Cultural Ecosystem Services of Urban Green Spaces–Supply and Demand in The Densely Built-Up Areas. Poznan Old Town Case Study

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Abstract: The quality of life of big city dwellers depends on the use of green infrastructure. The idea of a compact city, opposed to urban sprawl, can lead to reduced access to green areas and increased demand for cultural services provided through urban green infrastructure. Considering the above, the aim of the paper was to identify the supply of and demand for cultural ecosystem services related to the urban green spaces in densely built-up urban areas. To find out how important the ability to use green areas for dwellers of the densely built-up areas is, the questionnaire interviews with the residents of the area of the Old Town of Poznan were conducted. Questions in the survey concerned the amount of green spaces and their availability, the way of use, types of activity, factors limiting the use and factors encouraging to visit green spaces and the motives for using green areas away from inhabitants’ place of residence. Respondents claim that there is not enough greenery, especially associated with housing and street side greenery; the amount of parks (which they use most) is slightly higher, in their opinion. Limitations that influence utilising green spaces concern both greenery itself (e.g. insufficient recreational infrastructure, neglected green areas) as well as respondent’s issues (e.g. lack of free time). Improvements to recreational infrastructure and more well-kept green spaces would encourage respondents to utilise it more often. Active participation of inhabitants in developing and maintaining their closest neighbourhood would allow to enlarge green spaces in housing areas and make them more customized to the residents’ needs and requirements in terms of functionality and aesthetic.

1. Introduction

Urban green spaces are of strategic importance for the quality of life of the increasingly urbanised society. Besides essential environmental services such as air and water purification, the wind and noise filtering, or microclimate stabilisation, green infrastructure provides social and psychological services, which are of crucial significance for the well-being of urban dwellers. The presence of green spaces affects the health of the city’s inhabitants, their higher levels of physical activity and their ability to relax faster. The benefits that people receive from the existence of green spaces in the city is also the view of the window, the quality of public space and the possibility of recreation in the immediate vicinity of the place of residence [1]. Beside psychological, health and aesthetic benefits, natural features in cities can have other social benefits. Nature can encourage the use of outdoor spaces, increases social integration and interaction among neighbours [2]. Kuo et al. [3] also found out that greenery helps people to relax and renew, reducing aggression. These intangible benefits provided to
city dwellers are defined as cultural ecosystem services (CES) (more about ecosystem services (ES) and their classification [4, 5]), and they are amongst others ES – mostly final ES which influence human well-being directly [6].

However, the idea of a compact city, widely promoted as an antidote to urban sprawl, despite its numerous other benefits, can lead to limited access to green spaces and increased demand for cultural services provided through urban green infrastructure. The inability to meet the needs of the city inhabitants, resulting from the scarcity of green areas may adversely affect their well-being.

Considering the above, the aim of the paper is to identify the supply of and demand for cultural ecosystem services related to the urban green spaces in densely built-up urban areas. The key tool for collecting data necessary to attain the objective were questionnaire interviews, conducted among the residents of densely built-up Poznan Old Town. To achieve the primary goal, the detailed tasks were formulated: (i) to present the amount of green spaces and their availability (ii) to identify the use of the green spaces and types of activity being undertaken for the different types of green areas, (iii) to analyze the factors limiting the use of urban greenery and factors encouraging to visit green spaces more frequently (iv) to recognize motives for using green areas away from inhabitants’ place of residence.

2. Materials and methods

The structured questionnaire interview was the main method of data collection needed to achieve the goal. The questionnaires were administered in the Poznan Old Town (within the traces of the medieval city walls) and were addressed to the inhabitants of this part of the city. Concerning the subject matter of the paper, Poznan Old Town was chosen as an example of an area with intensive development and significant population density with a small share of green spaces in comparison to other parts of the city. It is likely that the residents of the area where the interviews were conducted, also benefit from green spaces in the vicinity of their place of residence understood as “walkable distance”. However there is no consensus about this often used term in studies on urban green spaces accessibility [7], what resulted in a different estimation of the radius e.g., 500 meters [7, 8] and 400 meters [9]. In our research we established immediate vicinity assuming a maximum radius of 800 meters as 10-minute walkable distance, taking into account that the average human walking speed is about five kilometres per hour. Therefore the area, which concerned the questions in the survey was expanded to include a buffer of 800 m. In the questionnaire, this area was referred to as "nearest vicinity". Respondents were interviewed in person. The face to face survey method allowed to increase response rates and gave the possibility to clarify ambiguities in the questions. The survey was conducted in September 2016, in which a total 70 respondents took part. The questionnaire consisted of five parts, which referred to the pre-designated research tasks. Apart the (1) personal data, collected for analysis of the sample group, the questions of the survey concerned: (2) the amount of green spaces and their availability (3) the use of the green spaces and types of activity being undertaken for the different types of green areas, (4) factors limiting the use of urban greenery and factors encouraging to visit green spaces more frequently (5) motives for using green areas away from inhabitants’ place of residence. In questions with the variants to choose, one could indicate more than one option but no more than three. In addition to the proposed variants, respondents could also add their suggestions using the "other" answer option.

