

Piotr Lupa

# ECOSYSTEMS' LOCAL RECREATIONAL SERVICES VALUATION. KRAJENKA MUNICIPALITY CASE STUDY

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Piotr Lupa, M.Sc. – Adam Mickiewicz University

address:

Faculty of Geographical and Geological Sciences, Department of Integrated Geography

Dziegielowa 27, 61-680 Poznań, Poland

piotr.lupa@amu.edu.pl

## WYCENA LOKALNYCH ŚWIADCZEŃ REKREACYJNYCH EKOSYSTEMÓW. PRZYKŁAD GMINY KRAJENKA

**STRESZCZENIE:** Przedmiotem badań zostały objęte świadczenia ekosystemów rozumiane jako materialne i niematerialne korzyści czerpane przez człowieka dzięki funkcjonowaniu układów przyrodniczych. Celem badań było oszacowanie wartości świadczeń związanych z wypoczynkiem i rekreacją na terenie gminy Krajenka, ze szczególnym uwzględnieniem lasów, jezior i rzek, oraz zaprezentowanie znaczenia koncepcji świadczeń ekosystemów przy ocenie oddziaływania na środowisko.

Obszarem badań objęto gminę miejsko-wiejską Krajenka położoną w północnej części województwa wielkopolskiego na pograniczu Pojezierza Krajeńskiego i Doliny Gwdy. Wycenie poddano lokalne walory rekreacyjne i wypoczynkowe środowiska przyrodniczego, które stanowią grupę świadczeń kulturowych. W postępowaniu badawczym wykorzystano dwie metody wyceny zasobów i walorów środowiska: metodę kosztów podróży (*Travel Cost Method* – TCM) oraz metodę wyceny warunkowej (*Contingent Valuation Method* – CVM) umożliwiającą oszacowanie gotowości do zapłaty (*Willingness To Pay* – WTP). Pierwsza z metod bazuje na ujawnionych preferencjach badanych osób, a podstawą wyceny warunkowej są potencjalne zachowania respondentów w stosunku do hipotetycznego scenariusza.

Zastosowanie wyceny świadczeń ekosystemów w ocenie oddziaływania na środowisko może zmniejszyć ryzyko podejmowania niewłaściwych decyzji wpływających na utrzymanie równowagi przyrodniczej na danym terenie.

**SŁOWA KLUCZOWE:** świadczenia rekreacyjne, koszty podróży, wycena warunkowa, zarządzanie środowiskiem

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## Introduction

Environmental resources and values, referred to as natural capital, are one of the human civilization development foundations. Exemplary use of those goods should therefore be targeted to meeting the needs of not only the present generation but also the needs of generations to come. This is the basis for sustainable development of the natural, economic and social areas harmonization in order to ensure the high quality of life. It is essential for this area to make the right decisions, concerning the environment's use, on the basis of quantitative and qualitative identification of the benefits derived by humans from the natural systems functioning. The ecosystem services' concept, which purpose is to identify and evaluate all humans benefits resulting from the ecosystems' metabolism, may prove helpful in carrying out this task.

The abovementioned benefits are increasingly becoming the subject of scientists' research around the world (e.g. initiatives such as MEA<sup>1</sup>, NCP<sup>2</sup>, TEEB<sup>3</sup>, MAES<sup>4</sup>).

The circle of researchers who saw this approach's attractiveness is widening in Poland as well<sup>5</sup> (e.g. Ryszkowski<sup>6</sup>, Czajkowski<sup>7</sup>, Mizgajski<sup>8</sup> i Stępniewska<sup>9</sup>,

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<sup>1</sup> Millennium Ecosystem Assessment ([www.maweb.org](http://www.maweb.org)) [Date of entry: 15-09-2012].

<sup>2</sup> The Natural Capital Project ([www.naturalcapitalproject.org](http://www.naturalcapitalproject.org)) [Date of entry: 15-09-2012].

