The Contingent Valuation Method in the Study of Ecosystem Services on the Example of the Urban Natural System of Lubartów

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Abstract. The living standards and quality in the city are determined mainly by the urban ecosystem. When the locals are more aware of the advantages provided by the services of this ecosystem, they have a positive approach to the presence of green areas in the city. The research of the economic values of ecosystem services is currently one of the strongest arguments in favour of protection and may turn out to be especially effective in support of sustainable urban development. This is the reason for initiation of research aimed at assessment of the values of the ecosystem services provided by specific elements of the urban ecosystem in Lubartów. The survey was conducted online in 2017. The monetary value of UNS was evaluated with the use of the contingent valuation method. For this purpose, the amount defined by the respondents in the survey which they were willing to pay (WTP) for the improvement of the quality of the environment and other advantages resulting from UNS, or for the sole certainty that a particular asset existed, or the amount of compensation (WTA) expected for the loss of that asset or limited access to it. The urban natural system of Lubartów (approx. 265 ha) was estimated by the residents at PLN 5,832,756 for WTP, and PLN 5,502,600 for WTA. Moreover, the respondents declared that annually they were willing to pay PLN 212 to ensure a non-degraded and correctly functioning natural environment or they were willing to accept a compensation of PLN 200 for its loss. The respondents considered the urban park to be of the greatest importance, but they earmarked the highest amount of money to the upkeep of home gardens and garden allotments.

1. Introduction

The standard and quality of life in towns are ruled by diverse environmental indicators. These indicators include the condition and the capacity of urban natural systems (UNS). The urban natural system plays a key role in local planning as well as in international documentation in Europe and across the world [1]. This is because UNS has an impact on microclimate, it regulates water conditions and prevents soil degradation. It forms a prominent issue in the shaping of landscape quality and the visual attractiveness of towns and cities. Managing such a system in a suitable way enables the effective functioning of the natural environment in an urban area, which in turn positively affects the quality of life of its residents [2]. Many authors [3; 4] highlight that even a degraded ecosystem
provides abundant resources; however, they are much more restricted than the resources generated by a non-degraded ecosystem.

All the assets and benefits resulting from the existence of the natural system are defined as “ecosystem services”, which are a specific form of services perceived in material and non-material categories [5]. One of the many methods of studying ecosystem services is the contingent valuation method (CVM). This method takes the form of a survey conducted amongst a group of people who wish to purchase particular goods or services. Its objective is to attain information on the respondents’ willingness to pay for particular ecological services or the amount of compensation they would be willing to accept to give up specific environmental services. The contingent valuation method is the only method which enables natural and atypical areas to be evaluated [6]. It can be used in relation to resources which bring benefits, and their value is difficult to be estimated using market categories, as they are not a subject of sale [7]. When embarking on the research, it was assumed that the research results would help to define the role of UNS for the residents of Lubartów and verify their knowledge on the role of ecosystems and ecosystem services in their town. The knowledge of the monetary value of a natural system may also be useful when making decisions planning, including that related to urban green areas, as the restoration of degraded ecosystems is costly and difficult to achieve [8].

2. Objective and research hypothesis

The aim of the research was the estimation of the value of ecosystem services provided by particular elements of UNS Lubartów based on: (1) willingness of respondents to pay for the ability to use the assets and services coming from a non-degraded and correctly functioning urban natural system and (2) the amount of compensation the respondents would be willing to accept to give up specific environmental services.

The research hypothesis assumes that the role and functions of individual elements of UNS are known to the residents and vital for their quality of life in the town. Consequently, they are willing to incur significant costs to maintain or expand green areas, or alternatively receive compensation for restricted access or loss of these assets.

