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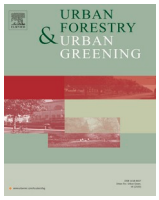

Understanding people's interactions with urban greenspace: Case studies in Eastern Europe

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ABSTRACT

This study explored and compared people's interactions with urban greenspace (UGS) using case studies in three Eastern European countries – Armenia, Georgia and Ukraine. These countries have experienced radical changes in governance systems and socio-economic structures, characteristic of a transition from planned to market economies. Recently, Armenia, Georgia and Ukraine have been arenas for armed conflicts, which have dramatically heightened instability throughout the region. Urban planners in Eastern Europe therefore urgently need context-relevant knowledge to facilitate the critical work of (re-)building more inclusive, safe, resilient and sustainable cities. An unrestricted, self-selected online survey was used to collect data in 2021–2022. A total of 3573 respondents completed the survey (N = 1142 in Armenia, N = 1069 in Georgia and N = 1362 in Ukraine). We identified 12 key explanatory factors linked to the frequency of people's interactions with UGS using multiple ordinal logistic regressions. The core findings are: (i) most factors are country-specific; (ii) age of respondents had a large effect on the frequency of UGS use in Armenia and Georgia, where older people were mostly infrequent users of UGS; (iii) those who lived further from UGS or could not access it on foot were less likely to use it often; and (iv) the only common key factor across three countries was that people who *'do not want'* to use UGS are infrequent users. The study shows that only 10–18% of respondents were satisfied with the UGS availability and quality. Among many constraints related to UGS use, litter in UGS and lack of time were the most mentioned. Large parks were the most preferred types of UGS. Our findings confirm the need for urban planners in Eastern Europe to consider and integrate diverse factors influencing people's willingness to interact with urban nature. A priority is to understand how to bring infrequent users to UGS, particularly older people in various cultural settings in Eastern European countries.

1. Introduction

Since the 1990s, Eastern European countries have experienced radical changes in governance systems and socio-economic structures, characteristic of a transition from planned to market economies. Institutional failures in management and planning as a result of this political, social and economic upheaval are often identified as a critical underlying factor in the ongoing degradation of urban greenspace (UGS) in so-called post-socialist countries (Hirt, 2013; Martín-Díaz, 2014). Additionally, current trends in urban development – densification and

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shrinkage – affect the provision of UGS in Eastern Europe. Densification of cities often leads to fragmentation and decline of UGS, and deprioritisation of UGS planning in the context of land exploitation (Fuller and Kevin., 2009; Haaland and van den Bosch., 2015; Lin et al., 2014). Urban shrinkage – decreased use and occupancy of urban space due to urban population declines – often leads to abandonment of existing UGS, although it also potentially opens up possibilities for re-greening and rewilding (Derkzen et al., 2017; Haase et al., 2016).

Further, Eastern European countries have been recent arenas for armed conflicts, most notably the Russian invasion of Ukraine in 2022, which has dramatically heightened instability throughout the region and threatens global Sustainable Development Goals (SDGs) (Pereira et al., 2022; Sousa et al., 2022; Tollefson, 2022). Several studies have shown that UGS often incurs severe damage during armed conflicts (Lacan and McBride, 2009; Stilgenbauer and McBride, 2010). Many Eastern European cities have also experienced indirect effects of armed conflicts in terms of a rapid influx of refugees resulting in increased pressures on natural capital. This turbulence creates a unique and immense set of challenges for policy-makers and urban planners in Eastern Europe, which are exaggerated by multiple simultaneous crises relating to global climate change, land use change and biodiversity loss (IPBES, 2018; Zeitlin et al., 2019). There is therefore an urgent need for context-relevant knowledge to facilitate the critical work of (re-)building more inclusive, safe, resilient and sustainable cities (SDG11) in this region.

UGS contributes to global policy objectives by generating comprehensive ecological and social benefits essential for human well-being (Elbakidze et al., 2022; Elmqvist et al., 2015; Hartig and Kahn, 2016; Kabisch and Haase, 2013; Pinto et al., 2022; Reyes-Riveros et al., 2021). UGS also improves environmental sustainability, supports ecological diversity, and helps cities to adapt and mitigate climate change (Lovell and Taylor, 2013; Pataki et al., 2011). Recent evidence suggests that increased use of UGS helped to maintain the mental and physical health of the urban population during the COVID-19 pandemic (Ugolini et al., 2020). Moreover, numerous studies from different contexts have shown that interaction with UGS can quicken healing times, reduce stress, and bring psychological benefits for children and adults (Tidball and Krasny, 2014). Such benefits may be of relevance in Eastern Europe, for example to address traumatic effects of armed conflict on people's mental and physical health (Pereira et al., 2022; Sousa et al., 2022; Tidball and Krasny, 2014). However, to obtain these benefits, people must choose to use UGS (Hitchings, 2013; Lin et al., 2014).

While a growing number of studies explore different factors influencing human interactions with UGS (Elbakidze et al., 2022; Hong et al. 2019; Palliwoda et al., 2017), most concern countries in Western Europe and the U.S., albeit with increasing research from China (Kabisch et al., 2015; Konijnendijk et al. 2011). The few studies to date that have explored UGS in Eastern Europe have primarily focused on comparing Soviet-era urban green planning with planning approaches established during the transition period (Hirt, 2013; Pichler-Milanovic et al., 2007). More recent studies have focused on factors that trigger changes in UGS availability (Badiu et al., 2019), and public perceptions, preferences and attitudes towards UGS in post-socialist countries (Ostoić et al., 2020). Kronenberg et al. (2020) investigated the contributions of UGS to environmental justice in Central and Eastern Europe, concluding that planning and investment for UGS were under-prioritised in this region. More extensive studies on UGS in different contexts across Eastern Europe are needed to better understand how to achieve global policies related to human well-being in diverse and contrasting political, economic and socio-cultural contexts.

Our study aims to explore and compare the frequency of people's interactions with UGS in an Eastern European context. The general concept of UGS is increasingly used in numerous disciplines, and the definitions of UGS and its implications often depend on the disciplinary context. Taylor and Hochuli (2017) argue that the concept of UGS remains inconsistent across disciplines. Based on the review of multiple studies, they proposed to use two interpretations of UGS. The first is based on nature or natural areas and refers to landscape vegetation and water objects of different sizes. The second interpretation is related to open space in an urban environment and related just to various types of urban vegetation. This study combines these two interpretations and identifies UGS as a broad spectrum of vegetated (green areas) and water objects (blue areas) of different sizes within urban and peri-urban areas. These green and blue areas are characterized by varying human interventions and provide multiple benefits important for human well-being and biodiversity.

We focus on three Eastern European countries – Armenia, Georgia and Ukraine – which have all undergone political, economic, and cultural transformation towards a market-oriented economy since the collapse of the Soviet Union in 1991. Existing studies on UGS in Armenia, Georgia, and Ukraine, in either native languages or English, are minimal in terms of number, topics and scale. Scholars have focused mainly on the effects of UGS on the urban environment, including microclimate, noise and air pollution; usage, management and inclusion of UGS in newly built residential districts (Dmytruk et al., 2010; Lesnik and Girs, 2015; Nazaruk and Zhuk, 2013; Sayadyan et al., 2005). We found only a few studies that explored people's preferences for UGS using field data. For example, Pelyukh and Zahvoyska (2018) studied people's preferences for the recreational forest in Lviv, Ukraine, which revealed the importance of species diversity, distance and recreational amenities for more frequent usage of this type of UGS. Recently, Buchavyi et al. (2023) analysed UGS dynamics in different functional zones in a large Ukrainian industrial city (Dnipro, Ukraine) and quantified seasonal variation in greening degree.

