frontiers in Sustainable Cities

REVIEW
published: 26 October 2021
doi: 10.3389/frsc.2021.755313

Public Perceptions of Urban Green Spaces: Convergences and Divergences

Shah Md. Atiqul Haq[1]*, *Mohammad Nazrul Islam*[2], *Ankita Siddhanta*[3], *Khandaker Jafor Ahmed*[4] and *Mohammed Thanvir Ahmed Chowdhury*[5]

[1] Department of Sociology, Shahjalal University of Science and Technology, Sylhet, Bangladesh, [2] Environmental Policy Institute (EPI), Memorial University of Newfoundland, Corner Brook, NL, Canada, [3] Independent Researcher, Houston, TX, United States, [4] Department of Geography, Environment and Population, The University of Adelaide, Adelaide, SA, Australia, [5] Department of Applied Sociology and Social Work, North East University Bangladesh, Sylhet, Bangladesh

OPEN ACCESS

Edited by:
Diogo Guedes Vidal, Fernando Pessoa Energy, Environment and Health Research Unit (FP-ENAS), Portugal

Reviewed by:
Agnieszka Anna Olszewska-Guizzo, National University of Singapore, Singapore
Eunice Castro Seixas, University of Lisbon, Portugal

***Correspondence:**
Shah Md. Atiqul Haq
shahatiq-soc@sust.edu; shahatiq1@yahoo.com

Specialty section:
This article was submitted to Urban Greening, a section of the journal Frontiers in Sustainable Cities

Received: 08 August 2021
Accepted: 28 September 2021
Published: 26 October 2021

Citation:
Atiqul Haq SM, Islam MN, Siddhanta A, Ahmed KJ and Chowdhury MTA (2021) Public Perceptions of Urban Green Spaces: Convergences and Divergences. Front. Sustain. Cities 3:755313. doi: 10.3389/frsc.2021.755313

In the context of rapid climate change, it is important to understand public perceptions of urban green spaces (UGSs), because green spaces have enormous potential as instruments for climate change adaptation and mitigation, and because the development of such spaces both requires and benefits from public support. This article attempts, through an extensive literature review, to understand convergences and divergences in perceptions of urban green spaces (UGSs) of city dwellers around the world and to identify gaps in the existing research. Additionally, the article explores research into the benefits associated with urban green spaces, including health (e.g., physical and mental), social (e.g., social networks and social relationships), economic (e.g., employment and income generation), and environmental (e.g., ecosystem services and biodiversity). This article further seeks to identify the extent to which urban residents have been found to perceive the roles UGSs can play in climate change adaptation and mitigation, and cultural exchange. Based on studies conducted in different countries over the past decade, this paper integrates environmental, social, cultural, and economic aspects of urban greening to provide insight into the similarities and differences in perceptions of urban green spaces and suggest approaches to building climate change resilient urban communities. This paper finds justification for: encouraging the use of integrated, multidisciplinary approaches, using innovative tools, for both the study and practical development of UGSs; conducting a greater number of studies of newer urban areas in developing countries; and considering the diverse disadvantages as well as the advantages of UGSs in order to support the continued development and expansion of this critical climate-friendly infrastructure. The more that residents' perceptions of and attitudes toward UGSs are incorporated into the design of such spaces, the more successful they will be at providing the myriad benefits they have the potential to offer.

Keywords: climate change, climate change mitigation, nature-based solutions, multidisciplinary approach, stakeholder engagement, urban green spaces, urban planning

INTRODUCTION

The extent and availability of urban green spaces (UGSs) are often considered among the most critical indicators of the quality of life and environmental sustainability of urban areas (Haq, 2011; Barrera et al., 2016). Conedera et al. (2015) and Hadavi et al. (2015) defined urban green spaces as publicly accessible urban and peri-urban open spaces which are either partially or entirely covered by a large amount of vegetation. In the context of increasing urbanization and urban population, which have a had significant impact on environmental sustainability (Haq, 2011), biodiversity, human health and well-being of people living in urban areas (Farahani and Maller, 2018), UGSs provide a number of key benefits, including several on an ecosystem level (Guenat et al., 2021; Randrup et al., 2021), which influence and improve the quality of life of urban residents (Kothencz et al., 2017; Lo et al., 2017; Gwedla and Shackleton, 2019). UGSs also offer direct benefits to urban residents, including but not limited to health promotion. Given the functional benefits of green spaces on human well-being in particular, it is important to understand how people perceive these spaces and their benefits.

Farahani and Maller (2018) conducted a literature review to explore the interaction between social practices, use patterns, and urban green spaces in terms of perceptions and preferences. They defined perception in terms of the assessment of the present conditions of existing green spaces and how they feel to the individual; preferences were linked to how that space could be used by the individual. Perceptions of the natural environment, including urban green space, are strongly correlated with the contextual setting of urban areas. For example, perceptions of usefulness, impacts, and coverage of urban vegetation were shown to differ among participants, depending on whether they are from Islamabad or Rawalpindi (Bokhari et al., 2018). In line with the literature on climate change perceptions, it can be stated that people's perceptions of UGSs vary not only by location, but also by socio-economic and demographic background (Haq and Ahmed, 2017). Public perceptions of the use and behavioral aspects of UGSs have been further demonstrated to vary with respect to social and cultural background and preference for natural and urban landscapes (Priego et al., 2008). In addition to the above, Gashu et al. (2020) noted that physical and institutional factors influence both the preference for green spaces and the use of green spaces by members of local communities. For example, residents in urban areas may prefer and be more motivated to use UGSs that result from the redevelopment of former industrial sites (Mathey et al., 2018).

The aim to meet the needs of urban residents and visitors to green spaces influences urban planning, management, and use patterns (Jim and Shan, 2013). Urban green spaces can serve as promising tools by which to address some of the challenges associated with climate change, such as heat island effects and pollution in cities arising from urbanization (Farahani and Maller, 2018; Guenat et al., 2021). By increasing the extent to which people can access nature, otherwise limited as a part of the increasing complexity of urban life, UGSs may positively affect the social life and psychological behavior of those who use them (Sen and Guchhait, 2021).

We have a limited understanding of perceptions of UGSs as well as a lack of scientific consensus on what factors affect perceptions of UGS. Given the limited research on general perceptions of UGSs, particularly in developing countries, and the fact that perceptions are known to vary due to environmental, location, socio-economic, demographic, and cultural backgrounds, we deemed it to be worth exploring how people from different countries and backgrounds perceive the benefits of UGSs.

Having a comprehensive awareness of the public perceptions of urban green space held by the intended users can have implications for urban planning and design. In order to formulate sound design recommendations, it is important to understand more deeply what kind of green space can be developed, who needs to or would use such a space, and at what time(s) the space would be used. This understanding will help the urban planners and policymakers to maximize the benefits of UGSs that are most valued by the public and contribute to the development of cities that match the aspirations of their residents. It is also crucial to study how the public assesses the contribution of these UGSs to climate change mitigation and adaptation. Any proposed evidence-based design will benefit from both a more thorough mapping of an individual's actual exposure to a particular green space type as well as a better understanding of the human experience in these green spaces and their benefits.

The article is structured as follows to present: description of methodology (section Methodology); socio-economic, demographic, and cultural factors influencing perceptions of UGSs (section Perception of Urban Green Spaces: Socio-Economic, Demographic, and Social Cohesion); perceived benefits of UGSs (section Perceptions Regarding the Diverse Benefits of Urban Green Spaces); perceived climate change adaptation, mitigation, and environmental benefits of UGSs (section Perception of the Role of Urban Green Spaces in Climate Change Mitigation and Adaptation); a comparison and evaluation of discipline-specific and integrative approaches to identifying perceptions of UGSs (section Understanding the Perceptions of UGSs From a Discipline-Specific Approach to an Integrative Approach); concluding statements, recommendations for policy makers, and limitations and recommendations for further research (section Discussion and Conclusions).

METHODOLOGY

To explore how the perception of UGS varies in relation to different aspects such as socio-demographics, economy, culture, health, and climate change mitigation, we conducted a literature review. To search articles, we used various databases (e.g., Web of Science, Scopus, Ebscohost, and PubMed) available through the online libraries of The University of Adelaide in Australia, the Memorial University of Newfoundland in Canada, and the Shahjalal University of Science and Technology in Bangladesh. Science Direct and Springer Link were also chosen, as they provide a broad overview of global scientific

output and cover some very important journals in the fields of urbanization, politics, ecology, environment, and management (Malinen, 2015). These databases have been widely used in previous literature reviews on this topic (Farahani and Maller, 2018; Wan et al., 2021). Although we limited our search to studies published between 2010 and 2021, our primary focus was on those studies on perceptions of UGSs published in the last 5 years, in order to examine the most recent and up-to-date developments. We note that in 1997, after the adoption of the Kyoto Protocol, the study of urban green space emerged as an area of research (Taylor and Hochuli, 2017).

This paper reviews articles from peer-reviewed journals on the environment, people and nature, climate change, urban ecology, urban forestry, and urban greening. Our search strategy included the following keywords: "perception" or "public perceptions," "urban green spaces" or "urban greening" or "urban greenness," and "urban residents" in "developed countries" and "developing countries." We selected studies that focused on public perceptions of urban green space in terms of socioeconomic, demographic, cultural, health, climate change, climate change mitigation, and integrative and interdisciplinary aspects. We only included published articles that focused on urban residents living in urban environments. We excluded studies that included both urban and rural areas and did not consider urban residents separately in the analysis. In addition, we excluded editorials, letters, meeting reports, and non-English literature to avoid confusion and complication associated with translating.