3. Research methodology

The survey was conducted in Lubartów, located in Poland, in the Lubelskie Voivodeship, (approx. 26 km north of Lublin). The surface area of the town is 13.9 km²; there are 22,369 residents. The mean population density is 1,608 people/km² [9]. The research was conducted online in May 2017 with the use of an electronic survey form made available at: https://pl-pl.facebook.com/lubartow.spotted/ (the survey lasted five days)[10]. Before beginning the survey, the respondents were able to become acquainted with the definition of ecosystem services in order to better understand the research topic. The survey included the characteristics of evaluated assets, description of the condition of the natural environment, presentation of suggested changes to services and natural assets, as well as payment or compensation thresholds [11]. The survey consisted of 12 exclusively closed questions [12]. Four questions were multiple-choice questions and related to the role and significance of specific elements of UNS, methods of use of green areas, source of information on ecosystem services and the advantages for the town from the maintenance of that system (respondents selected from a choice of 17 proposals for a particular element of UNS). However, the key questions applied to: (1) willingness of respondents to pay for ecosystem services of particular elements of UNS (WTP) and (2) the amount of compensation they would be willing to accept to give up specific environmental services (WTA). Moreover, the survey asked for the respondents’ personal data (gender, age, education and net monthly salary in order to define the dependencies between the amount specified by respondents to the benefit of UNS and their level of wealth). On the receipt of 250 survey questionnaires, the analysis of results began.

The study group was composed of (volunteer) residents of the city and people living outside of Lubartów aged 18-70 (respondent age groups: 18-29 – 17.1%; 30-44 – 28.6%; 45-59 – 23.5%, and 60-70 – 30.8%). 57% of the respondents are high school graduates, 38% have a college education, and the
remaining 5% declared vocational degrees. Among the respondents, 60% declared a monthly net income between PLN 1501 and 2000, 58% selected an income ranging between PLN 1000 and 1500, 25% of the respondents specified a monthly income between PLN 2001 and 3000, 5% defined their monthly remuneration as that below PLN 1000, while only 2% of the respondents declared a monthly income exceeding PLN 3000.

The monetary value of Lubartów’s natural system was evaluated with the use of the contingent valuation method. For this purpose, the amount defined by the respondents in the survey which they were willing to pay for the improvement of the quality of the environment and other advantages resulting from UNS, or for the sole certainty that a particular asset existed, or the amount of compensation expected for the loss of that asset or limited access to it. The survey questionnaire identified nine basic elements of UNS, such as urban parks, green squares, greenery near transportation routes, insulating vegetation, cemetery vegetation, allotment gardens, kitchen gardens, agricultural land as well as bodies of water with rivers. Also, the annual amount which the respondents would be willing to pay for a particular element of UNS or one which they would accept as compensation for the loss of that asset or limited access to it was specified using five brackets (up to PLN 200, PLN 201–300, PLN 301–400, PLN 401–500 and above PLN 500). By estimating a specific element of UNS, the respondents could choose their optimum amount, and in this way they declared their willingness to pay (WTP) or willingness to accept compensation (WTA) for a particular element. After summing up the declared amounts assigned to every element of UNS, it was possible to define the total value of UNS.

The estimated value of Lubartów’s UNS was achieved based on a mean amount which the respondents were willing to pay for the use or expansion of the area of a specific element of UNS (WTP value), or a mean amount which they were willing to accept as part of compensation for the loss of a particular asset (WTA value). The WTP/WTA value was calculated using the formula:

\[
\text{WTP/WTA} = \bar{k} \times n
\]

where:
- \(\text{WTP/WTA}\) – the value of the entire UNS obtained based on a mean WTP/WTA value,
- \(\bar{k}\) – average amount which the respondent was willing to pay for ecosystem services/was willing to accept as compensation for the loss or restricted access to UNS services,
- \(n\) – number of people who expressed willingness to pay for the ability to use an asset of a particular element of UNS/to accept compensation for the loss of a particular asset or restricted access to that asset.

The data on the estimated number of people present in the town within a year was obtained by means of surveys. Apart from the residents of Lubartów, the natural system was also taken advantage of by other users, whose number is unknown. As many as 100 people participated in the survey, among whom only 23 respondents – i.e. 23% – were from outside the town. It was assumed then that 23% of the total number of residents – 22,369 people – gives the estimated number of people from outside the town of 5,144. Having added to this number the actual number of residents, the total number using the elements of UNS within a year was obtained, i.e. 27,513.