We focus on the following research questions: How often do people use UGS in Armenia, Georgia, and Ukraine? What are the main factors that affect the frequency of people's interactions with UGS in these countries? What categories of UGS do people prefer to use and for what types of activities? How do people perceive availability, accessibility, and quality of UGS? Our overarching objective is to generate necessary knowledge needed to assist the planning and management of UGS in Eastern European countries and thereby provide help in achieving SDGs.

2. Methods

2.1. Armenia, Georgia and Ukraine as case studies

Armenia covers an area of 29 743 sq. km and is located in the Southern Caucasus region with a population of roughly 3 million (Fig. 1 and Table 1). Although the population is ageing and shrinking due to increasing life expectancy, low birth rates and a high emigration rate, urbanisation remains high in Armenia (Anon., 2019). More than 63% of the population lives in cities, and nearly 57% of the urban population is concentrated in the capital, Yerevan. All other regions experienced depopulation, with significant differences among the regions.

At the national level, there are no specific greening programs in the urban and peri-urban areas, and municipalities are responsible for UGS planning and management (Anon., 2019). UGS in Armenia is divided into three functional zones with different regulations for usage and management. Zone 1 is for general use (public parks and gardens, small parks and other publicly accessible UGS); zone 2 is for limited usage (surrounding different state or private organisations or factories); and zone 3 is for special use (graveyards, along streets, around waterways and water reservoirs) (Knuth, 2006). According to government documents, urban centres should comprise at least 40% of UGS (Anon., 2008). However, since 1990, Armenia has lost 40% of UGS, primarily due to the war with Azerbaijan in 1988–1994 during which massive illegal timber cutting occurred to procure firewood. UGS in zones 1 and 3, and in peri-urban areas were particularly affected (Knuth, 2006; Moreno-Sanchez and Sayadyan, 2005; Morin et al., 2021; Sargsyan, 2007). Current national urban development norms state the minimum provision of UGS to be 16 sq. m/person. However, the actual value

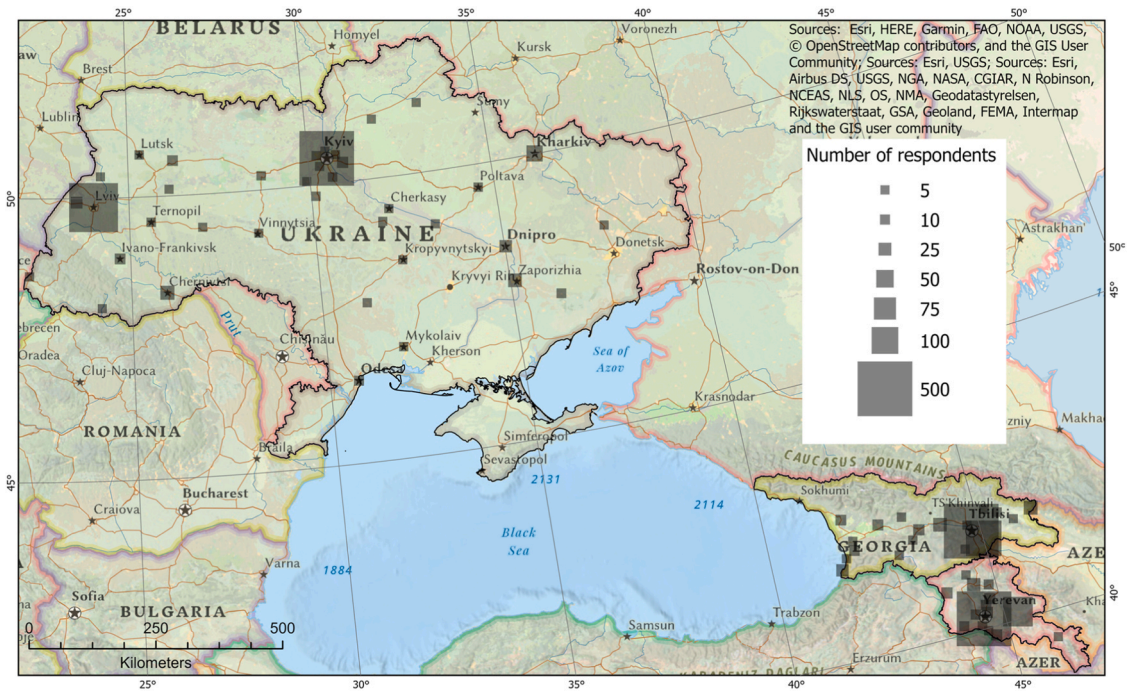

Fig. 1. Location of Armenia, Georgia and Ukraine as case studies and geography of respondents.

Table 1
Characteristics of Armenia, Georgia, and Ukraine as case studies.

	Armenia*	Georgia* *	Ukraine* **
Geographical size (sq. km)	29 743	69 700	603 700
Capital	Yerevan	Tbilisi	Kyiv
Total population (M)	2 976 800	3 736 400	41 167 335
Urban population (%)	63	60.3	69.7
Population density (residents per sq. km)	100	65.3	68.2
Forest cover (%)	11.2	40.3	15.9
UGS per capita	7.8	No official data	16.3
Legal status of UGS	Publicly owned with open access	Publicly owned, open access	Publicly owned, open access
Responsible body for management of UGS	Municipalities	Municipalities	Municipalities
Armed conflict	1988–1994 2023–on-going	1990–1993 2008	2014- on-going
Former USSR republic	1922–1991	1922–1991	1918–1991 (Eastern and Central parts) 1939–1991 (Western part)

Sources: * for Armenia - https://www.gov.am/en/geography, https://www.gov.am/en/demographics, https://www.yerevan.am/hy/nature-protectiona, * * for Georgia - https://www.president.gov.ge/en/page/sakartvelos-shesaxeb; www.geostat.ge. 2023; https://www.geostat.ge/media/49756/GAREMO_geo_2021.pdf, Code of Spatial Planning, Architectural and Construction Activities of Georgia", Law of Georgia, https://matsne.gov.ge/en/document/view/4276845?publication= 22, 2018 and * ** for Ukraine https://ukrstat.gov.ua/druk/publicat/kat_u/2022/zb/05/zb_%D0%A1huselnist.pdf State; Forest Resources

varies from 1.12 to 9.85 sq. m/person across the country.

Georgia covers an area of 69 700 sq. km and has a population of 3.7 million, of which 57.2% live in urban areas (GeoStat, 2017) (Fig. 1 and Table 1). The country is also located in the Southern Caucasus region. Tbilisi, the capital of Georgia, encompasses more than half of the urban population and almost 30% of the overall population nationwide (Salukvadze and Golubchikov, 2016). Following political conflicts in the early 1990s and the Russian-Georgian war of 2008, the Russian Federation currently occupy two areas of Georgia – Abkhazia and South Ossetia. These events have triggered mass emigration, with the population declining from 5.4 to just 3.7 million during the past 25 years (Salukvadze and Meladze, 2014; Salukvadze and Golubchikov, 2016). As in Armenia, there is no national program for UGS development and municipalities are responsible for UGS planning and management. During the Soviet period, cities with a population > 0.5 million people were required to provide at least 15 sq. m of UGS per person (ENVSEC, 2011). Rapid urbanisation has led to a reduction in UGS all over Georgia, primarily in Tbilisi. For example, UGS in Tbilisi declined from 13 to 5.6 sq. m/person between 1983 and 2001. Among the challenges in UGS planning is a need for new UGS inventory data with information about the availability and quality of UGS, including their ecological and recreational value (https://tbilisi.gov.ge/page/green-city?lang=en). Recent official documents (e.g., Report of the Public Defender, 2019) point out that it is crucial to enhance the accessibility of UGS, establish national norms of city greening, and improve UGS planning.