All contributing authors (S.M.A Haq, M.N. Islam, A. Siddhanta, K.J. Ahmed and M.T.A. Chowdhury) searched for relevant articles through the aforementioned databases and used the keywords separately for our study to identify appropriate texts based on the above-mentioned inclusion and exclusion criteria. The databases used displayed results by relevance, so, in our search, we chose relevant articles from the first 10 pages of search results (Raven et al., 2016). All relevant articles (216) were downloaded and sent to the corresponding author (S.M.A.H) for compilation. S.M.A.H. reviewed all downloaded articles, checked for article overlap, and then excluded repeated articles. EndNote software was used to confirm duplication among articles. This process resulted in the exclusion of 40 articles. Afterwards, S.M.A.H. created a separate file of the remaining 176 articles, and convened a meeting with M.N.I., A.S., K.J.A., and M.T.A.C. to select the articles for this study. Both the abstracts and complete texts of the articles were reviewed at that meeting. Cases that raised doubts were discussed by the researchers until a consensus was reached on their inclusion or exclusion; a further 110 articles that did not discuss public perceptions with respect to our research interests were excluded. After several meetings and thorough discussions, 66 articles were selected by consensus as our final sample for this study; these articles would best help us achieve our goal of investigating differences and convergences in public perceptions of the benefits, uses, and mitigations associated with UGSs, by taking an integrative and interdisciplinary approach. The process by which articles were selected for critical review is illustrated in **Figure 1**, below.

While our search for relevant articles focused on the urbanness of green spaces and on people's perceptions of these, we sought to include a range of international perspectives in our review. **Figure 2** and **Table 1**, below, offer breakdowns of research subjects within the 66 chosen articles by continent and by developed and developing countries, respectively. Locations studied in the articles chosen for critical review were concentrated in the continents of Europe and Asia (**Figure 2**), followed distantly by articles reporting research in Africa and South America and North America. Only one article, on UGSs in Australia, represented the Oceania region. Of the European countries, most of those studies were conducted in developed countries (**Table 1**). Articles presenting research in Asia include one developed country and six developing countries. Studies focused on developing countries in Africa and South America, and on developed countries in North America and Oceania. Our review also includes 11 articles that are review-based and do not specify country.

Once the 66 articles for critical review had been chosen, the corresponding author randomly selected and distributed a number of articles for review to each of the authors of this article (S.M.A.H = 13; M.N.I = 13; A.S = 14; K.J.A = 13; and M.T.A.C = 13, respectively). Each author conducted an analysis of the major topics, arguments, results, in their share of the selected papers. These analyses were then collected by S.M.A.H, who arranged meetings to identify and finalize topics and sections based on the information collected. Decisions regarding how to divide the sections were made among ourselves; each author then contributed accordingly to the initial draft of the article. Once complete, the draft article was reviewed and finalized by all authors.

PERCEPTION OF URBAN GREEN SPACES: SOCIO-ECONOMIC, DEMOGRAPHIC, AND SOCIAL COHESION

Based on the results and findings presented in the 66 articles selected as the final sample of the study, this section reveals how socio-demographic, economic, and cultural factors are linked to variations in perceptions of UGSs. This section also shows how the use of such green spaces can develop social cohesion among users and neighbors.

Socio-Demographic and Economic Factors Influencing the Perceptions of UGSs

Residents of urban areas often recognize the cumulative cultural environmental benefits that urban green spaces offer (Ostoić et al., 2020), but their perception and understanding of UGSs is more difficult to pinpoint. Studies from a range of countries on the perception of UGSs have identified several dominant factors that influence public perceptions (Tian et al., 2020). Bele and Chakradeo (2021) suggest that socio-economic aspects such as gender, age, religion, and marital status should be included in the determination of perceptions of urban green spaces. Gashu et al. (2020), in their study in Ethiopia, argue that demographic, socio-economic, institutional, and physical factors contribute

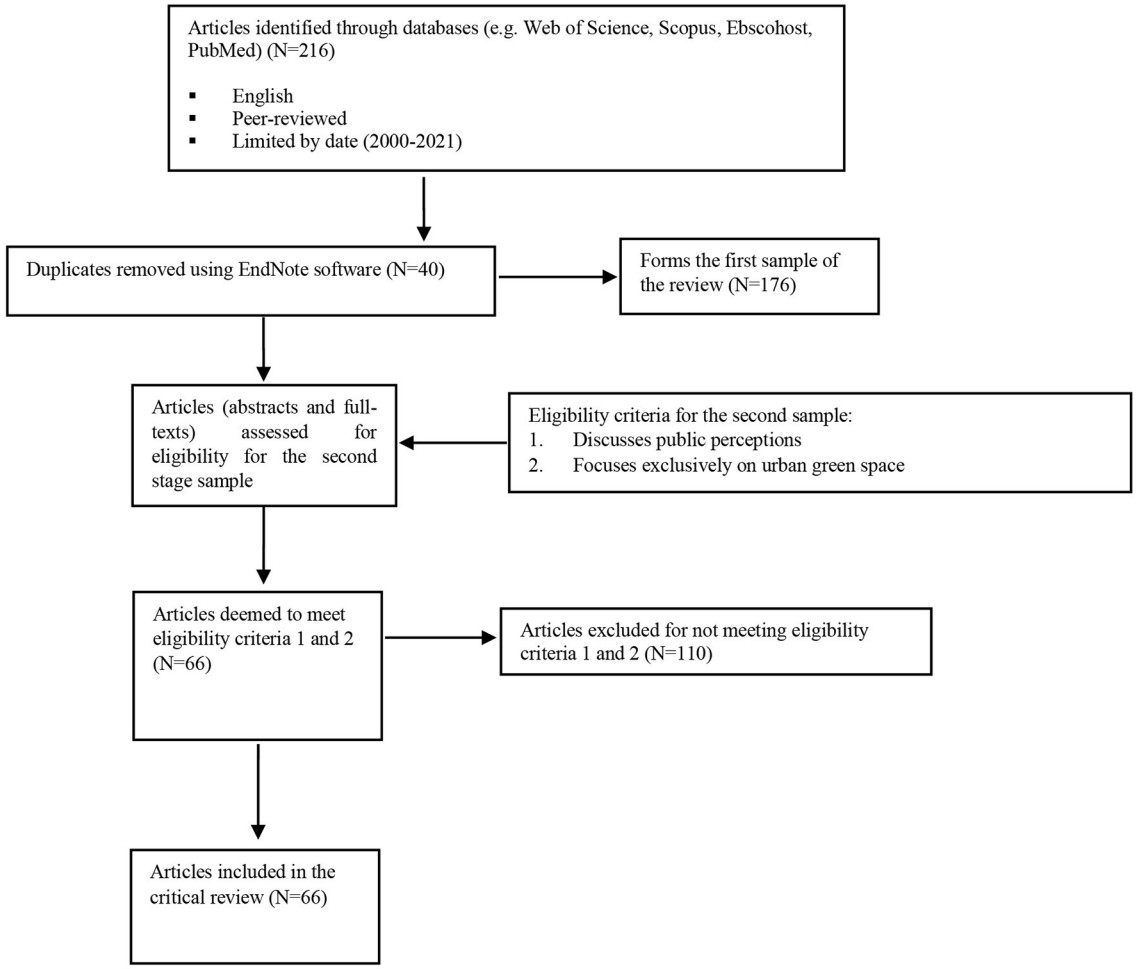

FIGURE 1 | Flow diagram of articles selection process.

to different perceptions of green infrastructure. Other studies associated with perceptions of climate change (e.g., Haq and Ahmed, 2017; Chowdhury et al., 2021) have also examined the socio-demographic and economic context of such perceptions in Bangladesh.

Priego et al. (2008), in their study of urban residents of surveyed areas in Chile, Germany, and Spain, observed that participants from these areas shared a strong interest in nature, especially the local environment. What is more, socio-economic predictors such as income, occupation, and education were found to be commonly associated with perceptions of and willingness to pay for green space services. Their results indicate that, in all three countries, the higher the social status of a community, the more green spaces are available for public use. Similarly, Tian et al. (2020) conclude that higher socio-economic status was associated with increased awareness of and willingness to pay for green space services in Central China.

In London, Collins et al. (2019) examined differences in perceptions of park trees with respect to different ecosystem services based on the gender, education, age, wealth of participants, and the frequency of their visits to such green spaces. They found no differences in the perception of the importance of the role park trees play in maintaining different

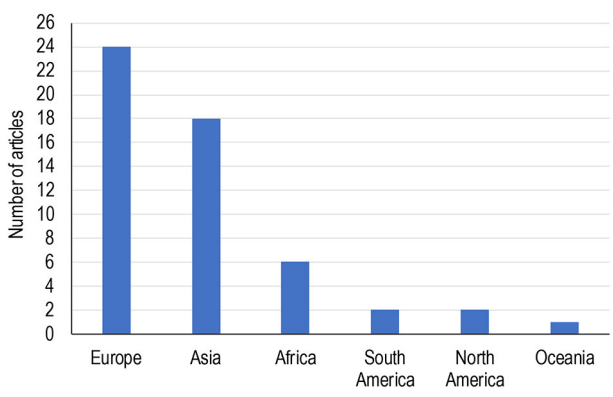

FIGURE 2 | Literature review study locations by continent.

TABLE 1 | Articles reviewed, by continent and economic status of countries studied (developed and developing).

