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URBAN FORESTS OF AGEING SOCIETIES. EXAMPLE OF ŁÓDŹ AND WARSAW (CENTRAL POLAND)

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ABSTRACT: The purpose of this work is to examine the opinions of respondents from Warsaw and Łódź forests, using the example of two forest complexes, Bielański Forest and Łagiewnicki Forest, which are the main places for active recreation. The work used a multi-mixed method that combines quantitative methods (analysis of demographic data) and qualitative methods (indicators of preferences of the elderly). Methods include a survey conducted among forest users via Google Forms and QR codes. Each respondent was assigned to a group based on age, gender, and socioeconomic status, which allowed for the detection of statistical significance (chi-square test, Statistica). Next, field inspections were conducted, as well as an assessment of the functioning of the forests and guidelines for municipal administrators. The surveys carried out in the Łagiewnicki Forest and the Bielański Forest in Łódź and the statistical analyses (test hi-square) show the fear of the ageing population about the actions initiated during the pandemic by managers and city authorities towards limiting active recreation in urban forests to promote ecology and protection of avifauna. The research points to the issue of environmental protection and active recreation in forests in the context of anthropopressure and further development of urban green infrastructure. The study could guide managers on properly manageing forest space in cities, adapting it to the needs of older people who visit it most often during the week.

KEYWORDS: anthropopressure, safety, recreation, environmental protection, greenery

Introduction

Urban forests, which function as nature reserves, are integral to the city's green infrastructure. Many urban forests in Poland act as reservoirs of urban greenery, providing biodiverse vegetation essential for active recreation development. The local community uses these areas daily for walking, cycling, running, and commuting from home to work. However, the complete natural protection of these places is often hindered by excessive anthropopression. We contend that an understanding of the needs of inhabitants of these locations will facilitate improvements in the management of urban greenery and the formulation of constructive guidelines for local authorities on how to protect valuable natural areas while ensuring the continued provision of recreational opportunities and meeting the needs of the local population in ageing societies.

The paper aims to determine whether the urban forest sites still differ regarding recreation and nature protection based on users' opinions in two big cities' agglomeration in Central Poland (Łódź and Warsaw). The paper constitutes a preliminary study and only highlights some comparisons that may serve as guidelines for other examples of cities. The secondary objective is to try to answer whether it is possible to develop a joint management model that integrates the needs of residents and local authorities.

In our pilot study, we chose two of the biggest and most visited nature protection urban forests in the two biggest post-industrial ageing cities in the central part of Poland (Kopecka-Piech, 2013). These cities – Łódź (293.25 km^2, 696 708) and Warsaw (area 517,2 km^2, population 1,765 000) are located near each other for about 140 kilometers (Central Statistical Office, 2024). Both cities are represented by ageing societies and a rapid growth of older people who need time to relax and recreate outside. (Figure 1).

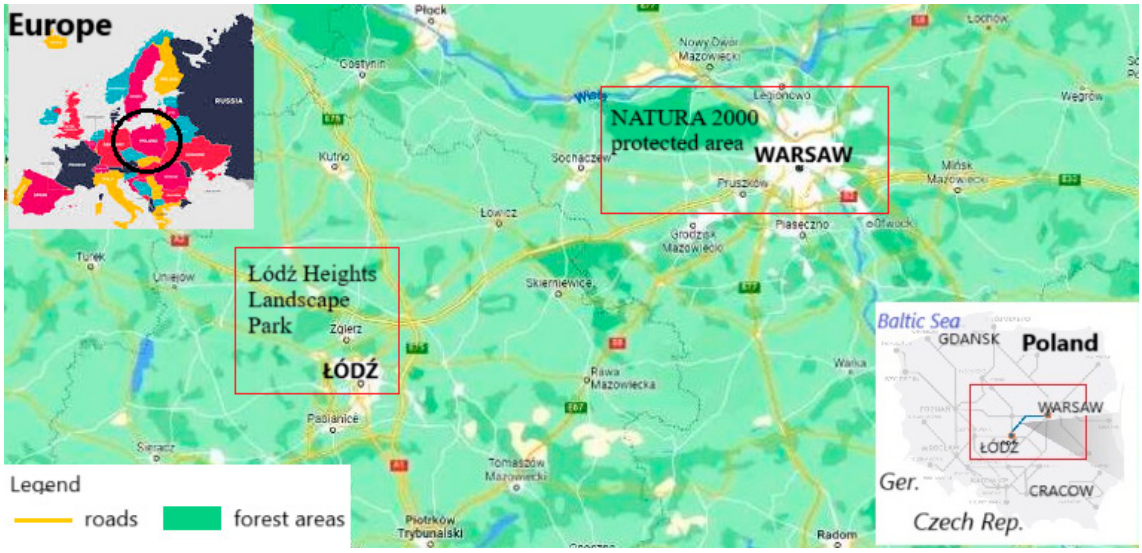

Figure 1. Location of Warsaw and Łódź cities in Central Poland

Source: Google Maps (2024) and Copernicus (2024).

Case study

The case study consists of two ample nature protection urban forests – Łagiewnicki Forest in Łódź and Bielański Forest in Warsaw, located in Central Poland. It is worth noting that the advantage of both forest sites in cities is their unique nature as a former wilderness area. The Bielański Forest covers an area of 151.83 ha, including over 100 hectares of NATURA 2000 protected area and nature reserve space with precious 400-year-old trees. The unique character of the space due to relict trees on Warsaw's slope near Vistula River is an icon of the forest, encourageing residents and tourists to visit the forest. The Łagiewnicki forest covers an area of a total of 1,200 ha, where only a tiny part is a reserved area (approx. 10 ha) located in the central part, which is fenced with no access for users.

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The rest of the forest area is accessible to visitors. The forest cover is part of Park Krajobrazowy Wzniesień Łódzkich (eng. Łódź Heights Landscape Park), with its hilly character extending beyond the city limits of Łódź (Figure 2).

Figure 2. Location of Bielanski Forest (BF) and Łagiewnicki Forest (ŁF) in Poland on the background of Warsaw (A) and Łódź (B) cities in Central Poland.

Legend: The black line indicates the forest boundaries and the red line represents the reserve area within the forest. Source: OpeenStreetMap (2024).

An overview of the literature

Currently, the issue of the perception of urban forest greenery in the literature is poorly recognised. This is due to the lack of comparisons between large cities in both Poland and Europe, as well as the lack of data on seniors, the largest group of urban residents, which is a pressing challenge for the future of adapting urban space to the expectations and needs of the elderly (Bamwesigye et al., 2021). The second important issue is the lack of local community involvement in forest activities, and immediately implementing conservation or landscaping plans without public opinion polls, which sometimes leads to conflicts (Fortuna-Antoszkiewicz et al., 2012). Urban nature reserves in Poland have a valuable stock of several hundred-year-old trees but have been insufficiently studied regarding safety for users' recreational activities (Długoński et al., 2023). Wooded forests in cities present aesthetic and landscape values (Malinowska & Szumacher, 2013; Biernacka et al., 2020; Koprowska et al., 2020; Kronenberg et al., 2021; Długoński et al., 2023). They also provide citizens with a wide range of possibilities for active recreation and numerous benefits for human well-being (Paganová & Kuczman, 2024). Also, the increased anthropopression pressure observed in these sites causes the impoverishment of the landscape and biodiversity reduction (Zaraś-Januszkiewicz et al., 2020). It is also a challenge for the manager and local authorities how to manage these spaces to present natural values and be friendly and accessible to the inhabitants without conflicts of interests of both parties (Długoński et al., 2023; Regionalna Dyrekcja Ochrony Środowiska w Warszawie, 2023). Currently, especially since the Corona period, we have observed heated debates around anthropopression, biodiversity on distancing between wildlife and humans (Bates et al., 2020; Bamwesigye et al., 2021; Fortuna-Antoszkiewicz & Łukaszkiewicz, 2021; Vimal, 2022; Procko et al., 2022; Ciesielski & Tkaczyk, 2023; Fialová, 2024). Our observations show that not only large Polish cities (e.g., Warsaw, Łódź, Cracow, Wocław) but also some European cities such as German, French, Belgian, and Dutch cities (e.g., Berlin, Leipzig, Dresden, Freiburg, Paris, Lille, Nantes, Brussel, Wageningen, Ede, Amsterdam) decide to establish the areas friendly for wildlife in huge ones (Fischer & Kowarik, 2020; von der Lippe et al., 2020; Trentanovi et al., 2021; Sielaff et al., 2024; van Helden et al., 2024). However, such an extension causes these selected areas to be predominated by wildlife and cease being predominated by humans. It is therefore debatable how to develop a coherent concept for urban (protected) forests with rich wildlife treated as open spaces, balancing possibilities for active recreation (Bamwesigye et al., 2021; Długoński et al., 2023). Even though in our pilot study in Warsaw and Łodź in Central Poland, both urban forests are preselected to be multifunctional (Larondelle & Haase, 2017;

