighbourhoods in which people feel safe, comfortable and inclined to walk because they feel safe are characterized by high population density, mixed land use (a range of retail, residential, and commercial usage), high connectivity (easy or direct routes between destinations due to street layout), good facilities for cyclists and pedestrians (cycle paths, sidewalks, and traffic calming measures), and accessibility (e.g., a variety of destinations or facilities, such as shops, greenspace, and transportation links) [17–19,77]. More detailed studies using GIS, considering the different typologies of the urban fabric (street width, street traffic volume, building height, form and load capacity, etc.) in relation to sociodemographic data (census 2021) and the existing availability of green spaces would facilitate the generation of strategies by which to increase walkability and the amount of green space in the studied area and contribute to an urban resilience strategy. This study intentionally prioritised subjective perceptions and self-reported behavioural patterns related to urban green space use. While the authors recognise that objective environmental metrics (e.g., GIS-based accessibility, land surface temperature, or air quality indices) could complement these findings, behavioural responses to green spaces are often shaped by perceived rather than measured accessibility or environmental quality. Future research analyses could combine these perception-based insights with objective geospatial and environmental data to provide a more comprehensive analysis.

The three most favourite and often visited green spaces identified within Athens are the Metropolitan Park “Antonis Tritsis,” which also constitutes the largest park in the Region of Attica (91.3 ha), Pedion Areos (24.0 ha), and Stavros Niarchos Park (21.0 ha). All three parks are considered to have a metropolitan character as they cater for the needs of the entire Region of Attica, providing a variety of structured (i.e., playgrounds, fountains, seating areas) and unstructured (i.e., paths, open grass and sheltered by trees areas) physical and passive activities and often hosting various events (e.g., concerts, festivals, fairs, etc.). Social events in green spaces constitute a pole of attraction and develop social cohesion amongst participants. However, most participants expressed that they do not visit or rarely visit their favourite green space on days with intense and prolonged extreme heat. As already presented above, extreme heat events negatively affect people’s outdoor activities, hence accessibility and visits to green spaces. Improving connectivity with green spaces could perhaps facilitate visits to green spaces, which can provide shelter from the heat in areas under relatively dense tree canopy [unpublished data]. The main benefits expressed by participants from practicing the most meaningful activity are reduced stress (54.0%), sense of calmness (42.3%), enjoyment of nature (41.8%), the ability to exercise (29.8%) and spend time outdoors (24.2%). These findings are consistent with the findings of other researchers [60] and highlight the benefits of green spaces offered to participants in the current study.

In general, young adult participants (15–24 years) state far more than participants over 65 years that the greatest benefits of practicing the most meaningful activity at their “favourite most visited green space” are being creative, spending time with friends, and communicating with their families. These results are in accordance with the results already presented in the previous section. Both the physical and social environment of green spaces affect human use and performed activities as well as social interactions [78]. The dynamic interaction between an individual and their surrounding environment generates creativity [79]. This is in line with “the theory of affordances” by Gibson [80], e.g., what the environment provides either for good or ill. Young adults’ perceptions are sensitive and

positively motivated by natural landscape elements such as trees and water features, good maintenance and cleanliness and a sense of safety of green spaces [72,78,81]. Hence, it is possible that these perceptions are fundamental for supporting young adults' creativity, as shown in the current study, and are provided by the participants' "favourite most visited green space." Furthermore, green spaces provide young adults (15–24 yrs) with the opportunity to connect with people and foster social cohesion [78]. Other studies have also shown that young people visit green spaces with friends and family members, although to a lesser degree, and contribute to a strengthening in their relationships with them [72]. In contrast to the different age groups, the greatest benefits of the most meaningful activity practised at the "favourite most visited green space" were similar between genders ($p < 0.05$), suggesting that both genders benefit equally from their visits to their "favourite most visited green space" and mainly from reduced stress, relaxation and calmness, and enjoyment of nature.