Ukraine is the second largest European country by land area and covers 604,000 sq. km (Fig. 1 and Table 1). In January 2022, the total population was 41.2 million, excluding territories occupied by Russia in 2014, which amounted to approximately 20% of Ukraine's territory. Ukraine's population has declined sharply as a result of an overall ageing trend, a significant decline in fertility, out-migration and annexation of territories (Anon., 2015). Following the most recent Russia invasion in 2022, six million fled to neighbouring countries, while seven million people were displaced inside Ukraine. At the beginning of 2022, more than 69% of the population was in cities. According to Ukrainian law, UGS is divided into three groups with different regulations for usage and management (Anon., 2006). Group 1 is for general use and includes public parks and gardens, small parks, botanical gardens, zoos, gardens among residential buildings, forest parks and other publicly accessible green spaces. Group 2 is UGS for limited usage. This group includes UGS associated with public and residential buildings, schools, children's, higher and secondary educational institutions,

vocational schools, healthcare institutions, industrial enterprises and warehouse zones, sanatoriums, cultural and educational and sports and health facilities and others. Finally, group 3 is for special purposes and includes UGS along transport highways and streets, in sanitary and protective areas around industrial enterprises, exhibitions, cemeteries and crematoria, high voltage power lines, forest reclamation, water protection, wind protection, anti-erosion, plantations of nurseries, flower farms, off-road plantations within settlements. National legislation defines local authorities in urban and rural settlements as responsible for maintaining and monitoring UGS (https://zakon.rada.gov.ua/laws/show/2807–15#Text). More than half of regional centres in Ukraine do not meet the World Health Organisation's minimum standard (9 sq. m/person of UGS). The recent governmental regulation requires that large parks (more than 100 ha) and urban forests should make up more than 10% of the total area of UGS in settlements; city parks should be accessible within 20 min of residences, and district parks within 15 min; vertical gardens and other innovative types of UGS should be created (Anon., 2019).

2.2. Data collection

An unrestricted, self-selected online survey was used to collect data across the three selected countries. An internet-based questionnaire previously applied in Sweden (Elbakidze et al. 2022, Dawson et al. 2023) was updated to ensure relevance to the contexts in Armenia, Georgia, and Ukraine. Updates were minor and included e.g., a new question concerning the use of dachas (summer houses), the option to select 'military service' under employment status, the option to select games such as chess and nardy that are commonly played in the region as a desired use of UGS, etc. Questionnaires were then translated into three national languages – Armenian, Georgian and Ukrainian – and tested using face-to-face interviews in each country and subsequently edited to avoid misinterpretations due to translation. The questionnaire began with a brief introduction explaining the purpose of the survey and how collected data would be stored, used, and reported. A total of 64 questions were organised into three domains (see Appendix 1): (1) individual characteristics of respondents, including socio-demographics, self-reported nature connectedness, perceived constraints limiting UGS usage, and perceived problems associated with UGS (2) perceived characteristics of UGS that includes benefits, and availability, quality, and accessibility of UGS in and around settlements where respondents live; (3) preferences of respondents that contain questions on the desired state of UGS, types of UGS used, and types of activities in UGS. The third domain included a comprehensive list of various types of UGS, which were categorized using the UGS typology developed by Cvejić et al. (2015). This typology encompasses a wide range of vegetated (green areas) and aquatic features (blue areas) of various sizes within urban and peri-urban areas. We allowed respondents to select an unlimited number of UGS types that they liked to use. In this way a vote for one preferred type did not preclude a vote for another (see Appendix 1). Our intention with this comprehensive list was twofold: 1) to ensure that our study reflected the variety of different UGS types available to users throughout the case study countries, given the nature of the uncontrolled online survey instrument, and 2) to encourage respondents to consider all types of UGS available to them in their responses rather than focusing merely on the most familiar types, e.g., large parks.

Three online questionnaires in three national languages – Armenian, Georgian and Ukrainian – and English were composed using the Survey Monkey software (www.surveymonkey.com). Data was collected between October 2020 and September 2021. The online questionnaires were distributed widely via the professional and private networks of the authors and multiple digital channels, including social media (Facebook and LinkedIn) linked to professional and personal networks associated with diverse stakeholders. Data was collected anonymously and did not allow for the personal identification of individual respondents.

2.3. Data analysis

To ensure coherent frequencies, we combined several cohorts where possible. For *frequency of use* we combined *have no access to such area* (n = 55), *never* (n = 11), and *almost never* (n = 203) to become *(almost) never* (n = 269). For *level of education*, we combined *primary school* (n = 19) and *secondary school* (n = 297) to become *primary or secondary school* (n = 316). For age, we combined *71–80* (n = 338) and *81–90* (n = 38) to become *71–90* (n = 376). For *number of children*, we combined *3* (n = 280), *4* (n = 83), *5* (n = 22), *6* (n = 11), *7* (n = 2), *8* (n = 1), *9* (n = 2), *10* (n = 3) and *12* (1) to *3 +* (n = 405). For gender, we excluded *other genders* (n = 14), since this group was considerably smaller than *male* (n = 987) and *female* (n = 2560). As such, the dataset was reduced from 3573 respondents to 3559 respondents.

The data was analysed using R (R Core Team, 2022) and RStudio (RStudio Team, 2022). Since *frequency of use* was investigated using an ordinal response scale (*never, almost never, once a month, once a week, several times a week, every day*) and most of the explanatory variable were either nominal (e.g., gender, perceived characteristics of UGS, types of activities) or ordinal (e.g., age, gender, distance to UGS), we conducted multiple ordinal logistic regressions. For each categorical predictor, one category was used as a reference category, against which remaining categories were systematically compared. Predictor variables included individual characteristics of respondents (socio-demographics, self-reported nature connectedness, perceived constraints of UGS usage), perceived characteristics of UGS (perceived benefits, accessibility, availability and quality of urban greenspace) and preferences of respondents (desired state of UGS, type of UGS, types of activities in UGS).

Odds ratios were used to determine if significant effects ($p < 0.05$) were meaningful using Sullivan and Feinn (2012) classification: > 1.5 (small effect), > 2 (medium effect), > 3 (large effect), with the multiplicative inverse (1/x) of the classification for negative effects. We used Spearman's rank correlation to investigate *perceived quality, perceived availability* and *perceived accessibility of UGS*, as these were measured as numeric variables. The r^2 was used to determine if significant effects ($p < 0.05$) were meaningful using Sullivan and Feinn (2012) classification: >0.04 (small effect), > 0.25 (medium effect) and > 0.64 (large effect). We considered all variables shown to have at least a small effect according to the above criteria as "key factors". Finally, descriptive statistics were used to illustrate use, preferences for and perception of UGS.

3. Results

3.1. Frequency of UGS use, preferences for and perceptions of UGS

A total of 3573 respondents completed the survey (N = 1142 in Armenia, N = 1069 in Georgia and N = 1362 in Ukraine). The respondents' socio-demographic characteristics and geographical coverage are further elaborated in Appendix 2 and Fig. 1.

Across the three countries, approximately 35% of respondents visited greenspace frequently (several times a week or every day), 20–33% once a week, 28–36% once a month and 4–10% never (Fig. 2). The highest proportion of daily users (11%) was in Armenia, weekly users (33%) in Ukraine, monthly users (36%) in Georgia and non-users (10%) in Armenia.

Respondents used all 16 types of UGS listed in the questionnaire located along an urban-peri-urban gradient (Fig. 3). Between 72% and 92% of respondents selected large parks as UGS that they liked to visit the most across the three countries. Other popular UGS types included small parks in Georgia (66%) and Ukraine (58%); forests, lakes and rivers in Ukraine (81%, 67%, and 62%, respectively); and farmland in Georgia (57%). Conversely, wetlands were among the least visited types in all three countries (8% in Armenia, 6% in Georgia, 10% in Ukraine).

