

SPATIAL ANALYSIS OF CULTURAL ECOSYSTEM SERVICES IN LUBLIN: PERCEPTIONS OF LOCAL RESIDENTS AND TOURISTS

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ABSTRACT

Motives: Cultural ecosystem services (CES) are perceived differently by local residents and tourists. Therefore, an understanding of spatial patterns in CES is important for urban planning.

Aim: To determine whether residents and tourists differ in their perceptions of CES groups in Lublin, and whether these perceptions are influenced by gender, age, occupation, and frequency of visits.

Results: The relative value of CES groups was ranked in the following descending order of importance: physical, social, cultural, inspirational, and spiritual activities by local residents ($n = 138$), and inspirational, cultural, spiritual, physical, and social activities by tourists ($n = 134$). The Wilcoxon test showed that the total and average number of the identified locations was higher among residents than tourists. The chi-square test revealed a difference between the CES categories identified by the local residents ($\chi^2 = 265.602$, $df = 5$, $p < 0.01$) and tourists ($\chi^2 = 25.660$, $df = 5$, $p < 0.01$).

Keywords: Public Participatory Geographical Information System, non-material values, cultural ecosystem services, urban green spaces

INTRODUCTION

Cultural ecosystem services (CES) are part of ecosystem services (Haines-Young & Potschin, 2018) and provide intangible benefits (MEA, 2003) and human well-being (Cheng et al., 2019) in gradually developing urban areas (UN, 2020; Willis, 2015). In large cities, where urban green areas are often lacking (Iraegui et al., 2020), CES is the most relevant for city dwellers (Chen et al., 2020) and such urban green areas are the only places available to city residents and tourists and

provide a fundamental interaction between people and nature (Andersson et al., 2014). While CES is important for improving the quality of life, it is not always considered in planning decisions (Dasgupta et al., 2021). At the same time, a fuller consideration of CES along with an analysis of the perceptions of different people can help avoid future conflicts (Darvill & Lindo, 2016) in cities. There is now a need not only to quantify CES, but also to incorporate them into decision-making activities (Hirons et al., 2016). Therefore, the Public Participation Geographic

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Information System (PPGIS) is used to characterize the CES spatially. This approach generates spatial information to assess CES by involving different categories of people (Brown & Fagerholm, 2015). For example, in our study we compared local residents, who live permanently in the city and tourists. People's perception of CES is greatly influenced by a variety of sociocultural factors such as gender, age, location, and education (Dade et al., 2020). In addition, the frequency of visits (Petrosillo et al., 2007) influences how visitors perceive CES. Often, the city's beautiful attractions are important tourism resources (Bachi et al., 2020). But also often, despite tourism's contribution to the local economy, tourism can have an antagonistic impact on local communities (Petrosillo et al., 2013). It is therefore important to strike a balance between the interests of the community and tourism businesses (Brown, 2006). Analyzing the perception of CES by local residents and tourists can help inform urban planning and management decisions. Spatial analysis methods have been used in the literature to assess CES. In the past, a difference in the perception of CES by seasonal and permanent residents has been demonstrated (Petrosillo et al., 2013). However, understanding of CES is still insufficient (Milcu et al., 2013). Among the numerous studies analyzed in the literature (Kosanic & Petzold, 2020; O'Brien et al., 2017) on urban CES, there is insufficient basis in the definition of CES and their nomenclature (Blicharska et al., 2017). There are also differences in CES, social and tourism policies in Poland, UK and Finland (Dłużewska et al., 2020). There are also too few CES assumptions in applications to the theoretical foundations and research practices of CES (Dłużewska, 2016). There is no sufficient research on the possibilities of city parks, such as, for example, research conducted for the city of Poznań on the provision and regulation of CES in the city and their social reception (Stępniewska, 2021). There is also a lack of research on the CES of the city parks of Lublin, which motivated us to conduct this research. This is particularly relevant in the overall context of the growth of the world's urban population (UN, 2020).

The use of participatory mapping methods known as participatory GIS (PPGIS) is promising. These methods involve people in creating spatial information for different urban layouts (Brown et al., 2018) and have been widely used for CES estimation since the 1990s (Jones et al., 2018). The aim of our study was to examine the perception of CES on the example of the city parks of Lublin, to show the differences in perception by tourists and residents and to determine whether perceptions of CES in Lublin is higher for local residents in comparison to tourists, whether they are influenced by gender, age, occupation and frequency of visits. PPGIS approach was also applied to map areas with high levels of perception of the top five groups of CES activities (Physical, Social, Inspirational, Cultural and Spiritual) of CES values by local residents and tourists and identify differences in their perception. The city of Lublin was chosen as one of the largest cities in eastern Poland (the regional center of the Lubelskie Voivodeship).