The significance of the sociodemographic characteristics for the respondents’ answers has been tested using statistical analyses of the Statistica 12.

3. Poznań Old Town as a case study

Poznań is the fifth largest Polish city with a population estimated at 540,000 residents. The city limits cover 261 square kilometres. Like most European big cities, Poznań faces the problem of urban sprawl. The idea of a compact city seems to be an alternative to this type of development. However, the implementation of the compact city policy often means that the open spaces are occupied to intensify the grey infrastructure. Furthermore, it may result in limiting access to cultural ecosystem services, the most often noticeable benefits provided by urban green spaces to the residents. In a densely built-up area of less developed green spaces, a survey was conducted to see how compact city can fulfil the needs of residents regarding cultural services. Poznań Old Town within the footprint of the medieval defensive walls embodies the idea of compact city, what stands behind the reason for
choosing this part of the city as a case study. Historically conditioned dense downtown development, dating back to the 13th century, covers the area of Old Market Square and the adjacent streets with tenement houses. The average percentage of building land development for the gross area is over 75%. The area within city walls lacks green spaces. There are only several small public squares and greenery associated with housing (lawns, trees, playgrounds, etc.) in the tenement backyards. The closest vicinity of the analysed area (buffer 800 m), also referred to in the questionnaire, with several urban parks and public squares of different sizes, street side greenery, and grasslands alongside the Warta River is much better equipped with the green spaces.

4. Results

4.1. Profile of respondents
As already mentioned, in total 70 inhabitants of Poznań Old Town took part in the survey. Regarding gender, the majority of respondents were women 59% (41/70), men accounted for 41% (29/70). The group of young people (up to 30 years) was represented by 19 respondents (27%), middle-aged group (31-50) by 26 respondents (37%) and older group (over 50) by 25 respondents (36%). The largest group of respondents by employment status were professionally active persons -35 (50%), 23 persons were non-working (33%) (the unemployed, pensioners, retirees), while 12 persons were students (17%).

The respondents’ time of living in Poznań Old Town ranged from 1 year to 71 years. For statistical purposes, three ranges of residence length were established: short (1-10 years), medium (11-30 years) and long (> 30 years). 19 persons of the respondents (27%) have been inhabited there relatively short time, 22 persons (31.5%) average period, and 29 respondents (41.5%) for more than 30 years.

4.2 The amount and availability of green spaces
In this part of the questionnaire, respondents answered the questions about the amount and availability of green spaces within the surveyed area. According to 32 respondents (46%), there were enough green spaces, but only one person less (44%) pointed out the deficiency of greenery. Only seven people (10%) answered that there were plenty of green spaces.

The analysis of the influence of the respondents’ sociodemographic characteristics for the answers given, showed a statistically significant relationship with age group and professional status. Young people mostly indicated that there were enough and plenty of green spaces (respectively 47% and 32%), middle-aged people that there were little and enough (respectively 50% and 46%) and the elderly also answered that little and enough (respectively 56% and 40%). Students responded that there were enough and plenty of green spaces (respectively 58% and 33%), those professionally active that little and enough (47% and 44% respectively), and those non-working also that little and enough (respectively 58% and 37%). In general, young people and students are satisfied with the amount of greenery; the least satisfied are older people and non-working people.

![Figure 1. The occurrence of the different types of green spaces within analysed area according to respondents](image-url)
Out of the proposals of green spaces included in the questionnaire, within the analyzed area (with a buffer of 800 m) the respondents pointed out: urban parks (70 answers), greenery associated with housing (68 answers), street side greenery (54 answers) areas without current use (15 answers) and allotment gardens (7 answers) (figure 1). Respondents were also asked to indicate other types of green spaces they observed in the neighbourhood, but no one took advantage of this opportunity and did not indicate the other type of green spaces outside the given list. The last two types of greenery (allotment gardens and land without current use), due to the small number of answers (less than 25% of respondents) were not considered in further analysis.