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Długoński et al., 2023; Kronenberg et al., 2023), we know this is really hard or rather impossible to achieve it due to some law restrictions (Act, 2004) and rapid antropopression pressure (Długoński, 2018). Our earlier observations of forest sites in both cases and our survey results presented in this article highlight the problem of urban forest sites being used due to the lack of proper local authorities' cooperation with the visitors. Some of these assumptions also appear in the literature on urban forests management (Długoński et al., 2023; Biernacka et al., 2020; Biernacka & Kronenberg, 2018; Kabisch et al., 2017; Larondelle & Haase, 2017; Koprowska et al., 2020; Kronenberg et al., 2021; Zaraś-Januszkiewicz et al., 2020; Kronenberg et al., 2017, 2023; Malinowska & Szumacher, 2013; Kronenberg, 2006). Both examples of urban forests presented in our pilot studies show how difficult it is to reconcile nature conservation and recreation in a relatively small area – looking at the examples of Łódź, local authorities back in the 1990s urban planning strategy. In countries like the Czech Republic with a similar system and old case studies, so-called post-socialist towns or urban regions (Haase et al., 2019; Fialová, 2024) e.g., Brno (Lesnický Slavín), showing that increasing the area in the municipality offers residents and tourists about 14 hectares of forests nestled in a picturesque mountain landscape. There are marked hiking and cycling paths and viewing spots. Areas protected or without access for visitors are fenced off. However, in a relatively large area, it is also possible to manage and act, e.g., to protect valuable avenues of trees (lime trees) and create recreation squares or parks close to the Svitava River. It should, therefore, be considered whether, in the case of forests in Poland such as Łódź (Łagiewnicki Forest) and Warsaw (Bielański Forest), the area should not be transferred to neighboring municipalities so that recreation could have its place in a larger area. Then, it will also be possible to reconcile recreation with nature conservation and specific forest use rules. It seems that never in a small area will a place be able to fully exploit the potential of a place that fulfills the two functions of recreation and nature conservation. The Czech example of the development and management of green urban infrastructure should, therefore, be a model for regional planning in Poland on how to properly manage the urban landscape and the landscape of forested urban recreation areas to prevent degradation due to the development of anthropopression. Thus, it is suggested that in the case of Łódź, the Łagiewnicki Forest and its functions may be extended to the area of the Łódź Hills Landscape Park (area 13,767 ha) and in the case of Warsaw to the area of Młociny forests, which are currently poorly managed in the context of both recreation and conservation. What is binding is to provide proper infrastructure communicating old natural areas such as Łagiewnicki Forest with the area of ZPKWŁ (pl. Zespół Parków Krajobrazowych Województwa Łódzkiego, eng. Complex of Landscape Parks of Łódź Voivodeship) and Bielański Forest with Młociński Forest, e.g. green paths for pedestrians and cyclists once good education and information boards to transfer recreation to new areas thus relieving old relics of nature from anthropopression. Therefore, the Czech example may be of great importance for improving the potential of urban forests in Poland and providing guidelines for similar places in Europe.

Research methods

Methodology

The methodology of our study included the following five-stage framework (Figure 3). In our reach, we use a multi-mixed method based on the combined experiences of the authors' research work in urban ecology forestry and landscape architecture on urban forests in Poland (Długoński et al., 2023). The first stage was the development of a literature search on urban forest management and functioning. The second stage of the work involved a cameral and field survey of forest users. The survey was collected in the Łagiewnicki Forest and the Bielański Forest by posting information with a QR code to the online forms (Google Forms, 2024). Interested visitors could complete the study at home on a smartphone or computer. Surveys were collected between 2019 and 2022, covering the time of the Corona pandemic. The survey consists of two parts. In the first part, residents were asked (single or multiple-choice questions) about their opinions on the functioning of the city's forests. In the second part, residents were asked to provide their age, gender, and socioeconomic status (Table 1). This allowed them to be classified into the appropriate group of respondents and to indicate statistical significance (chi-square test; $p > 0.05$). Another aspect was the open part of the survey, where respondents could express their opinions in the form of a free response. The next stage

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involved secondary cameral and field studies compiling statistical data from the surveys in Statistica 13.0 Software (2024) and site observation (field inspection) of both forest cases. The fourth stage included an assessment of the functioning and management of the forest trainers and their comparison, discussing the possibility of resolving conflicts between forest managers and users, and attempting to undertake corrective solutions based on compromise. The final stage of the work is to set directions for developing urban forests (in the example of Warsaw and Łódź) and broader guidelines for protecting urban forests with the possibility of developing forest recreation.

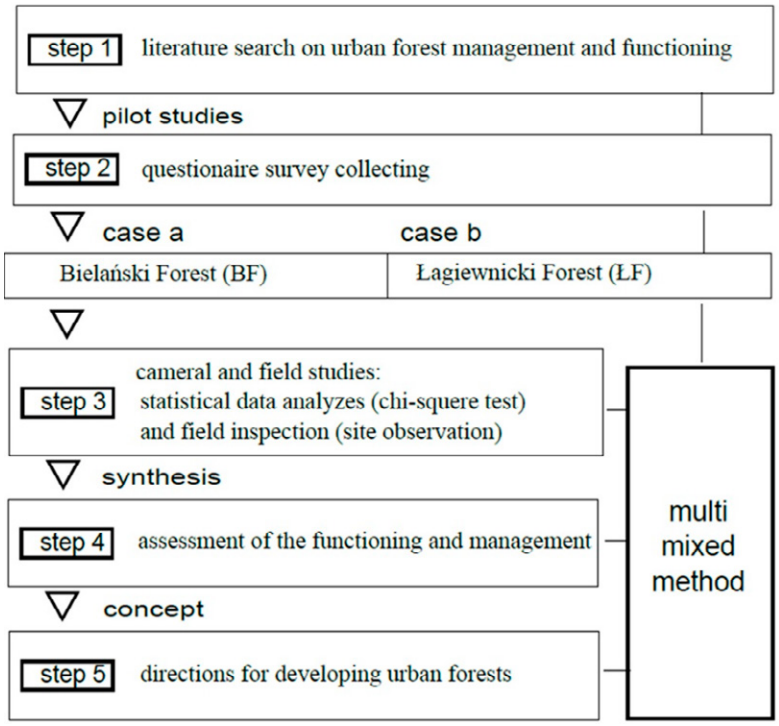

Figure 3. Research framework

Questionnaire survey

A total of 225 people took part in the study, including 117 users of the Bielański Forest in Warsaw (52.0%) and 108 users of the Łagiewnicki Forest in Łódź (48.0%). Table 1 presents the characteristics of the studied group in social terms; it is divided into users of the Bielański Forest (Warsaw) and the Łagiewnicki Forest (Łódź). Th/e chi-square test was used to check the significance of the differences between users of both forests (Berkson, 1938). In both groups, a slightly higher percentage of respondents were men. The most significant percentage of the Bielański Forest users were between 40 and 49, while the Łagiewnicki Forest users were between 30 and 39. Slightly more often in the case of Łagiewnicki Forest users, people over 50 years and those under 18 took part in the survey. However, the chi-square test did not show that the described differences statistically significantly differed between these two groups. Regarding educational attainment, the highest percentage of both groups were people with tertiary education, followed by secondary education. Similarly, in the case of employment, both groups are dominated by people working or learning.

