QUAESTIONES GEOGRAPHICAE 44(2) • 2025

IMPORTANCE OF URBAN PARKS IN PSYCHOLOGICAL RECOVERY: AN EXPERIMENT WITH YOUNG ADULTS FROM POLAND

Agata Kobyłka [1], Natalia Korcz [2]

[1] Department of Tourism and Recreation, Faculty of Agrobioengineering, University of Life Sciences in Lublin, Poland
[2] Department of Geomatics, Forest Research Institute, 05-090 Sękocin Stary, Poland

Manuscript received: May 8, 2024
Revised version: November 3, 2024

Kobyłka A., Korcz N., 2025. Importance of urban parks in psychological recovery: An experiment with young adults from Poland. *Quaestiones Geographicae* 44(2), Bogucki Wydawnictwo Naukowe, Poznań, pp. 107–119. 5 figs, 5 tables.

Abstract: Recently, attention has been focused on the role of urban green spaces in promoting people's health and well-being. There are many studies indicating the need and necessity of expanding green infrastructure to have a positive impact on urban dwellers' mental health. Many of them are conducted in spring and summer. This study is to determine how a walk in three different urban locations (the city park centre, the outskirts of the city park and the city centre) during the 'golden' autumn affects the well-being of young adult Poles. The research was conducted in 2022 in the Saski (Saxon) Garden and its immediate vicinity (Lublin, Poland). In order to check how walks in three different locations affect the psychological recovery of respondents, four types of psychometric questionnaires were used: the Positive and Negative Affect Scale (PANAS), Profile of Mood States (POMS), Subjective Vitality Style (SVS), and Restorative Outcome Scale (ROS), which respondents completed before and after a given type of walk. As a result of walking around the city park (both on its outskirts and near the fountain), the respondents' levels of tension, depression, anger, fatigue, and disorientation decreased. During the walk by the fountain, these drops were larger. However, after walking along a city street, the level of vigour was falling; it increased in the park and decreased when walking along a city street. The differences in the results (Δ = post-test – pre-test) of all tests examining the POMS mood state profile in various forms of walking turned out to be statistically significant. The results of tests measuring regeneration (ROS), vitality (SVS) and positive mood (PANAS positive) of those walking in the city park increased. During the walk by the fountain, these increases were more considerable compared to the walk along the edge of the park. The respondents' regeneration, vitality and level of positive mood decreased in a city street. These results were statistically significantly different. For the test measuring negative mood (PANAS negative), we observed an increase in the results after a walk along a city street, a decrease regarding a walk by the fountain and a slight increase in the case of a walk on the outskirts of the park. However, these differences are not statistically significant. The results indicate that walks conducted in various parts of the park in autumn have a positive impact on the psychological recovery of young people. It is therefore important to ensure access to green and blue infrastructure in urban areas.

Keywords: city park, forest bathing, psychological rehabilitation, psychometric tests

Corresponding author: Agata Kobyłka, Department of Tourism and Recreation, Faculty of Agrobioengineering, University of Life Sciences in Lublin, ul. Akademicka 15, 20-950 Lublin, Poland; e-mail: agata.kobylka@up.lublin.pl

https://doi.org/10.14746/quageo-2025-0012
ISSN 2082-2103, eISSN 2081-6383

Introduction

Today, most of the human population lives in metropolitan areas (Vlachokostas et al. 2014). People choose to live in cities because of more significant educational opportunities and better chances of finding work (Dye 2008). According to Glaeser and Mare (2001), city workers earn 33% more than outside workers. However, living in cities is associated with stress. This is caused, among other things, by a sedentary lifestyle (Mazurek-Kusiak et al. 2021), work and the general geo-political, climatic, or epidemiological situation associated with SARS-Cov-2 (Dong, Zheng 2020, Kaba, Sari 2020, Wu et al. 2020). A long-term factor causing adverse changes in people's psyche is distress (stress resulting from other stress) (Abubakar 2018, Zhang et al. 2020). By 2030, more than 80% of Europe's population is estimated to live in urban areas, so it will therefore be up to city governments to promote health and well-being (Carmichael et al. 2017).

The development of green infrastructure is a critical factor in supporting the well-being of city dwellers. Belčáková et al. (2019) point out that the prominent role of green infrastructure is to improve the quality of life through its environmental, social and economic potential based on the multifunctional use of natural capital. Mayer et al. (2012) emphasise the need to invest in greenery in cities, e.g., through the construction and expansion of parks, gardens, open spaces or urban and suburban forests, under the assumption that new green areas will not interfere with residential, commercial and industrial areas, and that their expansion as well as the adaptation of tourist infrastructure will be integral to the principles of sustainable development (Pakzad, Osmond 2016, Hanna, Comín 2021, New City Agenda).

Many works indicate that the key to solving these problems in cities is forest bathing in a broad sense (Li et al. 2007, Hansen et al. 2017, Bielinis et al. 2021, Korcz et al. 2021, Dudek et al. 2022). The World Health Organization (WHO) has identified forest ecosystems as key to the survival of humanity and life on Earth (WHO, 2015). However, in the post-COVID-19 pandemic era, when societies face numerous economic problems, travelling to forest areas for leisure purposes can be troublesome. Referowska-Chodak (2019) points out that there is a big problem with forest fragmentation in urban areas in Europe. Gołos (2013) and Jestaedt (2008) indicate that many people who want to vacation in forested areas can concern others and discourage recreation in the areas in question. Other reasons may be wild animals, insects, garbage or noise, which are stress factors for many people and cause discomfort (Milligan, Bingley 2007, Karjalainen et al. 2010). Economy, i.e. the funds needed for transport to forest areas or those directly related to appropriate clothing, can be also a limiting factor for forest recreation. Hence, parks or urban gardens are becoming an alternative place for spending time in the green.

Numerous studies confirm that urban parks enable psychological recovery (Li et al. 2010, Zhou et al. 2010, Mathias et al. 2020, Tsao et al. 2022). Simonienko et al. (2020) indicate that most studies in this area are conducted in the spring and summer. Research on forest bathing in winter is quite widely known, but not much research on forest bathing in the broader sense has been conducted in the autumn period (Song et al. 2015). Therefore, the study aims to determine how walking, practised in three different urban locations (the centre of an urban park, the outskirts of an urban park near the city centre) during the ongoing 'golden' autumn changes the well-being of young Polish adults. The following research hypotheses were formulated to investigate this problem:

1. A walk in a city park in autumn brings psychological restoration.
2. Walking inside a city park allows better psychological recovery than walking the park's outdoor alleys.