4. Study results
4.1. Identification and assessment of UNS elements
An analysis of the natural system of Lubartów has shown that its UNS consists of: publicly accessible green areas, such as: an urban park (18ha), boulevard (3ha) and green squares (25,6ha); greenery near transportation routes (along roads at a distance of 70 km); green areas with a special purpose, such as: allotment gardens (28,3ha), insulating greenery (16ha) and cemetery greenery (6,6ha); home gardens (89ha) agricultural land and woodland (190ha) as well as bodies of water and watercourses (13,5ha).

The research shows that the respondents’ knowledge on the subject of particular elements of UNS and their importance to the residents of Lubartów is diversified. All respondents (100%) declared their knowledge of the urban park, and according to 90% of them, the urban park is a very important
structure in urban space. Only a slightly smaller number of people regard garden allotments as a very significant component of the system; however, most of the respondents (70%) consider them as less important in the town's overall natural balance. As many as 88 people confirmed in the survey that such elements as green squares and greenery along transport routes are noticed by them in the urban space, but only 43% (in relation to green squares) and 44% (in relation to greenery along transport routes) of the respondents admitted to appreciating the crucial function of these two elements in human life. Another quite well-known element (52 people) were home gardens, and among this group 38 people considered them as significant in the urban natural system. About 46% of the respondents were aware of the presence of agricultural land in the town, and only half of them stated that this land was of foremost importance. A slightly smaller number of residents (43 and 44 respondents) claimed to have knowledge of the value of bodies of water and insulating vegetation in the spatial structure of Lubartów. Only 24 respondents linked cemetery greenery to UNS, and only a few residents considered it as important to the system, while 16% considered cemetery greenery as unimportant. Nearly half of all participants in the survey were unable to express an opinion on the importance of elements such as cemetery greenery, insulating greenery or agricultural land to UNS.

The respondents’ knowledge was much more limited in relation to the concept of ecosystem services – as many as 82% of the respondents had never come across this term before, and only 18% were aware of it, mainly thanks to television (46%) and Internet (31%). More than 20 survey participants declared lack of information sources on ecosystem services.

According to the respondents, the largest number of ecosystem services is provided by home gardens (15 of 17 possible items to mark), providing advantages resulting from supplying raw materials for food production (77%), the ability to enjoy recreation and leisure (74%) or supplying other raw materials of plant and animal origin (68%) (Table 1).

Garden allotments were second when it comes to the number of ecosystem advantages provided (11 out of 17) – being the source of food (acc. to 79% of respondents), used for the mobilisation of socially excluded, unemployed and elderly people (74%), used for leisure and recreation (69%), and supplying other raw materials of plant and animal origin (68%). The urban park was third when the number of advantages resulting from the ecosystem was considered. The results of the research show that the residents consider the greenery along transport routes (2 out of 17) and cemetery greenery (1 out of 17) as elements which provide the least ecosystem services.

When responding to a question on the negative effects of hypothetical changes to the ecosystem and their consequences which threaten human functioning, as many as 69% of survey respondents indicated that the consequences of these changes could significantly impede that functioning and their living conditions, 18% of respondents were unsure whether limited access to ecosystem services would influence their lives, while 11% of survey participants admitted to not noticing such an impact. Only 2% of respondents took into consideration the possibility of such difficulties in the future.

4.2. Estimated value of UNS

The above opinions were reflected in the declarations on the willingness to pay for a particular asset or the willingness to accept compensation for its loss or limited access to it. Every component of the natural system was estimated individually.