Continents	Number of studies	Case study countries	
		Developed	Developing
Europe	24	Belgium, Bulgaria, Croatia, Denmark, Finland, Germany, Hungary, Iceland, Italy, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, The Netherlands, and The United Kingdom	Bosnia and Herzegovina, Montenegro, Serbia, and The former Yugoslav Republic of Macedonia
Asia	18	Japan	Bangladesh, China, India, Malaysia, Pakistan, and Singapore
Africa	6	South Africa	Ethiopia, Ghana, and Malawi
South America	2	/	Chile
North America	2	The USA	/
Oceania	1	Australia	/

ecosystem services between wealthier and poorer areas in London. In contrast, Gwedla and Shackleton (2019) reveal that South African residents of wealthier cities and wealthier suburbs perceive street trees as more critical to the environment than residents of more impoverished cities and suburbs do.

Ostoić et al. (2017) examined differences in perceptions of urban forests and green spaces of research participants in southeastern European cities with respect to four factors: age, gender, education, and income. They noticed that age, while results varied from city to city, was a significant predictor of perceptions of some aspects of urban forests and green spaces, such as their importance, size, accessibility, availability of parking for cars, need for more bike lanes and community caretakers. Although gender was found to play a varied role across a number of variables, women generally demonstrated having stronger perceptions than men. Stessens et al. (2020) also suggest that gender be considered in examinations of perceptions of public green spaces, as their research in Belgium revealed that women pay more attention to safety issues than men. In Guangzhou, China, Jim and Shan (2013) observed that the influence of gender on perceptions of urban green spaces was relatively small, while education level and childhood experiences with nature had a strong influence on perceptions of urban green space. In their study, age was identified as an additional factor that influences perceptions; older respondents, especially those over 60, perceived UGSs more positively and were less concerned about safety in such spaces.

Pinto et al. (2021) identified multi-functionality, socio-demographic and economic characteristics, user motivation, the tranquility and scenic beauty of the space, distance and transportation required to travel to the park as factors influencing users' decisions to visit urban green spaces. In their study of three socio-economically diverse communities in Latin America, Barrera et al. (2016) examined preferences for green spaces and community attachment, perceptions of green spaces, sense of safety, and social cohesion. They found that the expectations people had of UGSs differed across socio-economic groups and were influenced by the availability of recreational and other amenities. Low-income communities were found to value green spaces more highly and to have a greater sense of responsibility for maintaining such spaces. Włodarczyk-Marciniak et al. (2020) noticed that the socio-demographic factors of participants, such as age and education, had a significantly impact on perceptions of various ecosystem services provided by informal green spaces. Age was a significant predictor of the perceptions of three functions of green spaces: aesthetics, relaxation, and noise reduction. Specifically, older participants were more likely to associate informal green spaces with mental health benefits and noise reduction. On the other hand, a larger number of younger people recognized the aesthetic function of these spaces. Respondents with higher levels of education rated the importance of green spaces higher for aesthetics and rainwater retention. Research conducted by Abass et al. (2019) yielded similar results; they found knowledge of the particular benefits of urban green spaces to be associated with the level of formal education attained by and the gender of their respondents. As an example, educated Christian women appreciated that green spaces could be used as places to pray.

This literature review suggests that gender, age, education, and income, regardless of country of residence, are critical factors influencing people's perceptions and uses of UGSs. It is important to note that the focus of the research reviewed for this study was primarily on developed countries and their cities. Because consideration of the socio-demographic dimensions of users' perceptions of green spaces can significantly benefit the work of urban planners charged with the planning, implementation, and development of such spaces, more research should be conducted in developing countries to develop a more comprehensive understanding of how these factors determine the perceptions and uses of UGSs worldwide.

Urban Green Spaces and Social Cohesion

Urban green spaces such as parks are potential places to meet and greet. Studies have shown that the presence and quality of UGSs help develop social cohesion among people of the area surrounding the green space (Hartig et al., 2014; Jennings et al., 2016; Wan et al., 2021). Wan et al. (2021) highlight the direct and indirect effects of green spaces on the development of social cohesion (see **Figure 3**). Among the direct effects, three aspects were related to promoting social cohesion: physical characteristics, perceptions of greenness, and patterns of use of green spaces. The physical characteristics (type of green space, presence of vegetation, structure, spacing, layout, size, maintenance and facilities) of green spaces help predict social cohesion. Perceptions of landscaping, safety and proximity to green spaces are also strongly associated with social cohesion. People who perceive places to be greener and more natural are more likely to participate in outdoor activities, which, in turn,

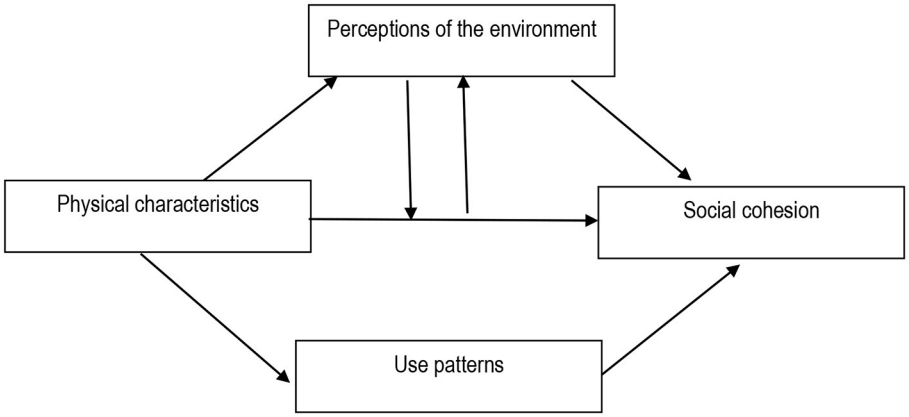

FIGURE 3 | Direct and indirect effects of aspects of green spaces on social cohesion. Source: Wan et al. (2021, p. 9).

fosters social contact between neighbors and people from nearby areas. The frequency with which green spaces are used depends on how remote these spaces are perceived to be; greater frequency allows for the development of social relationships. Francis et al. (2012) similarly found that both the quality of parks and the users' proximity to parks were significant to the development of a sense of community. In their study in the Croatian city of Zagreb, Ostoić et al. (2020) found that the perceived qualities of UGSs, such as cultural ecosystem services (Sen and Guchhait, 2021) influenced the use of these spaces. Moreover, they found that positive memories of past (for example, childhood) experiences in natural environments, their perception of urban spaces in terms of beneficial aspects of UGSs (e.g., recreational facilities) and their emotional responses to nature are essential factors needed to support urban greening. Barrera et al. (2016), in their study in South America, mentioned other factors such as amenities, community attachment, social cohesion, and sense of security as those that influence peoples' appreciation for and use of UGSs.

Ostoić et al. (2020) investigated how residents perceive the cultural ecosystem services provided by different types of urban green spaces with trees. The authors found that place-based, aesthetic and recreational services were more widely recognized than the services related to educational and cultural identity. In their research conducted in Chile, Germany, and Spain, Priego et al. (2008) found that while natural environments play a vital role in almost all urban societies observed, people from different social and cultural backgrounds used and perceived urban landscapes differently. The higher a person's social status, the more they use urban landscapes, for example, for personal purposes.

PERCEPTIONS REGARDING THE DIVERSE BENEFITS OF URBAN GREEN SPACES

Green spaces have been proven in a wide range of academic studies to offer multiple benefits (Barrera et al., 2016; Sen and Guchhait, 2021). However, the prospects for large-scale expansion of UGSs depend on these spaces being deemed useful and beneficial to the communities that have to pay for their development and maintenance. As a result, researchers and practitioners have developed a growing interest in understanding residents' perceptions of and preferences for green spaces (Farahani and Maller, 2018). This section discusses the benefits that people residing in urban areas have been found to perceive in UGSs.

UGSs and Improved Health, Well-Being and Quality of Life

Modern urban living is often connected with insufficient physical activity, continuous stress, and acute exposure to pollution. According to the WHO (2021), green or blue spaces can help improve mental and physical health among urban residents; such spaces can also reduce morbidity and mortality. The use of urban green spaces, in the forms of residential greenery, parks, and playgrounds, can relax the body and mind, relieve stress, support social interaction, and encourage physical activity (WHO, 2021).

By promoting the health and well-being of urban residents, UGSs have been considered to improve quality of life. Chen et al. (2020), noting that green spaces encourage people to improve their physical and mental health and that green spaces improve the quality of life of the urban residents who use them, examined the influence of the perceptions of young urban residents regarding the relationship between green space and health promotion and the impact of such perceptions on their behavior and willingness to use parks in China. The strongest predictor of the willingness of the young people to use the green spaces was their perception of the accessibility of such spaces. A study conducted by Beyene and Borishe (2021) in Addis Ababa showed that perceptions of health benefits have a significant association with the visiting habits of people to green spaces. People who held positive perceptions of the health benefits offered by UGSs were two times more likely to visit green spaces than the people who held negative perceptions.

Pinto et al. (2021) studied how users of urban parks in Coimbra, Portugal, perceived the services and benefits of cultural ecosystems with respect to physical and emotional well-being, social interaction and users' perceptions of UGSs. They found that most users consider the opportunity to walk, socialize, play sports, and do activities with children in urban parks has a positive impact on their emotional and physical well-being.

In Malaysia, people were found to be more eager to take care of their local green and blue urban spaces and desired to receive additional intangible gains from the ecosystems of such spaces, including social interaction, spiritual benefits, and inspiration. According to the people involved in this study, spending time in UGSs can play a vital role in improving their quality of life (Nasir and Rahim, 2020). Similarly, studies have found that residents in urban areas in Eastern Cape Province (South Africa), Romania, and Japan emphasized the positive impact that urban trees, green infrastructure, and green spaces have on critical aspects of their quality of life (Rupprecht, 2017; Gwedla and Shackleton, 2019; Gavrilidis et al., 2020).