Materials and methods

Research procedure

A test with repeated measurements was performed at two different moments in time (pre-test and post-test). The experiment was conducted both indoors and outdoors. The first part of the study, i.e. finding out the current emotional state of all participants using psychometric questionnaires, was conducted in the lecture hall of the University of Life Sciences in Lublin for organisational reasons. Then, the second part of the experiment (field research) was carried out in a

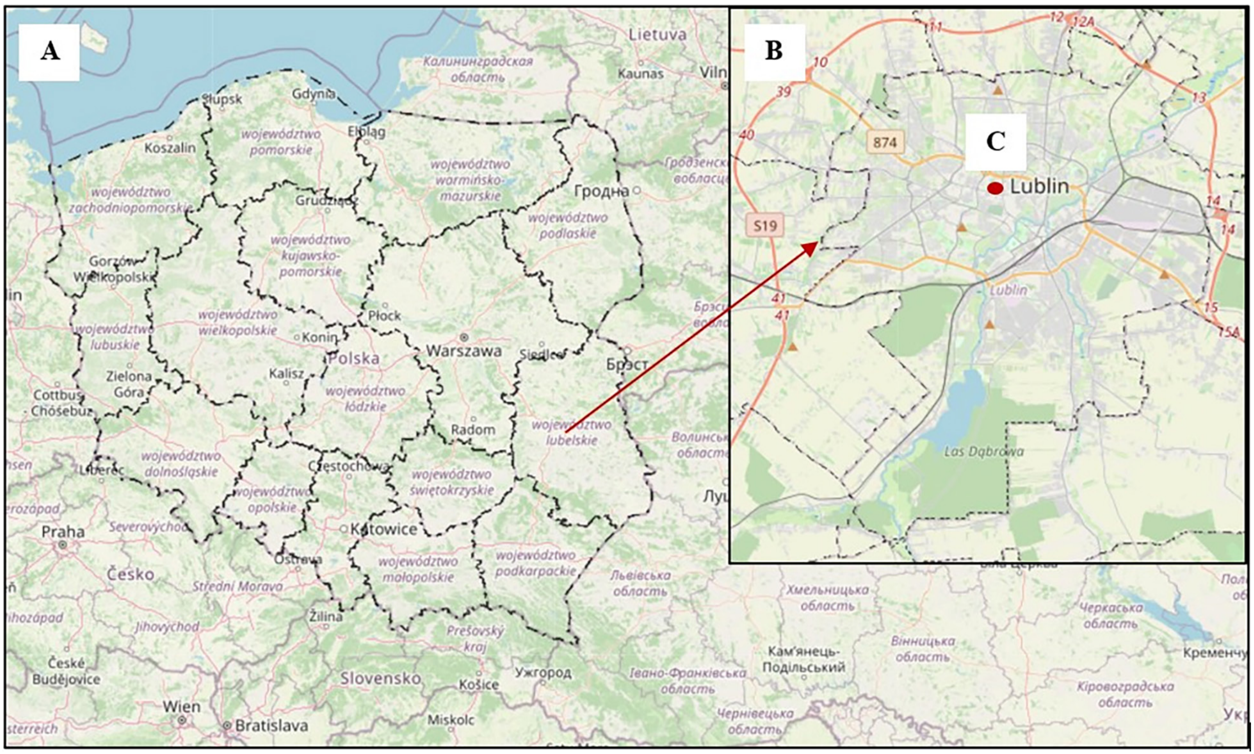

Fig. 1. Location of the study site.
A – Poland, B – Lublin, C – experimental site (https://www.bdl.lasy.gov.pl/portal/mapy).
The red dot indicates the area where the experiment took place.

city park – the Saski (Saxon) Garden, located in the immediate vicinity of the University's campus. Figure 1 shows the location of the research site against the background of the administrative division of Poland.

The meteorological data at the time of the experiment (5 October 2022) were determined using data from the nearest meteorological station – the Agrometeorological Observatory in Felin (Lublin), located at an altitude of 215 m above sea level (location: 51°14'N, 22°38'E). The average cloudiness on a scale of 0–8 was 2, the atmospheric pressure was 1013.11 hPa and the wind speed was SE 3 m · s^{-1} (three values averaged over time).

The study participants were divided into three groups. Each group had a specific meeting time. Participants assigned to a particular group met with a research supervisor at hourly intervals in a designated lecture hall at the University of Life Sciences in Lublin. The supervisors discussed in detail the course of the entire experiment, both indoors and in the field.

During the first part of the study, each participant filled out independently paper-form psychometric test questionnaires in a classroom (pre-test). The first set of psychometric test questionnaires completed by the participants served as a reference for later comparisons. The group then walked to the designated meeting place (A – the outskirts of the park, B – the centre of the park (by the fountain), C – the city centre), where the second part of the study took place, i.e. a walk along a designated route ending with the completion of the same psychometric tests, also in a paper form (post-test). All walking routes were approximately 1 km. The detailed course of the research procedure is shown in Figure 2.

The second part of the study took place for groups A and B in the city park Saski Garden and for group C on the way to Lithuanian Square (Figs 3 and 4). Each group walked for 30 minutes in different places. In most similar studies, the duration of the experiment is about 20–30 minutes, e.g. the study of Song et al. (2015) indicates that 15 minutes of observing greenery is enough for the brain to rest, while the study of Bielinis et al. (2018) proves that 15 minutes of exposure to a Central European winter forest has a beneficial, regenerative and vitalising effect on the body.

The Saski Garden covers an area of 12 ha. It was established according to the design of the engineer Feliks Bieczyński in 1837 in the style of an English garden[1]. In 2013, the project 'Revitalisation of the Saxon Garden in Lublin' was completed, aiming to restore the garden splendour in accordance with the canon of the English garden style. The park is to serve residents and tourists visiting the city with a relaxing atmosphere created in it. Its modernisation was intended to increase the number of users, including people with disabilities.

The park is fenced – 1300 m of concrete pedestal with a metal openwork fence on it, which refers in style to the fences of the 1920s, as well as to the remains of the retaining wall of Lublin's former fortifications and the high buildings of Wieniawska Street. Access to it is provided by eight gates, which are located on each side of the park. The area offers a modernised and attractive infrastructure that combines historical values with modern amenities such as[2]:

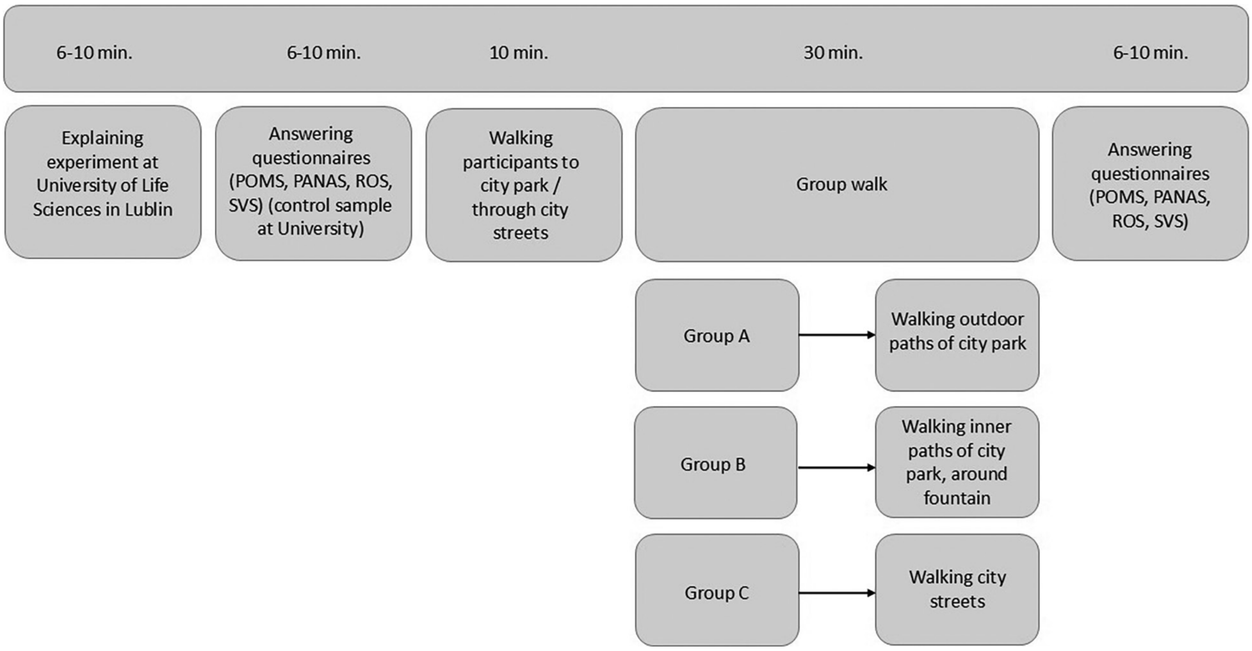

Fig. 2. Research procedure of the experiment.
POMS – Profile of Mood States; PANAS – Positive and Negative Affect Scale; ROS – Restorative Outcome Scale; SVS – Subjective Vitality Scale

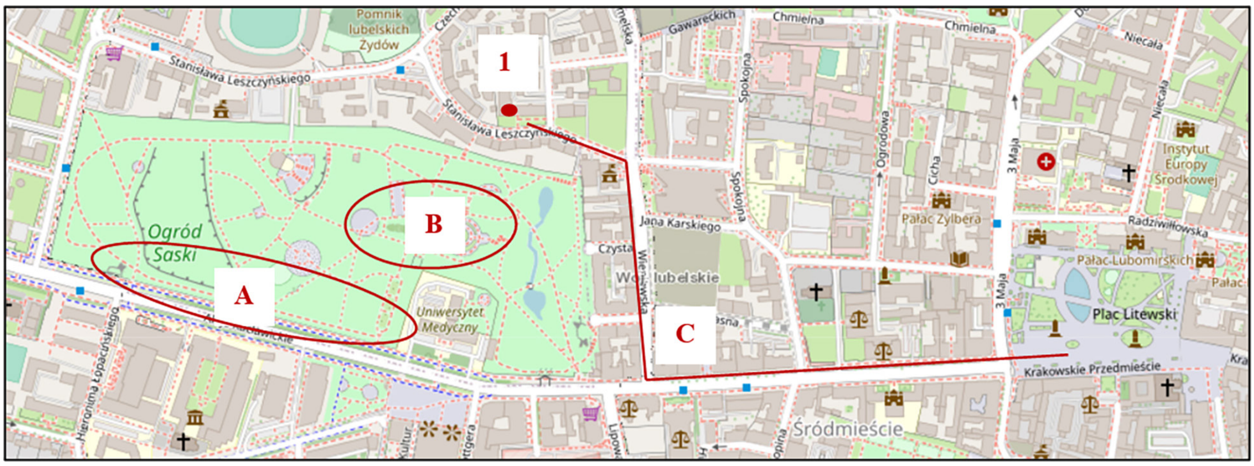

Fig. 3. Locations where different parts of the survey took place.
First part of the survey – 1, second part of the survey – walking sites of groups A, B and C (https://www.bdl.lasy.gov.pl/portal/mapy).

[1] https://teatrnn.pl/leksykon/artykuly/ogrod-saski-w-lublinie

[2] https://lublin.eu/gfx/lublin/userfiles/_public/lublin/lublin_w_ue/multimedia/ogrod_saski_folder.pdf

- walking alleys and paths – the park has carefully reconstructed alleys, which are paved with mineral aggregate, gravel and clay, asphalt concrete or granite pavers. The paths are suitable for pedestrians, as well as people on bicycles and families with strollers,
- small infrastructure – stylish benches, trash garbage cans and stylised lanterns have been placed in the park, adding to its charm and alluding to its historical character,
- a sundial,
- a fountain,
- the picturesque combination of two ponds (Lower Pond and Upper Pond) with bridges and viewing areas,
- a modern and safe playground equipped with such elements as swings, ladders, sandboxes and slides,
- recreation areas – places for relaxation and spaces for holding various outdoor events, such as picnics,
- a concert shell with a stage where concerts are held,
- an aviary for peacocks,
- greenery and vegetation – a carefully planned arrangement of plants, including numerous trees (dominated by deciduous trees such as English oak, small-leaved linden, maple, chestnut, poplar, etc. among the few conifers, spruce is predominant), shrubs, ground cover plants (such as periwinkle, ivy) and flower beds (including perennial), which are regularly maintained; there is also a natural monument (White Poplar) in the park,
- surveillance and lighting – the park is illuminated at night and covered by a surveillance system, which increases the safety of visitors; the lighting is stylised to blend harmoniously into the space,
- monuments and commemorative plaques – numerous monuments and plaques can be found in the park, which commemorate important historical events and people associated with the history of Lublin and the Saski Garden,
- a city toilet with a platform for people with disabilities.

Group A began the field part of the survey at 9:00 a.m. Volunteers navigated the designated park alleys along the periphery of the park, following signs explicitly placed for the survey on trees along the alleys, indicating the direction of the walk. Participants were asked to walk on their own and not engage in conversation with other group members. The route started at a barrow with a shrine and the only visible pieces of infrastructure along the alley were benches. After the walk, the directional signs led the participants to the starting point of the walk, where they completed psychometric test questionnaires (post-test) for the second time.

Experiment location for group A | Experiment location for group B | Experiment location for group C

Fig. 4. Photos detailing the experimental site (taken by Natalia Korcz).

The second group of participants (B) walked along a different route – the alleys inside the park near the fountain. There were also benches along the path as well as pergolas, plantings of red roses and boxwood, barberry and white roses, nesting boxes for birds, an aviary for peacocks, and a sundial. The route was also marked. After the walk, directional signs led the participants to the starting point of the walk, after which they again filled out psychometric test questionnaires (post-test).

Group C moved directly from the University building to Lithuanian Square (the city centre) on one of the main streets of Lublin. Along the route there are single plantings of maple trees and rose beds. On completion, the volunteers again filled in psychometric tests (post-test).

Our volunteers were accompanied during the study by four supervisors overseeing the experiment (Simkin et al. 2020). In order not to disturb the course of the experiment, before entering the Saski Garden, the subjects were informed of the presence of the overseeing party, maintaining an appropriate distance of 3–6 m from the participants.

Study participants

A total of 93 young people participated in the study. Volunteers who agreed to participate were informed about the study's objectives and the procedure before the experiment began. The study participants were young adults living in Lublin. Detailed characteristics of the respondents are presented in Table 1.

People were recruited to participate in the study using social media. The conditions for participation in the experiment were the following: an age of majority (according to Polish law, people aged ≥18), no mental illnesses and no physical or metabolic diseases. Participants in the study received small gifts in the form of notebooks and albums promoting tourism and environmental education in Poland. All activities undertaken in the study were compliant with the ethical standards of the Polish Committee for Ethics in Science and the 1964 Declaration of Helsinki, as amended. The participants' personal data were anonymised under the European Parliament's General Data Protection Regulation (GDPR 679/2016).