MATERIALS AND METHODS

The perception of 22 objects located in Lublin by residents and tourists was analyzed (Fig. 1). Among them, 14 parks as contemporary parks, created along with the development of new districts of Lublin, historical parks, with good historical and cultural values (Adamiec & Trzaskowska, 2012) and objects with domination of the area of green and water elements. Each time Lublin authorities intend to introduce any changes or improvements within landscape spatial management, a proper resolution of Lublin City Council has to be adopted, as it happened on 8 September 2022 (Uchwała, 2022). The city of Lublin covers an area of approximately 147.5 km² and has a population of 336,339 (Lublin, 2023). In 2022, more than twice as many tourists and domestic visitors (752,823) came to Lublin compared to data from 2021, and more than 20 percent more than in 2019 (Barometr turystyczny, 2022). Forests cover over 11% of the city's area and are an important element of Lublin's green structure.

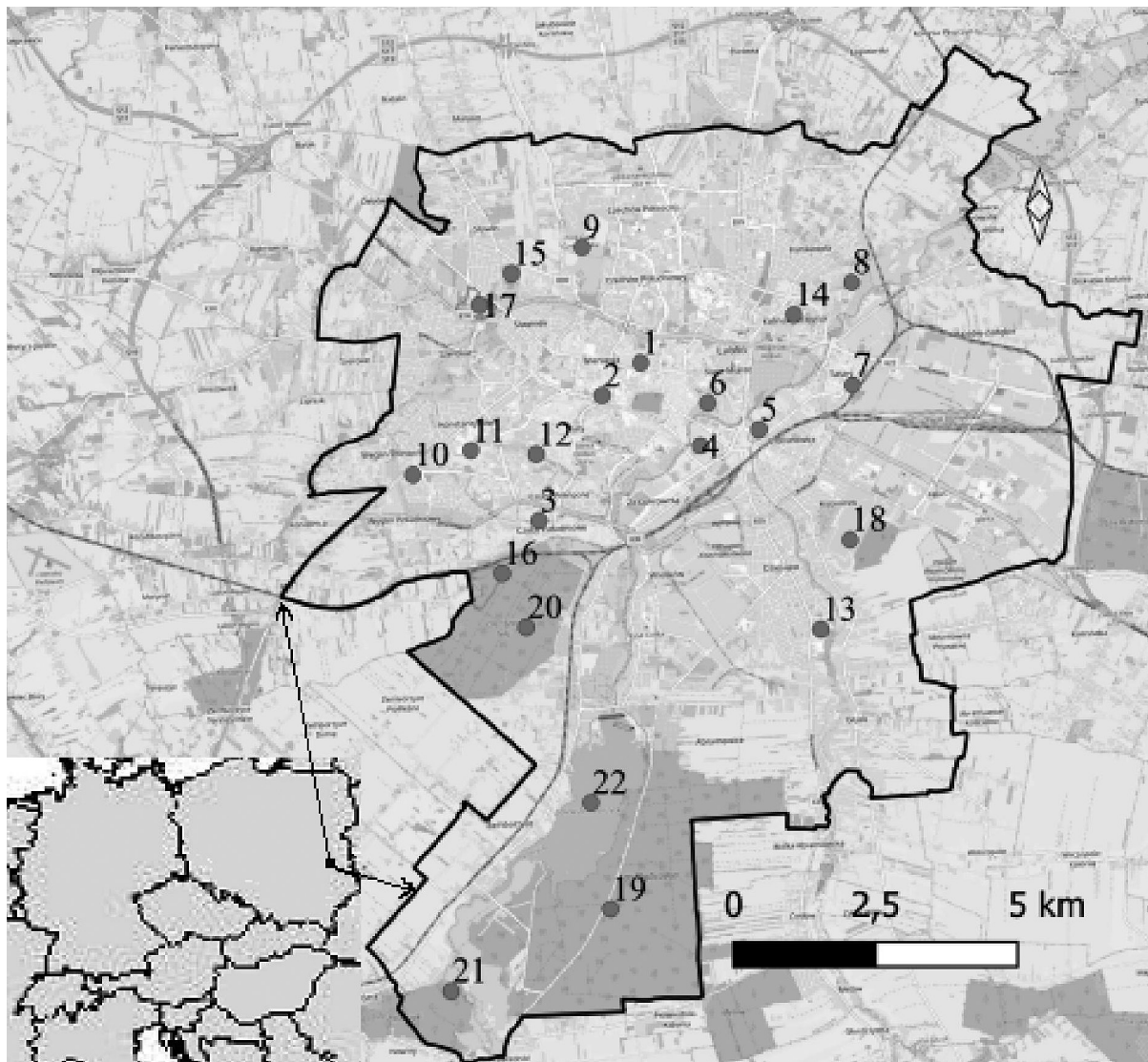


Fig. 1. Location of the Lublin study area and distribution of CES selected by local residents and tourists: 1 – Saski, 2 – Akademicki, 3 – Saint John Paul II, 4 – Ludowy, 5 – Bronowice, 6 – Rusalka, 7 – Tatary, 8 – Zawilcova, 9 – Gorki Czechovskie, 10 – Veglin, 11 – Poczekajka, 12 – Rury, 13 – Abramowice, 14 – Kalina parks, 15 – Botanical Garden, 16 – Stasin Reserve, 17 – Lublin Open Air Village, 18 – Majdanek museums, 19 – Dabrova, 20 – Stary Gaj, 21 – Rudki forests, 22 – Zemborzycki Reservoir

The main method of data collection was a structured questionnaire. This traditional questionnaire evaluation methods of CESs are mostly carried out (Yang & Cao, 2022). The survey was used to obtain subjective CES assessments of the city and was addressed to residents and tourists. The respondents were asked to choose up to 4 places on the map of Lublin that they consider important for each of the

5 CES categories, namely Physical, Social, Inspirational, Cultural, Spiritual (Table 1).

Table 2 presents the questions asked to the respondents in the questionnaire. These were questions related to the category of respondents, their gender, age, level of education. Then there was the question “where do you go most often, when you want” and ready-made answers, the first three of which can be

Table 1. Categories of cultural ecosystem services (CES) used for Public Participation Geographic Information System (PPGIS) survey in the Lublin (Poland)

Activity group	Associated to CES which promote	CICES v5.1 code*
Physical	recreational (passive and active), walking, cycling, sailing	3.1.1.1 3.1.1.2
Social	social interactions, e.g., doing picnics, seating in a bench with friends, walking with other senior	3.1.1.2
Inspirational	knowledge, and inspiration, e.g., scientific, educational, aesthetic appreciation.	3.1.2.1 3.1.2.2 3.1.2.4