UGSs as Places for Recreation and Stress Reduction

Because they facilitate connections among people, urban green spaces are often considered places for recreation, stress reduction, and social cohesion. Older adults in Manchester, England, mentioned that green spaces, places where they can do physical activities and experience lower stress levels, help improve their health and well-being (Macintyre et al., 2019). Recreation was determined to be the fundamental goal of the respondents when interacting with urban nature and greenery in the city of Zagreb, Croatia (Ostoić et al., 2020). Sen and Guchhait (2021), in their study of UGSs in India, also found recreation to be identified as the most perceivable benefit of regular visits to green spaces. It was further observed in the literature review that the presence of green space directly impacts the human mind psychologically. Urban park users visit parks for fresh air, to relieve stress, and to relax (Sreetheran, 2017; Beyene and Borishe, 2021) and for social interaction (Nasir and Rahim, 2020). Highlighting walking and talking as the most common activities enjoyed in parks of southwest Spain, Gozalo et al. (2019) observed that the absence of noise and the air quality in green spaces contributed to the relaxation the users felt in both small and large green spaces.

There is limited evidence to prove that exposure to green spaces has long-term mental health benefits (Gascon et al., 2015). In fact, when Xu et al. (2021) explored the relationships between green spaces and residents' self-reported physical health, mental health, and social health in neighborhoods in Beijing, the authors observed that UGSs had a more substantial effect on social health than on physical and mental health. That said, such exposure has been associated with improved physiological markers of mental health, such as momentary stress reduction and mood improvement (Olszewska-Guizzo et al., 2020). This same study argues that the quality rather than the quantity of green spaces plays the critical role in improving mental health. In the same vein, Wei et al. (2021) reported that public open space is considered vital to the psychological well-being of residents in Chinese cities. They noted that the availability of activities (sports facilities) and exposure to environmental features (e.g., lakes, statues and bridges, and biodiversity) were significantly associated with better psychological well-being. Further, Kothencz et al. (2017) observed that, in Szeged, Hungary, green spaces have direct well-being benefits that strongly influence visitors' attitudes toward such spaces. They also found that recreation capacity (a direct well-being benefit) and nature perception (an indirect well-being benefit) influence visitor satisfaction with green spaces. Other studies have found that people who live closer to public green spaces and gardens and spend time in these places see themselves as connected to nature (Dzhambov and Dimitrova, 2015; Hoyle et al., 2019) and are able to recognize the aesthetic function of these green spaces (Włodarczyk-Marciniak et al., 2020). Spending time in places that are natural and beautiful can arguably reduce stress and promote relaxation.

UGSs and Child Development

The use of green spaces such as parks and playgrounds has been linked to the physical and cognitive development of children. According to Jahan et al. (2019), residents in Pakistan perceived green spaces as stimulating children's holistic development and health. Informal green spaces were perceived by Japanese people as places where children could run and play (Rupprecht, 2017). In Ethiopia, most local community members had positive perceptions of green infrastructure and they visited UGSs to meet friends and bring children for play, exercise, and to participate in a range of sports and recreational activities (Gashu et al., 2020). Residents and visitors in China recognized the contribution of UGSs to children's development as well as to health and stress reduction (Jim and Shan, 2013).

Educational and Economic Benefits of UGSs

Urban green spaces are well-known for attracting development, creating jobs, and increasing property values. Respondents in Romania perceived green features as helpful to the ability of a company to attract customers and enhance work environments (Gavrilidis et al., 2020). Stakeholders in Malawi who were involved in urban green space planning, maintenance, and conservation perceived green spaces as potential places for educational activities where, for example, people could receive training on agroforestry practices or environmental issues (Guenat et al., 2021). These stakeholders also identified economic revenue, employment opportunities, and cultural services associated with green spaces. Beyene and Borishe (2021) identified an absence of recreational services in green spaces in Addis Ababa and argued that provision of these services would help increase the number of urban green space users and, in turn, create job opportunities that would facilitate health and economic benefits to the people.

UGSs and Biodiversity

Population growth and over-urbanization often threaten biodiversity and result in ecosystem service loss. Mathey et al. (2018) observed that brownfields in urban areas with natural

vegetation cover could positively contribute to the biodiversity of urban green systems. In their literature review of the public perception of biodiversity in UGSs, Bele and Chakradeo (2021) emphasize the significance and value of biodiversity on the quality of life in urban areas. They argue that despite the crucial role that urban green spaces play in maintaining urban biodiversity, the association of biodiversity, urban green spaces, and public perception had not received sufficient attention. In fact, their findings suggest that people have a limited view of the biodiversity benefits associated with UGSs. They recommend that planners identify, respond to, and influence urban residents' opinions, needs, awareness, and understanding with respect to biodiversity and green spaces.

Overall, it was observed in the literature review that people were inclined to focus more the on personal and health benefits that could be gained from accessing and using urban green spaces. Although it was generally accepted that UGSs also offered environmental and natural benefits, these were less emphasized by most people involved in the studies. Increasing people's awareness of these benefits could stimulate them to value, use, and push for the expansion of green spaces.

PERCEPTION OF THE ROLE OF URBAN GREEN SPACES IN CLIMATE CHANGE MITIGATION AND ADAPTATION

Climate change, with its adverse impacts on the natural environment and humankind, is the most crucial issue of our time. Adaptation and mitigation are considered fundamental approaches to addressing climate change. Adaptation involves preparing for and responding to actual and expected environmental changes. Mitigation focuses on lowering the rate of increase and magnitude of change in the amount of greenhouse gases (GHGs) in the atmosphere. Climate change adaptation and mitigation are similar in their goals, benefits, and drivers: both strategies seek to reduce the risks and losses associated with climate change, and both offer significant benefits for solving climate-related and other problems. Recently, innovations in science and technology have been driving climate change adaptation and mitigation practices (Zhao et al., 2018). This section discusses how urban green spaces can be developed as adaptation tools that can also potentially mitigate climate change and describes the extent to which users perceive the climate change mitigation benefits of UGSs.

Adaptation and UGSs

Adaptation to climate change involves the departments of land use planning, water management, agriculture, and human health, while mitigation engages the sectors of energy, transportation, architecture, and industry (Zhao et al., 2018). The establishment and expansion of urban green spaces is the responsibility of departments associated with adaptation, so it could be assumed that urban green spaces support this strategy for minimizing the negative effects of climate change; urban planners should take this into consideration when considering options for urban green development. If inappropriate urbanization is seen as a barrier to the development of urban green spaces (Guenat et al., 2021), such planning outcomes can be expected to slow the pace of implementing climate change adaptation and mitigation. Planners of UGSs can incorporate findings from studies which have indicated that these spaces can be defined quite broadly. For example, Kim et al. (2019) indicated that informal green spaces (IGSs) are strongly associated with urban green space planning in Japan.

Mitigation and UGSs

With respect to climate change mitigation, architects and urban planners can consider how to structure green spaces in cities to contribute to this approach, and note that urban greenery alone can serve as a potential tool to meet climate change mitigation objectives. Our literature review identified many studies which demonstrate that residents of many cities around the world believe that urban green spaces can positively contribute to protecting against changes in climate variability and extremes in the future. In their study in Hong Kong, Lo et al. (2017) discovered that most participants believed that the temperature would increase in the future and that there would be more frequent rainy days and hurricanes; they were concerned about the impact of these climatic changes on their daily lives and livelihoods. The researchers also found that perceptions of climate variables and extremes were related to participants' understanding of the functional benefits, such as cooling and carbon sequestration, of trees and urban green spaces. These perceptions were associated with their recognition of the possible climate change mitigation benefits of UGIs, including, for example, flood control and storm damage reduction. The better participants understood the negative impacts of climate changes, the more critical they perceived the positive functions of urban trees and green spaces to be.

Perceptions of Adaptive and Mitigating Benefits of UGSs

In a study in London Collins et al. (2019) found that people perceive urban greenery to be important to pollution mitigation, flood prevention, aesthetic value, climate regulation, and wildlife habitat provision. Another study in China by Duan et al. (2018) examined users' perceptions of urban green infrastructure (UGI) in terms of climate risks such as poor air quality, flooding and soaring temperatures, and the impacts of UGI on people's well-being. They found that, across a number of sociodemographic variables, users of UGI both perceived and witnessed the positive effects of UGIs on the urban environment, in particular on air quality and temperature.

Perceived Environmental Benefits of UGSs

Regardless of whether they are perceived as adaptive or mitigating climate change strategies, urban green spaces are seen to have natural and environmental benefits such as increased biodiversity, reduced air temperature, and lower air pollution. In a number of studies, urban residents were shown to widely acknowledge the natural and environmental benefits of urban trees, urban spaces, and even informal green spaces in their neighborhoods (Lo et al., 2017; Hoyle et al., 2019; Jahan et al.,

2019; Włodarczyk-Marciniak et al., 2020; Beyene and Borishe, 2021). According to Włodarczyk-Marciniak et al. (2020), research participants in Poland identified rainwater retention, habitats for plants, and wildlife as the standard ecosystem services of informal green spaces. As reported by respondents in Addis Ababa, Ethiopia, the advantages of green spaces include their natural ability to purify air and balance temperature (Beyene and Borishe, 2021). Residents in Lahore, Pakistan, acknowledged the positive environmental impact of green spaces on lowering levels of air pollution and maintaining an area's climate (Jahan et al., 2019). As mentioned previously, these benefits were not only associated with designated green spaces; residents of four major cities in Japan reported that they value and use informal green spaces/IGS, including vacant lots, street verges, brownfields, gap spaces, areas along waterways, power line corridors, and railway verges. Such spaces are often preferred over parks or open green spaces as they are located near to residents' homes, not crowded, and have no restrictions associated with their use. Environmental benefits most associated with IGS, as reported by the Japanese respondents, were related to city greening and ecosystem services such as cooling, air filtration and wildlife habitat, and the opportunities offered by green spaces for contact with nature, the promotion of urban agriculture, food benefits and conservation (Rupprecht, 2017). Having identified contact with the natural environment as a key benefit of UGSs perceived by participants in Germany, Chile and Spain, Priego et al. (2008) argue that it is vital to have such spaces in the urban landscape to satisfy the needs of urban residents. Results of a study by Tian et al. (2020) indicated that city dwellers in China are willing to pay for the preservation of urban green spaces that facilitate such contact, but noted that this willingness to pay varies from city to city. For example, residents of Nanchang and Changsha in China are more inclined to pay for the protection of green space than residents of Wuhan. Similarly, in Zagreb, Croatia, residents' willingness to contribute financially to support green spaces differs from city to city and often depends on the type of urban green spaces to developed or preserved (Ostoić et al., 2020).