<sup>3</sup> The Economics of Ecosystems & Biodiversity ([www.teebweb.org](http://www.teebweb.org)) [Date of entry: 15-09-2012].

<sup>4</sup> The Mapping and Assessment of Ecosystems and their Services in Europe ([www.biodiversity.europa.eu/ecosystem-assessments/european-level](http://www.biodiversity.europa.eu/ecosystem-assessments/european-level)) [Date of entry: 15-09-2012].

<sup>5</sup> In 2010, Adam Mickiewicz University in Poznan, Department of Integrated Geography has organized the first symposium in Poland, devoted entirely to the issue of ecosystem services, *Ecoserv2010: Ecosystem services as a subject of transdisciplinary research*. The conference resulted in publication of *Ekonomia i Środowisko* (Economics and Environment) journal's issue No. 1(37), which presents the current scientific achievements of Polish researchers in the field of ecosystem services. In July 2011, at the University of Lodz, an international conference *Synthesizing different perspectives on the value of urban ecosystem services* was held. It was dedicated to the issue of assessment and valuation of ecosystem services in the city. Again, in 2012, in reference to the *Ecoserv2010* symposium, the Department of Integrated Geography organized a second edition of *Ecoserv2012* conference: *Ecosystem services in transdisciplinary approach*, which was dedicated to shaping the platform for cooperation between representatives of the natural sciences and economics in the field of research on ecosystem services. The special guest was Robert Costanza.

<sup>6</sup> L. Ryszkowski, *Adaptacja działalności ekonomicznej do procesu metabolizmu ekosystemów podstawą zrównoważonego rozwoju*, in: *Prace Naukowe Akademii Ekonomicznej we Wrocławiu. Zrównoważony rozwój w teorii ekonomii i w praktyce*, Graczyk A. [ed.], Wydawnictwo Akademii Ekonomicznej, Wrocław 2007, p. 186.

<sup>7</sup> M. Czajkowski, M. Buszko-Briggs, N. Hanley, *Valuing changes in forest biodiversity*, "Ecological Economics" 2009 No. 68, p. 2910-2917.

<sup>8</sup> A. Mizgajski, *Świadczenia ekosystemów jako rozwijające się pole badawcze i aplikacyjne*, „Ekonomia i Środowisko” 2010 No. 1(37), p. 10-19.

<sup>9</sup> A. Mizgajski, M. Stępniewska, *Zastosowanie koncepcji świadczeń ekosystemów i koncepcji świadczeń infrastrukturalnych w programowaniu gospodarki ściekowej*, „Ekonomia i Środowisko” 2009 No. 1 (35), p. 125-139.

Zylicz<sup>10</sup>, Lowicki<sup>11</sup>, Kronenberg<sup>12</sup>).

This research's subject were the local recreational services associated with the natural environment functions of Krajenka municipality, located in the northern part of the Wielkopolska district in the confines of Gwda Valley and Krajeńskie Lakeland. The study area is characterized by high natural values associated with numerous forests and bodies of water together with the small pressure from industry. In socio-economic terms, the municipality has one of the highest shares of unemployed people in the working-age population group in the district<sup>13</sup>.

The study's nature was methodological and diagnostic. Its purpose was to estimate the recreation and leisure cultural services value in the Krajenka municipality, including economic valuation methods. In terms of diagnostics the study examined the vacationing people's preferences in relation to chosen natural qualities, while as in methodological terms it assessed the appropriateness of the valuation methods used. The author's intention was for the study's results to become premises for the environment's protection and management at the local level and that it can be used in cost-benefit analyzes for projects which are likely to have significant effects on the environment.

## Methods and assumptions

### The survey's design

Data necessary to carry out the statistical analyzes have been obtained through surveys on randomly selected municipality resident's groups, who were delivered the questionnaires. The various stages of research, including the survey, were designed in account with the experience gained during the pilot study, conducted in late July and early August 2011, which was related to the valuation of Wapieńskie Lake recreational services<sup>14</sup>.