Cultural	cultural benefits for the users, e.g., educational, cultural, heritage.	3.1.2.2 3.1.2.3 3.2.1.3
Spiritual	spiritual experiences associated to nature, e.g., symbolic, sacred or religious.	3.2.1.1 3.2.1.2

* Some CICES codes linked to more than one activity group and corresponds to dominant group.

Table 2. Survey questionnaire for residents and tourists

Questions	Answers
Are you a local resident of Lublin city or tourist?	local resident/tourist
Gender	female/male
Age group	up to 18/18–30/31–40/41–50/51–60/more than 60
Level of education	secondary/higher/other
Where do you go most often when do you want to:	Please pointe 4 objects and relevance of activity (as 1/2/3/4/5-points Likert-scale) for them and frequency of your visit (daily/weekly/monthly/yearely)
to be close to nature	
to be where is quiet and in piece	-//-
to relax (walking, running, sweeming)	-//-
to be with friends	-//-
to be with family	-//-
to meet new people	-//-
take part in a social events	-//-
inspiration of unique of place	-//-
inspiration with creatione (paint, poem, song, photo)	-//-
to develop knowledge	-//-
to learn about things	-//-
to learn history and traditions	-//-
to understand things and cultural heritage	-//-
to attend cultural events	-//-
to meditate	-//-
to develop spiritual values	-//-
to reflect on personal religious values	-//-
Do you partake in any environmental activities	yes/no

attributed to Physical activity, the next four to Social activity, the next four to Inspirational activity, the next three to Cultural activity, and the last three to Spiritual activity (Table 2). In the questionnaire, following these answers, the respondents assessed the relative importance of the places they visited, using a rank from 1 to 5 (from 1 very unimportant to 5 very important – Likert scale) and frequency of visits (daily/weekly/monthly/yearly). The last question (Table 2) reflected the respondents' activity for environmental protection. The city map showed respondents landmarks and major roads to help them identify places that were important to them in creating CES. We used translations of the questionnaire into English and Polish. The study was conducted from 01.05 to 31.05. 2023, taking into account the distribution of population in all districts of Lublin. This period also included weekends. 272 respondents were interviewed (138 for residents and 134 for tourists) in various parts of the city (also at the bus station, railway station and airport). Each of respondents were asked pointed 4 objects and selected 1/2/3/4/5-points Likert-scale for them and thus represented 552 repetitions for residents and 536 for tourists of selected objects on the analyzed map of the city of Lublin. The high representativeness of the sample of respondents can be seen in the example of women (53.8% in the population of Lublin in 2023 and 51.3% in sample of respondents) among the surveyed residents of Lublin.