Urban Green Infrastructure and Climate Change Mitigation

The contribution of urban green infrastructure, in particular, to climate change mitigation has been noted by users of such spaces. This can be shown using China as an example. In four public green spaces in Guangzhou, China, Duan et al. (2018) examined the perception of urban green infrastructure (UGI) users regarding how these spaces affect flooding, poor air quality, high temperatures, and general human and environmental well-being. The findings indicated that UGI users generally believe that environmental risks have a significant impact on human and environmental well-being and that they, in fact, have already encountered these risks. Most participants reported their perceptions that UGIs can mitigate problems of poor air quality, high temperature and flooding. This study provides strong evidence that participants believe that UGIs can effectively mitigate environmental risks.

UNDERSTANDING THE PERCEPTIONS OF UGSs FROM A DISCIPLINE-SPECIFIC APPROACH TO AN INTEGRATIVE APPROACH

To maximize the benefits of UGSs with respect to environmental and ecological sustainability, an integrated approach to the design, maintenance, monitoring, and evaluation of such spaces is essential (Haq, 2011). However, our review of the literature revealed that researchers tend to take discipline-specific approaches to assess and explain the public perceptions of UGSs. Our findings strongly indicate that a comprehensive approach integrating interdisciplinary features should be used to examine the uses and benefits of UGSs as perceived by different stakeholders involved in the design, planning, management, and monitoring of UGSs in both developing and developed countries. In this section, we provide examples of the use of discipline-specific and integrative approaches to understanding public perceptions of UGSs. We also identify how the link between public engagement and urban green space policy supports taking an integrative approach.

Discipline-Specific Perspectives in Understanding Public Perceptions of UGSs

Our literature review revealed that people's perceptions of UGSs have been described from health and well-being, ecological and environmental, socio-economic and cultural perspectives. In our sample of 66 articles, most of the research into public perceptions of UGSs was conducted from health perspectives. Kothencz et al. (2017) and Macintyre et al. (2019) examined perceptions of UGSs with respect to health and well-being benefits. Physical and mental health have been identified in the literature as the driving purposes of the creation and expansion of UGSs (Chen et al., 2020; Paul et al., 2020). Using Chittagong as a case study area in Bangladesh, Paul et al. (2020) demonstrated that perceived health benefits associated with engaging in outdoor physical activities in UGSs could make urban residents physically fit, improve their active lifestyles, raise their energy levels, and increase their self-confidence and critical thinking skills. They found that their respondents associated visiting public open spaces with light exercise (e.g., walking and jogging), and they believed that such physical activity can help lower body weight, cholesterol, hypertension, liver fat, and blood sugar.

Considering perspectives of UGSs from ecological and environmental disciplines explores how integral such spaces are seen to be to the maintenance of balanced ecosystems. Taking these perspectives in their research, Dzhambov and Dimitrova (2015), Gunnarsson et al. (2017), Mathey et al. (2018), and Włodarczyk-Marciniak et al. (2020) illustrated international publics perceptions of the ecological and environmental benefits of UGSs in terms of urban greening, park management, and biodiversity conservation. From this disciplinary point of view, studies identified the following as being preferred by residents to

achieve optimal use of urban landscapes: spontaneous vegetation for the regeneration of urban ruins (Mathey et al., 2018); the importance of order, improved maintenance, cleanliness and improved public services (Włodarczyk-Marciniak et al., 2020); and the natural reduction of noise exposure (Dzhambov and Dimitrova, 2015). Taking a socio-ecological approach, Gunnarsson et al. (2017) examined the effects of biodiversity and environmental attitudes on the auditory and visual perceptions of UGSs in Gothenburg, Sweden. They found that attitudes toward nature and urban orientation play an important role in influencing positive perceptions of the aesthetics and green-related sounds offered by UGSs.

From a socio-cultural perspective, Macintyre et al. (2019) and Klein et al. (2021) demonstrated that socio-economic and cultural dimensions influenced public perceptions of UGSs. Their studies focused on how social cohesion, cognitive behavior, and attachment to a place contribute to a person's perceptions of UGSs. For example, Klein et al. (2021) identified the following three socio-cultural factors influence perceptions and use of public spaces: the sense of place (people, activities, novelty, and capacity); narratives of space (relationships with the place); and boundary expansion (the mental map and perceived boundary of a place, e.g., spatial, temporal, and social). This study further described the relationships between people and green spaces that influence perceptions of UGSs using five narratives: structural constructs, implicit cultural understandings, specific narratives, personal memories, and direct visual feedback. In their study, Macintyre et al. (2019) concluded that social cohesion could be improved by providing urban residents living next to green spaces with places that facilitate the socialization of park visitors.

A Comprehensive and Integrative Approach to Understanding UGSs

Given that the actual and perceived benefits associated with urban green spaces can be viewed from the range of disciplines noted above, the developers of such spaces would certainly benefit from taking a multidisciplinary approach. In fact, Bokhari et al. (2018), in their study comparing Islamabad and Rawalpindi, argue that holistic management of urban greening in urban planning should consider the influence of socio-economic factors that can shape people's perception of the importance and use of green spaces. Wei et al. (2021) recommend that urban planners of UGIs consider both quantitative aspects, such as the proportion of green space and park area per capita, and the qualitative aspects, including resident's perceptions of UGSs when designing such spaces. Qualitative aspects to be factored into the design process could also include the ways in which residents use similar existing spaces and the physical, social, psychological and spiritual benefits they associate with their use (Bele and Chakradeo, 2021). An exploration of residents' perceptions of existing green spaces and of their preferences for such spaces across specific disciplinary boundaries can improve the quality of urban green spaces developed in the future (Farahani and Maller, 2018; Xiang et al., 2021).

Examples of such interdisciplinary approaches exist. In China, visual methods have been applied in combination with field studies to understand landscape perceptions and preferences, taking into account seasons and vegetation (Xiang et al., 2021). Bonnes et al. (2011) suggest the use of a multidisciplinary framework, and Sanesi and Chiarello (2006) recommend the use of mixed methods and multiple methodologies to understand people's perceptions of the green vision for UGSs and of residents' daily interactions with these spaces, not only among urban residents and visitors but also among management officials and planners. Sanesi and Chiarello (2006) and Li et al. (2019) recommend the use of mixed methods and multiple methodologies to understand people's perceptions of the green vision for UGSs and of residents' daily interactions with these spaces. Li et al. (2019) would argue that this approach would apply not only to determine the perspectives of urban residents and visitors but also to examine those of management officials and planners. The literature notes that he perceptions of public users of UGIs and of professionals working in the green space field undoubtedly differ, and suggests that, for example, while the public may focus on their enjoyment of the space and prefer more artistic green spaces, experts and professionals may focus more on considerations of application and management-based aspects (Hofmann et al., 2012; Li et al., 2019).

For the above reasons and following the above examples, it is evident that interdisciplinary research and integrated approaches are essential to further exploration of the relationship between people's perception of the utility of urban green spaces and their actual use of such places in their everyday lives (Haq, 2011).

The Link Between Public Engagement and Urban Green Space Policy (UGSP): The Importance of an Integrative Approach

Public engagement is key to taking an inclusive approach to the development of any government policies. Xu et al. (2021) propose that consideration of public perceptions of UGSs complement the formulation of public urban green policies by policymakers and urban planners to generate creative ideas and achieve a balance between various competing factors, such as population density, over-urbanization, the existence of slums, land use for commercial purposes, and administrative costs. Wagner et al. (2019) suggest that inclusive and multidimensional multi-stakeholder engagement can play an essential role in overcoming conflicting interests and negative perceptions toward UGSs; furthermore, such engagement can support the development of a more comprehensive policy strategy (Sreetheran, 2017). Specifically, researchers suggest that the following should be considered in urban green policy formulation: aesthetics, recreational services, and regulating ecosystem services (Kothencz et al., 2017); and public needs, economic opportunities, and practices (Priego et al., 2008).

It has been argued that the promotion of positive perceptions of UGS conservation, provision, and use by local governments in policy decision-making processes can help fulfill the diverse needs and changing demands of people residing in urban areas (Jim and Shan, 2013). Studies demonstrate that positive perceptions can be generated by prioritizing, in particular, the risk reduction and human well-being benefits of urban green

infrastructure (UGI) in future urban development (Duan et al., 2018; Randrup et al., 2021).