The survey's questionnaire was divided into three main modules: introductory (formal), stated preferences with the description of a hypothetical scenario, and socio-economic module. The introductory part identifies the study's organizer and provides information about the purpose and nature of the research. The stated preferences module included questions about the views on natural values,

<sup>10</sup> T. Żylicz, *Wycena usług ekosystemów. Przegląd wyników badań światowych*, „Ekonomia i Środowisko” 2010 No. 1(37), p. 31-45.

<sup>11</sup> D. Łowicki, *Wartość krajobrazu w świetle cen terenów pod zabudowę w latach 1995-2000*, „Ekonomia i Środowisko” 2010 No. 1(37), p. 146-156.

<sup>12</sup> J. Kronenberg, *Usługi ekosystemów w miastach*, „Zrównoważony rozwój – zastosowania” 2012 No. 3, p. 11-26.

<sup>13</sup> Local Data Bank, Central Statistical Office, 2010, <http://www.stat.gov.pl/bdl> [Date of entry: 15-09-2012].

<sup>14</sup> P. Lupa, *Wartość rekreacyjna zbiorników wodnych w koncepcji świadczeń ekosystemów*, in: *Współczesne zagadnienia, problemy i wyzwania w badaniach geograficznych*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2012 [in press].

travel costs (including the means of transport, the time needed to reach the holiday destinations, frequency of visits per year), followed by a hypothetical scenario concluded with a question about the willingness to pay (*WTP*). The scenario assumes that the Krajenka municipality's natural environment which was always characterized as high-quality would experience degradation as a result of a potential investment's implementation. At the same time, it would lose all of its recreational values. With reference to that information the respondents had to declare the monthly cost's size they could incur in exchange for preventing the situation described and the possibility of continuing the recreational services use. The socio-economic module included questions designed to determine the respondents' social and economic status. It related to the following characteristics: gender, respondent's age, their place of residence, education, occupational status and income.

In most cases, the questions prepared had a combined nature, i.e., the respondent, at the same time, could answer using the selected item/s from a defined set, as well as put an individual response in a designated place.

### Contingent valuation method – CVM

The contingent valuation method is based on the people's views and their contingent markets preferences (not necessarily existing in reality) study. Respondents are informed about a hypothetical (less often real) situation of the environment's deterioration and respond to questions about their willingness to pay (*WTP*) for preventing environmental degradation, or the willingness to accept (*WTA*) monetary compensation for the loss in this environment<sup>15,16</sup>. As pointed out by Żylicz<sup>17,18</sup>, the development of CVM was initially very slow, but after validation of this method in the USA in 1993, the frequency of its use has increased considerably.

The study analyzed respondents' willingness to pay for preventing a potential ecosystem degradation and loss of its recreational values. The respondents could answer by:

- 1) selecting one of seven amounts in the range of 0-100 PLN/month in total,
- 2) entering their own amount, or
- 3) selecting the answer „I would not pay”.

<sup>15</sup> J. T. Winpenny, *Wartość środowiska. Metody wyceny ekonomicznej*, PWN, Warszawa 1995, p. 91-97.

<sup>16</sup> J. Famielec, *Straty i korzyści ekologiczne w gospodarce narodowej*, PWN, Warszawa-Kraków 1999, p. 154-157.

<sup>17</sup> T. Żylicz, *Ekonomia środowiska i zasobów naturalnych*, PWE Warszawa 2004, p. 41.

<sup>18</sup> T. Żylicz, *Wycena usług ...*, op. cit., p. 31-45.

## Travel Cost Method – TCM

The analyzed method is the most common of all the environmental resources and qualities valuation methods<sup>19</sup>. The method's aim is to estimate the value of ecosystem services from the perspective of costs incurred by people, in order to reach the high natural value places, taking into account the cost of lost time. In other words, the benefits derived by the person in the recreational area depends on the distance that they are willing to travel in order to reach that area, and therefore of the direct value of money spent and the indirect value of travel time<sup>20</sup>. As stressed by Winpenny<sup>21</sup>, the particular advantage of TCM is its reliance on actual observed people's behavior, which makes it more reliable in comparison with the stated preference methods.