Concerning UGS-related activities, respondents selected all 21

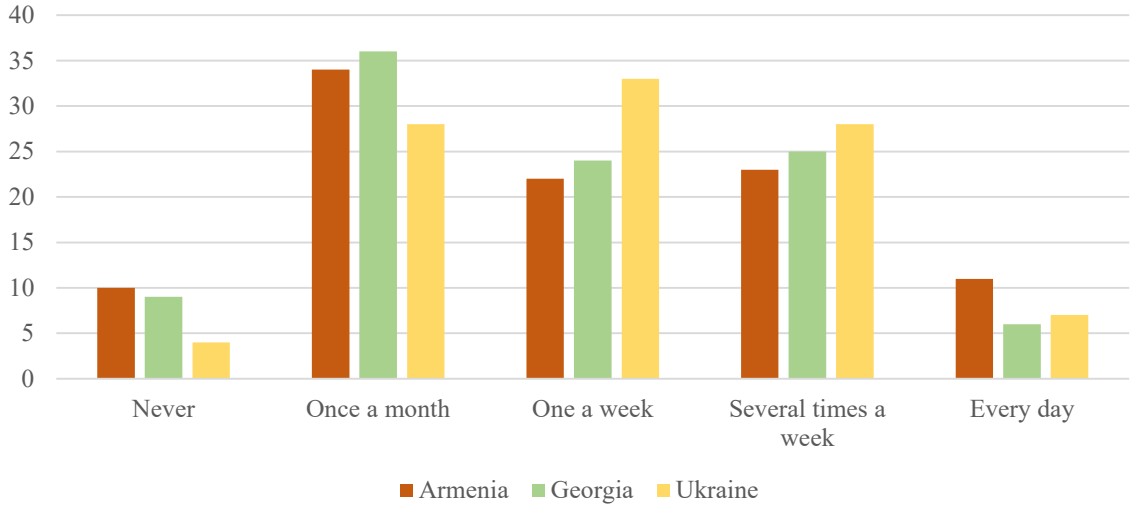

Fig. 2. Frequency of UGS usage (in % of respondents) in each country.

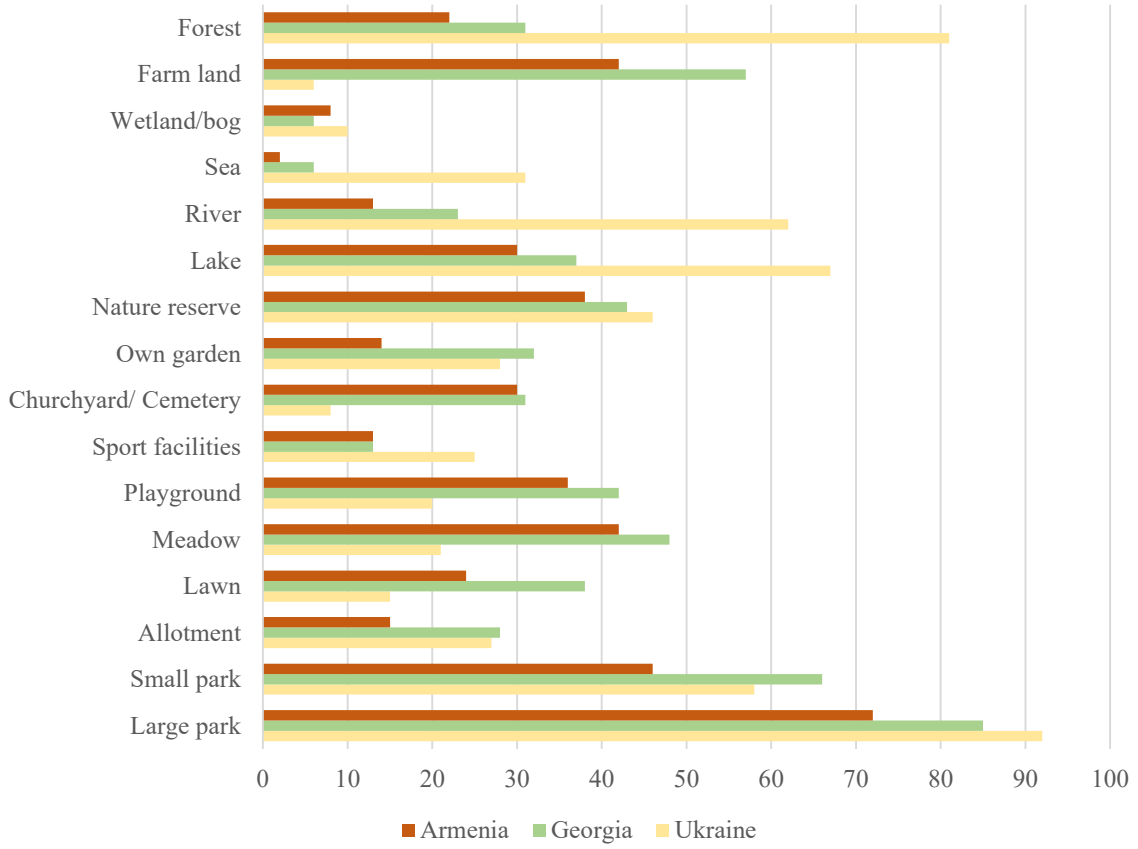

Fig. 3. Proportion of respondents that used various types of UGS in Armenia, Georgia and Ukraine.

activities listed in the questionnaire that they conducted in UGS (Fig. 4). *'Walking'* was the only activity performed by a majority of respondents in all three countries (63% of respondents in Armenia, 83% in Georgia, and 92% in Ukraine). Additionally, more than 50% of respondents selected *'hanging out with friends/family'* in Georgia and Ukraine; *'escape the city'*, *'enjoying the view'*, and *'photography'* in Ukraine; and using greenspace for *'children's play and activities'* in Armenia. On the other hand, the least chosen activities (by less than 10% of respondents) across the three countries were *'dancing'*, *'golf'*, *'winter sports'*, and *'fishing'*; alongside *'outdoor games'* in Georgia and Ukraine, *'swimming'* in Armenia and Georgia, and *'picking plants, berries'* in Georgia.

Between 10% and 18% of respondents were satisfied with the *quality* of UGS across the three countries, 13–18% with its *availability* and 28–39% with its *accessibility* (Table 2). In contrast, 54–61% of respondents were dissatisfied with the *quality* of UGS across the three countries, 45–69% with its *availability* and 28–37% with its *accessibility*.

A majority of respondents in all three countries (58% in Armenia, 56% in Georgia and 52% in Ukraine) identified that *lack of time* prevented them from UGS usage more often. Respondents associated different problems with UGS in and around their settlements (Fig. 5). The majority of respondents in three counties (84% in Armenia, 76% in Georgia and 86% in Ukraine) identified litter as a problem. Fewer than