When asked about the amount which the respondents were willing to pay for the ability to use the assets and services provided by the particular elements of the urban natural system, the answers given were quite diverse. The respondents are willing to pay a specific amount for maintenance or protection of only the City Park, water reservoirs, arable land, and community gardens (Table 2). Based on the values of UNS constituents defined by the respondents (expressed as willingness to pay – WTP), its total value was calculated at PLN 64,800.
Table 1. Percentage of respondents according to whom particular UNS elements provide specific ecosystem services.

| Item no. | Ecosystem services [Sudra 2015] | Element of Lubartów's natural system |
|----------|---------------------------------|--------------------------------------|
|          |                                  | urban park | green squares | greenery near transportation | allotment gardens | insulating greenery | cemetery greenery | home gardens | agricultural land | bodies of water |
| 1        | water supply                     | –         | –           | –                             | –                  | –                     | –                  | –            | –             | 98            |
| 2        | provision of raw materials of plant and animal origin | – | – | – | 68 | – | 68 | 77 | 6 |
| 3        | food manufacture                 | –         | –           | –                             | 79 | – | 77 | 77 | – |
| 4        | oxygen generation and absorption of pollutants from the air | 85 | 36 | 36 | 3 | 46 | – | 4 | – |
| 5        | adjustment of the town's climate | 36 | – | – | 2 | 23 | – | 2 | 6 |
| 6        | protection from extreme weather conditions | 4 | – | – | 1 | – | – | 2 | – |
| 7        | purification and filtration of rainwater | 36 | 36 | 45 | 3 | 13 | – | 4 | – |
| 8        | shelter for insects, including pollinators | 59 | – | – | 2 | – | – | 4 | – |
| 9        | animal and plant habitat         | 5 | – | – | – | – | – | 4 | 75 | 86 |
| 10       | biodiversity conservation        | –         | –           | –                             | –                 | –                     | –                  | –            | 86            |
| 11       | ensuring the circulation of nitrogen, carbon, sulphur, phosphorous and other | – | – | – | – | – | – | – | 1 | 88 |
| 12       | enabling photosynthesis and primary production | – | – | – | – | – | – | – | 2 | – |
| 13       | soil formation                   | –         | –           | –                             | –                 | –                     | –                  | –            | 63            |
| 14       | place of recreation and leisure  | 95        | 20          | –                             | 69 | – | 74 | – | 81 |
| 15       | provision of aesthetic experience | 95 | 15 | – | 4 | 40 | – | 14 | – | 5 |
| 16       | Mobilisation of socially excluded, unemployed and elderly people | – | – | – | 74 | – | – | 4 | – |
| 17       | provision of spiritual experience | 2 | – | – | – | – | 4 | 1 | – |
|          | Total number of ecosystem service indications | 9 | 4 | 2 | 11 | 4 | 1 | 15 | 5 | 7 |


Table 2. Estimated value of individual elements of UNS expressed by WTP.

| UNS element                     | Characteristics | Declared amount in PLN | WTP in PLN |
|---------------------------------|----------------|------------------------|------------|
|                                 |                | <200 | 201-300 | 301-400 | 401-500 | >500 |
| Urban park                      | N              | 66   | 12      | –       | –       | –       | 16,800 |
|                                 | WTP            | 12,200 | 3,600   | –       | –       | –       | 16,800 |
| Green squares                   | N              | –    | –       | –       | –       | –       | 0     |
|                                 | WTP            | –    | –       | –       | –       | –       | 0     |
| Greenery near transportation routes | N          | –    | –       | –       | –       | –       | 0     |
|                                 | WTP            | –    | –       | –       | –       | –       | 0     |
| Allotment gardens               | N              | 36   | 4       | 21      | –       | –       | 16,800 |
|                                 | WTP            | 7,200 | 1,200   | 8,400   | –       | –       | 16,800 |
| Insulating greenery             | N              | –    | –       | –       | –       | –       | 0     |
|                                 | WTP            | –    | –       | –       | –       | –       | 0     |
| Cemetery greenery               | N              | –    | –       | –       | –       | –       | 0     |
|                                 | WTP            | –    | –       | –       | –       | –       | 0     |
| Home gardens                    | N              | 53   | 2       | 20      | –       | –       | 12,000 |
|                                 | WTP            | 10,600 | 600    | 800     | –       | –       | 12,000 |
| Agricultural land               | N              | 36   | –       | –       | –       | –       | 7,200 |
|                                 | WTP            | 7,200 | –       | –       | –       | –       | 7,200 |
| Bodies of water                 | N              | 56   | –       | –       | –       | –       | 12,000 |
|                                 | WTP            | 12,000 | –       | –       | –       | –       | 12,000 |
| Total value of SMP expressed in WTP |                |       |         |         |         |         | 64,800 |