In this paper, the travel cost method is used to value the recreational services associated with the municipality residents recreation within the lake's, river's and forest's ecosystems.

While interpreting the amounts obtained by this method, they should be understood as the lower estimations of the sought value<sup>22,23</sup>. Thus, it was assumed that the minimum value that respondents attach to the given ecosystems group corresponds with the sum of their travel costs and the loss of time (equation 1).

$$\bar{x}_w = \frac{\sum_{i=1}^n F_i \left[ \frac{(2 * S_i * CS_i)}{3} + (t_i * Ct_i) \right]}{\sum_{i=1}^n F_i} \quad (1)$$

- $\bar{x}_w$  - weighted average value of a travel to the place of recreation [PLN/visit]
- $F_i$  - frequency of travels [number of visits/year]
- $S_i$  - distance from respondents' place of residence to the leisure site [km]
- $CS_i$  - unit cost of 1 km run over by car (0,43 PLN/km)
- $t_i$  - time spent in travel [h]
- $Ct_i$  - unit cost of lost time (21 PLN/h)

During the fieldwork, it was noted that an average of three people travelled in one car, hence, in the equation, the direct costs of a route were divided by three. While estimating the unit cost of lost time, Bartczak's<sup>24</sup> studies results were included. In 2002, she calculated the value of personal travel time in Poland at 16 PLN/h using the stated preference methods. For the purpose of this study, this ratio was realigned accordingly with the inflation over the period of

<sup>19</sup> J. Famielec, op. cit., p. 147-154.

<sup>20</sup> Ibidem, p. 148.

<sup>21</sup> J. T. Winpenny, op. cit., p. 90.

<sup>22</sup> T. Żylicz, *Ekonomia środowiska ...*, op. cit., p. 39.

<sup>23</sup> M. Czajkowski, *Nierynkowe metody wyceny*, in: *Wyzwania zrównoważonego rozwoju w Polsce*, ed. J. Kronenberg, T. Bergier, Kraków 2010, p. 15.

<sup>24</sup> A. Bartczak, *Wartość czasu podróży prywatnych w Polsce*, „Ekonomia” 2003 No. 7, p. 100-121.

2003-2012 (based on NBP data). In some studies, the given person's rate of pay that reflects the lost wage was assumed as the measurement unit for the time spent travelling, but this approach is not very objective in most cases<sup>25</sup>.

## Results

### The respondents' characteristics and their preferences

The survey was conducted in the period from 21 to 30 May 2012, and concerned the residents' population in Krajenka municipality. In terms of questions related to the contingent valuation, the study group was limited only to adult residents of the municipality. Random selection was used while determining the research sample. Total of 350 questionnaires were distributed, and 63,4%, i.e. 222 surveys, were returned. To test the distribution of examined qualitative (nominal) variables hypotheses, Pearson's chi-square test ( $\chi^2$ ) was used. The value of  $p \leq 0,05$  was accepted as the level of the statistical significance.

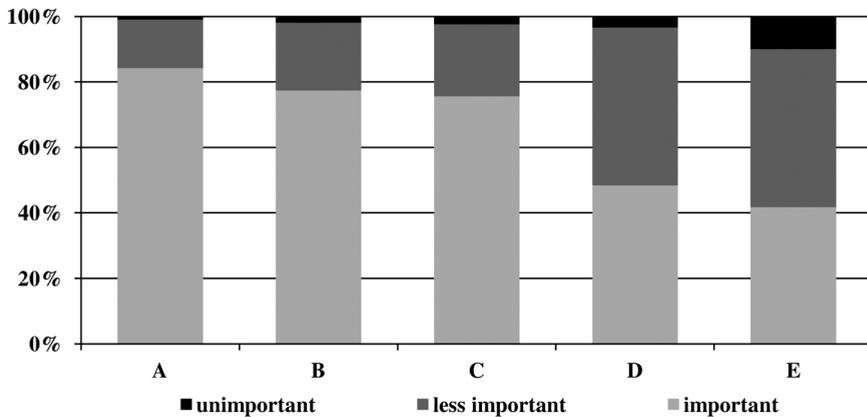
Most respondents taking part in the study were women (65%). 52% of the respondents were in their middle age (31-60 years), the least frequently represented (14%) age group were the elderly people (61 years and more). Over 23% of the respondents had lower education, almost 44% had secondary education, and nearly 33% had higher education. Most of the respondents were city residents (58%). More than 50% of the respondents were characterized by the highest income per one person in the household (> 1000 PLN/month), 34% of respondents found themselves in the group of middle-income ratio (500-1000 PLN/month), and almost 16% were in the group with low income (<500 PLN/month).