DISCUSSION AND CONCLUSIONS

Convergence of Socio-Demographic Factors

Any kind of green space can contribute to the fight against the changing climate and frequent extreme weather events. Green spaces, which play an integral part in improving the quality of life of urban residents (Chen et al., 2020), can be private gardens, tree plantations, urban parks or recreational areas in or near cities, and benefit residents regardless of their socio-economic and cultural backgrounds (Priego et al., 2008). The papers included in this review support the fact that many factors influence residents' perceptions of the urban green spaces available to them, irrespective of whether they live in developing or developed countries. Notable factors are education, gender, religion, age (Jim and Shan, 2013; Abass et al., 2019; Włodarczyk-Marciniak et al., 2020), and residence (Petrişor and Petrişor, 2020). Given the influence of these factors, we argue that it will be necessary to consider demographic and socio-economic dimensions of users' perceptions of and attitudes toward green spaces while planning and implementing new green spaces or preserving old ones (Collins et al., 2019; Hoyle et al., 2019). Most urban residents in both developing and developed countries ignore or are unaware of a number of environmental and natural ecosystem benefits of urban green spaces. When new green spaces are being created, urban planners should promote the natural and environmental benefits of these spaces; a better understanding of the benefits of UGSs will motivate residents to value and use green spaces more functionally.

Divergence of Socio-Cultural Contexts

Peoples' previous experiences, values, beliefs, histories, and local cultures significantly influence their perceptions of the benefits of UGSs (e.g., physical, social, mental, economic, climate change mitigation, and ecosystem services) and their use of UGSs contributes to an understanding of their environmental behavior (Petrişor and Petrişor, 2020). In studies of perceptions of climate change in Bangladesh among on university students (Haq and Ahmed, 2020), on school and college teachers (Chowdhury et al., 2021), and on indigenous people (Ahmed and Atiqul Haq, 2019), a wide range of factors influencing peoples' perception was found. The divergent contexts in which the studies reviewed were conducted are likely to explain differences in public perceptions of urban green space. Different people value different things, so different green spaces should be planned and implemented, depending on the context. Without an identification and understanding of the perceptions of all stakeholders regarding urban green spaces, the planning, management, and conservation of local UGSs and urban greening infrastructures will lack key information that could support successful implementation (Priego et al., 2008; Guenat et al., 2021). If the basic needs of urban residents with respect to the benefits of UGSs are not prioritized, it will be more difficult to use UGSs as tools to achieve global sustainable development goals (Cilliers et al., 2013) and ensure environmental sustainability (Haq, 2011).

The social role of urban greening should also be incorporated into specific strategic plans for urban and peri-urban areas (Priego et al., 2008). By recognizing the human social benefits of UGSs, such spaces will gain increased support, and improvements to urban green infrastructure and increases in urban greening can better contribute to urban and environmental sustainability (Bokhari et al., 2018; Islam et al., 2020). Moreover, urban greening can be systematically promoted in developing countries based on an understanding of divergent perceptions of UGSs; cross-sectoral collaboration can enable the creation of specific guidelines for sustainable green spaces for urban residents (Wagner et al., 2019; Islam et al., 2020). Taking into consideration the needs of different stakeholders for ecosystem services and social benefits, as well as the perspectives and anticipated participation of urban residents, can improve the management of urban green spaces (Guenat et al., 2021; Randrup et al., 2021) and allow for the proper measurement of the role and impacts of such spaces (Stessens et al., 2020).

Direct and Indirect Effects of UGSs on Health and Well-Being

Inherent qualities of urban green spaces include tranquility, space, and climate-friendly measures that can balance increases in city size and population density (Wagner et al., 2019; Stessens et al., 2020) and rapid urbanization (Collins et al., 2019; Bele and Chakradeo, 2021; Randrup et al., 2021). Direct and indirect benefits of green spaces can be seen (Kothencz et al., 2017) when the physical characteristics, perceptions and patterns of use of UGSs promote social cohesion among urban residents, enhance child development and help stress reduction (Macintyre et al., 2019; Sen and Guchhait, 2021). UGSs have been shown to contribute, either directly or indirectly, to the health and well-being of urban residents and researchers have recommended that efforts can be made to maximize the well-being benefits of UGSs by guiding the use of these spaces and by promoting the values associated with spending time in nature to the users (Priego et al., 2008; Chen et al., 2020; Xu et al., 2021). From studies such as those conducted by Lo et al. (2017) in Hong Kong, Collins et al. (2019) in London, and Duan et al. (2018) in China, we can conclude that users believe that urban green spaces and infrastructure can effectively help reduce climate risks; this belief minimizes the stress associated with such risks and, as such, supports their well-being.

Development of an Integrated and Holistic Approach

It has been argued that no single approach could be used to fully comprehend the diverse perceptions of urban green space (Farahani and Maller, 2018). Interdisciplinary and integrated approaches can better address the issue (Haq, 2011; Farahani and Maller, 2018; Bele and Chakradeo, 2021) and explore the complex, diversified relationships between perceptions of urban green space, the benefits of urban green spaces, and the impacts

of these benefits on climate change adaptation and mitigation (Sreetheran, 2017).

As part of an integrated, holistic approach to this subject, studies should examine perceptions of UGSs in both developing and developed countries. Our review of the literature shows that an overwhelming number of studies focused on public perceptions of urban green spaces in Europe or China. Specifically, Wan et al. (2021) revealed that most research into aspects of UGSs have been done in Europe and North America. Studies on this subject should be conducted in areas experiencing significant growth in urbanization, such as sub-Saharan Africa, Latin America, and southern and western Asia.

Given that UGSs can serve to mitigate the risks associated with the negative impacts of rapidly changing climate conditions, increase resilience, and cope with frequent extreme weather events, taking an integrated, multidisciplinary, holistic approach to understanding public perspective of these spaces will give us the best chance of implementing these spaces to the greatest benefit.

Recommendations for Policy Makers

Our review of the literature has brought us to the conclusion that the proper planning, implementation, management, and protection of UGSs cannot be achieved without a comprehensive understanding of public perceptions of the benefits and uses of urban green spaces and their contribution to climate change mitigation. To provide more convincing and robust evidence-based advice for policymakers, organizations, and urban stakeholders, it would be worthwhile to conduct longitudinal studies with a gap of 1 or 2 years of the benefits gained by residents from newly-established or restored urban green spaces. The focus of such studies should be shifted to include the negative perceptions of such spaces or the problems the residents generally face when utilizing the space. Including non-users in assessment studies can also highlight associated problems and help increase the popularity and usefulness of these spaces. Meaningful investigation that is deliberately and reasonably designed and uses appropriate tools for comparing urban green spaces across developed and developing countries can bring empirical evidence to explain why UGSs are less likely to be seen as popular or useful in developing or underdeveloped nations. GIS technology could be used to develop an appropriate tool to do this comparison. Only one study in our sample assessed users' perceptions and the quality of urban green space based on GIS models (Madureira et al., 2018), and another identified a need to develop a GIS-based model that assesses the quality of green space (Stessens et al., 2020).

Implicit evidence has shown that UGSs can revitalize the surrounding community, improve social cohesion, and enhance healthy lifestyles. As they do in developed countries, urban planners in developing countries should focus more on introducing urban green spaces in policy and practice. However, it is important to understand, as research has shown, that the perceptions of residents play an essential role in determining the multifunctionality, usefulness, and popularity of a given green space. Users' needs and desires should be prioritized in the design and management of urban green spaces (Pinto et al., 2021).

The development of ways to increase the awareness of urban residents of the environmentally friendly benefits of UGSs and to enhance their appreciation of the different UGSs in urban and peri-urban areas should be a focus of strategic planning and environmental education conducted by urban planners (Haq and Ahmed, 2020), could incorporate. Planners should also consider the size and type of proposed urban green spaces with respect to the opportunities they can provide to urban residents (Macintyre et al., 2019).

It is important for planners to note that multilevel frameworks, multi-sectoral collaboration, and more participatory development processes that engage the public have been shown to be necessary to the successful installation of formal purpose-built urban green spaces and the restoration of informal urban green spaces. To some extent, public perceptions of UGS are diverse and multifarious since the public wants more comprehensive, functional, and participatory strategies for landscape conservation and management (Scott, 2003).

Knowing what residents of a given area perceive to be the benefits of UGSs can aid city or urban planners and managers in the installation, development and design of traditional and non-traditional urban green spaces that can maximize these benefits. In recognition of the many and varied benefits of urban green spaces, more public and private funding should be allocated to improve and design new green spaces.

Limitations and Recommendations for Further Research

The literature cited in this study was mainly published between 2010 and 2021. The authors found that much of the literature review or research was done in the 2000's, when the concept of urban space was a newly emerging topic. Residents' perceptions of urban green spaces could not be compared across developed and developing countries, as studies conducted in developing and developed countries were not equally represented in the surveys. The present study focused on people's perceptions of urban green spaces in their own region or in general, and followed specific data sources, data availability criteria, inclusion and exclusion criteria for the selection of relevant articles, but did not fully apply the Preferred Reporting Items for Systematic Reviews and Meta-Analyses of Standards (PRISMA) process guidelines.

The study found perceptions included a range of positive effects of UGSs in the areas of socio-economics, health and well-being, climate change mitigation, policy, governance and planning. However, perceptions of urban residents regarding the formation and type of different kinds of green spaces and the many disadvantages associated with urban green spaces, including maintenance costs, crime, fear and insecurity experienced in green spaces, and unequal access to green spaces, have not been not widely discussed. Future studies should take into account the actual lifestyle changes facing urban dwellers in new urban communities.

This study focused on users' perceptions of urban green spaces. Future studies could use quantitative and qualitative methods to compare the perceptions of users and non-users of

urban green spaces in an integrated way. Such studies would benefit from taking into account the length and duration of urban residence, as the experience of living in an urban area for a short or long period of time can influence changes in perceptions of urban green spaces, especially in developing countries, due to various push and pull factors, including political conflict and, employment opportunities. The findings of this literature review suggest that urban green spaces can promote social cohesion between different groups. As demographics become increasingly complex in multicultural societies, future research could also examine the role UGSs can play to facilitate integration and respect for multiculturalism in cities.