Table 3. Estimated value of individual elements of UNS expressed by WTA.

| UNS element                     | Characteristics | Declared amount in PLN | WTA in PLN |
|---------------------------------|----------------|------------------------|------------|
|                                 |                | <200 | 201-300 | 301-400 | 401-500 | >500  |
| Urban park                      | N              | 46   | –       | –       | –       | –       | 9200 |
|                                 | WTA            | 9200 | –       | –       | –       | –       | 9200 |
| Green squares                   | N              | 21   | –       | –       | –       | –       | 4200 |
|                                 | WTA            | 4200 | –       | –       | –       | –       | 4200 |
| Greenery near transportation routes | N          | 26   | –       | –       | –       | –       | 5200 |
|                                 | WTA            | 5200 | –       | –       | –       | –       | 5200 |
| Allotment gardens               | N              | 47   | –       | –       | –       | –       | 9400 |
|                                 | WTA            | 9400 | –       | –       | –       | –       | 9400 |
| Insulating greenery             | N              | –    | –       | –       | –       | –       | 0     |
|                                 | WTA            | –    | –       | –       | –       | –       | 0     |
| Cemetery greenery               | N              | –    | –       | –       | –       | –       | 0     |
|                                 | WTA            | –    | –       | –       | –       | –       | 0     |
| Home gardens                    | N              | 48   | –       | –       | –       | –       | 9600 |
|                                 | WTA            | 9600 | –       | –       | –       | –       | 9600 |
| Agricultural land               | N              | –    | –       | –       | –       | –       | 0     |
|                                 | WTA            | –    | –       | –       | –       | –       | 0     |
| Bodies of water                 | N              | 36   | –       | –       | –       | –       | 7200 |
|                                 | WTA            | 7200 | –       | –       | –       | –       | 7200 |
| Total value of SMP expressed in WTA |                |       |         |         |         |         | 44,800 |

N – Number of people declaring a specific amount
The research showed that among the people willing to accept compensation, 46%, 47% and 48% would be satisfied by an amount of PLN 200 for the loss or restricted access to the urban park, allotment gardens and home gardens (Table 3). A similar compensation amount would be accepted by 36% of respondents for the lack of access to bodies of water, and 21 and 26%, respectively, for the lack of access to green squares and greenery along transport routes. Slightly more than half of the respondents did not expect any compensation.

By dividing the total value of all elements of the system (WTP or WTA) by the multiple quantity of the selected amounts, the estimated mean amount was obtained which the respondent was willing to pay or accept, which was PLN 212 and PLN 200, respectively (Table 4).

Table 4. Estimated mean amount which the respondent was willing to pay (WTP) or accept (WTA).

| Detailed list                                      | WTP value | WTA value |
|---------------------------------------------------|-----------|-----------|
| Total value of UNS acc. to the respondents         | PLN 64,800| PLN 44,800|
| Multiple quantity of the selected amounts          | 306       | 224       |
| Estimated mean amount which the respondent was     |           |           |
| willing to pay (WTP) or accept (WTA)              | PLN 212   | PLN 200   |

The amounts specified by the respondents were correlated with their income to define the dependencies between the declared amount and that income. The correlation coefficient amounted to 0.10349. This analysis points to a very weak dependency between the amount that the respondents were willing to pay and their monthly remuneration. Similarly, the amount of remuneration did not have any influence on the amount which the respondents were willing to earmark for a particular element of UNS.

The estimated value of the urban natural system of Lubartów was estimated exclusively on the basis of the analysis of the survey results in which 100 respondents took part. The estimation of the UNS value by all potential users of the system required additional calculations. Having calculated the potential number of people, the estimated WTP value and the mean WTA value of Lubartów’s UNS was obtained. This was achieved by multiplying the mean estimated amount (PLN 212 or PLN 200), which the respondents were willing to pay or accept, by the number of 27,513 people who use UNS elements throughout the year. The annual estimated value of the entire urban natural system was PLN 5,832,756 for WTP, and PLN 5,502,600 for WTA.