CES locations (number of locations for each group indicated by local residents and tourists), impact of the frequency of visits to the city on the respondents' perception of CES were processed in QGIS software. The total number of places mentioned by tourists and local residents for each category of CES was calculated. According to the frequency daily, weekly, monthly and yearly visits were identified. The significance level of 0.05 was used in all statistical analyses. Wilcoxon test was also used to analyse differences in the number of places for each CES. Statistical analysis was conducted using the Statistics software. To spatially characterise the location of CES sites and the differences in their perception by local residents and tourists density maps of sites (using the Kernel density function) were created. The data obtained

(provided by each respondent) on the importance of CES was extrapolated as the weight of each point, with a search radius of 1500 m and a grid resolution of 100 m. The statistical significance of the difference between local residents and tourists was investigated using the chi-square test.

RESULTS

When analyzing the descriptive statistics, it should be noted that among the surveyed residents of Lublin ($n = 138$), women amounted to 51.3% and men to 48.7%. Gender showed the greatest influence in the social group. The social group was mentioned slightly more often by women than by men. In age groups, the majority of residents (51.2%) have less than 30 years, and 9.1% were over 60 years old. Age also has the greatest impact on social activity. Young people (aged 19–30) consider social and physical activity very important. In terms of education, people with higher education prevailed (39.2%). The level of education had no effect on the analyzed activity groups. Most of the respondents visited selected places once a week (40.5%), and only 3.4% visited them every day. Less than 10% of local residents participated in conservation activities. Among tourists ($n = 134$), women accounted for 65.6% and men for 34.4%. The majority (57.2%) were no more than 30 years old and 14.8% were over 60 years old. People with higher education prevailed (42.4%). In the case of tourists, the Inspirational group had a slight advantage. Only age had the greatest impact on Spiritual activity (people over 60 more often chose places from the Spiritual activity group). The Wilcoxon test showed that for all CES categories, the average number of places identified by local residents was higher than for tourists (Table 3). Table 3 shows not only the total but also the average number of CES facilities belonging to each of the five CES groups identified by local residents and tourists. The relative importance of the CES groups for tourists and local residents varied and can be ranked in 1 descending order of importance for local residents: Physical, Social, Cultural, Inspirational and Spiritual activity, and for tourists: Inspirational, Cultural, Spiritual Physical and Social activity.

Table 3. Total and average number of CES locations identified by local residents and tourists by CES groups

Category	Respondence Category	Physical	Social	Inspirational	Cultural	Spiritual
Total	Local Residents	365	354	345	347	261
	Tourists	190	187	235	225	203
Average	Local Residents	2.6	2.5	2.1	2.2	1.6
	Tourists	1.6	1.5	2.1	2.0	1.7

Local residents of the city who permanently resided in the city visited CES facilities in various parts of the city. We have identified clear spatial patterns for local residents and tourists. In particular, the locations with the highest concentration of CES (intense red color) differed between local residents and tourists. For local residents, the maps highlighted the rather varied distribution of areas identified by

those interviewed. The Physical activity group is characterized by a dispersed arrangement of facilities selected by residents in the northern and southern parts of the city. At the same time, respondents indicated more objects in the northern part, and less in the southern part (Fig. 2a). However, the importance of these objects for the respondents was quite high both in the northern and southern