The analysis of the responses' number showed that, for most of the respondents, the most important natural advantage of the studied area was the clean air and favorable climatic conditions. Calmness as well as purity and availability of water also proved very important for the residents' relaxation and recreation. Flora and fauna, together with its diversity, was considered to be less attractive, and the lowest importance was attributed by the respondents to the local landscape and relief (Figure 1).

Statistically significant ( $p \leq 0,05$ ) differences in the responses distribution were noted for the two combinations of variables: „climate and air quality – age” and „landscape and relief – education” (Table 1). Climatic conditions and air quality were more frequently described as important by the group of middle aged and older people (90% and 82%). For most of the younger respondents (almost 76%) those values were also important, however, in comparison to people in other age groups, they attributed average weight (24%) to the climatic conditions statistically more often. Every second respondent in the lower education group attributed the highest rank to landscape and relief, while every fifth

<sup>25</sup> J. T. Winpenny, op. cit., p. 89; J. Famielec, op. cit., p. 152-153; A. Bartczak, op. cit., p. 106.

Figure 1  
Importance assigned to natural advantages of Krajenska municipality



A) climate and air quality (n = 215), B) calmness (n = 212), C) water quality and availability (n = 209), D) flora and fauna, biodiversity (n = 209), E) landscape and relief (n = 211)

Source: Own study.

believed these qualities are unattractive. Distribution of answers in groups of people with secondary and higher education were very similar. Most of them, described these values as having average importance (by 58% and 51% of people with secondary and higher education accordingly).

### Willingness to pay

The data on the amounts declared by the respondents, acquired during the survey, was analyzed in terms of credibility and errors. As a result of further study 27 cases were excluded from the total of 222 (n = 195). The next step concerned the normality of residual distribution test for the declared amounts. Shapiro-Wilk test was used. In each of the examined cases, the residual distribution differed significantly from the normal distribution, which prevented the use of standard parametric methods. Cases were decided to be organized into four WTP groups: lack of willingness to pay (WTP = 0), low annual WTP value ( $\bar{x} = 101$ ), average annual WTP value ( $\bar{x} = 278$ ) and high annual WTP value ( $\bar{x} = 788$ ). This allowed the use of Pearson's chi-square test ( $\chi^2$ ) and to analyze the differences in respondents' answers distributions.

Based on the analysis of multi-way tables (crosstabulation tables), statistically significant ( $p \leq 0,05$ ) differences in the respondents' answers distributions on the declared WTP value were noted for three classification groups: household income, place of residence and level of education (Table 2).

**Table 1**  
Significant differences in the distribution of importance assigned to the natural environment advantages

No.	Group	Sample size n	Importance of advantages [%]			Sum [%]
			important	less important	unimportant	
climate and air quality – age						
1.	chi-square test ( $\chi^2$ ) = 10,1854, df = 4, p = 0,0374					
	young respondents	n = 70	75,71	24,29	0,00	100
	middle aged respondents	n = 108	89,81	8,33	1,85	100
	older respondents	n = 28	82,14	17,86	0,00	100
	total	n = 206	83,98	15,05	0,97	100
landscape and relief – education						
2.	chi-square test ( $\chi^2$ ) = 16,1559, df = 4, p = 0,0028					
	primary education (lower)	n = 45	55,56	24,44	20,00	100
	secondary education	n = 92	36,96	57,61	5,43	100
	higher education	n = 70	38,57	51,43	10,00	100
	total	n = 207	41,55	48,31	10,14	100

Source: Own study.