The questionnaire consists of 7 multiple and single-choice questions. The questions on the usage of urban forests are summarised in Table 2. The last part of the survey consisted of open comments from respondents, which, due to the multi-threaded and extensive character, we tried to point out and join more widely to the assessment part of our research in the following subsections and discussion part.

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Table 1. Characteristics of the study group

	Sex					
	Male			Female		
Warsaw (n=117)	61 [52.1%]			56 [47.9%]		
Łódź (n=104)	60 [57.7%]			44 [42.3%]		
Total (n=221)	121 [54.7%]			100 [42.3%]		
Chi-square	p= 0.4075; X2= 0.69; df = 1					
Age [years]						
	<18	18-29	30-39	40-49	50-59	>60
Warsaw (n=117)	3 [2.6%]	25 [21.4%]	33 [28.9%]	36 [30.8%]	11 [9.4%]	9 [7.7%]
Łódź (n=105)	6 [5.7%]	22 [20.9%]	34 [32.4%]	20 [19.0%]	12 [11.4%]	11 [10.5%]
Total (n=222)	8 [4.0]	47 [21.%2]	67 [25.2%]	56 [25.2%	23 [10.4%]	20 [9.0%]
Chi-square	p= 0.3703; X2= 5.34; df = 5					
Education level						
	Higher	secondary		vocational	basic	
Warsaw (n=117)	90 [76.9%]	24 [20.6%]		1 [0.8%]	2 [1.7%]	
Łódź (n=106)	72 [67.9%]	28 [26.4%]		1 [1.0%]	5 [4.7%]	
Total [n=223]	162 [72.6%]	52 [23.3%]		2 [1,0%]	7 [3.1%]	
Chi-square	p= 0.3827; X2= 3.06; df = 3					
Professional activity						
	Working/Learning		Pensioner		Not working	
Warsaw (n=116)	106 [91.4%]		7 [6.0%]		3 [2.6%]	
Łódź (n=106)	98 [92.4%]		6 [5.7%]		2 [1.9%]	
Total [n=223]	204 [91.9%]		13 [5.9%]		5 [2.2%]	
Chi-square	p= 0.9322; X2= 0.14; df = 2					

Source: authors' work based on Google Forms [12-12-2024].

Table 2. A questionnaire survey was conducted among Łagiewnicki and Bielański forests visitors

Question	Answers
What is the goal of visiting the forest?	1) walking; 2) running; 3) cycling; 4) mushroom picking; 5) meeting with friends; 6) relaxation/quieting; 7) other Multiple answers were possible.
Why do you choose this place? What are the advantages of this place?	1) it is close to home/on the way to school or work; 2) it is well equipped with necessary, well-maintained equipment (e.g., benches, garbage bins); 3) it is usually clean; 4) it is quiet and peaceful; 5) the air here is clean and fresh; 6) I am surrounded by well-groomed and well-maintained vegetation; 7) I do not feel crowded and rushed here Multiple answers were possible.

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Question	Answers
How do you most often reach the forest?	1) on foot 2) bike 3) public transport 4) car
Time to reach the forest	1) < 15 min. 2) 15-30 min 3) 30-60 min 4) > 60 min
Do you observe wildlife? (e.g., old trees, squirrels, foxes, hedgehogs,singing birds, etc.)	1) yes 2) no 3) I do not pay attention to it
Do you feel safe in the forest site?	1) yes 2) no 3) I do not pay attention to it
What benefits can the forest area provide to the inhabitants?	1) Health 2) Regulatory 3) Cultural 4) Production 5) Other Multiple answers were possible

Source: authors' work based on Google Forms [12-12-2024].

Results of the research

Pilot studies

In Table 3, we summarise the results obtained after counting the answers given by the respondents to questions about why they chose the Bielański Forest (BF) or the Łagiewnicki Forest (ŁF) as a place of rest and why they chose them. The percentage of individual responses was calculated as the number of indications of a specific goal/reason to the total number of responses given by respondents.

For the question about why they go to these forests, respondents gave a total of 508 answers, which gives an average of 2.3 answers per respondent. Slightly more answers were given by Łagiewnicki Forest users, with an average of 2.4 answers per respondent, while for Bielański Forest users, it was an average of 2.1 answers per respondent. Regardless of the residence, the respondents most often indicate walking (respectively BF 39.9%, ŁF 38.1%), followed by running (respectively BF 39.1%, ŁF 36.5%). Less usually, the goal of a visit to urban forests is cycling (respectively BF 15.7%, ŁF 17.3%). The rarest goal of visits to both forests is to observe nature, which is indicated as different, and in both cases, this goal indicates one person. In any case, there were no statistically significant differences in the response rates between users of the two forests.

Respondents from Warsaw asked about the advantages of the Bielański Forest most often indicated its location close to their residence (21.3% of all separated answers). In the case of Łagiewnicki Forest, the advantage of its proximity was indicated in 16.3% of the answers. This characteristic statistically significantly differentiates the two surveyed areas ($p = 0.0001$; $X2 = 14.78$; $df = 1$) and is the only one for which there was a statistically significant difference in the number of indications by the users of both forests. This state of affairs may be due to the location of both forests. The Bielański Forest is located in the central part of the city, near multi-family buildings. At the same time, Łagiewnicki Forest is placed on the outskirts of towns and is surrounded to a greater extent by single-family buildings. The next advantage for users of the Bielański Forest is that they do not feel the rush and crowds in this place (19.2% of the answers), as well as the peace of the place and the clean air (18.8%). On the other hand, the Łagiewnicki Forest users consider its most important advantage

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for peace (22.2% of all replies), as well as the lack of crowd and rush (21.1%), and clean air of this place (20.9%). Regardless of the place of residence (Warsaw or Łódź), the respondents less often point to the cleanliness of both forests and their equipment (infrastructure) as an advantage and also choose the answer related to the well-groomed and well-maintained vegetation (greenery). Moreover, other respondents in the survey of both forest sites indicate that the advantage of these forests is the relatively natural character of the places (small number of concrete surface paths, natural vegetation, presence of fallen trees, etc.), which allows them acceptable contact with nature. They indicate that if the vegetation of both forests were overly maintained, the forests would lose their function and become an urban park. They also highlight the role of both sites in preserving biodiversity, both flora and fauna.

Table 3. The purpose and reason for visiting forests in the selected case studies

Question 1	What is the goal of visiting the forest?						
	A1	A2	A3	A4	A5	A6	A7
Warsaw (n=248)	99 (39.9)	97 (39.1)	39 (15.7)	6 (2.4)	2 (0.8)	4 (1.6)	1 (0.4)
Łódź (n=260)	99 (38.1)	65 (36.5)	45 (17.3)	13 (5.0)	3 (1.2)	4 (1.5)	1 (0.4)
Total (508)	198 (39.0)	192 (37.8)	84 (16.5)	19 (3.7)	5 (1.0)	8 (1.6)	2 (0.4)
Question 2	**Why do you choose this place? What are its advantages?**						
	A1	A2	A3	A4	A5	A6	A7	A8
Warsaw (n=437)	93 (21.3)	19 (4.3)	40 (9.2)	82 (18.8)	82 (18.8)	30 (6.9)	84 (19.2)	7 (1.6)
Łódź (n=369)	60 (16.3)	13 (3.5)	29 (7.9)	82 (22.2)	77 (20.9)	26 (7.0)	78 (21.1)	4 (1.6)
Total (806)	153 (19.0)	32 (4.0)	69 (8.6)	164 (20.3)	159 (19.7)	56 (6.9)	162 (20.1)	11 (1.4)

Where: Question 1: A1 – walking; A2 – running; A3 – cycling; A4-mushroom picking; A45 meeting with friends; A6 – relaxation/quieting; A7 – other; Question 2: A1: is close to home/on the way to school or work; A2: it is well equipped with necessary, well-maintained equipment (e.g., benches, garbage bins); A3 – it is usually clean; A4 – it is quiet and peaceful; A5 – the air here is clean and fresh; A6 – I am surrounded by well-groomed and well-maintained vegetation; A7 – I do not feel crowded and rushed here; A8 – other.