The choice of students from the University of Life Sciences was made for organisational and logistical reasons. Recruiting such a large group of respondents (93 people) was the most efficient in this environment. These students are characterised by their young age and time availability, which was conducive to the smooth conduct of the survey. In addition, participation in the experiment provided them with an additional opportunity to broaden their teaching and research experience, which could influence their academic development.

Instruments

Four psychometric test questionnaires were used in the experiment to assess the emotional state of the subjects:

1. The Polish version of the Watson and LA Clark Positive and Negative Affect Scale (PANAS), developed by Brzozowski (1991, 2010), was used to measure the intensity of negative and positive emotions. The psychometric test consists of 20 questions, half of them dealing with positive emotions and the other half with negative ones. Each question is rated on a five-point Likert scale (from 1 – 'definitely no' to 5 – 'definitely yes'). The reliability and accuracy of the PANAS questionnaire have been repeatedly confirmed in many studies (Janeczko et al. 2020, Korcz et al. 2021).
2. The Restorative Outcome Scale (ROS) contains six items, each rated by participants using a

Table 1. Characteristics of the respondents.

Respondents		Percentage (%)	Mean age (years)
Group	A – walk along edge of city park	33.33	22.81
	B – walk by fountain in city park	38.71	21.36
	C – walk down city street	27.96	21.96
Gender	woman	41.94	21.90
	man	58.06	22.09
Total		100.00	22.01

seven-point Likert scale (from 1 – 'definitely no' to 7 – 'definitely yes'). The scale, developed by Korpela et al. (2008, 2010), was modified for experiments in forest areas, including parks or gardens by Takayama et al. (2014) and adapted to the Polish language by Bielinis et al. (2018). ROS can be used to investigate restorative emotional and cognitive outcomes in a given environment with the following six items. It is one of many tools for assessing psychological restoration commonly used in this type of research.

3. The Subjective Vitality Scale (SVS) developed by Ryan and Frederick (1997) was used to assess vitality. This scale reflects feelings of energy, vitality and well-being. The study used a version adapted from research Takayama et al. (2014). The four items were rated by participants using a seven-point Likert scale (from 1 – 'very unlikely' to 7 – 'very likely').
4. The Profile of Mood States (POMS) self-mood questionnaire was used to profile participants' emotional states and moods. It was developed by McNair et al. (1992). The Polish adaptation was developed by Dudek and Koniarek (1987). The POMS is a reliable and contemporary measure of mood state and is also used to assess the impact of the forest environment on people's moods (Furuyashiki et al. 2019, Korcz et al. 2021). Each question uses a five-point Likert scale (from 0 – 'strongly disagree' to 4 – 'strongly agree') to assess participants' mood. POMS results are captured in the form of six scales (mood states): Tension-Anxiety (a generalised state of discomfort), Depression-Depression (a mood of sadness with a sense of inadequacy, a feeling of inferiority), Anger-Enthusiasm, Vigour-Activity (a state of high energy, constant readiness for action, a cheerful mood), Fatigue-Fatigue (a feeling of inertia, low energy), Perplexity-Confusion (a state of confusion, confusion). Five scales describe negative emotions and one relates to positive emotions. In addition, the study calculated a total mood disorder (TMD) score using POMS data. The POMS scale is commonly used in this work type, confirming its reliability.

Sound and light levels were measured with a Samsung Galaxy M21 smartphone using the 'Sound Meter' and 'Light Meter' apps. Other studies have also used these apps as devices that meet standards comparable to professional laboratory equipment for sound analysis (Elsadek et al. 2019, Korcz et al. 2021).

Air quality was measured using the Dienmern® DM106A air sensor (Langer technology CO., LTD), which operates with three built-in laser sensors. This device complies with the essential requirements and other relevant provisions of Directive 2014/53/EU (Directive 2014/53/EU). Measured items:

- PM1.0 – particulate matter with a diameter ≤1.0 μm,
- PM2.5 – particulate matter with a diameter ≤2.5 μm (according to WHO, the most harmful to humans among atmospheric pollutants),
- PM10 – particulate matter with a diameter ≤10 μm,
- HCHO – formaldehyde (safe concentration ≤0.10 mg · m^{-3}),
- TVOC – total volatile organic compounds (safe concentration ≤0.60 mg · m^{-3}),
- AQI – air quality index.

Table 2 shows the average sound and light levels and air quality values for different groups during the experiment. The given values were measured at the beginning of the experiment (in the hall of the University of Life Sciences in

Table 2. Measurement of sound levels, light levels and atmospheric pollutant concentrations during the experiment.

Group	Time	Level		Concentration measurement					AQI
		Sound	Light	PM1.0	PM2.5	PM10	HCHO	TVOC	
		db	lx	μg · m^{-3}	μg · m^{-3}	μg · m^{-3}	mg · m^{-3}	mg · m^{-3}	
A	Before	56	149	18.50	30.70	39.70	0.037	0.098	Excellent
	After	62	13,842	24.05	35.50	37.75	0.034	0.154	Good
B	Before	56	87	18.54	30.50	39.88	0.024	0.113	Excellent
	After	59	9441	19.00	33.00	40.50	0.028	0.129	Excellent
C	Before	58	272	18.45	30.30	38.94	0.029	0.137	Excellent
	After	83	3330	23.60	41.67	51.00	0.050	0.227	Good

Lublin) and in the middle of the experiment outdoors (45 minutes of the experiment).

Noise levels were highest when walking along a city street. The highest light levels were observed during two types of walks in the city park. The level of concentrations of individual air pollutants was relatively low on the survey day; of which the highest concentrations were observed when walking along the city street. According to the AQI, the air quality in the hall and the city park was excellent. Other points of the survey were good.

Statistical calculations

The raw data were put in Excel. For each respondent, the differences (Δ) between pre- and post-walk test scores were calculated (Δ test = post-test – pre-test). Then, the mean values and standard deviations (SD) were calculated for the calculated differences (Δ) for the three study groups (A, B, C). On this basis, it is possible to interpret decreases or increases in the value of the score of a given test under the influence of different forms of walking (along the edge of the city park, inside the park at the fountain and one of the city streets). A one-way ANOVA (Analysis of Variance) was used to test for significant differences between Δ tests. It was followed by *post hoc* comparisons using Tukey's HSD test (Tukey's Honestly Significant Difference test). Results for which $p > 0.05$ was statistically significant were included in the analyses. Groups marked with the same letter (e.g., 'a') do not show statistically significant differences in their means based on Tukey's HSD test ($p>0.05$). Groups with different letters (e.g., 'a' vs. 'b') have statistically significant differences in their means ($p<0.05$).

Principal component analysis (PCA) was used to show associations between the results of various psychometric tests.

Statistical analyses were performed using STATISTICA 13.3 PL (StatSoft Inc., Tulsa, OK, USA).