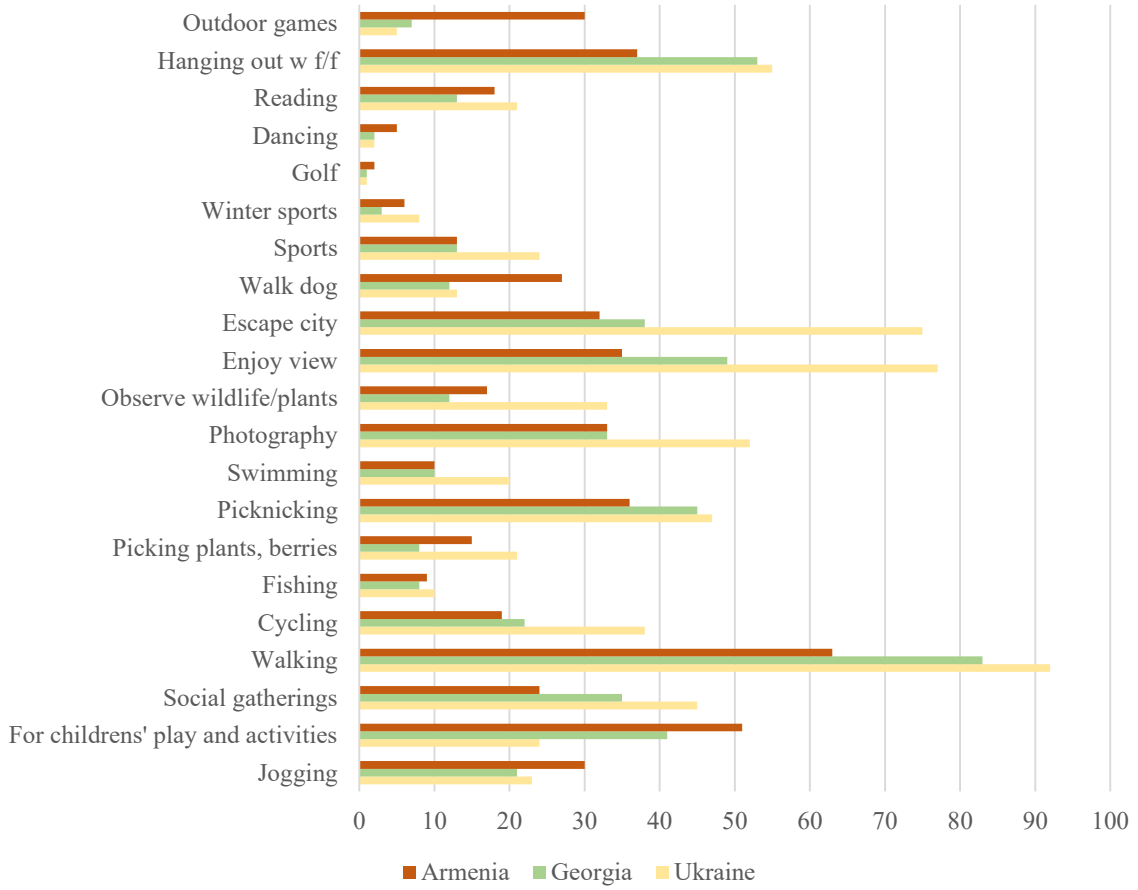

Fig. 4. Proportion of respondents that performed different types of activities in UGS in Armenia, Georgia and Ukraine.

Table 2
Proportions of respondents (%) that acknowledged a state of quality, availability, and accessibility of UGS in towns/cities where they lived.

	Armenia	Georgia	Ukraine
Quality			
Very dissatisfied	19	15	16
Dissatisfied	38	39	45
Neither satisfied nor dissatisfied	33	30	21
Satisfied	9	15	17
Very Satisfied	1	1	1
Availability			
Very dissatisfied	11	23	21
Dissatisfied	34	43	48
Neither satisfied nor dissatisfied	37	21	14
Satisfied	17	12	16
Very Satisfied	1	1	1
Accessibility			
Very dissatisfied	7	11	9
Dissatisfied	21	26	25
Neither satisfied nor dissatisfied	44	35	27
Satisfied	25	26	37
Very Satisfied	3	2	2

Perceived constraints to UGS usage. Out of 10 tested variables, only *'do not want to'* was a key factor in all three countries, with those who reported that they *'do not want to'* visit UGS less likely to use UGS frequently.

20% of respondents stated that they *see no problems* with UGS.

3.2. Key factors linked to the frequency of peoples' interactions with UGS

3.2.1. Individual characteristics of respondents

Socio-demographic characteristics. Among 13 tested socio-demographic variables, '*country of origin*' and '*age*' were identified as key factors for frequency of UGS usage in Armenia, and '*age*' and '*education*' in Georgia (Table 3). People born in Armenia were more likely to use UGS more frequently than those born outside the country, while those 71–80 years old were less likely to be frequent users compared with 18–20 year-olds. In Georgia, older people were also less likely to use UGS frequently compared to younger people, while respondents with a higher level of formal education were more likely to use UGS more frequently than those with lower levels of education. No key factors were found linking socio-demographic characteristics with the frequency of UGS visits in Ukraine.

3.2.2. Perceived characteristics of UGS

Perceived distance to the most visited UGS and *mode of transportation.* We identified two variables – distance to UGS and *'by foot'*– as key factors of the frequency of people's interactions with UGS in Georgia and Ukraine (Table 4). In Georgia, those who lived within 1–3 km of UGS were more likely to be frequent users than those who lived more than 10 km away. However, those who lived less than 100 m from UGS were less likely to visit frequently than those who lived 1–3 km away. In Ukraine, respondents who lived more than 10 km from UGS were more likely to be infrequent users. Respondents who reached UGS on foot were more likely to be frequent users in Georgia and Ukraine than those who used other transport modes.

3.2.3. Preferences of respondents

Preferred type of UGS. Of 16 tested variables, two were identified as key factors (Table 5). In Armenia, users who selected *wetlands* as a preferred type of UGS were less likely to be frequent users. In Georgia, those who preferred *churchyards/cemeteries* were less frequent users.

Type of activities. Three out of 21 tested types of activities were key factors of frequency of people's interactions with UGS. In Georgia,