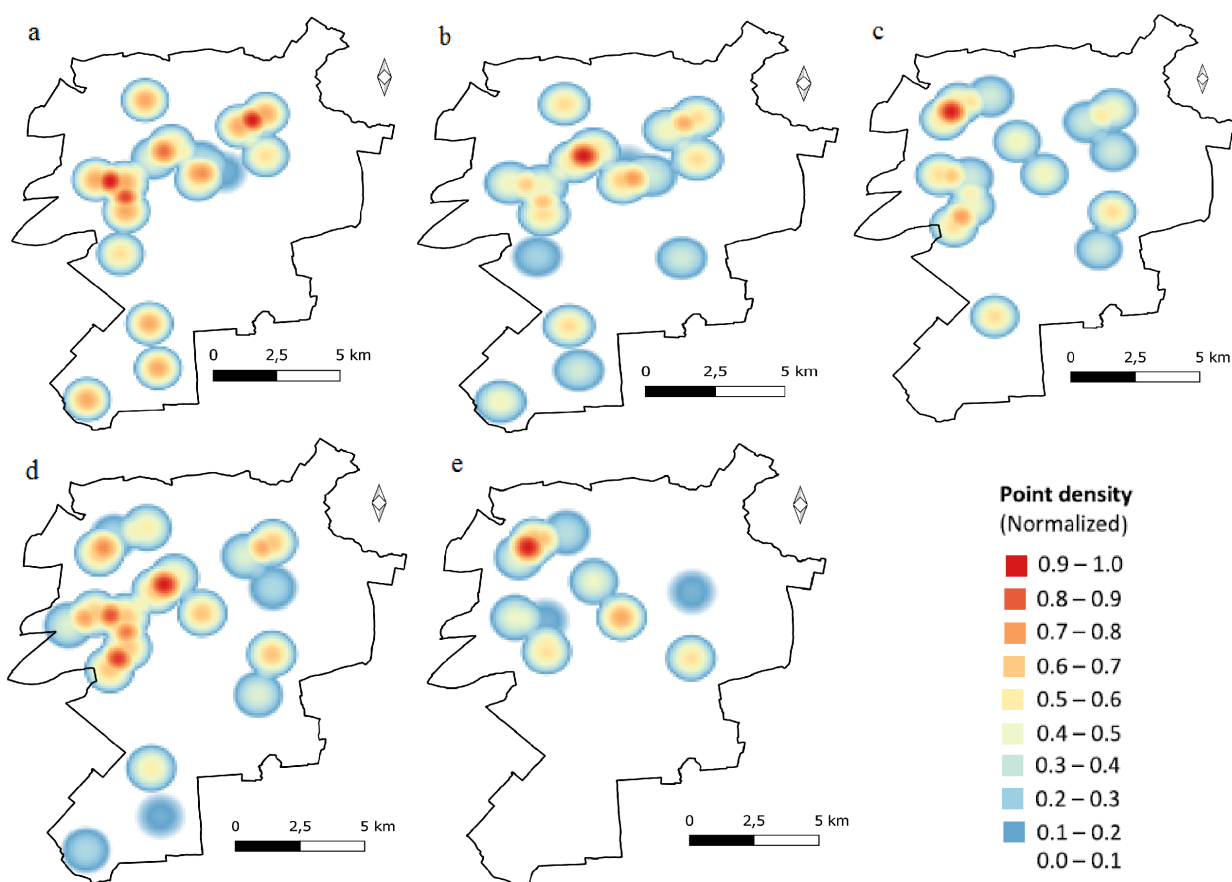


Fig. 2. Kernel density map of distribution of CES for local residents for activity groups: a – Physical, b – Social, c – Inspirational, d – Cultural, e – Spiritual

parts (red circle in the figures). This is facilitated by the presence of picturesque parks, such as the Saski Park, the cemetery-park on Lipowa Street, the Academic Park in the northern part, and the forests of Dąbrowa, Stary Gaj and Rudki in the southern part, which attract the attention of Lublin residents. In the groups Social activity and Cultural activity, clusters of objects selected by the respondents in the northern and southern parts of the city are still noticeable, although the weight of objects in the southern part is smaller (Fig. 2b, 2d). In the case of the Inspirational group (Fig. 2c) and the Spiritual group, this division into the northern and southern parts becomes less noticeable (Fig. 2c, 2e) and, for example, numerous objects for the Spiritual groups were recorded only in the northern and central parts of the city (Fig. 2e).