Results

The mean values for the PANAS positive subscale obtained from the walks (both on its periphery and at the fountain) increased compared to those obtained before the walks. The increase was more significant during the walk at the fountain, but the results obtained for both forms of walking in the city park were not statistically significantly different. On the other hand, after walking along the city street, the average values of the PANAS positive test results received by the respondents decreased. We have observed statistically significant differences in the change in the intensity of positive emotions between the group that walked at the fountain and the group that walked along the city street (Table 3).

For the PANAS negative test, there was an increase in the intensity of positive emotions after walking along the city street, a decrease when walking by the fountain and a slight increase when walking along the edge of the park. However, these differences are not statistically significant (Table 3).

Walks in the city park (both on the park's periphery and at the fountain) resulted in increases in test scores measuring regeneration (ROS) and vitality (SVS). When walking by the fountain, these increases were more outstanding than while walking along the park's periphery, but the results were not statistically significantly different. By contrast, respondents' recovery and vitality decreased after walking along the city street. These results were statistically significantly different from those for both types of walks in the city park (Table 4).

As a result of the walks in the city park (both on its outskirts and at the fountain), respondents'

Table 3. Mean and SD of ΔPANAS measurements and the results of the ANOVA test and Tukey's *post hoc* test.

Measures	A – walk along edge of park	B – walk by fountain	C – walk down city street	F	p
	Mean ± SD	Mean ± SD	Mean ± SD		
ΔPANAS positive	0.07 ± 0.78^{ab}	0.34 ± 0.80^{b}	-0.28 ± 0.77^{a}	4.84	0.010*
ΔPANAS negative	0.03 ± 0.74	–0.24 ± 1.00	0.15 ± 0.85	1.70	0.188

* statistically significant results at $p < 0.05$.
SD – standard deviation; PANAS – Positive and Negative Affect Scale.

test scores measuring tension, depression, anger, fatigue and confusion fell. During the walk by the fountain, these decreases were more significant. By contrast, after walking along the city street, the results of these tests increased. On the other hand, the results of the test measuring vigour were in the opposite direction. Here, we have observed an increase in both types of walks in the park and a decrease in the number of walks along the city street (Table 5).

Differences in the results of all tests examining the profile of mood states during different forms of walking were found to be statistically significant. The tension, anger and vigour change differed between walking in the city park (both forms) and walking along the street. The change in levels of depression, fatigue and confusion differed between walking at the fountain and walking along the city street. By contrast, there were no statistically significant differences between the test results of these three tests during the two experiments in the park (walking along the edge of the park and walking by the fountain) (Table 5).

Figure 5 shows the results of PCA. Factors 1 and 2 identified in the course of the analysis explain a total of 100% of the variance in the analysed differences (Δ) in the results of psychometric tests before and after the walk. Factor 1 explains 97.77% of the total variance and is highly correlated with all indicators. Factor 2 explains 2.23% of the total variance and is most strongly correlated with ΔVigour. When it comes to walk variants, B (walk by the fountain) and C (walk down the city street) were most strongly correlated with factor 1 and a walk along the edge of the park (A) was correlated to a comparable extent with factors 1 and 2. It can be seen that the increases in the results of tests measuring anger, tension, depression, fatigue, confusion and PANAS negative, i.e. negative feelings, were the highest in the case of walking along the city street (C). However, the highest increases in test results measuring vigour, PANAS positive, ROS and SVS were observed in the case of a walk along the edge of the park and at the fountain, and for a walk along the city street, we observed a decrease in the value of these tests after the walk. These outcomes confirm the results presented in Tables 3–5. The results of some tests were highly correlated. As the intensity of positive emotions (ΔPANAS positive) increased, the regeneration of responders (ROS) increased. An increase in anger was accompanied by an increase in tension and an increase in depression was accompanied by an increase in fatigue. ΔROS and ΔPANAS positive were negatively correlated with ΔDepression and ΔFatigue, so as the mentioned positive elements increased, the negative ones decreased.

Table 4. Mean and SD of ΔROS and ΔSVS measurements and the results of the ANOVA test and Tukey's *post hoc* test.

Measures	A – walk along edge of park	B – walk by fountain	C – walk down city street	*F*	*p*
	Mean ± SD	Mean ± SD	Mean ± SD		
ΔROS	0.44 ± 1.42[a]	1.25 ± 1.57[a]	−0.63 ± 1.26[b]	12.85	0.000*
ΔSVS	0.55 ± 1.48[a]	0.94 ± 1.55[a]	−0.64 ± 1.11[b]	9.81	0.000*

* statistically significant results at $p < 0.05$.
ROS – Restorative Outcome Scale; SVS – Subjective Vitality Scale; SD – standard deviation.

Table 5. Mean and SD of ΔPOMS scale measurements and the results of the ANOVA test and Tukey's *post hoc* test.

Measures	A – walk along edge of park	B – walk by fountain	C – walk down city street	*F*	*p*
	Mean ± SD	Mean ± SD	Mean ± SD		
ΔTension	−2.06 ± 6.51[a]	−4.22 ± 9.00[a]	3.15 ± 8.27[b]	6.50	0.002*
ΔDepression	−0.65 ± 7.82[ab]	−5.53 ± 15.06[a]	6.35 ± 11.49[b]	7.33	0.001*
ΔAnger	−1.26 ± 5.88[a]	−3.94 ± 11.05[a]	5.46 ± 10.04[b]	7.86	0.000*
ΔFatigue	−1.16 ± 5.25[ab]	−4.94 ± 8.17[a]	3.96 ± 5.90[b]	13.35	0.000*
ΔConfusion	−1.16 ± 4.87[ab]	−3.92 ± 6.57[a]	1.77 ± 5.56[b]	7.37	0.001*
ΔVigour	2.58 ± 4.94[a]	4.00 ± 5.95[a]	−5.23 ± 6.76[b]	20.38	0.000*
ΔTMD	−8.87 ± 31.26[a]	−26.56 ± 47.55[a]	25.92 ± 36.34[b]	13.35	0.000*

* statistically significant results at $p < 0.05$.
POMS – Profile of Mood States; TMD – Total Mood Disorder; SD – standard deviation.