This study also reveals that further research could be done to explore how green space or urban infrastructure development can meet the urgent need for climate change adaptation and mitigation strategies, and to identify residents' perceptions of the role(s) UGIs play in such strategies. We expect results to differ between developed and developing countries.

AUTHOR CONTRIBUTIONS

SA: conception of the paper, design, structure and lead the project, drafting abstract, introduction, discussion, and conclusion. SA, MI, and KA: searching for relevant articles, organizing, and distributing the selected articles for a review. SA, MI, AS, KA, and MC: systematic reviews of an equal number of selected articles, critical revision of the article, and approval of the final version for submission. MI: drafting section Understanding the Perceptions of UGSs from a Discipline-Specific Approach to an Integrative Approach. AS: drafting section Perceptions Regarding the Diverse Benefits of Urban Green Spaces. KA: drafting sections Methodology and Perception of the Role Of Urban Green Spaces in Climate Change Mitigation and Adaptation. MC: drafting section Perception of Urban Green Spaces: Socio-Economic, Demographic, and Social Cohesion. SA, AS, and KA: compiling all sections and finalizing the article. All authors contributed to the article and approved the submitted version.

REFERENCES

Abass, K., Appiah, D. O., and Afriyie, K. (2019). Does green space matter? Public knowledge and attitude towards urban greenery in Ghana. *Urban Forest. Urban Green.* 46:126462. doi: 10.1016/j.ufug.2019.126462

Ahmed, M. N. Q., and Atiqul Haq, S. M. (2019). Indigenous people's perceptions about climate change, forest resource management, and coping strategies: a comparative study in Bangladesh. *Environ. Dev. Sustain.* 21, 679–708. doi: 10.1007/s10668-017-0055-1

Barrera, F., Reyes-Paecke, S., Harris, J., Bascuñán, D., and Farías, J. M. (2016). People's perception influences on the use of green spaces in socio-economically differentiated neighborhoods. *Urban Forest. Urban Green.* 20, 254–264. doi: 10.1016/j.ufug.2016.09.007

Bele, A., and Chakradeo, U. (2021). Public perception of biodiversity: a literature review of its role in urban green spaces. *J Landscape Ecol.* 14:8. doi: 10.2478/jlecol-2021-0008

Beyene, G. A., and Borishe, E. N. (2021). Public Urban green spaces' visiting habits and perception regarding their health benefits in Addis Ababa City, Ethiopia. *Int. J. Environ. Protection Policy* 9, 50–58. doi: 10.11648/j.ijepp.20210903.11

Bokhari, S. A., Saqib, Z., Ali, A., and Zaman-Ul-Haq, M. (2018). Perception of residents about urban vegetation: A comparative study of planned versus semi-planned cities of Islamabad and Rawalpindi. *J. Ecosys. Ecograph.* 8:251. doi: 10.4172/2157-7625.1000251

Bonnes, M., Passafaro, P., and Carrus, G. (2011). The ambivalence of attitudes toward urban green areas: Between pro-environmental worldviews and daily residential experience. *Environ. Behav.* 43, 207–232. doi: 10.1177/0013916509354699

Chen, C., Luo, W., Li, H., Zhang, D., Kang, N., Yang, X., et al. (2020). Impact of perception of green space for health promotion on willingness to use parks and actual use among young urban residents. *Int. J. Environ. Res. Public Health* 17:5560. doi: 10.3390/ijerph17155560

Chowdhury, M. T. A., Ahmed, K. J., Ahmed, M. N. Q., and Haq, S. M. A. (2021). How do teachers' perceptions of climate change vary in terms of importance, causes, impacts and mitigation? A comparative study in Bangladesh. *SN Soc. Sci.* 1:174. doi: 10.1007/s43545-021-00194-7

Cilliers, S., Cilliers, J., Lubbe, R., and Siebert, S. (2013). Ecosystem services of urban green spaces in African countries-perspectives and challenges. *Urban Ecosyst.* 16, 681–702. doi: 10.1007/s11252-012-0254-3

Collins, C. M. T., Cook-Monie, I., and Raum, S. (2019). What do people know? Ecosystem services, public perception and sustainable management of urban park trees in London, U.K. *Urban Forest. Urban Green.* 43:126362. doi: 10.1016/j.ufug.2019.06.005

Conedera, M., Del Biaggio, A., Seeland, K., Moretti, M., and Home, R. (2015). Residents' preferences and use of urban and peri-urban green spaces in a Swiss mountainous region of the Southern Alps. *Urban Forest. Urban Green.* 14, 139–147. doi: 10.1016/j.ufug.2015.01.003

Duan, J., Wang, Y., Fan, C., Xia, B., and de Groot, R. (2018). Perception of urban environmental risks and the effects of urban green infrastructures (UGIs) on human well-being in four public green spaces of Guangzhou, China. *Environ. Manage.* 62, 500–517. doi: 10.1007/s00267-018-1068-8

Dzhambov, A. M., and Dimitrova, D. D. (2015). Green spaces and environmental noise perception. *Urban Forest. Urban Green.* 14, 1000–1008. doi: 10.1016/j.ufug.2015.09.006

Farahani, L. M., and Maller, C. (2018). Perceptions and preferences of urban greenspaces: A literature review and framework for policy and practice. *Landscape Online* 61, 1–22. doi: 10.3097/LO.201861

Francis, J., Giles-Corti, B., Wood, L., and Knuiman, M. (2012). Creating sense of community: The role of public space. *J. Environ. Psychol.* 32, 401–409. doi: 10.1016/j.jenvp.2012.07.002

Gascon, M., Triguero-Mas, M., Martínez, D., Dadvand, P., Forns, J., Plasència, A., et al. (2015). Mental health benefits of long-term exposure to residential green and blue spaces: a systematic review. *Int. J. Environ. Res. Public Health* 12, 4354–4379. doi: 10.3390/ijerph120404354

Gashu, K., Gebre-Egziabher, T., and Wubneh, M. (2020). Local communities' perceptions and use of urban green infrastructure in two Ethiopian cities: Bahir Dar and Hawassa. *J. Environ. Plan. Manage.* 63, 287–316. doi: 10.1080/09640568.2019.1578643

Gavrilidis, A.-A., Popa, A.-M., Nita, M.-R., Onose, D.-A., and Denisa-Lavinia Badiu, D.-L. (2020). Planning the "unknown": Perception of urban green infrastructure concept in Romania. *Urban Forest. Urban Green.* 51:126649. doi: 10.1016/j.ufug.2020.126649

Gozalo, G. R., Morillas, J. M. B., and González, D. M. (2019). Perceptions and use of urban green spaces on the basis of size. *Urban Forest. Urban Green.* 46:126470. doi: 10.1016/j.ufug.2019.126470

Guenat, S., Porras Lopez, G., Mkwambisi, D. D., and Dallimer, M. (2021). Unpacking stakeholder perceptions of the benefits and challenges associated with urban greenspaces in sub-Saharan Africa. *Front. Environ. Sci.* 9:e591512. doi: 10.3389/fenvs.2021.591512

Gunnarsson, B., Knez, I., Hedblom, M., and Sang, Å. O. (2017). Effects of biodiversity and environment-related attitude on perception of urban green space. *Urban Ecosyst.* 20, 37–49. doi: 10.1007/s11252-016-0581-x

Gwedla, N., and Shackleton, C. M. (2019). Perceptions and preferences for urban trees across multiple socio-economic contexts in the

Eastern Cape, South Africa. *Landsc. Urban Plan.* 189, 225–234. doi: 10.1016/j.landurbplan.2019.05.001

Hadavi, S., Kaplan, R., and Hunter, M. C. R. (2015). Environmental affordances: A practical approach for design of nearby outdoor settings in urban residential areas. *Landsc. Urban Plan.* 134, 19–32. doi: 10.1016/j.landurbplan.2014.10.001

Haq, S. A., and Ahmed, K. J. (2017). Does the perception of climate change vary with the socio-demographic dimensions? A study on vulnerable populations in Bangladesh. *Nat. Hazards* 85, 1759–1785. doi: 10.1007/s11069-016-2664-7

Haq, S. A., and Ahmed, K. J. (2020). Perceptions about climate change among university students in Bangladesh. *Nat. Hazards* 103, 3683–3713. doi: 10.1007/s11069-020-04151-0

Haq, S. M. A. (2011). Urban green spaces and an integrative approach to sustainable environment. *J. Environ. Prot.* 2, 601–608. doi: 10.4236/jep.2011.25069

Hartig, T., Mitchell, R., de Vries, S., and Frumkin, H. (2014). Nature and health. *Annu. Rev. Public Health* 35:182443. doi: 10.1146/annurev-publhealth-032013-182443

Hofmann, M., Westermann, J. R., Kowarik, I., and van der Meer, E. (2012). Perceptions of parks and urban derelict land by landscape planners and residents. *Urban Forest. Urban Green.* 11, 303–312. doi: 10.1016/j.ufug.2012.04.001

Hoyle, H., Jorgensen, A., and Hitchmough, J. D. (2019). What deter- mines how we see nature? Perceptions of naturalness in designed urban green spaces. *People Nat.* 1, 167–180. doi: 10.1002/pan3.19

Islam, M. K., Chowdhury, K. J., and Alam, M. S. (2020). urban green infrastructure development as perceived by urban household in Chittagong City of Bangladesh. *Asian J. Biol.* 10, 13–24. doi: 10.9734/ajob/2020/v10i330107

Jahan, Z., Shirazi, S. A., and Sharkullah, K. (2019). Evaluation of residents perception about socio-economic and environmental impacts of urban green spaces of Lahore, Pakistan. *Int. J. Econ. Environ. Geol.* 10, 87–96. doi: 10.46660/ijeeg.Vol10.Iss2.2019.267