The CES facilities indicated by tourists were less concentrated in comparison to the facilities selected by local residents. For tourists, in the northern part, the facilities were concentrated around the Saski Park, and in the southern part around the Zemborzycki Reservoir. Such a division was noticeable in the answers of tourists for the Physical and Social groups (Fig. 3a, 3b). On the other hand, the facilities selected by tourists for the Inspirational group are the largest and concentrated not only around the Saski Park and the Akademicki Park, but also around the Botanical Garden, Lublin Open Air Village Museum, Majdanek Museum and Zemborzycki Reservoir (Fig. 3c). The objects selected by tourists for Cultural and Spiritual groups had a different character, they spread from the north-east to the south-west (Fig. 3d, 3e)

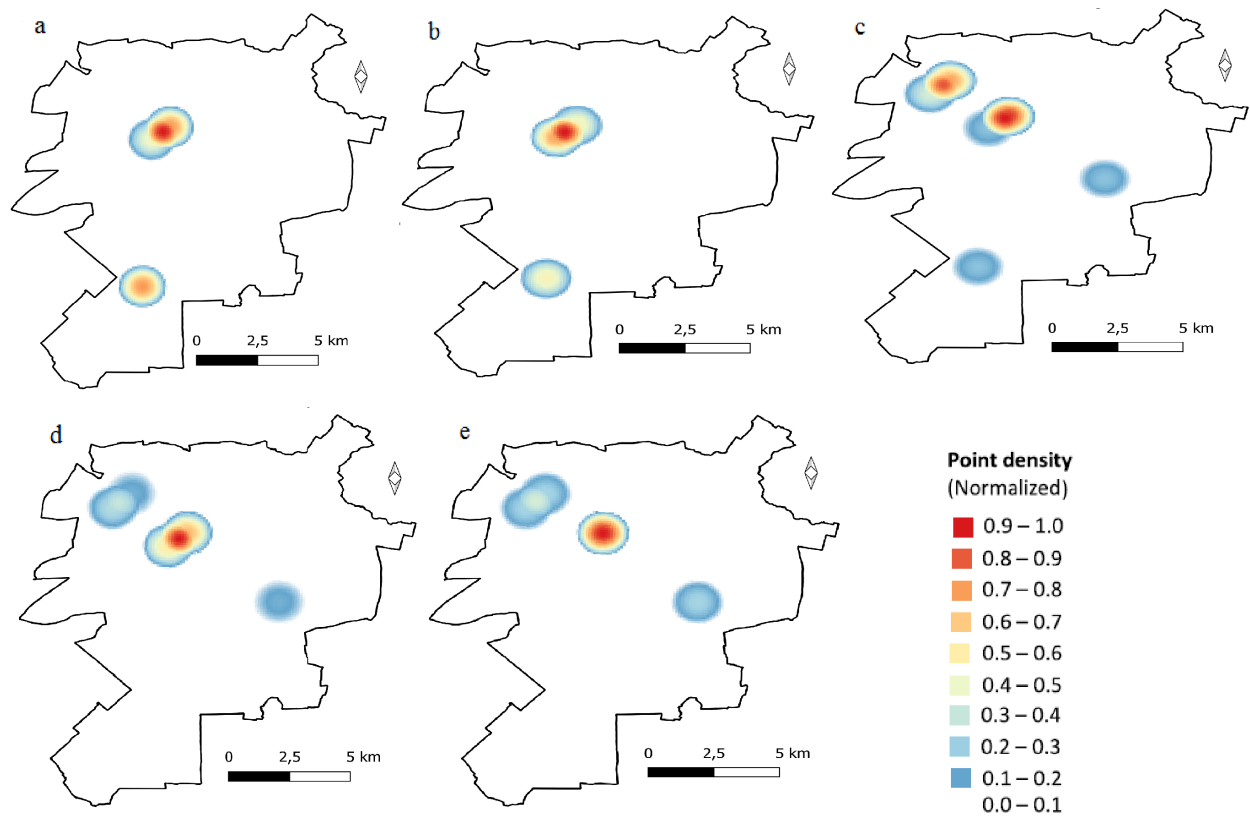


Fig. 3. Kernel density map illustrating distribution of CES for tourists for activity groups: a – Physical, b – Social, c – Inspirational, d – Cultural, e – Spiritual

and were concentrated close to the city center. The chi-square test showed that there is a difference between the CES categories for local residents ($\chi^2 = 265.602$, $df = 5$, $p < 0.01$) and tourists ($\chi^2 = 25.660$, $df = 5$, $p < 0.01$).