After identifying the green spaces located in the surveyed area, the respondents indicated their amount. The vast majority of the respondents declared that there was little greenery associated with housing and street side greenery in the analysed area, while slightly more than half of the respondents considered that the amount of urban parks was sufficient (Figure 2).

![Figure 2. The amount of particular types of green spaces in respondents’ opinion](image)

In the next step, the respondents considered to what degree the particular green spaces were available to them (Figure 3). The vast majority of respondents believed that all types of greenery were available. Some of the asked persons claimed that access to the parks was limited, mainly due to the closure of the park at night (according to some respondents, the park was closed too early and opened too late).

Also, twelve people presented the same opinion regarding greenery associated with housing. Limited accessibility mainly resulted from the closure of tenements’ backyards for people who don’t live in them.

![Figure 3. The availability of the green spaces in respondents’ opinion](image)
4.3. Utilisation of green spaces

In the next part of the questionnaire, the respondents pointed out the frequency of listed activities related to green spaces. The results are presented in Table 1. For the inhabitants of Poznań Old Town, the most important forms of activity connected with the urban park and the greenery associated with housing are spending time in the open air (contact with nature) and nature observation as well as walking, connected with street side greenery – walking and cycling/skating. None of the respondents used the analysed greenery for fruit and vegetable cultivation, almost no one was actively involved in the maintenance of green areas nor utilised it to do other sports than mentioned in the questionnaire. Also, five people pointed out other activities in both city park and the greenery associated with housing, such as walking with dog or jogging. In general, residents are more likely to use urban parks, relatively more often than street side greenery – which is proven by a significant percentage of “never” answers for street side greenery in the case of the majority of activities.

Table 1. Frequency of different activities connected with green spaces.

| Type of green spaces: | Urban park | Greenery associated with housing | Street side greenery |
|----------------------|------------|---------------------------------|--------------------|
|                      | often      | sometimes | never | often | sometimes | never | often | sometimes | never |
| Walking              | 50         | 34        | 16    | 22    | 50        | 28    | 54    | 24        | 22    |
| Social meetings      | 17         | 47        | 37    | 19    | 37        | 44    | 7     | 11        | 82    |
| Spending time in the open air (contact with nature) | 56 | 33 | 11 | 39 | 43 | 18 | 6 | 18 | 76 |
| Nature observation   | 36         | 39        | 25    | 25    | 43        | 32    | 7     | 6         | 87    |
| Cycling/skating      | 4          | 13        | 83    | 0     | 13        | 87    | 15    | 13        | 72    |
| Team games/social games | 1       | 3         | 96    | 1,5   | 1,5       | 97    | 0     | 0         | 100   |
| Visiting playground  | 16         | 11        | 73    | 13    | 13        | 74    | 0     | 0         | 100   |
| Active participation in greenery maintenance | 0 | 3 | 97 | 0 | 3 | 97 | 0 | 0 | 100 |
| Vegetable, fruits cultivation | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 |
| Taking part in organized events | 4 | 31 | 65 | 3 | 18 | 79 | 0 | 0 | 100 |
| Other sports         | 1,5        | 1,5       | 97    | 1     | 3         | 96    | 0     | 2         | 98    |
| Other activities     | 4          | 3         | 93    | 4     | 4         | 92    | 2     | 2         | 96    |

Undertaking activities such as spending time in the open air or nature observation were influenced by gender – women were more likely to do it than men; cycling/skating was influenced by age – the younger the respondents were, the more likely such activity was undertaken.

4.4. Limits and encouragements to utilise green spaces

Next research goal was to indicate factors responsible for both limiting utilisation of green spaces and encouraging to utilise them. Firstly, respondents’ task was to define whether a factor is an important or non-important limitation. Table 2. illustrates a frequency of given answers. In general, for all types of green spaces, the majority of limitations mentioned in the questionnaire were non-important for most of the respondents.