Jennings, V., Larson, L., and Yun, J. (2016). Advancing sustainability through urban green space: Cultural ecosystem services, equity, and social determinants of health. *Int. J. Environ. Res. Public Health* 13:196. doi: 10.3390/ijerph13020196

Jim, C. Y., and Shan, X. (2013). Socio-economic effect on perception of urban green spaces in Guangzhou, China. *Cities* 31, 123–131. doi: 10.1016/j.cities.2012.06.017

Kim, M., Rupprecht, C. D. D., and Furuya, K. (2019). Typology and perception of informal green space in urban interstices: a case study of Ichikawa City, Japan. *Int. Rev. Spatial Plan. Sustain. Dev.* 8, 4–20. doi: 10.14246/irspsd.8.1_4

Klein, W., Dove, M. R., and Felson, A. J. (2021). Engaging the unengaged: Understanding residents' perceptions of social access to urban public space. *Urban Forest. Urban Green.* 59:126991. doi: 10.1016/j.ufug.2021.126991

Kothencz, G., Kolcsár, R., Cabrera-Barona, P., and Szilassi, P. (2017). Urban green space perception and its contribution to well-being. *Int. J.Environ. Res. Public Health* 14:766. doi: 10.3390/ijerph14070766

Li, X.-P., Fan, S.-X., Kühn, N., Dong, L., and Hao, P.-Y. (2019). Residents' ecological and aesthetical perceptions toward spontaneous vegetation in urban parks in China. *Urban Forest. Urban Green.* 44:126397. doi: 10.1016/j.ufug.2019.126397

Lo, A. Y., Byrne, J. A., and Jim, C. Y. (2017). How climate change perception is reshaping attitudes attitudes towards the functional benefits of urban trees and green space: Lessons from Hong Kong. *Urban Forest. Urban Green.* 23, 74–83. doi: 10.1016/j.ufug.2017.03.007

Macintyre, V. G., Cotterill, S., Anderson, J., Phillipson, C., Benton, J. S., and French, D. P. (2019). I would never come here because I've got my own garden: Older adults' perceptions of small urban green spaces. *Int. J. Environ. Res. Public Health* 16:1994. doi: 10.3390/ijerph16111994

Madureira, H., Nunes, F., Oliveira, J., and Madureira, T. (2018). Preferences for urban green space characteristics: A comparative study in three Portuguese Cities. *Environments* 5:23. doi: 10.3390/environments5020023

Malinen, S. (2015). Understanding user participation in online communities: A systematic literature review of empirical studies. *Comp. Hum. Behav.* 46, 228–238. doi: 10.1016/j.chb.2015.01.004

Mathey, J., Arndt, T., Banse, J., and Rink, D. (2018). Public perception of spontaneous vegetation on brownfields in urban areas-Results from surveys in Dresden and Leipzig (Germany). *Urban Forest. Urban Green.* 29, 384–392. doi: 10.1016/j.ufug.2016.10.007

Nasir, M. I. B. M., and Rahim, A. A. (2020). Community attitude towards urban green-blue space and perceived cultural ecosystem benefits: A preliminary study at Taiping Lake Garden, Perak, Malaysia. *Malaysian J. Soc. Sci. Human.* 5, 228–239. doi: 10.47405/mjssh.v5i11.550

Olszewska-Guizzo, A., Sia, A., Fogel, A., and Ho, R. (2020). Can exposure to certain urban green spaces trigger frontal alpha asymmetry in the brain?-Preliminary findings from a passive task EEG study. *Int. J. Environ. Rese. Public Health* 17:394. doi: 10.3390/ijerph17020394

Ostoić, K. S., van den Bosch, C. C. K., Vuletić, D., Stevanov, M., Živojinović, I., MutabdŽija-Bećirović, S., et al. (2017). Citizens' perception of and satisfaction with urban forests and green space: Results from selected Southeast European cities. *Urban Forest. Urban Green.* 23, 93–103. doi: 10.1016/j.ufug.2017.02.005

Ostoić, S. K., Marin, A. M., Kičić, M., and Vuletić, D. (2020). Qualitative exploration of perception and use of cultural ecosystem services from tree-based urban green space in the city of Zagreb (Croatia). *Forests* 11:876. doi: 10.3390/f11080876

Paul, A., Nath, T. K., Noon, S. J., Islam, M. M., and Lechner, A. M. (2020). Public open space, green exercise and well-being in Chittagong, Bangladesh. *Urban Forest. Urban Green.* 55:126825. doi: 10.1016/j.ufug.2020.126825

Petrişor, L. E., and Petrişor, A. (2020). Environmental perception of young urban planners after an ecology course: The surprise of a total disagreement. *PESD* 14:41003. doi: 10.15551/pesd2020141003

Pinto, L., Ferreira, C. S., and Pereira, P. (2021). Environmental and socio-economic factors influencing the use of urban green spaces in Coimbra (Portugal). *Sci. Total Environ.* 792:148293. doi: 10.1016/j.scitotenv.2021.148293

Priego, C., Breuste, J., and Rojas, J. (2008). Perception and value of nature in urban landscapes: comparative analysis in cities in Germany, Chile and Spain. *Landscape Online* 7:22. doi: 10.3097/LO.200807

Randrup, T. B., Sv, annel, J., Sunding, A. M., and Jansson, Å. O. (2021). Urban open space management in the Nordic countries. Identification of current challenges based on managers' perceptions. *Cities* 115:103225. doi: 10.1016/j.cities.2021.103225

Raven, R., Kern, F., Verhees, B., and Smith, A. (2016). Niche construction and empowerment through socio-political work. A meta-analysis of six low-carbon technology cases. *Environ. Innovat. Soc. Transit.* 18, 164–180. doi: 10.1016/j.eist.2015.02.002

Rupprecht, C. D. (2017). Informal urban green space: Residents' perception, use, and management preferences across four major Japanese shrinking cities. *Land* 6:59. doi: 10.3390/land6030059

Sanesi, G., and Chiarello, F. (2006). Residents and urban green spaces: The case of Bari. *Urban Forest. Urban Green.* 4, 125–134. doi: 10.1016/j.ufug.2005.12.001

Scott, A. (2003). Assessing public perception of landscape: from practice to policy. *J. Environ. Policy Plann.* 5, 123–144. doi: 10.1080/1523908032000121193

Sen, S., and Guchhait, S. K. (2021). Urban green space in India: Perception of cultural ecosystem services and psychology of situatedness and connectedness. *Ecol. Indicat.* 123:107338. doi: 10.1016/j.ecolind.2021.107338

Sreetheran, M. (2017). Exploring the urban park use, preference and behaviours among the residents of Kuala Lumpur, Malaysia. *Urban Forest. Urban Green.* 25, 85–93. doi: 10.1016/j.ufug.2017.05.003

Stessens, P., Canters, F., Huysmans, M., and Khan, A. Z. (2020). Urban green space qualities: An integrated approach towards GIS-based assessment reflecting user perception. *Land Use Policy* 91:104319. doi: 10.1016/j.landusepol.2019.104319

Taylor, L., and Hochuli, D. F. (2017). Defining greenspace: Multiple uses across multiple disciplines. *Landscape Urban Plan.* 158, 25–38. doi: 10.1016/j.landurbplan.2016.09.024

Tian, Y., Wu, H., Zhang, G., Wang, L., Zheng, D., and Li, S. (2020). Perceptions of ecosystem services, disservices and willingness-to-pay for urban green space conservation. *J. Environ. Manage.* 260:110140. doi: 10.1016/j.jenvman.2020.110140

Wagner, M., Mager, C., Schmidt, N., Kiese, N., and Growe, A. (2019). Conflicts about urban green spaces in metropolitan areas under conditions of climate change: A multidisciplinary analysis of stakeholders' perceptions of planning processes. *Urban Sci.* 3, 14–20. doi: 10.3390/urbansci3010015

Wan, C., Shen, G. Q., and Choi, S. (2021). Underlying relationships between public urban green spaces and social cohesion: A systematic literature review. *City Cult. Soc.* 24:100383. doi: 10.1016/j.ccs.2021.100383

Wei, Z., Wang, J., and Qin, B. (2021). Quantity or quality? Exploring the association between public open space and mental health in urban China. *Landscape Urban Plan.* 213:104128. doi: 10.1016/j.landurbplan.2021.104128

WHO (2021). *Green and Blue Spaces and Mental Health: New Evidence and Perspectives for Action*. Copenhagen: WHO Regional Office for Europe.

Włodarczyk-Marciniak, R., Sikorska, D., and Krauze, K. (2020). Residents' awareness of the role of informal green spaces in a post-industrial city, with a focus on regulating services and urban adaptation potential. *Sustain. Cities Soc.* 59:102236. doi: 10.1016/j.scs.2020.102236

Xiang, Y., Liang, H., Fang, X., Chen, Y., Xu, N., Hu, M., et al. (2021). The comparisons of on-site and off-site applications in surveys on perception of and preference for urban green spaces: Which approach is more reliable? *Urban Forest. Urban Green.* 58:126961. doi: 10.1016/j.ufug.2020.126961

Xu, J., Wang, F., Chen, L., and Zhang, W. (2021). Perceived urban green and residents' health in Beijing. *SSM Populat. Health* 14:100790. doi: 10.1016/j.ssmph.2021.100790

Zhao, C., Yan, Y., Wang, C., Tang, M., Wu, G., Ding, D., et al. (2018). Adaptation and mitigation for combating climate change - from single to joint. *Ecosyst. Health Sustainabil.* 4, 85–94. doi: 10.1080/20964129.2018.1466632

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