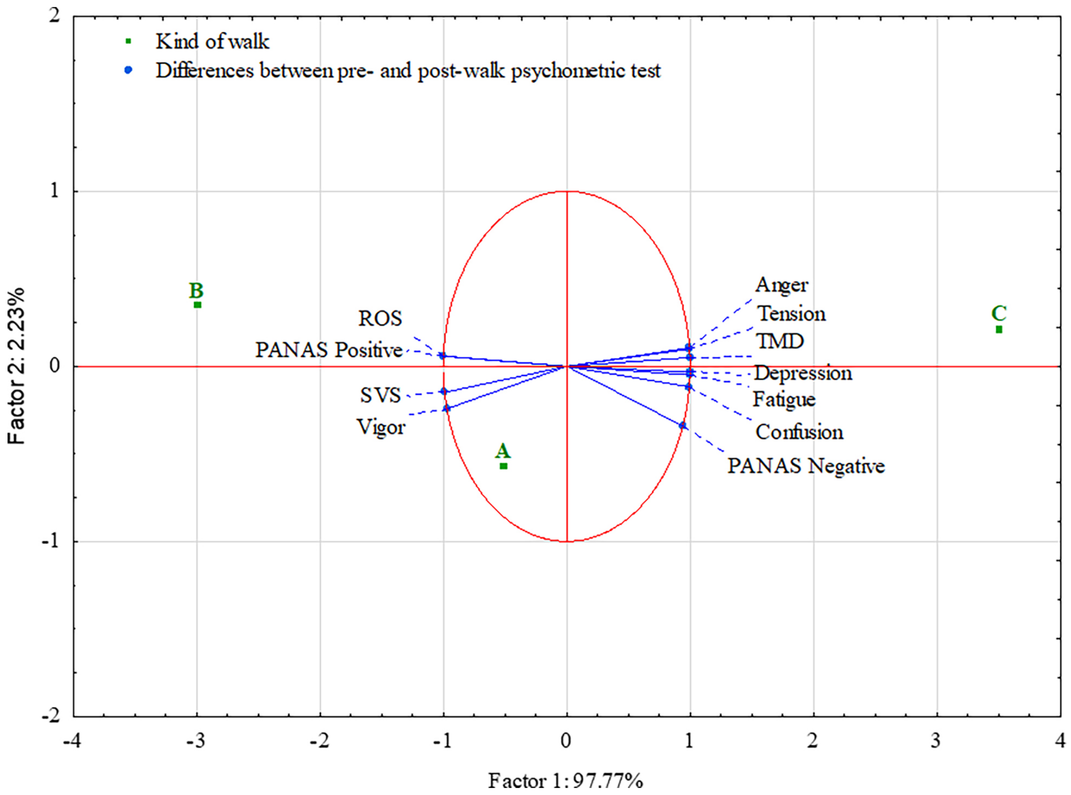

Fig. 5. PCA – Principal component analysis.
A – walk along edge of park; B – walk by fountain; C – walk down city street; PANAS – Positive and Negative Affect Scale; ROS – Restorative Outcome Scale; SVS – Subjective Vitality Scale; TMD – Total Mood Disorder.

Discussion

Man has been adapting to the natural environment for millions of years, so the current urban environment is an evolutionarily new and unfamiliar habitat, full of stimuli that adversely affect our mental and physical health (Lee et al. 2011). Nowadays, knowledge about physical activity is being popularised worldwide (Halabchi et al. 2018) as well as healthy lifestyles (Gao et al. 2021, Bao et al. 2022). This knowledge is designed to help people adapt to new changing trends of life because, as Nilsen and Pavel (2013) note, technological progress or widespread urbanisation has one main goal: to improve the quality of life for people around the world.

Hanna and Comín (2011) found that green and blue urban infrastructure can alleviate many problems facing a growing urban population. A study by Zhou et al. (2019) indicates that urban parks or gardens provide an ideal place for forest bathing. Song et al. (2015) showed that Japanese students who took a 15-minute walk in a city park during the fall season lowered their stress levels and heart rates. The work of Janeczko et al. (2020) indicated that walking in autumn in a suburban, plant-covered area positively affected human health, as the subjects' blood pressure dropped. The authors' study also showed that autumn walks in a city park positively affected people's psychological recovery. The results for a walk by the fountain in the park's centre for the POMS, PANAS, RSV or SVS scales were always the highest. However, there were not always statistically significant differences between this walk and the walk along the edges of the park. Although the concentration of trees, shrubs and flowers is highest in the centre of the park, as indicated by the study of McCaffrey et al. (2010) or Janeczko et al. (2020), a small amount of greenery is sufficient for psychological restoration.

Another factor that influences the authors' results of the study may be the water noise. During the study, the fountain in the park centre was active. According to Yang and Kang (2005) and Franco et al. (2017), water noise also has a calming effect, resulting in the highest scores for the four scales analysed. The issues of using water in urban parks in the broadest sense and its effects on psychological recovery are relatively little known, as pointed out by Janeczko et al. (2023). Nevertheless, Franco et al. (2017) indicate that the noise of water can be a factor in the choice of leisure, tourism or recreation destinations.

In order to promote healthy lifestyles and fight depression or other diseases, it is worth combining environmental and health education with urban tourism in the broadest sense. Landscape architects face a significant challenge of providing ecosystem benefits, whether resource, regulatory, cultural or supportive (Kostecka et al. 2012), through the design of green and blue infrastructure in urban areas. Nevertheless, through appropriate designs and their implementation, in addition to improving the quality of health of urban residents, the places in question can gain a measurable number of tourists from other regions who want to relax in parks and urban gardens. According to Aisyianita et al. (2022), forest bathing as Nature, Eco, Wellness and Adventure (NEWA) is predicted to become a new tourism trend. Forest bathing is also recognised as one of the most common practices of eco-tourism, which is described as "a wide range of organized tourism experiences and products that are based on nature and wild spaces, for tourists seeking health, well-being and regeneration" (Guardini et al. 2023).

Summary and conclusions

The experiment examined the emotional, restorative and revitalising effects of briefly walking in a city park and along a city street. It seems that even short visits to a city park generate many positive psychological effects on mood and affect subjective recovery and vitality compared to walking down a downtown street. Walking in an urban park compared to walking on an urban street improved the mood of the young subjects, increased positive emotions and increased feelings of subjective recovery and subjective vitality.

Thus, the results indicate that walking in different parts of the park in autumn promotes relaxation and has a positive effect on the psychological recovery of young people. In contrast, urban street environments can be stressful and negatively affect well-being. It is, therefore, essential in the context of urban planning to provide access to green and blue infrastructure in urban areas.

The results for walking by the fountain in the centre of the park were the best for each scale, but there were not always statistically significant differences between the results for this type of walk and walking along the edges of the park. So, even walking around the park's edges is vital for psychological restoration, calming down, relaxing and feeling better. Therefore, city parks should be open as much as possible to visitors and should encourage them to enter. Small infrastructure like benches will allow people to stay longer and relax.

The experiment was conducted in a well-managed urban park renovated in 2011–2013. The psychological effects of walking in urban parks may depend on the condition of the vegetation, as well as the state of park maintenance. Comparisons between different types of parks and different types of urban areas are recommended in future studies.

Acknowledgements

We would like to express our sincere thanks to the volunteers from Lublin who made the study possible.

Authors' contribution

AK and NK: conceptualisation, methodology, investigation, data curation, writing – original draft preparation, writing – review and editing, visualisation; AK: formal analysis, data curation.

Funding

This research received no external funding. The translation of the article was financed by the University of Life Sciences in Lublin.

References

Abubakar A.M., 2018. Linking work-family interference, workplace incivility, gender and psychological distress. *Journal of Management Development* 37(3): 226–242. DOI 10.1108/JMD-06-2017-0207.

Aisyianita R.A., Afif F., Anwari H., 2022. Forest bathing opportunities as a new trend of tourism in Indonesia on the new and next normal era. In: *Current Issues in Tourism, Gastronomy, and Tourist Destination Research*: 86–91. Routledge.

Bao X., Chen D., Shi L., Xia Y., Shi Z., Wang D., 2022. The relationship between COVID-19-related prevention cognition and healthy lifestyle behaviors among university students: Mediated by e-health literacy and self-efficacy. *Journal of Affective Disorders* 309: 236–241. DOI 10.1016/j.jad.2022.04.044.