A study undertaken in Hangzhou, China, showed age to be positively correlated with the number of park visits. In the current study, young adult participants (15–24 years) practice the most meaningful activity at the "favourite most visited green space" less frequently than elderly participants (>65 years). Limited visits by the young adult age group raise concerns for their mental and physical well-being [78]. Research has shown that natural landscape elements such as plants and water, as well as recreational facilities, have a positive impact, while uncivilised behaviour (e.g., litter) and noise have a negative impact on young adult visits to parks [21,78]. In the current study, as shown above, poor maintenance was identified as the main reason for not visiting green spaces and young adult participants (15–24 years) expressed their concern that the parks and open green spaces they visit are understaffed and do not meet their personal needs, justifying why young adults visit their "favourite most visited green space" less frequently than the elderly (>65 years). Poor maintenance of green spaces negatively affects their aesthetics [57,69]. Further detailed research would provide more information on why the young adult participants visit their "favourite most visited green space" less frequently.

Furthermore, the frequency of the most meaningful activity practiced at the most popular green space was similar between genders, suggesting that there are no gender-related issues that might affect the practicing of their activities. The fact that both genders practice their most meaningful activity at their "favourite most visited green space" possibly suggests that their "favourite most visited green space" meets their needs and does not raise any major concerns.

Research has also shown that green spaces located within walking distance from people's residence support green space visits, while the necessity to drive to a green space deters them [57]. The current study did not show differences amongst the age groups or genders in the duration of travel to the "favourite most visited green space" and the duration of the visit or the means of travel. However, a relatively large amount of participants take >10' to visit their "favourite most visited green space," which most visit weekly or, for a relatively large amount of participants, monthly. It is encouraging that most participants walk to their "favourite most visited green space," though a relatively large amount of them require a vehicle, and the use of public transport is relatively low, suggesting possibly that the public transport network is not convenient to use. Nearly half the participants stay at their "favourite most visited green space" for less than 45'. The above results emphasise that participants living in the studied area have limited access and opportunities to benefit from visits to green spaces. Researchers have shown that at least 2–3 visits to green spaces or 120' per week is associated with good health and well-being (reduced stress and depression symptoms) [82,83]. Stress reduction requires a minimum exposure of 20–30', while longer durations (i.e., 45–60') increase the benefits from the

practice of physical activities and for social interaction [84]. The above findings highlight the need to improve green space access and use by participants of the studied area.

4.4. Effect of COVID-19 on the Use of Green Spaces

Changes in the frequency with which most participants practice their activities at green spaces were not observed since COVID-19 for many activities (visit to parks or woodlands, use of shared open space, walking, outdoor recreation, outdoor exercise, and observing nature from the window), though a relatively large increase (approximately a third of the participants) was also observed in walking and visits to the parks or woodlands since COVID-19. An increase in walking has been noted by other researchers [31]. A survey undertaken in Italy showed COVID-19 led to a favourable view of the advantages offered by urban green spaces, which in turn led to an increase in their usage; this effect appeared to be permanent, even post COVID-19 lockdown [85]. Similar results have also been shown by research undertaken in other Mediterranean countries [31,86]. However, in more detail, studies have also shown that, while visits to woodlands increased, visits to parks decreased during the pandemic and identified two groups of people; people who wanted to spend time and be in contact with nature and people who avoided visits to green spaces in fear of being infected [31,85]. The current study did not research visits to parks and woodlands separately, which may have indicated differences as shown in the studies mentioned above. However, in the current study, though less notable, visits to shared open spaces (e.g., urban squares, playgrounds) were observed to increase since COVID-19, suggesting that the participants of the study were not majorly concerned about being infected by visits to green spaces. Furthermore, for many practiced activities in green spaces (visits to parks or woodlands, use of shared open space, walking, outdoor recreation, outdoor exercise, and observing nature from the window), participants expressed no changes since COVID-19, suggesting that they continued to carry out their activities in green spaces as “normal.” These findings somewhat agree with the findings of another study that did not show changes in parks visits in Sweden and Japan due to COVID-19 [87]. The variation in urban green space use, pre- or post- COVID-19 and during COVID-19 are attributed to the combined effect of the number, size, and distance of urban green spaces from the homes of residents, dwelling type (possessing a private/communal outdoor space, i.e., yard, garden or balcony) and the restrictive measures implemented due to the pandemic [31,88]. To understand more conclusively the effect of COVID-19 on the use of green spaces in the studied area of this research, a more detailed study on peoples’ perceptions on the use of green spaces in relation to COVID-19 would be needed, and this was not the purpose of the current study. The overall results of the current study, showing an increase in walking and visits to parks and woodlands since COVID-19, highlight the importance of green spaces in developing urban resilience.