DISCUSSION

As research within the city of Lublin has shown, the relative importance of CES groups varied for local residents and tourists. For local residents in descending order of importance, these are Physical, Social, Cultural, Inspirational and Spiritual activity groups. These CES groups are also recognised in the literature as the main factors contributing to people's health and well-being (Cheng et al., 2019). Our order of importance is consistent with previous studies that have pointed to the importance of, for example, recreational (in our division, this is close to the Physical group) CES for residents and non-residents (Muñoz et al., 2019). For tourists in descending order of importance, these are Inspirational, Cultural, Spiritual Physical and Social activities that are different than for local residents. Research has found that the average number of objects indicated by local residents was higher than that indicated by tourists, possibly because local residents had a broader knowledge of the city. This contributed to their better perception of the assessed sites and to recognising more CES. Tourists indicated that although they had visited the city of Lublin many times, they had only visited a limited number of tourist sites and therefore had limited information about the city. Perhaps this is why they mentioned fewer CES than local residents. In this situation, it would be advantageous to increase the number and area of greenery sites in Lublin as CES sites, especially as the city of Lublin itself is below average in terms of urban greenery in Poland (Łachowski & Łęczek, 2020).

Spatial patterns of CES across the Lublin city are different between tourists and local residents. The objects indicated by tourists have a simpler spatial pattern than those indicated by local residents. These patterns for tourists, who choose popular

tourist destinations mainly in the old part of the city, were relatively similar across CES groups and had a concentrate distribution. The core density map shows a higher concentration of them around the Saski Park, known for its beauty and various types of outdoor recreation, as well as Botanical Garden and Lublin Open Air Village Museum. However, to fully provide all 5 types of CES, additional activities may be needed for greater opportunities and safety especially for the elderly, as well as environmental education. To this end, it is necessary to take into account the differences in the types and locations of CES and their perception by residents and tourists. The most widespread and diverse were the positions indicated by local residents. Spiritual CES focused around the Museum at Majdanek, the Lublin Open Air Village Museum and the John Paul II Park. Here, the park as a cultural practice is a source of sacredness. This shows that religious beliefs, customs and traditions are important in providing CES. Often, after visiting churches, chapels, monasteries or a museum, the respondents visited the nearest parks. These findings are in line with the findings of other authors (Muñoz et al., 2019) who have argued that not only the biophysical characteristics of the area, but also the people experiencing CES influence the type of CES. In the parks, we surveyed most people on Sundays and weekends, and especially during the time after services in the Catholic churches and Orthodox churches (Tserkvas) closest to the parks, since after the mass some people went to the parks. It is worth noting that our study had some limitations because the survey was not sustainable. We only reviewed 2 groups, i.e. local residents and tourists. A more detailed breakdown of respondents, for example by type of business (Darvill & Lindo, 2015), could provide more data for participatory CES mapping. As the research carried out in Lublin showed, of how CES features are perceived by local residents and tourists would be valuable, and CES visualization could improve not only interpersonal contact, but also the decision-making process, with a view to the future development of tourism and well-being of the inhabitants. In the future, the diversification

of tourist destinations may reduce the concentration of visitors in the city. This has been mentioned in the literature (Bramwell, 2015). In Lublin, facilities visited by residents and tourists in the old part of the city overlap to the greatest extent. Therefore, taking this into account can prevent residents from opposing tourism development. As research in Lublin showed, the use of CES depended most on age and gender. Similar results have been reported in other studies (Fischer et al., 2018). Local residents in Lublin value Physical, Social and Cultural activity the most, which is also consistent with the results of previous studies (Syrbe et al., 2021; Ugolini et al., 2021; Xin et al., 2020). The importance of these activities is explained by their role in physical and mental well-being (Pinto et al., 2021). It is worth emphasizing the need to invest in the analysis of the relationship between man and nature, especially in multicultural communities, such as the city of Lublin. In this article, for the first time, it was possible to determine the nature of the perception of CES not only among residents, but also tourists in Lublin during a new phase of Russian military aggression against Ukraine, which has resulted in international armed conflict on the territory of Ukraine (Geneva Convention, 1949). In 2022, a lot of visiting Ukrainians were recorded in Lublin (Barometr turystyczny, 2022). This could have influenced the reception of the CES in Lublin. However, a separate analysis of Ukrainians who arrived to Lublin after 24 February 2022 and are subject to different (special) legal regime (Ustawa, 2022), in the perception of CES did not fall within the scope of our research, although it may be prospective in subsequent publications.