Belčáková I., Świąder M., Bartyna-Zielińska M., 2019. The green infrastructure in cities as a tool for climate change adaptation and mitigation: Slovakian and Polish experiences. *Atmosphere* 10(9): 552. DOI 10.3390/atmos10090552.

Bielinis E., Janeczko E., Takayama N., Zawadzka A., Słupska A., Anna Z., Bielinis L., 2021. *A view of waste might decrease relaxation: The effects of viewing an open dump in a forest environment on the psychological response of healthy young adults*. Preprint. DOI 10.20944/preprints202112.0099.v1.

Bielinis E., Takayama N., Boiko S., Omelan A., Bielinis L., 2018. The effect of winter forest bathing on psychological relaxation of young Polish adults. *Urban Forestry & Urban Greening* 29: 276–283. DOI 10.1016/j.ufug.2017.12.006.

Brzozowski P., 1991. Internal structure stability of positive and negative concepts. *Polish Psychological Bulletin* 22: 91–106.

Brzozowski P., 2010. *Skala uczuć pozytywnych i negatywnych SUPIN: polska adaptacja skali PANAS Davida Watsona i Lee Ann Clark: podręcznik* (SUPIN positive and negative feelings scale: A Polish adaptation of the PANAS scale by David Watson and Lee Ann Clark: manual). Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warsaw.

Carmichael L., Racioppi F., Calvert T., Sinnett D., 2017. *Environment and health for European cities in the 21st century: Making a difference*. University of the West of England, UWE Bristol. ISBN 978 92 890 5290 0

Directive 2014/53/EU of the European Parliament and of the Council of April 16, 2014 on the harmonization of the laws of the Member States concerning the making available on the market of radio equipment and repealing Directive 1999/5/EC.

Dong M., Zheng J., 2020. Headline stress disorder caused by Netnews during the outbreak of COVID-19. *Health Expectations: An International Journal of Public Participation in Health Care and Health Policy* 23(2): 259. DOI 10.1111/hex.13055.

Dudek B., Koniarek J., 1987. The adaptation of profile of mood states (POMS) by DM McNair M., Lorr L.F. Droppelman. *Przegląd Psychologiczny* 30: 753–762.

Dudek T., Marć M., Zabiegała B., 2022. Chemical composition of atmospheric air in nemoral scots pine forests and submountainous beech forests: The potential region for the introduction of forest therapy. *International Journal of Environmental Research and Public Health* 19(23): 15838. DOI 10.3390/ijerph192315838.

Dye C., 2008. Health and urban living. *Science* 319(5864): 766–769. DOI 10.1126/science.1150198.

Elsadek M., Liu B., Lian Z., Xie J., 2019. The influence of urban roadside trees and their physical environment on stress relief measures: A field experiment in Shanghai. *Urban Forestry & Urban Greening* 42: 51–60. DOI 10.1016/j.ufug.2019.05.007.

Franco L.S., Shanahan D.F., Fuller R.A., 2017. A review of the benefits of nature experiences: More than meets the eye. *International Journal of Environmental Research and Public Health* 14(8): 864. DOI 10.3390/ijerph14080864.

Furuyashiki A., Tabuchi K., Norikoshi K., Kobayashi T., Oriyama S., 2019. A comparative study of the physiological and psychological effects of forest bathing (Shinrin-yoku) on working age people with and without depressive tendencies. *Environmental Health and Preventive Medicine* 24: 1–11. DOI 10.1186/s12199-019-0800-1.

Gao Y., Li Z., Mao Z., 2021. Health communication and popularization in the context of epidemic era: Preferences of the Chinese general population. Preprint. DOI 10.21203/rs.3.rs-895623/v1.

Glaeser E.L., Mare D.C., 2001. Cities and skills. *Journal of Labor Economics* 19(2): 316–342. DOI 10.1086/319563.

Gołos P., 2013. The recreational functions of Warsaw's urban and suburban forests. *Forest Research Papers* 74(1): 57–70. DOI 10.2478/frp-2013-0007.

Guardini B., Secco L., Moè A., Pazzaglia F., De Mas G., Vegetti M., Perrone R., Tilman A., Renzi M., Rapisarda S., 2023. A three-day forest-bathing retreat enhances positive affect, vitality, optimism, and gratitude: An option for green-care tourism in Italy? *Forests* 14(7): 1423. DOI 10.3390/f14071423.

Halabchi F., Hosseini L., Zebardast J., Seif-Barghi T., 2018. Popularization of science in exercise, nutrition and lifestyle: A successful example of science communication in Iran. *Asian Journal of Sports Medicine* 9(3): e59339. DOI 10.5812/asjsm.59339.

Hanna E., Comín F.A., 2021. Urban green infrastructure and sustainable development: A review. *Sustainability* 13(20): 11498. DOI 10.3390/su132011498.

Hansen M.M., Jones R., Tocchini K., 2017. Shinrin-yoku (forest bathing) and nature therapy: A state-of-the-art review. *International Journal of Environmental Research and Public Health* 14(8): 851. DOI 10.3390/ijerph14080851.

Janeczko E., Bielinis E., Wójcik R., Woźnicka M., Kędziora W., Łukowski A., Elsadek M., Szyc K., Janeczko K., 2020. When urban environment is restorative: The effect of walking in suburbs and forests on psychological and physiological relaxation of young Polish adults. *Forests* 11(5): 591. DOI 10.3390/f11050591.

Janeczko E., Czyżyk K., Korcz N., Woźnicka M., Bielinis E., 2023. The psychological effects and benefits of using green spaces in the city: A field experiment with young Polish adults. *Forests* 14(3): 497. DOI 10.3390/f14030497.

Jestaedt M., 2008. Experiences in the management of urban recreational forests in Germany. In: Carreiro M.M., Song Y.C., Wu J. (eds), *Ecology, Planning, and Management of Urban Forests: International Perspectives*. Springer, New York: 301–311. DOI 10.1007/978-0-387-71425-7_19.

Kaba D., Sari B.A., 2020. Acute stress disorder with panic episodes induced by exposure to COVID-19 outbreak news in a child. *Dusunen Adam* 33(2): 221–222. DOI 10.14744/DAJPNS.2020.00084.

Karjalainen E., Sarjala T., Raitio H., 2010. Promoting human health through forests: Overview and major challenges. *Environmental Health and Preventive Medicine* 15(1): 1–8. DOI 10.1007/s12199-008-0069-2.

Korcz N., Janeczko E., Bielinis E., Urban D., Koba J., Szabat P., Małecki M., 2021. Influence of informal education in the forest stand redevelopment area on the psychological restoration of working adults. *Forests* 12(8): 993. DOI 10.3390/f12080993.

Korpela K.M., Ylén M., Tyrväinen L., Silvennoinen H., 2008. Determinants of restorative experiences in everyday favorite places. *Health & Place* 14(4): 636–652. DOI 10.1016/j.healthplace.2007.10.008.

Korpela K.M., Ylén M., Tyrväinen L., Silvennoinen H., 2010. Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland. *Health Promotion International* 25(2): 200–209. DOI 10.1093/heapro/daq007.