**Table 2**  
Significant differences in the WTP distribution depending on the respondents' characteristics

No.	Group	Sample size n	Willingness to pay (WTP) [%]				Sum [%]
			lack	low	average	high	
household income							
1.	chi-square test ( $\chi^2$ ) = 48,7864, df = 6, p = 0,0000						
	<500 PLN	n = 31	58,06	32,26	6,45	3,23	100
	500-1000 PLN	n = 66	9,09	50,00	30,30	10,61	100
	>1000 PLN	n = 98	11,22	38,78	25,51	24,49	100
	total	n = 195	17,95	41,54	24,10	16,41	100
place of residence							
2.	chi-square test ( $\chi^2$ ) = 15,4574, df = 3, p = 0,0015						
	town area	n = 119	10,08	42,02	26,89	21,01	100
	rural area	n = 76	30,26	40,79	19,74	9,21	100
	total	n = 195	17,95	41,54	24,10	16,41	100
level of education							
3.	chi-square test ( $\chi^2$ ) = 12,8680, df = 6, p = 0,0452						
	primary education (lower)	n = 42	33,33	38,10	19,05	9,52	100
	secondary education	n = 84	14,29	47,62	23,81	14,29	100
	higher education	n = 68	13,24	35,29	27,94	23,53	100
	total	n = 194	18,04	41,24	24,23	16,49	100

Source: Own study.

Accordingly with the earlier assumptions, household income proved to be an important variable that affected the amounts declared by the respondents. People with higher incomes were more likely to be willing to pay more than those with the lowest incomes, who often declared unwillingness to pay. In other words, with an increase in the wealth level of the respondents, the percentage of people willing to pay higher amounts for the offered goods also increased. Expected correlation was also noted in the case of the residence place impact on the WTP amount. Respondents living in rural areas usually declared small amounts (<41%) or lack of willingness to pay (>30%), while residents of the city declared accordingly: small (>42%), followed by medium-sized (<27%) and a large WTP amounts (>21%) (therefore they were more willing to pay higher amounts). It was connected with the interaction observed between the place of residence and the respondent's income amount. In the group of city residents, higher income was indicated more often in comparison with the respondents living in rural areas ( $\chi^2 = 19,4212$ ,  $df = 2$ ,  $p = 0,0001$ ). In the case of „education” variable a positive relation was found as well. With the increase in the respondents' education level, the percentage of people, declaring a higher willingness to pay, also increased. However, the strength of this relation was much lower than in the case of the previously described interactions.

In order to verify the research results, a log-linear analysis<sup>26</sup>, which examined the relations of individual variables (WTP, income, place of residence, education), was carried out. As a result, the direct effect of education on the declared amounts was ruled out (Figure 2), hence the extrapolation of results to the whole population included only the effects connected with the household income amount and respondents place of residence (Table 3).

Table 3  
Willingness to pay – test results

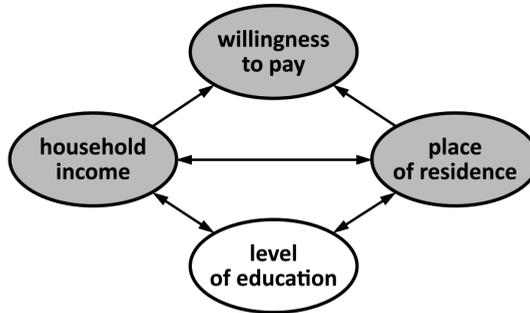
Place of residence	Survey results, n = 195				Extrapolated results	
	WTP [PLN/person/year]				population <sup>a)</sup>	WTP [thous. PLN/year]
	low income	average income	high income	total		
rural area	128,6	189,6	400,0	264,9	2004	530,8
town area	210,0	280,8	322,9	302,8	2745	831,2
municipality	158,5	234,0	347,5	286,8	4749	1362,0

<sup>a)</sup> population of adult residents announcing their willingness to pay (based on Registry Office in Krajenka data, 2012)

Source: Own study.