Source: authors' work based on Google Forms [12-12-2024].

Furthermore, the respondents were asked how long it takes them to reach both forest sides and how they most often reach the forest area. In this case, respondents were asked to list all their options and indicate how long the results are summarised in Table 4.

According to the results, both users of the Bielański Forest and the Łagiewnicki Forest often go on foot (48.7% and 57.0%, respectively); the journey takes less than 15 minutes. It was also noted that users of the Bielański Forest often go there by bicycle, while users of the Łagiewnicki Forest more often by car. As for these differences, the overall chi-square test showed that these differences are statistically significant. In this case, as in the case of the question about the advantages of this place, these differences may be due to the peripheral location of the Łagiewnicki Forest (outskirts of the city). Similarly, the parking spaces available at the Łagiewnicki Forest may also impact this. While it is difficult to find a parking space in or approximately close (2 kilometers ring) to the area of Bielański Forest, in the case of Łagiewnicki Forest, there are two relatively large car parks near main roads leading to the forest site (at Wycieczkowa and Skrzydlata Streets), including one free of charge, and also extra parking spaces along Skrzydlata Street.

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Table 4. Way and time to reach the forest for the selected case studies

Question 3	How do you most often reach the forest?				
		on foot	Bike	public transport	Car
Warsaw (n=117)		57 (48.7%)	23 (19.7%)	8 (6.4%)	29 (24.8)
Łódź (n=107)		61 (57.0%)	7 (6.5%)	7 (6,5%)	32 (29.9%)
Total (224)		118 (52.7%)	30 (13.4%)	15 (6.7%)	61 (27.2%)
Warsaw vs Łódź Chi square			p = 0.0375; X2 = 8.45; df = 3		
Question 4	**Time to reach the forest**				
	Time [min]	**on foot**	**Bike**	**public transport**	**Car**
Warsaw	<15	41 (71.9%)	12 (52.2%)	3 (37.5%)	13 (44.8%)
	15-30	14 (24.7%)	10 (43.5%)	1 (12.5%)	15 (51.8%)
	30-60	1 (1.7%)	1 (4.3%)	4 (50.0%)	1 (3.4%)
	>60	1 (1.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Łódź	<15	40 (65.6%)	2 (28.6%)	0 (0.0%)	16 (50.0%)
	15-30	14 (22.9%)	3 (42.8%)	3 (42.9%)	13 (40.6%)
	30-60	6 (9.9%)	2 (28.6%)	3 (42.9%)	3 (9.4%)
	>60	1 (1.6%)	0 (0.0%)	1 (14.2%)	0 (0.0%)

Source: authors' work based on Google Forms [12-12-2024].

Next, forest users were asked whether they observed wildlife during their visits to the forest and, if so, what they paid particular attention to. They were also asked if they felt safe going out into the forest and, if not, what makes them feel unsafe. The results of this part of the study are summarised in Table 5.

Most respondents of both forests declare that they pay attention to nature. For Łagiewnicki Forest users, more than 95% of users and less than 5% declare that they ignore it. A much more significant proportion of Bielański Forest users either do not observe nature during visits to the forest or do not pay attention to it, which is slightly over 17%. These differences are statistically significant. Among the people who declare that they observe nature during their visits, regardless of where they live and the forest they visit, they emphasise that they observe both fauna and flora. Some respondents mention specific observed species, e.g., deer, wild boars, woodpeckers (e.g., black or green), blacksmiths, or kingfishes. They also draw attention to inanimate elements of nature, such as bed boulders, or less popular systematic groups, such as mucous membranes.

As for the feeling of security, a higher percentage of users of the Bielański Forest declare that they feel safe there (84.5%), in the case of the Łagiewnicki Forest, almost 19% of users do not feel safe there, and 8% of them do not pay attention to this issue. Among users who declared unsafe in the park, 23 respondents indicated specific reasons for this state of affairs (see chapter 3.2.). Regardless of the forest studied and given answers, the most frequently mentioned reasons were the presence of other people, incredibly drunk or homeless (60.8%), followed by boars (17.4%). Among the responses, indications referred to loose dogs (13.0%). Respondents also indicated a lack of lighting after dark (8.8%).

Respondents were also asked what they think forest areas provide benefits for citizens. Respondents could indicate more than one of the proposed answers to this question; if they did not, they considered the right one to enter their proposal. The results of this part of the study are shown in Table 6. The percentage of each response was estimated as a proportion of all responses. In total, the respondents indicated 612 answers, which gives an average number of indications per 1 respondent equal to 2.7 (respectively BF 2.6%, ŁF 2.8%). Regardless of the place of residence, the respondents most often pointed to the health functions of the Forest (37.1% and 34.8% of all indications). Next, the subjects pointed to the regulatory function of forests.

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Table 5. Wild nature observations and safety of selected case study

Question 5	Do you observe wildlife? (e.g., old trees, squirrels, foxes, hedgehogs, singing birds, etc.)		
	Yes	No	I do not pay attention to it
Warsaw (n=117)	97 (82.9%)	12 (10.3%)	8 (6.8%)
Łódź (n=107)	102 (95.3%)	2 (1.9%)	3 (2.8%)
Total (n=224)	199 (88.8%)	14 (6.3%)	11 (4.9%)
Warsaw vs Łódź Chi square		p = 0.0105; X2 = 9.11; df = 2	
Question 6	**Do you feel safe in the forest site?**		
	Yes	No	I do not pay attention to it
Warsaw (n=116)	98 (84.5%)	15 (12.9%)	3 (2.6%)
Łódź (n=106)	77 (72.6%)	20 (18.9%)	9 (8.5%)
Total (n=222)	175 (78.8%)	34 (15.8%)	12 (5,4%)
Warsaw vs Łódź Chi square		p = 0.0551; X2 = 5.79; df = 2	

Source: authors' work based on Google Forms [12-12-2024].

Only 4.6% of respondents considered the productive function of forests important; slightly more often, the Łagiewnicki Forest users consider this function necessary. The chi-square test showed no significant differences in the frequency of indicating specific responses between users of both forests. Among the people who indicated other functions of forests as necessary (a total of 3.3% in both groups), they most often stated the possibility of rest, including mental rest (rest from rush, technology, etc.), which is more important than the users of the Bielański Forest (41.7%). In the case of the users of the Łagiewnicki Forest, 25% of the people who chose another answer indicated this function of the forest. The educational and scientific value of forests, including the maintenance of biodiversity, was noted by 25% of respondents, who indicated a different answer. Next, contact and respect for nature and biodiversity were indicated (15% of all people stated a different answer). The percentage share of these other forest functions is shown graphically in Figure 4.

Table 6. Benefits of forests perceived by visitors of both forest sites

Question 7	What benefits can the forest area provide to the inhabitants?				
	Health	regulatory	Cultural	Production	other
Warsaw (n=310)	115 (37.1%)	95 (30.6%)	78 (25.2%)	10 (3.2%)	12 (3.9%)
Łódź (n=302)	105 (34.8%)	95 (31.5%)	80 (26.5%)	14 (4.6%)	8 (2.6%)
Total (n=612)	220 (35.9%)	190 (31.0%)	158 (25.8%)	24 (4.6%)	20 (3.3%)

Source: authors' work based on Google Forms [12-12-2024].

Users of both forests were asked whether forest areas, including urban forests with such valuable trees/growth as in BF and ŁF, should be made available to residents and tourists – people who replied that they were not asked for an additional comment stating why they think so. The results of this part of the study are presented in Figure 4. Users of both Forests agree that forests should be made available to residents. Only 2.7% of all respondents think they do not (respectively 1.9% for Łódź' forests and 3.4% for Warsaw' forests). The reason for this approach is that the behaviour of some users threatens the safety of the permanent inhabitants of the forests. They also emphasise, particularly in the case of the users of the Bielański Forest, that it is a nature reserve of precious landscape and biodiversity.