5. Discussions

The research was aimed at the estimation of the monetary value of the urban natural system of the town of Lubartów which corresponds to the ecosystem services belonging to that system. The estimated value of ecosystem services plays a key role when making decisions and undertaking actions linked to the fulfilment of needs of both current and future generations, thus determining the future of ecosystems [13].

When assessing the respondents' awareness level of the role and significance of UNS, it was possible to evaluate the approximate value of natural environment in the opinion of the survey participants by means of the contingent valuation method. This method is commonly used to assess the value of natural environment [14; 15], including in relation to urban ecosystem services [16; 17; 18], and it is very often based on monetary valuation methods [19; 20].

The majority of the residents found it considerably challenging to define ecosystem services. This difficulty might have stemmed from the fact that this is quite a new term in the field of ecological economics [21; 22]. Moreover, the unfamiliarity with the term of ecosystem services could also have been caused by the insufficient interest of the respondents in environmental issues. Also, the poor knowledge of the actual natural system of the town and its components lead to some issues in defining
the role and function of individual elements of the system. As evidenced by numerous studies [23; 24; 25], knowing the value of UNS facilitates making planning decisions, contributes to better urban planning, harmonious shaping and management of space, but also counteracts uncontrolled urbanisation. The research showed that elements such as the urban park, allotment gardens, green squares and greenery along transport routes are best known to the survey participants and in their opinion constitute a crucial element of the urban natural system. According to the respondents, the most valuable element of this system is the urban park, as it provides the largest number of benefits and ecosystem services. Other elements are of lesser significance or not as crucial. The residents of Lubartów do not hold smaller green spaces in the town, such as green squares, insulating vegetation or even bodies of water, in high esteem. This clearly illustrates the relationship of the residents to green areas with a smaller share in the spatial structure of the town.

The use of the contingent valuation method made it possible to acquire information on the willingness of the residents to pay (WTP value) for the expansion of the UNS. The results obtained confirm that the survey participants were keen to expand the surface area of their home gardens and garden allotments. The study results show that the residents of Lubartów are willing to take care of only that element of the system which is well-known to them and from which they can benefit directly.

Obtaining information on the willingness of the respondents to pay for the ability to use a healthy natural environment or for the expansion of the natural system in order to improve living standards enabled the verification of the value of individual elements of UNS. The declarations of the respondents state that they were willing to pay PLN 212 a year to enjoy a non-degraded and correctly-functioning natural environment.

Other authors [26; 27] point out the issue of restricted accessibility to ecosystem services, thus highlighting their value. Also in the conducted survey, the participants defined the compensation amount which they were willing to accept as part of compensation for the loss of a particular asset or limited access to that asset. The WTA amount is slightly lower than WTP and amounts to approx. PLN 200. Other research [28] showed that two-thirds of the residents of Joensuu and Salo (Finland) are willing to pay for the ability to use urban green areas (EUR 7–9 EUR a month), and half of them – for preventing these areas from being built on (EUR 21–35 a year per household, to be paid for three consecutive years). Also, the residents of Warsaw expressed their willingness to co-finance the non-productive functions of forests and forest management in order to ensure their ability to use Warsaw's suburban forests for leisure and recreation (53% of respondents used the contingent valuation method to declare a hypothetical amount of PLN 52 per person per year) [29]. Treiman and Gartner [30] used the contingent valuation method to determine people’s willingness to pay for the better upkeep of trees in 44 cities in the state of Missouri (in St. Louis and Kansas). Particularly in larger cities, more than half of residents expressed their willingness to pay USD 14–16 a year per household.