Notably, the majority of participants reported not engaging in bird and wildlife watching, dog walking, gardening, or indoor plant care. Concerning dog walking, these observations are expected as most participants are not dog owners. However, lack of engagement in bird and wildlife watching is worrisome, suggesting either the lack of education and interest of participants or that the qualitative characteristics of the green spaces of the studied areas do not adequately support the birds and wildlife, and hence are not noticeable enough or do not catch the attention of participants. Further research is required to determine these factors. Regarding indoor plant care, researchers showed that indoor plant interaction cannot substitute different outdoor green experiences to mitigate stress symptoms [89]. However, indoor plant interaction has been found to reduce stress levels as well as gardening in private green spaces [90]. The fact that, in the current study, most participants were not observed to engage in gardening and indoor plant care suggests

that they did not own plants or owned only a few plants. Many private outdoor spaces (e.g., courtyards, verandas, balconies) of participants' households, as shown above to be considered amongst the easiest and safest accessed outdoor spaces, do not have or have few plants. It is encouraging, however, to also observe that >30% of the participants did not change their habits in gardening and indoor plant care, suggesting that they owned plants. Therefore, in view of the lack of available space in densely built areas, such as the studied area of Athens, an initiative to support the planting of private open spaces would facilitate the promotion of healthy and restorative living environments that would also provide multiple benefits to its owners and beyond, such as the improvement of the microclimate and building urban resilience.

5. Conclusions

Landscape architects, urban planners, and legislators require a thorough understanding of the variables influencing the way urban green spaces are used to create inclusive and functional green spaces that support a variety of urban populations while enhancing human health and well-being. The findings of this study highlight the intricate and multifaceted relationship between residents of four selected regional units of the Athens Metropolitan Area characterised by high building density (Athens Western Sector, Athens Central Sector, Athens Southern Sector, Piraeus) and the urban green spaces available to them. The results of the questionnaire survey undertaken provide valuable insights into how sociodemographics, environmental conditions, urban morphology, and recent events—such as extreme heatwaves and the COVID-19 pandemic—have shaped residents' experiences, preferences, and perceptions of green spaces. Collectively, these findings contribute to understanding how green spaces can be designed, maintained, and distributed to enhance urban resilience, social cohesion, and public well-being. They also highlight the need for urgent and sustained efforts to reimagine the green infrastructure of the four regional units of the Region of Attica into an inclusive, resilient, and life-enhancing system for all its residents. The main conclusions drawn to meet the above objectives follow:

- **Consider Participant Demographics and Representation**

People of all ages, genders, occupations, and parental and dog-owner statuses participated in the survey, offering perspectives that reflect the sociodemographics of the studied area. The distribution of participants across the four regional units (West Athens, Central Athens, South Athens, and Piraeus) mirrors census patterns, ensuring that the findings reflect real population distributions. These sociodemographics are important to consider because preferences for green spaces, their accessibility, and their perceived safety differ significantly across groups, underscoring the need for tailored landscape planning and design approaches.

- **Address the Impact of Extreme Heat on Routine Activities in Public Spaces**

Participants reported significant challenges in carrying out routine activities—such as walking, shopping, exercising, or family play—during heatwaves. Urban streets, which account for the majority of public space, are particularly affected due to the thermal radiation emitted by the surfaces and human activities and deep urban canyon forms. Vulnerable groups, such as the elderly and women, reported greater difficulties, reflecting both physiological and social factors. This highlights the urgent need for heat-mitigating interventions in urban design, such as shading, tree planting, reflective surfaces, and climate-responsive building arrangements (e.g., green roofs or walls, etc.), especially in densely built urban areas, as in the studied area.