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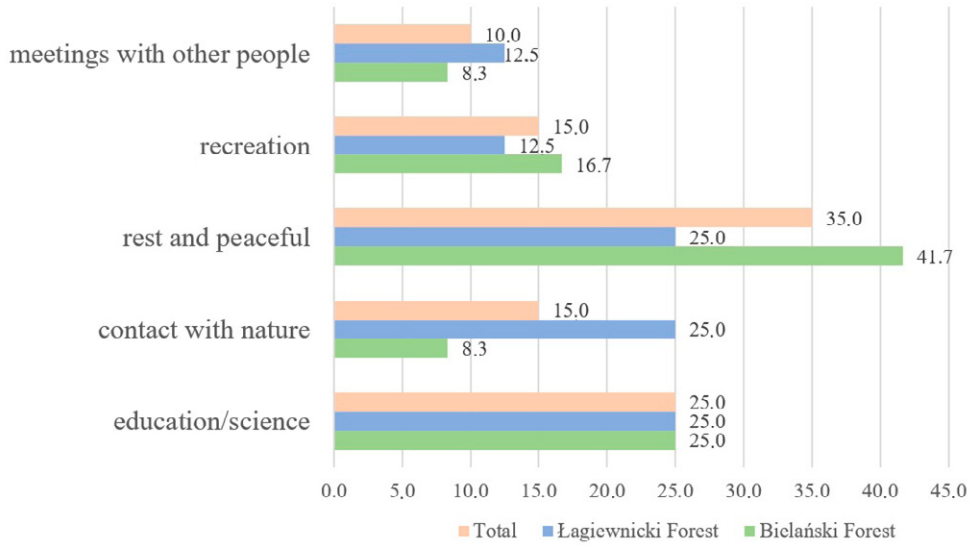

Figure 4. Other functions of the Łagiewnicki and Bielański forests in Poland

Source: Google Forms (2024).

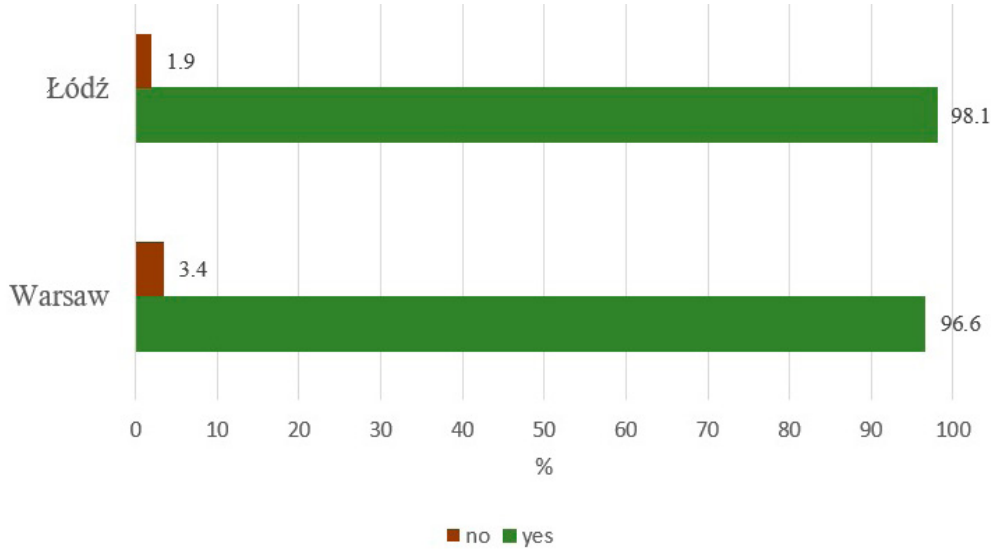

Figure 5. Accessibility for urban forest users in the example of the analysed cities

Source: Google Forms (2024).

Respondents were then asked if they thought it was a good idea to gradually close walking and cycling paths in the forest to protect and maintain the area's unique landscape. No statistically significant differences were observed between the two study groups ($p = 0.1581$; $X2 = 3.69$ $df = 2$). People who indicated that closing paths is not a good idea were asked for an additional comment. The walkers indicate that the local authorities' pressure limits their freedom of movement in the forest, and certainly not, and this way of thinking about forest management should look like landscape protection. Respondents have repeatedly stressed that they are annoyed by the closure of the trails by the forest management, mainly since they could have used them to go to their favorite parts of the forest in the past before the coronavirus pandemic. In turn, cyclists argue in the surveys that they do not forgive the forest bans and mount amateur bike rides because there is a lack of such in the forest, which they believe is due to their current needs and desire for recreation outside concrete settlements and squares, especially during the summer.

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Visitors site assessment and field inspection

Pilot studies conducted in Łódź and Warsaw among users of forest sites have shown that these are valuable green spaces that respondents choose because of their proximity to access, wild nature, recreation, and valuable natural values. Unfortunately, they are not fully safe places, distinguishing them significantly from urban green spaces like urban parks within the greenery of the analysed cities (Zaraś-Januszkiewicz et al., 2020).

The wilderness, the density of tree canopies, the natural character and large size of the area, as well as minimal maintenance and thus limited interference from managers, make these spaces unsafe for some respondents. Admittedly, more than half of the respondents (78.8%, table 5) felt safe in the forest area; however, these responses were largely related to visiting during daylight hours. The situation is different at dusk or in the middle of the day outside the weekend when the forest receives relatively few visitors. This group of users commented negatively on the level of safety. Certainly, the solution to this problem would be installing street lamps and a monitoring system because neither forest has sufficient equipment. From the field inspection, we know that only the entrance road to Bielański Forest and Łagiewnicki Forest is illuminated, and in the case of the latter, also one of the roads around the pond in the central part of the forest. Łagiewnicki Forest also has a monitoring system in this part. Independent announcements by visitors about the problem also report dissatisfaction with the state of safety in the forests. In Łagiewnicki Forest, exhibitionists have been spotted, while in Bielański Forest, suspicious people accost women, especially after dark. Thus, the wildness of nature, on the one hand, provides comfort to users; on the other hand, it is the cause of loss of security and a sense of fear among some respondents. Both forests' second major safety problem is stray dogs or dogs running without leashes. According to respondents, the forest space is conducive to excursions with dogs, which respondents also cited as one of the purposes of the visit. However, one has to wonder if going in with animals is a good thing at all. Animals such as dogs often scare off forest animals, which limits human contact with birds and makes it difficult for animals to exist as natural inhabitants of the forests. The forest is also not a safe place for family visits due to the unrestricted access of cyclists. Despite the designated bicycle routes, bicyclists do not follow the information and often break hiking trails and undergrowth, cutting short their journey. The openness of the forests to the need for recreation deserves positive attention. The forests are open 24 hours a day and are accessible to various user groups. Respondents noted that their satisfaction was strong before the pandemic. The pandemic was a time for managers to modernise and revitalise the forest. After the pandemic, when the forests were opened to users, new forest protection restrictions were introduced, which was met with dissatisfaction by most respondents. Respondents often stressed that many hiking trails formerly accessible were closed after the pandemic, making recreation far more limited. Regardless of the timing of the pandemic, respondents appreciated access to large forest clearings that allowed for team games. Thus, these issues might be a guideline for managers to promote these values more strongly in social media (Kronenberg, 2006).