From the point of view of the residents of Lubartów, many elements of UNS do not have a significant function in the town, and therefore, they do not provide any functions. This results in a lower value of the entire UNS. Similar observations were made by other authors. According to Schumacher [31], people are unaware of taking advantage of most ecosystem services, and this makes the determination of their value more difficult, as such services are consequently undervalued. Environmental valuation is a challenging study subject, primarily because of social aspects, also in the ethical context – is it possible to assess the value of the environment? Intangible valuation in this context seems to be much less controversial, but also less “distinctive”. The main issue is the lack of knowledge on all decisions made by humans and insufficient awareness of the consequences of human actions which are detrimental to the natural environment [32].

The value of the natural system of the town of Lubartów, with a total surface area of approx. 265 ha, was assessed by the residents at PLN 5,832,756 for WTP, and PLN 5,502,600 for WTA. The contingent valuation method was used primarily in the research conducted by Zydroń and Sikora [33] on the valuation of ecosystem services provided by a park with a surface area of 14.63 ha, located in the villa district of Solacz in Poznań. The valuation was made based on the amount of compensation which the respondents declared as sufficient for the restricted use of the park (WTA), and also based
on the costs which they would be willing to pay to prevent the park from becoming environmentally degraded (WTP). The values obtained (WTA = PLN 5,008,334, WTP = PLN 1,223,514) were of a hypothetical and indicative character, but they provided an image of the social value of the Sołacki Park. When comparing the research mentioned above to the obtained (also indicative) value of the urban park in Lubartów (WTP=PLN 16,800; WTA=PLN 9,200), it can be stated that these results vary considerably. The parks have a similar surface area, they fulfil a similar function and provide similar benefits and environmental assets. The hypothetical value of the park in Poznań is ten times greater than the estimated value of the park in Lubartów. This difference results mostly from the parks' location. The park located in a large and densely-populated city is a more appreciated component of UNS than the park located in a town with a small surface area with limited population density [34].

The contingent valuation method was also used to estimate the value of access to the natural open areas of Kraków, showing that most households are willing to cover additional payments in order to increase their access to such areas [35].

A vast majority of respondents, when asked about the possibility of potential losses in the city’s ecosystem, replied that any such losses would have a direct effect on their life and health. Therefore, the willingness of the residents to pay for the expansion of the natural system resulted from their wish to improve their quality of life. Consequently, it can be surmised that investments made in green infrastructure of a town or city could bring both social and economic benefits, while better living conditions would improve work efficiency [36]. This could also have a positive impact on the shape of urban space in the future. The need to introduce green areas and vegetation into urban space has been known since the Baroque period, and non-compliance with this requirement may prove to be one of the most acute issues in contemporary discussions about shaping of space [37].

6. Overview and conclusions

The conducted research shows that the city park is the most important element of the Lubartów urban ecosystem to the local residents, they earmarked the highest amount of money to the upkeep of home gardens and garden allotments. A decidedly less important role was given to green squares, insulating greenery, cemetery greenery and agricultural land, both in terms of their significance and the amounts declared. Taking into consideration the height of the compensation which the respondents were willing to accept for the loss of particular assets, the highest scoring elements included the urban park, garden allotments and kitchen gardens. The entire natural system of Lubartów was estimated by the residents at PLN 5,832,756 for WTP, and PLN 5,502,600 for WTA.

The obtained survey results clearly point to the residents’ insufficient knowledge of environmental benefits, including ecosystem services. Therefore, many survey participants found it exceptionally challenging to define the role and function of the particular elements of the urban natural system. This confirms the validity of the conducted research as:

- The knowledge of ecosystem services provided by green areas and the awareness of their monetary value may constitute a deciding factor in the change of the residents’ approach to the role and function of green spaces, and consequently to their protection and recognition;
- the awareness of the UNS value can also be a crucial argument for decision-makers and institutions which are responsible for spatial order in a town or city, as this facilitates making planning decisions and contributes to better urban planning, harmonious shaping and management of space, but also counteracts uncontrolled urbanization;

The estimated value of Lubartów’s UNS obtained in the study will enable the municipal authorities to efficiently manage and use natural resources, and make it possible for the residents to use the elements of the natural environment in a sustainable manner.

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