As our research has shown, the spatial distribution of the identified locations presents an aggregated image, particularly dense in the city center. This concentration is approaching the territory of the old city. It is also worth noting that most services are concentrated mainly in the northern and central parts of the city, and the density of CES perception decreases from the inner to the outer border of Lublin. Similar results were also obtained by other researchers (Rall et al., 2017). It has been noticed that

people are actively looking for places to relax in the city, heading towards the Lublin Open Air Village Museum, Botanical Garden, Zemborzycki Reservoir or Dąbrowa, Stary Gaj or Rudki forests located within the borders of Lublin. This is beneficial for people's physical and mental health as, for example, forests have a high regenerative capacity (Nghiem et al., 2021). The densest zones of Spiritual Activity are more convergent with the central part of the old town, with a greater concentration of sacral buildings (Catholic and Orthodox churches, chapels). Future research should also consider expanding the number of CES assessment activities analyzed that could provide more detailed information needed for city governance. The publication is limited to 5 main activities to ensure efficient data management. In the future, it will also be interesting to focus on the assessment of respondents' motivation, because its analysis goes beyond the scope of this article. It is important to take into account both the preferences of residents regarding CES and the availability of CES for management (Almeida et al., 2018). Given the great interest in social activity of older people (60+), their social interactions should be promoted (Trzaskowska, 2023). For example, the installation of benches and the use of deciduous tree species to increase shade in summer and sunlight in winter. This is important due to the projected aging of the population (Artmann et al., 2017) and climate change (Klemm et al., 2016), as all these factors affect the well-being of older people. There is also a need to involve older users more in decision-making (Onose et al., 2020). This is important in the context of the UN Decade of Healthy Aging 2021-2030 (WHO, 2020). It is also worth thinking about the distribution of recreational facilities, expanding them more and more often beyond the central part of the old town. This is important to redistribute some users to avoid potential conflicts between recreation and conservation efforts. New areas of the city with recreational potential should be further explored and promoted as alternatives to the existing ones. Given the importance of physical and social activity, benches, fountains, sheds, exercise equipment and playing fields can be installed in new areas. Places that are popular

in an Lublin area should be used to assist lift other near destinations to take more equitable cost-effective advance in the future. In the world there are examples of that activity using Placemaking Approach (Priatmoko et al., 2021).

CONCLUSIONS

The most relevant CES activities for local residents and tourists for the city of Lublin were identified. Local residents of the city most often chose Physical and Social activities. Tourists, on the other hand, most frequently selected the Inspirational activity. For local residents, the relative importance of the CES groups ranked in descending order of importance were Physical, Social, Cultural, Inspirational and Spiritual activities, and for tourists were Inspirational, Cultural, Spiritual Physical and Social activities. The PPGIS approach showed a greater number of locations indicated by residents (22) and a smaller number (6) by tourists. From this we can conclude that the tourist potential of the city of Lublin is not sufficiently used and that, for the time being, the perception of CES is higher by local residents compared to tourists. For local residents and tourists, perceptions of CES are influenced by gender, age, occupation and frequency of visits. The chi-square test showed that there was a difference between the categories of CES for local residents and tourists, and the Wilcoxon test showed that the total and average number of spaces identified by local residents was higher than for tourists. The spatial patterns of the CES identified by tourists were close to the northern part of the city of Lublin, with the exception of the Zęborzycki Reservoir in the southern part of the city for Inspirational, Physical, and Social groups activity. The concentration of objects indicated by tourists was much simpler than the concentration of objects identified by local residents. The objects selected by local residents were scattered in different parts of the city, mostly in the northern and southern parts. It seems very important that the sites chosen

by local residents for the CES go beyond those chosen by tourists. This may mean that future tourism development may have a negative impact on the well-being of Lublin's residents. This points to the need to find a compromise for tourists and local residents. It may be beneficial to expand the potential tourist base in various parts of the city in the future, especially in the southern part, where there are extensive forest massifs. A greater representation of the Stasin reserve in the southern part of the town for tourists may also be prospective. This could prompt further research into the contribution of protected areas and nature-related activities to the CES and lead to improvements in the health and well-being of the city's residents. The spatial distribution of the CES indicates that the green sites which are closest to the old part of the city, where there is a high concentration of cultural monuments, were most frequently visited by tourists. The intensity of use established is indicative of the strain on the central part of the city, and also highlights the need to take into account the interests of older people using the CES. The results of the study provide a better understanding of potential conflicts and may be of relevance to the city administration. The research results presented in the article and their analysis may help the authorities and interested partners in Lublin in making decisions that support the health and well-being of people.

Author contributions: authors have given approval to the final version of the article. Authors contributed to this work as follows: I.K. developed the concept and designed the study and methodology, prepared draft of article, collected the data, analysed and interpreted the data, M.M. revised the article critically for important intellectual content and editing, I.K.-B. collected the data, analysed and interpreted the data visualization and legal research.

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