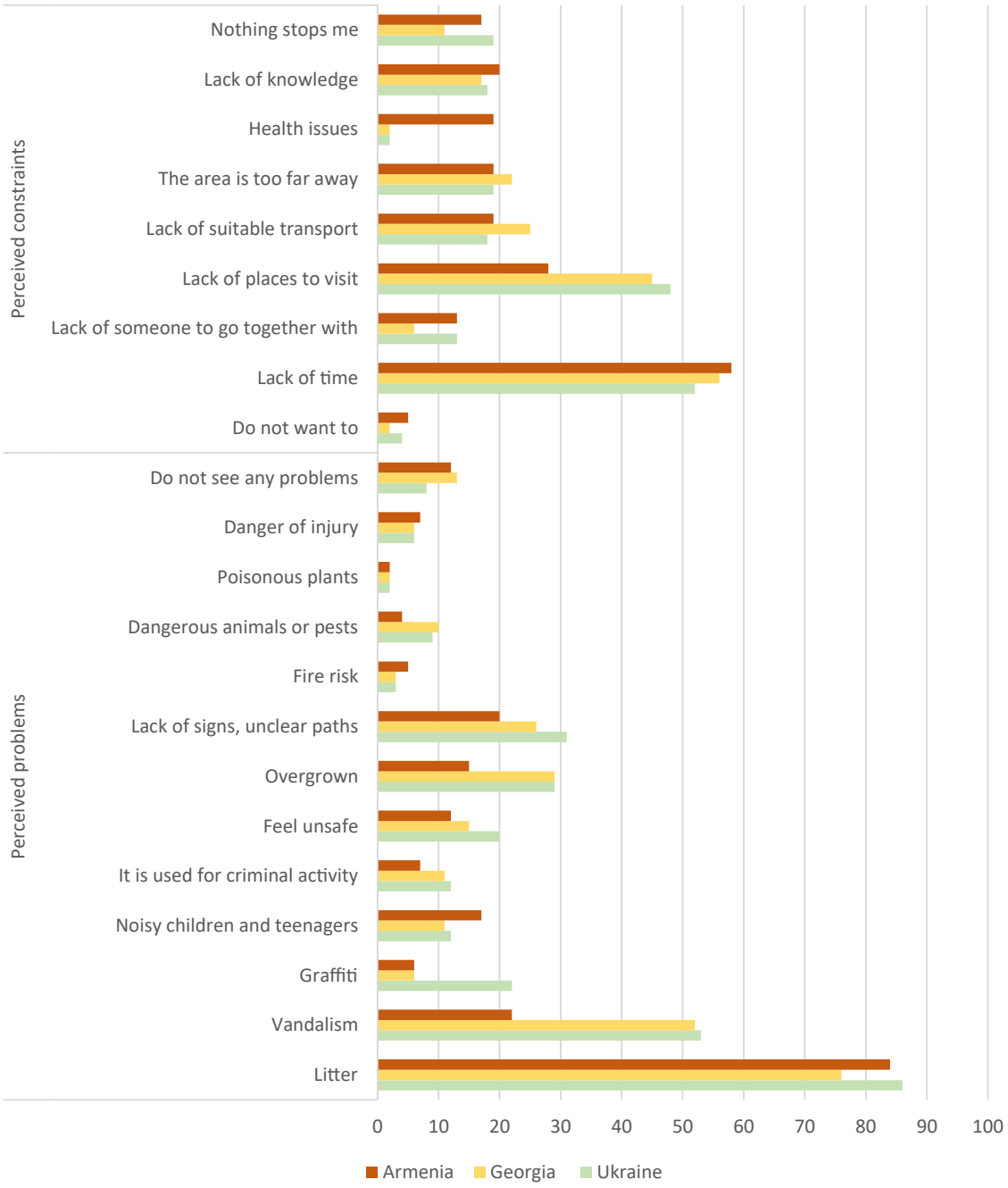

Fig. 5. Perceived constraints to visit UGS more often and perceived problems in UGS (in % of respondents) in Armenia, Georgia, and Ukraine.

people who used UGS for '*walking*' were more likely to be frequent users, while those who selected '*swimming*' were less likely to use UGS frequently. In Ukraine, those who used UGS for '*walking the dog*' were less likely to visit UGS frequently (Table 5). We did not identify any key factors belonging to the group of preferred states of UGS across the three countries.

4. Discussion

4.1. Similarities and differences in people's interactions with UGS across within an Eastern European context

This study contributes to filling knowledge gaps concerning preferences, perceptions and use of UGS in non-EU Eastern Europe. In the following section, we outline five overarching similarities in use, perceptions of, and preferences for UGS among respondents in Armenia, Georgia and Ukraine. First, overall, the proportion of infrequent users in Armenia, Georgia, and Ukraine appears to be higher compared to certain Western European contexts. We found that 32–45% of respondents in the three countries were classified as infrequent and non-users, while fewer than 11% used UGS every day. This result contrasts with recent surveys in Northern Europe, which indicated notably higher proportions of frequent UGS users. For example, an analogous study in Sweden applying the same methodology indicated that only 2% were infrequent or non-users with 29% used UGS every day (Elbakidze et al., 2022). On the other hand, according to a nation-wide survey in the UK, 32% of respondents were infrequent users of UGS (Flowers et al., 2016). This discrepancy underscores the intricate influence of cultural, socio-economic, and biophysical contexts that remain not fully comprehended. The frequency of UGS usage is affected by multiple factors

Table 3
Key factors related to individual characteristics of respondents ($p < 0.05$) linked to greater frequency of interactions of urban people with UGS in Armenia, Georgia, and Ukraine. All key factors were significant ($p < 0.05$) and had either small (+), medium (++) or large effect (+++).

Explanatory factor	Value	*p*-value	Odds Ratio	Effect size
Socio-demographic characteristics				
Armenia				
Age (Ref=18–20)				
71–90	-1.82	0.002 * *	0.16	+ ++
Country of origin: born in Armenia (Ref=No)				
Yes	0.58	0.047 *	1.79	+
Georgia				
Age (Ref=18–20)				
41–50	-0.99	0.006 * *	0.34	+ +
51–60	-1.09	0.004 * *	0.33	+ ++
61–70	-0.94	0.043 *	0.39	+ +
Education (Ref=College)				
University	0.58	0.028 *	1.78	+
Perceived preventions to UGS usage				
Armenia				
Do not want to	-0.64	0.018 *	0.53	+
Georgia				
Do not want to	*-0.94*	0.036*	0.39	+ +
Ukraine				
Do not want to	-0.63	0.017 *	0.53	+

Perceived problems in UGS. Of 13 tested variables, only one was identified as a key factor. In Georgia, those who reported *'feels unsafe'* in UGS were less like to use UGS frequently (Table 4). No key factors were identified belonging to perceived benefits of UGS, nor concerning perceived accessibility, availability or quality of UGS.

Table 4
Key factors related to perceived characteristics of UGS ($p < 0.05$) linked to greater frequency of interactions of urban people with UGS in Armenia, Georgia, and Ukraine. The key factors had either small (+), medium (++) or large effect (+++).

Explanatory factor	Value	p-value	Odds Ratio	Effect size
Perceived distance to the most visited UGS and mode of transportation				
Georgia (Ref= 1 – 3 km)				
More than 10 km	-0.91	0.0004 * **	0.40	+ +
Less than 100 m	-0.80	0.0004 * **	0.45	+ +
By foot	0.58	0.0005 * **	1.77	+
Ukraine (Ref= 1 – 3 km)				
More than 10 km	-0.72	0.003 * *	0.48	+ +
By foot	0.61	0.0007 * **	1.82	+
Perceived problems in UGS				
Georgia				
Feels unsafe	-0.50	0.006 * *	0.61	+

Table 5
Key factors related to preferences of respondents ($p < 0.05$) linked to greater frequency of interactions of urban people with UGS in Armenia, Georgia, and Ukraine. The key factors had either small (+), medium (++) or large effect (+++).

Explanatory factor	Value	*p*-value	Odds Ratio	Effect size
Preferred type of UGS				
Armenia				
Wetland	-0.94	0.025 *	0.39	+ +
Georgia				
Churchyard/Cemetery	-0.46	0.010 *	0.63	+
Type of activity in UGS				
Georgia				
Walking	0.64	0.0007 * **	1.90	+
Swimming	-0.41	0.036 *	0.66	+
Ukraine				
Walking the dog	-0.54	0.0004 * **	0.58	+

(Elbakidze et al., 2022), and as such, is likely intertwined with contextual variations in a number of factors.

Second, a low proportion of respondents (ranging from 10% to 18%) was satisfied with quality and availability of UGS in Armenia, Georgia and Ukraine. Many studies linked the quality, availability, and accessibility of UGS with the frequency of UGS use (e.g., Dinda and Ghosh, 2021; Gozalo et al., 2019; Grodzynska, 2008; Elbakidze et al., 2022). Moreover, suitable provision of UGS is considered an issue of environmental justice (Kronenberg et al., 2020). In Armenia, Georgia and Ukraine during the Soviet regime, the policy to enhance UGS and ensure its equitable distribution across urban regions was rooted in a robust political foundation, aligning with socialist ideals. Dushkova et al. (2020) show that urban greening policy served as a means to establish socially inclusive UGS, intended to benefit all segments of the population, rather than solely privileged groups. Unfortunately, many UGS were lost during the transitional phase, attributed to deficiencies in urban management and planning (Haase et al., 2019), armed conflicts, and corruption spanning various levels of governance (Kronenberg et al., 2020).

Third, our study indicates that respondents in Armenia, Georgia and Ukraine use various UGS types, with the strongest preference for parks. Most respondents preferred large urban parks, followed by small parks, in all three countries. In contrast, many surveys from Nordic countries show that natural areas with old trees, multi-layered vegetation structures, and simple recreational facilities are often preferred as recreational environments (Aasetre et al., 2016; Gundersen and Frivold, 2008). One explanation might be the historical significance of urban parks in Armenia, Georgia and Ukraine, where these areas function as recreational attractions and important cultural landmarks. As in many contemporary countries, parks were considered key flagship categories of UGS in formal urban planning during the Soviet period, with large urban parks considered critical spaces for citizens' health and well-being. Even if the quality and maintenance of these parks varied, they were often well-funded compared to other types of UGS.