Discussion/Limitation and future research

Trade-offs protection and recreation multifunctional possibilities

Our surveys clearly show that residents know the need to protect natural resources. However, city dwellers, in their opinion, often need to understand why local authorities forcefully impose their will on visitors without listening to their needs. Therefore, this situation sometimes provokes conflicts and discussions at the local level, which we observe in the forest protection forum in the capital of Poland. This may be because, in Polish practice, the protection of nature is put first at the expense of recreation, which may have negative consequences, especially in cities where there is strong anthropopression (Łukaszkiewicz et al., 2019; Bamwesigye et al., 2021). It is, therefore, necessary to find a compromise between nature conservation and recreation. However, this approach is currently primarily limited by forest managers who are not keeping up with the current needs of citizens. The problem is firmly rooted in post-socialist countries of Eastern Europe, such as the Czech Republic, Slovak, Poland, and Hungary (Kaiser, 2024, Fialová, 2024). The examples described during the conference in Křtiny in the Moravian region of Czech Republik (Fialová, 2024) show the problem and

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reasonable solutions based on zones for a particular type of recreation. Examples of similar countries that have undergone structural transformation, such as Slovakia, show that in the protected area, it is possible to separate zones or one zone depending on the size of the forest area where different types of recreation can be carried out (Paganová & Kuczman, 2024). For example, each zone can be dedicated to a different user group. We found that the protection and variety of recreation zones do not have to be large, significantly facilitating the management and protection of valuable natural resources in the forest area. Therefore, Poland and prominent city authorities should take the example of Slovakia, which has forestry traditions and valuable forest areas available for tourism and protecting valuable landscapes. However, at the same time, it is necessary to change the regulations on protecting nature (Act, 2004), which is planned shortly in Poland. Consultations are currently underway for changes to the legislation, and it can be assumed that with the entry into force of the new law, activities involving the participation of the public and specialists in the field of forestry, urban ecology, or landscape architecture will also be important (Łukaszkiewicz et al., 2023). The Warsaw greenery example shows how residents' lack of discussion of these issues and the exclusion of different areas from recreation has negatively affected society, causing numerous conflicts and protests (Fortuna-Antoszkiewicz et al., 2012). Unfortunately, the local authorities learned little from previous wrong solutions such as the revaluation of the Krasiński Garden Park, where the whole area was closed and then most of the valuable trees were cut down, which was met with numerous social actions such as burning destroys or writing signs like "a massacre with a chainsaw." Even well-known people, such as actors supporting the wrong actions of local authorities, got involved in the initiative. Unfortunately, the example of Warsaw shows the growing tension and the conferences organised by the city are not respected and well received by the inhabitants. On the contrary, it is in Łódź where the city's revitalisation process is being implemented in stages and with the participation of residents. However, it seems that the local problems of society and managers cannot go beyond the areas of the cities themselves, and the conflicts become irremediable, which has been observed for many years. The tension has increased significantly after the coronavirus (Fortuna-Antoszkiewicz & Łukaszkiewicz, 2021). Therefore, it is necessary to encourage the two cities to develop novelty management that supports current ecological trends and people's education (Długoński, 2018; Korcz & Janeczko, 2022). This could be, for example, a broadly understood promotion of cultural values within the framework of outbound tourism in both cities agglomeration region. However, it is worth referring to these demands and taking a broader look at the standard natural and recreational potential of cities within the areas of NATURA or many hectares of undeveloped forests in the Central Polish region in the direction of tourism and recreation development of the Warsaw and Łódź cities (Kronenberg et al., 2017, 2023; Długoński et al., 2023; Paganová & Kuczman, 2024).

Guidelines for city managers

Our research shows that visitors' opinions of both cases selected through our pilot study may develop new ecological equipment that integrates local interests using dwellers' needs. In this way, we distinguished four main forest management issues in selected case studies and discussed proposals for their solution. Based on feedback from survey respondents and our field visits, we suggest that managers consider introducing or improving the following safety issues. First, the level of security in the forests should be enhanced through frequent patrols by police and forest guards. This can help improve public perception and calm conflicts between local authorities and users dissatisfied with recreation restrictions. Also, bicyclists in unauthorised areas and suspected unwanted users will respect and adhere to applicable ethical rules or local work regulations. Monitoring is a good but ineffective solution, much weaker than the presence of on-site services. Secondly, funds should be obtained for street lighting of main streets and squares. Lighting will help users avoid obstacles and barriers, such as yielding roots or falling branches. Funds can be raised through voluntary online fundraising. Lighting can be implemented in small stages each year, and funds can be obtained for grants from the European Union for lanterns using LEED Technology and solar panels, which will significantly save the equipment's cost. Moreover, areas with the highest concentration of old trees and the risk of ragging or breaking branches should be fenced off. Such places must be fenced off, and forest revitalisation should occur first. These places can be places for new trees when the old trees die entirely, and they will give opportunities for the development of new individuals by the process

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and circle of life of natural forests. It should be borne in mind that it is impossible to protect old valuable trees indefinitely as every tree is not immortal and must give chances to the next generation.

When mentioning the youngest users, one cannot also forget about the needs of the elderly, given the rapid demographic ageing process of the populations of Warsaw and Łódź (Central Statistical Office, 2024). We particularly recommend introducing green stops that promote biodiversity and climate mitigation and can encourage residents to use public transportation more often when traveling to and from the forests of Łódź and Warsaw. This task is part of the strategy for greening the city of Łódź (Arcadis & DS Consulting, 2024), as well as the standards for shaping the greenery of the city of Warsaw (Borowski et al., 2016). The second issue is introducing health trails in forests that encourage outdoor activities for the elderly, as well as activating seniors through meetings at environmental education centers that can expand their offerings for the elderly, not just younger people like children. Currently, a significant portion of residents commute to and from the forest on bicycles, as indicated by our pilot studies. It is, therefore, important to provide access to good quality bike paths in order to reduce the risk of accidents, which is currently the case, especially at road crossings and intersections with car roads. It is also important to protect pedestrians and cyclists from noise and pollution from car roads through buffer strips consisting of vegetation (vines, trees, and shrubs on the side of the road) of varying heights that serve as a barrier (Suchocka et al., 2019; Borowski et al., 2016). Research conducted in Germany, Switzerland, the Czech Republic, and Scandinavia shows that proper marking of bike and pedestrian paths encourages active recreation and the use of this mode of transportation instead of cars, which are problematic especially due to their carbon footprint and the need to create space for additional parking (Jurczak & Rzeńca, 2024). The problem is especially noticeable in Warsaw, where there is a lack of parking space, and the roads with priority for cars limit the possibility of cycling. This applies to two main roads in Warsaw (Dewajtis Street) and Łódź (Wycieczkowa Street). Therefore, car transport in the forests of Warsaw should be limited to a minimum.

Conclusions

The study indicated that achieving comprehensive enhancement of the urban forest as a multi-functional forest is not feasible. Nevertheless, it is feasible to augment the satisfaction of forest visitors by implementing novel solutions that do not elicit intense emotional responses or engender discord between managers and users during their visits to the forest. Our research findings can potentially inform more effective management of urban forests, which are also nature reserves. The studies have indicated that protecting valuable natural resources and recreational opportunities within a relatively small forest area in an urban environment requires significant effort. A survey can be an effective instrument for evaluating the management of the site's forests. Furthermore, by soliciting feedback from forest users, it is possible to gain insight into their needs and concerns, which can inform future development perspectives. It is not our contention that this approach will resolve all the issues associated with forest management. However, it can alter how we conceptualise the role of forests as recreational spaces. The proposed solutions for enhancing security can assist in reducing apprehension and ameliorating unfavorable perceptions regarding compliance with urban forest spaces.

Furthermore, it can be observed that the implementation of such solutions enables the simultaneous protection and recreation of forests without a notable reduction in the critical elements and functions associated with multi-functionality. The guidelines may be employed as a model for the dual management of other European urban forest areas where wildlife is experiencing difficulties adapting to the multifunctionality of forest ecosystems and the effects of human activity. Therefore, the forest space should be arranged by zoning to suit the needs of individual social groups better. Areas of the greatest value must remain safeguarded from anthropogenic pressures. Education and social dialogue can be conducted on impartial grounds. It appears that agglomerations may collaborate at the regional level to establish enhanced standards for spatial management, which represents a significant challenge for the revitalisation of urban areas. Such an approach can be facilitated by fostering dialogue between the public, forestry officials, and residents through educational initiatives, given that forests are a national asset. Safeguarding urban wildlife by incorporating cultural activities into recreational programs is possible.