- **Consider Patterns of Green Space Use and User Preferences**

Participants' use of outdoor spaces revealed strong preferences for household-associated areas (courtyards, verandas, and balconies) due to their safety and accessibility, followed by public parks and woodlands. This underscores the dual importance of private and public green spaces in supporting well-being in densely built urban areas. Balconies and courtyards in particular can offer restorative benefits, though their potential for enhancing microclimates and visual quality has yet to be researched. Young adult residents tended to prefer active, socially engaging spaces such as urban squares, sidewalks, and natural areas, while elderly participants emphasised nearby, less active green spaces. Gender differences were also noted, with men favouring urban squares and cycle paths and women expressing more concern about heat discomfort and chemical use in parks. These findings demonstrate the importance of equity and inclusivity in green space design, ensuring that diverse needs are accommodated.

- Address Barriers to Green Space Use

Significant barriers to green space use were identified, including poor maintenance, lack of security, socially irresponsible behaviour (e.g., littering, etc.), crowdedness, and lack of sense of safety. These barriers were particularly concerning for young adults and elderly residents, who both expressed dissatisfaction when spaces failed to meet their needs for safety and functionality. Poorly maintained green areas not only diminish their aesthetic and recreational value but may also foster perceptions of insecurity and even facilitate minor infractions. This highlights the necessity of securing sustained management, staffing, and safety measures.

- Identify Spatial Inequalities and Protect Major Green Spaces

Regarding particular green spaces, the research revealed that participants' favourite and most frequently visited green spaces (Metropolitan Park "Antonis Tritsis," Pedion Areos, and Stavros Niarchos Park) have a metropolitan value catering to the wider Attica population. Participants' favourite and most frequently visited green spaces were valued primarily for contact with nature, opportunities for walking, and stress relief. However, extreme heat limited their use during prolonged heatwaves, despite their potential for offering shaded, cooler microclimates. The uneven distribution of these spaces, concentrated mainly in an arc-shaped area and their relative scarcity mainly in the West Athens and Piraeus regional units, illustrates persistent inequalities in green space accessibility. Addressing these disparities requires not only creating new green spaces but also enhancing connectivity, walkability, and inclusiveness through strategic urban landscape planning and design.

- Enhance Green Spaces to Address the Observed Impact of COVID-19

While changes due to COVID-19 in the frequencies of practiced activities in green spaces by participants' were not observed for most activities, a relatively large increase was observed in walking and visits to parks and woodlands. The latter is consistent with international findings that the pandemic raised awareness of the essential role of green spaces in health and well-being, fostering a greater engagement with nature. Interestingly, unlike in some other contexts, participants of the four regional units of the Region of Attica did not avoid shared open spaces due to infection fears, suggesting differences in risk perceptions. These results underline the importance of green spaces as adaptive infrastructures that support urban resilience in times of crisis. Concomitantly, underutilization of activities such as birdwatching, gardening, or indoor plant care was observed, raising questions about both the biodiversity of available green spaces and the cultural valuation of such practices. In densely built environments, promoting the planting of private open spaces (e.g., courtyards, verandas, balconies) can provide opportunities for interaction with nature, while improving the microclimate and contributing to building urban resilience.

- **Proposed Future Directions for Urban Green Space Design and Research**

Considering all of the above, the results of this study emphasise that urban green spaces are indispensable infrastructures for health, well-being, and resilience, but their effect is undermined by uneven distribution and barriers related to access, maintenance, and extreme heat. Addressing these challenges requires integrated strategies that align with the United Nations sustainable development goals (particularly SDG 11 on sustainable cities and communities), based on participatory planning and design, inclusiveness and long-term stewardship. Future research should include GIS data collection and analyses on green space use with empathy for vulnerable groups (i.e., elderly, women and disabled people) combined with sociodemographics, microclimatic conditions, and accessibility. Equally important is the need for cross-disciplinary collaboration among urban planners, landscape architects, architects, civil engineers and traffic engineers with expertise in sustainable urban mobility to co-create solutions along with the residents, ensuring no person is left behind.

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