Fourth, a substantial portion of respondents perceived a broad range of constraints with UGS usage, while fewer than 20% of respondents stated that 'nothing stops me' from using UGS more often or that they "see no problems" with UGS. Notably, litter and lack of time emerged as the most prevalent constraints perceived across the three countries, followed by concerns regarding vandalism (with the exception of Armenia). Scholars have shown that incivilities such as litter and vandalism deter people from spending time in UGS as they generate suspicion and distrust and also disturb expectations of serenity that are important for many UGS users (Dawson et al., 2023; Bedimo-Rung et al., 2005; Sreetheran and van den Bosch, 2014; Palliwoda and Priess, 2021). UGS that are well-maintained, clean, and safe are more likely to be used often, while those that are poorly maintained or perceived as unsafe may be avoided (Akpinar, 2020; Dawson et al., 2023; Duncan and Mummery, 2005; McCormack et al., 2010).

Fifth, walking for leisure was the most common activity in UGS in all three countries. UGS are usually designed with paths and trails for walking, and people of all ages and fitness levels can enjoy this activity. Walking is commonly found to be the most preferred UGS activity in different contexts (García de Jalón et al., 2021; Gozalo et al., 2019; Song et al., 2015; Zwierzchowska et al., 2018). Our study also showed that UGS is used for individual-focused activities, such as escaping the city and reading, and more social activities, like hanging out with friends and family, picnicking, and social gatherings.

Finally, while we identified similarities across the three studied countries, our analysis revealed several differences regarding preferred types of UGS and favored activities, particularly in the context of Ukraine compared to Armenia and Georgia. For example, a more significant proportion of respondents in Ukraine selected a more diverse set of UGS which they liked to visit the most compared to respondents in Armenia and Georgia. Ukrainian respondents displayed a greater preference for forests and aquatic (lake, rivers, sea) ecosystems than

respondents in Armenia and Georgia. At the same time, Armenian and Georgian respondents both appear to prefer farmland, meadows, churchyards/cemeteries, playgrounds and lawns to a greater degree than Ukrainian respondents. Ukrainian respondents exhibited a stronger preference for certain activities compared to their counterparts in Armenia and Georgia. These activities encompassed photography, taking pleasure in scenic views, seeking urban escapism, and engaging in cycling. These differences might be influenced by the context. For example, Ukraine, as a much larger country with more diverse natural and cultural settings, offers greater diversity in UGS, and its much larger population encompasses more diverse perceptions concerning UGS. However, some of these differences may relate to differences between the Ukrainian sample and those of Armenia and Georgia, despite applying the same methodology in all cases. For example, respondents in Ukraine had a more diverse age structure than those from Armenia and Georgia, which were more skewed towards younger cohorts. Ukrainian respondents were also more highly educated and less likely to have children than other country representatives.

4.2. Key explanatory factors of the frequency of people's interactions with UGS in Eastern Europe

We tested 122 factors and identified only 12 unique key explanatory factors linked to the frequency of people's interactions with UGS in the three Eastern European countries (Table 6). There are four core findings related to the key factors.

The majority of identified key factors influencing the frequency of people's interactions with UGS were context-specific, only emerging as significant factors within one of the three studied. They belong to three groups: individual characteristics of respondents (origin, education level), perceived characteristics of UGS (safety) and preferences of respondents for UGS types (wetlands, church/cemetery) and activities (walking, swimming, and walking the dog). This confirms that the frequency of people's interactions with UGS is shaped by diverse sets of factors, often studied by scholars separately (Farahani and Maller, 2018). Therefore, the importance of interdisciplinary research becomes evident to gain a holistic understanding on how to enhance and improve people's interactions with urban nature which is crucial if we want to make our cities more inclusive, safe, resilient and sustainable (SDG11) (James et al. 2009).

The only common key factor across the three studied countries was that respondents who stated that they *'do not want'* to use UGS are also less likely to be frequent users. While this seems evident, this unwillingness may be linked to a variety of factors (e.g., Dawson et al. 2023), including personal characteristics (e.g., age, origin), perceived quality (e.g., lack of amenities), accessibility (e.g., too far) and availability (e.g., lack of places to visit) of UGS. Cultural attitudes to outdoor activities and lack of awareness about the benefits provided by UGS could also affect the willingness of people to use UGS. Furthermore, the work of Soga and Gaston (2016) underscores a concerning trend where individuals are progressively less likely to engage in direct contact with nature as part of their daily routines, a phenomenon termed the "extinction of experience". They illustrate that the loss of interaction with nature diminishes a wide spectrum of health and well-being benefits, but also fosters adverse effects on positive emotions, attitudes, and behaviors towards nature. Moreover, Pergams and Zaradic (2006) show that in our digital era there is a human tendency to focus on passive indoor activities involving electronic media instead of spending time outdoor in nature. As highlighted in Dawson et al. (2023), these findings underline a need to deepen current knowledge regarding constraints to UGS usage if we want to improve the interaction of people with urban nature. We argue that this knowledge is particularly needed in Eastern European countries due to the relative infrequency of use and the limited research on this topic. Scholars also argue that fostering a stronger connection between people and the natural environment is increasingly crucial for engaging individuals in the sustainable management and governance of nature, given the significant impacts of urgent environmental challenges such as climate change, biodiversity loss, and land degradation (IPBES, 2018; Dickson and Gray, 2022).

Table 6
Common and specific key factors affecting the frequency of UGS usage in Armenia, Georgia and Ukraine.

	Common key factor	Specific key factor		
		Armenia	Georgia	Ukraine
Individual characteristics of respondents	'do not want to'	Age Origin	Education	
Perceived characteristics of UGS			Perceived distance to UGS 'by foot' Feels unsafe	
Preferences of respondents		Wetland	Church/ Cemetery Walking Swimming	 Walking the dog

Age was also a common key factor in both Armenia and Georgia, where older people were less likely to use UGS frequently than younger people. Literature shows that retaining physical and psychological function in later life is essential to 'active ageing' (Blondell et al., 2014; Carvalho et al., 2014; Dalton et al., 2016). By contrast, many studies show that older people in developed countries are more frequent users than younger people (e.g., Elbakidze et al. 2022). We did not investigate causal links among different explanatory factors. However, the low frequency of UGS usage by older people may be linked to the perceived low quality and availability of UGS in these countries. Another reason could be safety concerns, the key factor linked to the frequency of UGS use in Georgia. Some older adults may perceive UGS as unsafe due to poor lighting, insufficient seating or resting areas.

Distance to UGS and transport mode were also common key factors linked to the frequency of people's interactions with urban nature in Georgia and Ukraine. Those who lived further from UGS or could not access it on foot were less likely to use it often. These results are broadly in line with many studies from other contexts that show that UGS is used more frequently the closer it is to people's homes, with a distance of 300–400 m often mentioned as a threshold after which use frequency declines (e.g., Elbakidze et al., 2022; Grahn and Stigsdotter, 2003). However, in this regard, our results are partly confounding. In Georgia, those who lived less than 100 m from the UGS were less likely to be frequent users.

4.3. Increasing interactions with urban nature

Our findings suggest a need for urban planners and managers in Eastern Europe to consider and integrate diverse factors influencing people's willingness to interact with urban nature. Based on our study, we propose the following actionable steps. To start, urban planners could prioritize improving the availability, accessibility, and quality of UGS. Regarding availability, while large parks are often the preferred choice, considering the ongoing urban densification in regions such as Armenia, Georgia, and Ukraine, as well as the potential qualitative and quantitative losses of UGS due to on-going armed conflicts, establishing additional large parks may not be feasible. Research has shown that various types of UGS play complementary roles in providing benefits to urban citizens (Liu et al., 2017). Therefore, a balance may be struck by providing diverse types of UGS, including both smaller and larger ones (Schipperijn et al., 2010) to increase opportunities for daily recreation. Additionally, political will at different governance levels is essential to protect existing urban parks from conversion to buildings and infrastructure. While ensuring the accessibility of UGS is crucial issue, further research is required as few studies have assessed and measured the accessibility of UGS in Eastern European contexts. More generally, it is necessary to consider whether accessibility should be assessed for all

UGS or only for specific types, and to better understand the importance of differences in user preferences and perceptions when assessing accessibility. Regarding quality, even if some generic traits could be proposed there is a lack of evidence on what constitutes UGS quality in different Eastern European contexts. Moreover, many cities in Armenia, Georgia and Ukraine UGS lack sufficient inventory data concerning the availability and quality of UGS, including ecological and recreational values. The lack of such data is a core challenge for UGS planning in the region (https://tbilisi.gov.ge/page/green-city?lang=en). In this respect, improved availability and quality of remote sensing data offers considerable potential (Chen et al., 2018). More research is also needed to explore how people in Eastern European contexts perceive quality concerning the biophysical characteristics, design, amenities, and safety aspects of UGS, as well as how these qualities relate to various benefits for human well-being *sensu* (Nguyen et al., 2021).