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The solutions developed can serve as a model for other European agglomerations in manageing naturally valuable areas in a relatively small area while respecting the protection of valuable natural resources and developing recreational opportunities for various social groups. The integration of common conservation and recreation objectives can be achieved through the education of society. A common feature of cities is their users' and managers' pursuit of leisure and pressure on wildlife. The novel education concept of cities has the potential to inform new directions for developing forest tourism and recreation of valuable natural resources. It may also be tested in other urban studies in Europe and around the world, representing a significant challenge for the future.

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The contribution of the authors

Conceptualisation, A.D., D.H. and T.W.; literature review, A.D.; methodology, A.D.; formal analysis, A.D. and J.M.; writing, A.D., T.W., D.H. and J.M.; conclusions and discussion, A.D., T.W., D.H. and J.M.

The authors have read and agreed to the published version of the manuscript.

References

Act from 16 April 2004. Law on Nature Protection. Journal of Laws No. 92, item 880, as amended. https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=wdu20040920880 (in Polish).

Arcadis & DS Consulting. (2024). *Strategia zazieleniania Łodzi do 2030 roku z perspektywą do 2050 r.* https://uml.lodz.pl/files/public/dla_mieszkanca/Strategia_zazieleniania_Lodzi.pdf (in Polish).

Bamwesigye, D., Fialová, J., Kupec, P., Łukaszkiewicz, J., & Fortuna-Antoszkiewicz, B. (2021). Forest recreational services in the face of COVID-19 pandemic stress. Land, 10(12), 1347. https://doi.org/10.3390/land10121347

Bates, A. E., Primack, R. B., Moraga, P., & Duarte, C. M. (2020). COVID-19 pandemic and associated lockdown as a "Global Human Confinement Experiment" to investigate biodiversity conservation. Biological Conservation, 248, 108665. https://doi.org/10.1016/j.biocon.2020.108665

Berkson, J. (1938). Some difficulties of interpretation were encountered in the application of the Chi-square test. Journal of the American Statistical Association, 33, 526-536. https://doi.org/10.2307/2279690

Biernacka, M., & Kronenberg, J. (2018). Classification of institutional barriers affecting the availability, accessibility and attractiveness of urban green spaces. Urban Forestry & Urban Greening, 36*,* 22-33. https://doi.org/10.1016/j.ufug.2018.09.007

Biernacka, M., Kronenberg, J., & Łaszkiewicz, E. (2020). An integrated system of monitoring the availability, accessibility and attractiveness of urban parks and green squares. Applied Geography, 116, 102152. https://doi.org/10.1016/j.apgeog.2020.102152

Borowski, J., Fortuna-Antoszkiewicz, B., Łukaszkiewicz, J., Rosłon-Szeryńska, E., Sitarki, M., Suchocka, M., & Wysocki, Cz. (2016). *Standardy kształtowania zieleni Warszawy. Program ochrony środowiska dla m.st. Warszawy na lata 2017-2020 z perspektywą do 2023 r.* Warszawa: Zarząd Zieleni ms.t. Warszawy. https://zzw.waw.pl/wp-content/uploads/2021/06/Standardy_zieleni.pdf (in Polish).

Central Statistical Office. (2024). *Statistical data (area, population) for Łódź and Warsaw*. https://stat.gov.pl (in Polish).

Ciesielski, M., & Tkaczyk, M. (2023). Visits in Forests During the Covid-19 Pandemic in the Cross-Border Area of Poland, the Czech Republic and Germany. Quaestiones Geographicae, 42(2), 71-84. https://doi.org/10.14746/quageo-2023-0016

Copernicus. (2024, December 20). *Urban Atlas. Map of Poland and Europe.* https://www.copernicus.eu/pl/network/mapa-sieci (in Polish).

Długoński, A. (2018). Recreational development of old landfill: the case study of Górka Rogowska landfill in Łódź city, Poland. Detritus, 2, 155-162. https://doi.org/10.31025/2611-4135/2018.13653

Długoński, A., Wellmann, T., & Haase, D. (2023). Old-Growth Forests in Urban Nature Reserves: Balancing Risks for Visitors and Biodiversity Protection in Warsaw, Poland. Land, 12(2), 275. https://doi.org/10.3390/land12020275

Fialov**á,** J. (Ed.). (2024). *Public recreation and landscape protection with the environment go hand in hand!* Krtiny: Mendel University in Brno. https://doi.org/10.11118/978-80-7509-963-1

Fischer, L. K., & Kowarik, I. (2020). Dog walkers' views of urban biodiversity across five European cities. Sustainability, 12(9), 3507. https://doi.org/10.3390/su12093507

Fortuna-Antoszkiewicz, B., & Łukaszkiewicz, J. (2021). Social benefits of the urban greenery during the COVID pandemic. In J. Fialová (Ed.), *Public recreation and landscape protection–with sense hand in hand* (pp. 424-427). Brno: Mendel University.

Fortuna-Antoszkiewicz, B., Gawłowska, A., Łukaszkiewicz, J., & Rosłon-Szeryńska, E. (2012). Problemy rewaloryzacji i ochrony parków historycznych w centrum miasta na przykładzie Ogrodu Krasińskich w Warszawie. Technical Transactions – Architecture, 109(6-A), 145-166. https://www.researchgate.net/publication/320905759_PROBLEMY_REWALORYZACJI_I_OCHRONY_PARKOW_HISTORYCZNYCH_W_CENTRUM_MIASTA_NA_PRZYKLADZIE_OGRODU_KRASINSKICH_W_WARSZAWIE_PROBLEMS_OF_RESTORATION_AND_PRESERVATION_DOWNTOWN_HISTORICAL_PARKS_OF_THE_EXAMPLE_O (in Polish).

Google Forms. (2024). *Questionnaire survey for Bielański Forest and Łagiewnicki Forest visitors in Warsaw and Łódź*. https://docs.google.com/forms/d/1Xb2yYGyxd-rJMCzK8ZhWH6SQxbgXKcKjONaLSPAmkuU/edit (in Polish).

Google Maps. (2024). *The British Library, London, UK.* https://www.google.com/maps/@52.1120549,19.9802235,9.08z?hl=pl&entry=ttu&g_ep=EgoyMDI0MTIxMC4wIKXMDSoASAFQAw%3D%3D (in Polish).

Haase, D., Dushkova, D., Haase, A., & Kronenberg, J. (2019). *Green infrastructure in post-socialist cities: Evidence and experiences from Eastern Germany, Poland and Russia*. In T. Tuvikene, W. Sgibnev & C.S. Neugebauer (Eds.), *Post-Socialist Urban Infrastructures* (pp. 105-124). Routledge.

Jurczak, T., & Rzeńca, A. (2024). W jaki sposób zredukować szkodliwą emisję gazów cieplarnianych na terenie Łodzi o 55% do 2030 roku? II Łódzki Panel Obywatelski w praktyce. In K. Brzeziński, T. Jurczak & A. Rzeńca (Eds.), *Społeczny udział w tworzeniu miejskiej polityki klimatycznej. Przykład Łodzi* (pp. 209-225). Łódź: Wydawnictwo Uniwersytetu Łódzkiego. (in Polish).

Kabisch, N., van den Bosch, M., & Lafortezza, R. (2017). The health benefits of nature-based solutions to urbanization challenges for children and the elderly–A systematic review. Environmental Research, 159, 362-373. https://doi.org/10.1016/j.envres.2017.08.004

Kaiser, B. (2024). *The objectives of forest management in a changing world. Why the world is changing faster than forests and why forests are changing faster than the organisations that manage them.* Warszawa: Instytut Nauk Leśnych SGGW. (in Polish).

Kopecka-Piech, K. (2013). Creative and cultural industries policy in Poland of 2012. Status, strategies and inaugurating projects. Transformations, 78-79, 306-328. https://www.academia.edu/7353062/Creative_and_Cultural_Industries_Policy_in_Poland_of_2012_Status_Strategies_and_Inaugurating_Projects

Koprowska, K., Kronenberg, J., Kuźma, I. B., & Łaszkiewicz, E. (2020). Condemned to green? Accessibility and attractiveness of urban green spaces to people experiencing homelessness. Geoforum, 113, 1-13. https://doi.org/10.1016/j.geoforum.2020.04.017.