Insufficient recreational infrastructure was one of the most often indicated important limitations for all types of green spaces (none statistically significant connections between given answer and respondent’s sociodemographic features were detected). Also, lack of free time was indicated for urban parks and greenery associated with housing utilisation, as well as neglecting of green spaces for greenery associated with housing and street side greenery, for the last one also the lack of security
sense. Furthermore, respondents mentioned other, single limitations such as smoking, walking a dog or sitting on a grass prohibitions, health issues or municipal services inactivity, especially in case of passiveness towards law disobedience.

Distribution of given answers regarding the lack of free time was influenced by respondents’ age and occupational status. The younger respondents were the bigger rate of people who considered the lack of free time as the limitation was. Statistical analysis also shows that 62% of professionally active persons and 58% of students in terms of urban parks, and 56% of professionally active persons and 75% of students in terms of greenery associated with housing indicated this limitation as important, whereas only 12.5% in terms of urban parks and 4% in terms of greenery associated with housing of non-working people pointed out that lack of free time is a major limitation.

**Table 2. Limits to utilise green spaces.**

| Type of green spaces:                      | Urban park | Greenery associated with housing | Street side greenery |
|-------------------------------------------|------------|---------------------------------|----------------------|
|                                           | significant | non-significant | significant | non-significant | significant | non-significant |
| Type of limitation:                        |            |                      |            |                      |            |                      |
| Long distance to green areas              | 10         | 90                   | 9          | 91                   | 0          | 100                   |
| Lack of sense of security                 | 24         | 76                   | 38         | 62                   | 28         | 72                    |
| Neglected greenery                        | 9          | 91                   | 43         | 57                   | 46         | 54                    |
| Insufficient infrastructure for leisure and recreation | 36   | 64                   | 65         | 35                   | 63         | 37                    |
| Lack of organised events                  | 29         | 71                   | 32         | 68                   | 8          | 92                    |
| Noise                                     | 9          | 91                   | 13         | 87                   | 15         | 85                    |
| Too many people                           | 10         | 90                   | 10         | 90                   | 6          | 94                    |
| Lack of free time                         | 44         | 56                   | 43         | 57                   | 13         | 87                    |
| Other                                     | 8          | 92                   | 4          | 96                   | 7          | 93                    |

In further part of the questionnaire, respondents indicated factors which would encourage them to the more frequent utilisation of different green spaces. In general, improvements to recreational infrastructure and better greenery maintenance were pointed out for every type of green spaces, as well as cultural events organisation (for urban park and greenery associated with housing) and higher safety level (for street side greenery) (Table 3).

Aesthetics of green spaces has also an influence on their utilisation frequency. In general, respondents were satisfied with green spaces aesthetics in the analysed area – almost all of them indicated urban parks as well-kept. Significantly less of them (although the percentage was the highest, close to 50% of given answers) indicated that greenery associated with housing and street side greenery is well-kept (Figure 4).

Such positive rating of green spaces aesthetics may be surprising, especially after analysis of answers given to the previous question, where the majority of respondents indicated that better maintenance would be a factor encouraging them to utilise green spaces.

Factors which were rated by respondents regarding having an influence on green spaces aesthetics are presented in figure 5. The majority of respondents did not consider mentioned factors to have an influence on green spaces aesthetics. Only the unkempt neighbourhood was considered as a factor lowering green spaces quality. On the other hand, however, a major percentage of respondents did not indicate neglected greenery as a factor which decreases green spaces quality – a statement that is surprising regarding answers given to questions about factors encouraging to utilise green spaces.
Table 3. Encouragements to utilize green spaces.

| Type of green spaces: | Urban park | Greenery associated with housing | Street side greenery |
|----------------------|------------|----------------------------------|----------------------|
|                      | Would encourage | Would not encourage | I have no opinion | Would encourage | Would not encourage | I have no opinion |
| Encouragement:       |             |                                |                      |
| Closer location      | 34          | 10                              | 56                   | 30              | 10                   | 60                 |
| Improved security    | 59          | 0                               | 41                   | 71              | 0                    | 29                 |
| Better maintenance of green areas | 79          | 0                               | 21                   | 91              | 0                    | 9                  |
| Better recreational infrastructure | 84          | 0                               | 16                   | 93              | 0                    | 7                  |
| Organized events     | 83          | 1                               | 16                   | 80              | 1                    | 19                 |
| Fewer users          | 28,5        | 28,5                            | 43                   | 80              | 1                    | 19                 |
| Other                | 1           | 0                               | 99                   | 1               | 0                    | 99                 |

Figure 4. Aesthetic of the green spaces in respondents’ opinion

Figure 5. Factors limiting the aesthetic of green spaces in respondents’ opinion.
4.5. Usage of green spaces outside the respondents’ residential area

In addition to using the green spaces in the closest vicinity of respondent’s place of living they also visit green spaces at greater distances and most of them do it several times a month. Areas indicated by respondents were mainly located within the city limits of Poznań or in nearby suburban areas. The reasons for visiting green spaces outside their residential area are primarily the place of meeting with friends or family, the larger area of green spaces compared to those in the immediate neighbourhood, and better infrastructure for leisure and recreation (Figure 6).