Understanding how to attract infrequent users, particularly those who are reluctant to visit UGS and older people in Eastern European countries, could be of particular help in guiding the redesign or maintenance of UGS (Reyes-Riveros et al., 2021). We suggest that improvements in the quality and availability of UGS might increase the frequency of UGS visitation. Planning, design, and management of UGS that is suitable for older users is an increasingly important task for urban planners given rapid global growth in older demographic cohorts, and the increasing concentration of older individuals in urban areas. However, there is still a lack of knowledge regarding older people's preferences for nature-based recreation. Wen et al (2018) show that existing studies primarily focus on walking and general physical activity of older people in UGS. More knowledge is needed to understand older people's emotional ties with different types of UGS, the potential uses of UGS for local cultural activities, and other forms of social interaction. We argue that providing UGS that supports active aging is particularly crucial in Eastern European countries, where societal turbulence has left many older people financially disadvantaged. There are different ways to enhance use of UGS by old people. For example, access limitations can be partly compensated by increasing the mobility of the elderly (Wen et al. 2020). In general, creating inclusive and age-friendly UGS might contribute to enhancing the quality of life of older people in urban and peri-urban areas.

We also suggest that addressing vandalism and litter in UGS is essential to improve their use and create a welcoming environment for visitors. Organizing educational campaigns to raise awareness about the negative impacts of vandalism and littering, as well as the importance of keeping UGS clean and respecting public property, could be effective (Hansmann and Steimer, 2015). Encouragement of activities that promote positive use and enjoyment of UGS can further support these efforts. Lack of time is also a significant constraint to UGS use for many individuals in diverse contexts (Dawson et al., 2023; Holt et al., 2019). Addressing this issue might involve considering how UGS can be conveniently located, offering accessible and time-efficient activities, and promoting the overall value and benefits of spending time in nature for physical and mental well-being. Additionally, creating awareness about the positive impact of UGS visits on stress reduction and overall well-being can encourage people to make time for such experiences.

Finally, we suggest that a big step in improving people's interaction with urban nature might be a more inclusive UGS planning approach. For example, Maisuradze (2019) argues the crucial importance of public involvement in the development of urban policy in Georgia. Currently, UGS planning in all three countries is top-down, following governmental and municipal regulations with formal public involvement in the planning process. Rather than advancing one-size-fits-all solutions, there is a need for a broader view concerning the quality, availability, and accessibility of UGS from the perspectives of different groups of the society. Haase et al. (2017) suggest that there is a need for a multi-actor governance structure to steer greening agendas in cities. Such governance structures may include national and local governments, together with civil society organizations, to ensure inclusive representation of all residents.

4.4. Limitations of the study

We applied a self-selected online survey. This method may result in selection bias because respondents are not systematically chosen from all relevant sections of a population. Although we employed multiple sampling procedures to mitigate such potential biases (see Methods), women were overrepresented in our sample compared to men; respondents with university education were better represented than those with a lower level of education; and older cohorts were less represented than other age groups. Additionally, females tend to cooperate more often with surveys than males (Porter and Umbach, 2008; Dillman et al., 2014; Smith, 2008), and this difference may be due to differences in social norms and communication styles, cultural and gender norms, availability and specific survey design features (Dillman et al., 2014, Galesic & Bosnjak 2009, Couper & Miller, 2008). While these biases could have implications for the interpretation of results based on the frequency of responses, the inclusion of gender, education level and age as predictor variables mitigates the influence of an unbalanced sample on results concerning key factors. Despite this, due to the presence of selection bias, we exercised caution in interpreting results and generalizing findings to the broader population.

Moreover, while all questions in the survey were formulated to identify a general pattern of UGS use, preferences, and perceptions, our data collection period was conducted during the COVID-19 pandemic. We did not collect any information on how respondents understood the questions – whether they interpreted them in a more general way or related them to their UGS use during the pandemic period. Recent studies have noted differences in UGS usage during the pandemic globally, primarily linked to whether a country had lockdown restrictions or not (Bristowe and Heckert, 2023). In the three countries studied here, there were no restrictions on using UGS during the pandemic and we remain unaware of the degree to which frequency of use was affected during the pandemic period. It is possible, for example, the low frequency of use amongst older respondents might be partly explained by a greater sensitivity to recommendations to avoid public places. At the same time, the survey included the following statement '*The nature and green areas in and around my town have been especially important for my physical and mental health during the Corona-virus pandemic'* to which more than 70% of respondents in all three countries selected '*strongly agree'*. This suggests that the overall frequency of UGS use might have been higher during the pandemic than otherwise.

Additionally, interpretations of '*sea*' as UGS varied among respondents in Ukraine. For example, 30% of respondents in Ukraine, when asked the survey question '*What type(s) of nature and green areas in and around your town do you like to use?) (More than one choice is possible),* selected '*sea'* along with other types of UGS. However, many of these respondents did not live close to the Black Sea or Azov Sea. One explanation is that it is common among urban respondents to refer to large water bodies, often water reservoirs, as 'sea.' For instance, citizens in Kyiv often colloquially refer to the large water reservoir on the Dnipro River as 'the sea.' For this reason, interpretation of results concerning '*sea*' should consider that it may include non-maritime waterbodies.

4.5. Conclusion

Numerous studies demonstrate that the interaction of people with urban nature leads to various measurable benefits at both individual and societal levels. This is particularly crucial for countries in Eastern Europe, where human wellbeing has been drastically affected by radical socio-economic transformations and armed conflicts. Given the cumulative impacts of these ongoing societal disruptions in Eastern European countries, it is imperative to maintain and further develop multifunctional UGS to sustain critical benefits for human wellbeing, especially for health and post-trauma recovery. Our study reveals that urban

planners are required to address a multitude of challenges aimed at enhancing the connection of urban residents with UGS. Our findings indicate that the level of interaction of people with UGS remains relatively low in this region, particularly among the elderly population. Furthermore, there is notable dissatisfaction with the quality and accessibility of UGS, and respondents perceive various constraints on their use. As shown in other contexts, the interaction of people with UGS in Eastern Europe appears to be influenced by diverse sets of factors related to socio-demographic characteristics, personal perceptions, and preferences regarding UGS. The majority of these factors are context-specific, which can be explained by differences in biophysical, socio-economic, and cultural contexts among Armenia, Georgia, and Ukraine. 'Do not want to' was the only common key factor across the three countries influencing the frequency of people's interaction with UGS. We suggest at least four actionable steps for urban planners: (i) prioritize improving the availability, accessibility, and quality of UGS; (ii) attract infrequent users, particularly those who are reluctant to visit UGS and older people; (iii) address vandalism and litter in UGS to improve their use and create a welcoming environment for visitors; and (iv) practice an inclusive UGS planning approach to consider a broader view concerning the quality, availability, and accessibility of UGS from the perspectives of different societal groups in UGS planning.

Declaration of Competing Interest

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

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