Kostecka J., Mazur-Pączka A., Jasińska T., Batóg K., 2012. Pojęcie „świadczenia ekosystemowe" i jego rola w edukacji dla zrównoważonego rozwoju (na przykładzie bzu czarnego *Sambucus nigra* L.) (The concept of 'ecosystem benefits' and its role in education for sustainable development (using the elderberry *Sambucus nigra* L. as an example)). *Inżynieria i ochrona środowiska* 15: 405–417.

Lee J., Park B.J., Tsunetsugu Y., Ohira T., Kagawa T., Miyazaki Y., 2011. Effect of forest bathing on physiological and psychological responses in young Japanese male subjects. *Public Health* 125(2): 93–100. DOI 10.1016/j.puhe.2010.09.005.

Li Q., Kobayashi M., Inagaki H., Hirata Y., Li Y.J., Hirata K., Shimizu T., Suzuki H., Katsumata M., Wakayama Y., 2010. A day trip to a forest park increases human natural killer activity and the expression of anti-cancer proteins in male subjects. *Journal of Biological Regulators and Homeostatic Agents* 24(2): 157–165.

Li Q., Morimoto K., Nakadai A., Inagaki H., Katsumata M., Shimizu T., Hirata Y., Hirata K., Suzuki H., Miyazaki Y., 2007. Forest bathing enhances human natural killer activity and expression of anti-cancer proteins. *International Journal of Immunopathology and Pharmacology* 20(2): 3–8. DOI 10.1177/03946320070200S202.

Mathias S., Daigle P., Dancause K.N., Gadais T., 2020. Forest bathing: A narrative review of the effects on health for outdoor and environmental education use in Canada. *Journal of Outdoor and Environmental Education* 23(3): 309–321. DOI 10.1007/s42322-020-00058-3.

Mayer A.L., Shuster W.D., Beaulieu J.J., Hopton M.E., Rhea L.K., Roy A.H., Thurston H.W., 2012. Environmental reviews and case studies: Building green infrastructure via citizen participation: A six-year study in the Shepherd Creek (Ohio). *Environmental Practice* 14(1): 57–67. DOI 10.1017/S1466046611000494.

Mazurek-Kusiak A.K., Kobyłka A., Korcz N., Sosnowska M., 2021. Analysis of eating habits and body composition of young adult poles. *Nutrients* 13(11): 4083. DOI 10.3390/nu13114083.

McCaffrey R., Hanson C., McCaffrey W., 2010. Garden walking for depression: A research report. *Holistic Nursing Practice* 24(5): 252–259. DOI 10.1097/HNP.0b013e3181f1acd7.

McNair D.M., Lorr M., Droppleman L.F., 1992. *EdITS manual for the profile of mood states (POMS)*. Educational and Industrial Testing Service, San Diego.

Milligan C., Bingley A., 2007. Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults. *Health & Place* 13(4): 799–811. DOI 10.1016/j.healthplace.2007.01.005.

New City Agenda. Online: https://newcityagenda.co.uk (accessed 14 November 2023).

Nilsen W.J., Pavel M., 2013. Moving behavioral theories into the 21st century: Technological advancements for improving quality of life. *IEEE Pulse* 4(5): 25–28. DOI 10.1109/MPUL.2013.2271682.

Pakzad P., Osmond P., 2016. Developing a sustainability indicator set for measuring green infrastructure performance. *Procedia-Social and Behavioral Sciences* 216: 68–79. DOI 10.1016/j.sbspro.2015.12.009.

Puczyńska K., *Ogród Saski w Lublinie* (Saxon Garden in Lublin). Online: https://teatrnn.pl/leksykon/artykuly/ogrod-saski-w-lublinie (accessed 1 November 2024).

Referowska-Chodak E., 2019. Pressures and threats to nature related to human activities in European Urban and suburban forests. *Forests* 10(9): 765. DOI 10.3390/f10090765.

Rewaloryzacja Ogrodu Saskiego w Lublinie (Revalorisation of the Saxon Garden in Lublin). Online: https://lublin.eu/gfx/lublin/userfiles/_public/lublin/lublin_w_ue/multimedia/ogrod_saski_folder.pdf (accessed 1 November 2024).

Ryan R.M., Frederick C., 1997. On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality* 65(3): 529–565. DOI 10.1111/j.1467-6494.1997.tb00326.x.

Simkin J., Ojala A., Tyrväinen L., 2020. Restorative effects of mature and young commercial forests, pristine old-growth forest and urban recreation forest – A field experiment. *Urban Forestry & Urban Greening* 48: 126567. DOI 10.1016/j.ufug.2019.126567.

Simonienko K., Jakubowska M., Konarzewska B., 2020. Shinrin-yoku i terapia lasem – przegląd literatury (Shinrin-yoku and forest therapy – review of literature). *Psychiatria* 17(3): 145–154. DOI 10.5603/PSYCH.2020.0022.

Song C., Ikei H., Igarashi M., Takagaki M., Miyazaki Y., 2015. Physiological and psychological effects of a walk in urban parks in fall. *International Journal of Environmental Research and Public Health* 12(11): 14216–14228. DOI 10.3390/ijerph121114216.

Takayama N., Korpela K., Lee J., Morikawa T., Tsunetsugu Y., Park B.J., Li Q., Tyrväinen L., Miyazaki Y., Kagawa T., 2014. Emotional, restorative and vitalizing effects of forest and urban environments at four sites in Japan. *International Journal of Environmental Research and Public Health* 11(7): 7207–7230. DOI 10.3390/ijerph110707207.

Tsao T.M., Hwang J.S., Lin S.T., Wu C., Tai M.J., Su T.C., 2022. Forest bathing is better than walking in urban park: Comparison of cardiac and vascular function between urban and forest parks. *International Journal of Environmental Research and Public Health* 19(6): 3451. DOI 10.3390/ijerph19063451.

Vlachokostas C., Banias G., Athanasiadis A., Achillas C., Akylas V., Moussiopoulos N., 2014. Cense: A tool to assess combined exposure to environmental health stressors in urban areas. *Environment International* 63: 1–10. DOI 10.1016/j.envint.2013.10.014.

World Health Organization, 2015. *Connecting global priorities: Biodiversity and human health: A state of knowledge review*.

Wu J., Snell G., Samji H., 2020. Climate anxiety in young people: A call to action. *The Lancet Planetary Health* 4(10): e435–e436. DOI 10.1016/s2542-5196(20)30223-0.

Yang W., Kang J., 2005. Soundscape and sound preferences in urban squares: A case study in Sheffield. *Journal of Urban Design* 10(1): 61–80. DOI 10.1080/13574800500062395.

Zhang S.X., Wang Y., Rauch A., Wei F., 2020. Unprecedented disruption of lives and work: Health, distress and life satisfaction of working adults in China one month into the COVID-19 outbreak. *Psychiatry Research* 288: 112958. DOI 10.1016/j.psychres.2020.112958.

Zhou C., Yan L., Yu L., Wei H., Guan H., Shang C., Chen F., Bao J., 2019. Effect of short-term forest bathing in urban parks on perceived anxiety of young-adults: A pilot study in Guiyang, Southwest China. *Chinese Geographical Science* 29(1): 139–150. DOI 10.1007/s11769-018-0987-x.

Online sources

https://www.bdl.lasy.gov.pl/portal/mapy.