Also, 16 people mentioned other reasons, such as water coolness, calmness, silence, hobbies, more flowers, wildlife observation, nicer surroundings, less traffic, cleaner air, open space, less regulatory restrictions.

![Figure 6. Reasons for visiting green spaces outside the respondents’ residential area](image)

Although the most important reason for visiting green spaces in the distance indicated by the respondents did not refer directly to feature of the green areas (place for meetings with friends and family), also a larger area and better infrastructure for leisure and recreation were very often pointed out as a reason. It gives the impression that green areas in the nearest vicinity do not quite meet the needs of residents.

4.6. Discussion

This paper contributes to better understanding of the urban residents’ demands for CES in the scope of the urban green spaces supply. It answers the needs of expanding the research on socio-perceptual issues of urban green spaces [10] and refers not only to urban parks, which supply of and demand for cultural ecosystem services are well recognised in the literature [11, 12, 13] but also to other types of green spaces which are present within the densely built-up urban fabric.

Although respondents live in Poznań with very intensive development and a high share of sealed areas, more than half of them perceived the amount of urban parks as sufficient and even some of them as plenty. The amount of other green spaces was assessed much far lower. The most popular way to use urban parks and greeneries associated with housing is to spend time outdoors (contact with nature), walking and nature observation. The preferences of residents of Poznań Old Town do not differ from the results of research conducted in other European cities. Based on a survey conducted for Amsterdam [10], as the main reason for visiting urban parks, respondents provided relaxation and leisure and spending time in nature, defined as listening and watching nature. In studies conducted for Danish green areas [14], the majority of respondents as motives for visiting urban park indicated enjoying the weather and fresh air, stress reduction and relaxation. Similar motives were given by the
visitors of a park in Hangzhou [11], where for the vast majority of respondents the reason was relaxation, followed by organised events, meditations, exercises. However, as opposed to European examples enjoying nature is not among the most important reasons for visiting the park. What could encourage the respondents to the more frequent utilization of urban greenery is the better maintenance and better infrastructure for recreation. It seems that modestly managed, formal greenery is rather more appreciated than semi-natural green spaces. It is also mirrored in motives of using green spaces in the distance. As the study show, utilizing the green spaces is also based on sociodemographic traits of respondents. Age, occupational status and gender predominantly had an impact on given answers. Length of residence at a given location did not influence on answers. Similarly, according to Zhang et al. among the sociodemographic characteristics of respondents being considered, length of residence was not significantly related to any of the outcome variables, [15].

5. Conclusions

Due to the small size of the interviews conducted, and very local character of the survey, no universal conclusions can be consistently made about the role of urban green spaces in providing the CES on densely built-up areas in general. However, some conclusive remarks can be made.

In the context of this study, the role of urban green spaces as provider of CES and their importance for well-being has been addressed.

Respondents claim that there is not enough greenery, especially associated with housing and street side greenery; the amount of parks (which they use most) is slightly higher, according to their estimations. Limitations that influence utilising green spaces concern both greenery itself (e.g. insufficient recreational infrastructure, neglected green areas) as well as respondent’s issues (e.g. lack of free time).

Improvements to recreational infrastructure and more well-kept green spaces would encourage respondents to utilise it more often. Active participation of inhabitants in developing and maintaining their closest neighbourhood (e.g. by creating social gardens) would allow to enlarge green spaces in housing areas and make them more customized to the residents’ needs and requirements in terms of functionality and aesthetic. It would also bring social benefits such as tightening of neighbours relations, sense of having an impact on the closest environment and developing local communities. As shown in the study, the approach to quantity and quality of urban greenery as well as the demands for cultural ecosystem services depends on sociodemographic features. Thus green spaces planning on urban areas, especially in locations which suffer from the lack of such spaces has to be carefully planned, so as to be multifunctional and meet all the social groups expectations.

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