Korcz, N., & Janeczko, E. (2022). Forest Education with the Use of Educational Infrastructure in the Opinion of the Public-Experience from Poland. Sustainability, 14(3), 1915. https://doi.org/10.3390/su14031915

Kronenberg, J., Krauze, K., & Wagner, I. (2017). Focusing on ecosystem services in the multiple social-ecological transitions of Lodz. In N. Frantzeskaki, V. Castan-Broto, L. Coenen & D. Loorbach (Eds.), *Urban sustainability transitions* (pp. 331-345). Routledge.

Kronenberg, J., Łaszkiewicz, E., & Sziło, J. (2021). Voting with one's chainsaw: What happens when people are given the opportunity to freely remove urban trees? Landscape and Urban Planning, 209, 104041. https://doi.org/10.1016/j.landurbplan.2021.104041

Kronenberg, J., Skuza, M., & Łaszkiewicz, E. (2023). To what extent do developers capitalise on urban green assets? Urban Forestry & Urban Greening, 87, 128063. https://doi.org/10.1016/j.ufug.2023.128063

Kronenberg, M. (2006). Teoretyczne i rzeczywiste obszary penetracji turystycznej na terenie Łodzi. Turyzm, 16(1), 21-32. http://hdl.handle.net/11089/28878

Larondelle, N., & Haase, D. (2017). Back to nature! Or not? Urban dwellers and their forest in Berlin. Urban Ecosystems, 20, 1069-1079. https://link.springer.com/article/10.1007/s11252-017-0660-7

Lasy Miejskie Warszawa. (2024). *Co jest zagrożeniem dla Rezerwatu Przyrody Las Bielański?* [Video]. *https://www.youtube.com/watch?v=o1MkCyLFe0M* (in Polish).

Łukaszkiewicz, J., Fortuna-Antoszkiewicz, B., & Botwina, J. (2023). Społeczne znaczenie zieleni miejskiej podczas pandemii COVID-19. Stan badań. MAZOWSZE Studia Regionalne, 47, 9-25. https://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.ojs-doi-10_21858_msr_47_01 (in Polish).

Łukaszkiewicz, J., Fortuna-Antoszkiewicz, B., Długoński, A., & Wiśniewski, P. (2019). From the heap to the park–reclamation and adaptation of degraded urban areas for recreational functions in Poland. Scientific Review Engineering and Environmental Sciences, 28(4), 664-681. http://iks.pn.sggw.pl/PN86/A15/zeszyt86art15en.html

Malinowska, E., & Szumacher, I. (2013). Survey of recreational use of The forest nature reserve in Warsaw (Poland). Miscellanea Geographica, 17(3), 12-18. https://intapi.sciendo.com/pdf/10.2478/v10288-012-0039-9

OpenStreetMap. (2024). *OpenStreetMap Foundation, London, UK.* https://www.openstreetmap.org/#map=9/52.089/20.336 (in Polish).

Paganová, V., & Kuczman, G. (2024). Landscape-architectural design of the old orchard in location presel'any for recreation and well-being. In J. Fialová (Ed.) *Public recreation and landscape protection with environmental hand in hand!* (pp. 199-205). Brno: Mendel University. https://doi.org/10.11118/978-80-7509-963-1-0199

Procko, M., Naidoo, R., LeMay, V., & Burton, A. C. (2022). Human impacts on mammals in and around a protected area before, during, and after COVID-19 lockdowns. Conservation Science and Practice, 4(7), e12743. https://doi.org/10.1111/csp2.12743

Regionalna Dyrekcja Ochrony Środowiska w Warszawie. (2023). *To moje magiczne miejsce….* https://www.gov.pl/web/rdos-warszawa/to-moje-magiczne-miejsce (in Polish).

Sielaff, H., Bundschuh, L., Moritz, L., Taubmann, C., Badack, J., Weinhold, K., & Hübscher, M. (2024). COVID-19 pandemic and urban green spaces: Shifting usage behaviours and perceptions in Leipzig (Germany)? Moravian Geographical Reports, 32(1), 26-36. https://doi.org/10.2478/mgr-2024-0003

Statistica. (2024). *Statistica* (Version 13.0)[Softwere]. https://www.statsoft.pl/statistica_13/ (in Polish).

Suchocka, M., Gawłowska, A., & Semeniuk, P. (2019). Rola roślin na terenach miejskich i ich wpływ na środowisko w kontekście zagospodarowania ciągów pieszo-jezdnych. Drogownictwo, 10, 299-302. https://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-64f712d1-074e-4bbf-ba81-a27207c925e5 (in Polish).

Trentanovi, G., Campagnaro, T., Kowarik, I., Munafò, M., Semenzato, P., & Sitzia, T. (2021). Integrating spontaneous urban woodlands into the green infrastructure: Unexploited opportunities for urban regeneration. Land Use Policy, 102, 105221. https://doi.org/10.1016/j.landusepol.2020.105221

Van Helden, B. E., Skates, L. M., & Close, P. G. (2024). Use of wildlife-friendly structures in residential gardens by animal wildlife: evidence from citizen scientists in a global biodiversity hotspot. Urban Ecosystems, 27, 1493-1507. https://link.springer.com/article/10.1007/s11252-024-01530-4

Vimal, R. (2022). The impact of the Covid-19 lockdown on the human experience of nature. Science of the Total Environment, 803, 149571. https://doi.org/10.1016/j.scitotenv.2021.149571

von Der Lippe, M., Buchholz, S., Hiller, A., Seitz, B., & Kowarik, I. (2020). CityScapeLab Berlin: A research platform for untangling urbanization effects on biodiversity. Sustainability, 12(6), 2565. https://doi.org/10.3390/su12062565

Zaraś-Januszkiewicz, E., Botwina, J., Żarska, B., Swoczyna, T., & Krupa, T. (2020). Fortresses as specific areas of urban greenery defining the uniqueness of the urban cultural landscape: Warsaw Fortress – a case study. Sustainability, 12(3), 1043. https://doi.org/10.3390/su12031043

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LASY MIEJSKIE STARZEJĄCYCH SIĘ SPOŁECZEŃSTW. PRZYKŁAD ŁODZI I WARSZAWY (POLSKA CENTRALNA)

STRESZCZENIE: Celem pracy jest zbadanie opinii respondentów z lasów Warszawy i Łodzi na przykładzie dwóch kompleksów leśnych: Lasu Bielańskiego i Lasu Łagiewnickiego, które są głównymi miejscami aktywnego wypoczynku. W pracy zastosowano metodę wielomieszankową, która łączy metody ilościowe (analiza danych demograficznych) i jakościowe (wskaźniki preferencji osób starszych). Metody obejmują ankietę przeprowadzoną wśród użytkowników lasów za pośrednictwem formularzy Google i kodów QR. Każdy respondent został przydzielony do grupy na podstawie wieku, płci i statusu społeczno-ekonomicznego, co pozwoliło na wykrycie istotności statystycznej (test chi-kwadrat, Statistica). Następnie przeprowadzono kontrole terenowe, a także ocenę funkcjonowania lasów i wytyczne dla administratorów gmin. Wykonane badania ankietowe w Lesie Łagiewnickim i Lesie Bielańskim w Łodzi i przeprowadzone analizy statystyczne (test hi kwadrat) pokazują strach starzejącego się społeczeństwa o zapoczątkowane w czasie pandemii działania zarządców i władz miejskich w kierunku ograniczania rekreacji czynnej w lasach miejskich na rzecz promocji ekologii i ochrony awifauny. Badania wskazują na problem ochrony środowiska przyrodniczego i czynnej rekreacji w lasach w kontekście antropopresji i dalszych kierunków rozwoju terenów zielonej infrastruktury miast. Badania mogą stanowić wytyczne dla zarządców jak właściwie zarządzać przestrzenią lasów w miastach dostosowując ją do potrzeb starszych ludzi, którzy odwiedzają go w ciągu tygodnia najczęściej.

SŁOWA KLUCZOWE: antropopresja, bezpieczeństwo, rekreacja, ochrona środowiska, zieleń