<sup>26</sup> Log-linear analysis provides a „sophisticated” way of looking at crosstabulation tables (to explore the data or verify specific hypotheses). Specifically, it allows the user to test the different factors that are used in the crosstabulation (e.g., gender, region, etc.) and their interactions for statistical significance (see A. Stanisław, Podstawy statystyki dla prowadzących badania naukowe. Odcinek 36: Analiza log-liniowa, „Medycyna Praktyczna” 2002/07, <http://www.mp.pl/artykuly/?aid=13111> [Date of entry: 07.09.2012].

Figure 2  
Model of WTP dependency on respondents selected features based on the log-linear analysis



Source: Own study.

## Travel costs

Before moving on to the actual calculations, the data from 222 forms was analyzed in detail in terms of containing relevant information and verifying their credibility. In each group of ecosystems, a number of questionnaires, which did not meet the formal conditions, was rejected (lakes – 5, rivers – 10, forests – 8).

Availability of various leisure areas, in terms of distance that needed to be covered by the respondent in order to reach them, had a significant impact on the range of travel costs. Therefore, spatial diversity of municipality's land use structure, especially the configuration of built-up areas in regard to recreation sites, was meaningful. Hence sections of rivers and forest complexes, which distribution was more even in regard to built-up areas, were more accessible to tourists than the lakes, focused solely on the southern border of the municipality. It needs to be kept in mind, of course, that, in addition to the distance criterion, other factors, such as the quality of the environment, were used to decide on the choice of a particular leisure area.

Among the analyzed ecosystems' groups, the forests and lakes enjoyed the greatest interest among respondents. The respondents most frequently choose the municipality's forest areas (21 visits per year), followed by lakes and rivers (17 visits a year for each). The highest average estimated value of a single visit was calculated for trips to the lakes (10,1 PLN). For trips to the forests this value was calculated at 6,1 PLN level, and for visits to the river at the level of 3,4 PLN. The annual average level of travel costs per one travelling respondent was estimated at 175 PLN for visits to the lakes, 129 PLN for visit to the forests and just 59 PLN for visits by the rivers (table 4). The calculated costs are also considered as the lower estimate of the local cultural services value associated with the conditions for leisure and recreation created by the environment.

Table 4  
Travel cost method – test results

Group of ecosystems	Share of travelers in the sample	Number of travelers in the population <sup>a)</sup>	Average number of visits per year for a single traveler	Value of a single visit	Travel and lost time costs for a single traveler <sup>b)</sup>	Total recreational value <sup>c)</sup>
	[%]	[No. of people]	[No. of visits]	[PLN]	[PLN/year]	[thous. PLN/year]
Lakes	74,6	5 620	17	10,1	174,9	983,0
Rivers	49,6	3 735	17	3,4	58,7	219,2
Forests	91,8	6 911	21	6,1	129,1	892,4
					SUM	2094,6

<sup>a)</sup> extrapolated taking into account the share of travelers in the sample and the Registry Office data

<sup>b)</sup> weighted average value

<sup>c)</sup> extrapolated taking into account number of travelers in the population

Source: Own study.

## Discussion

The results fit into the research on the natural environment's advantages and resources valuation. From Żylicz's<sup>27</sup> review on the ecosystem services valuation research's results comes a conclusion that both of the used methods have been successfully implemented around the world and tested by Polish researchers as well.

An example of contingent valuation method application is a study, conducted in the mid-90's, as a part of the international protection of the Baltic Sea<sup>28</sup> research project. At that time, an adult Pole's willingness to pay for the purification of the Baltic Sea was calculated as 169 PLN/year. The modified method was also used in the international studies on recreation by the lakes in Poland, Czech Republic and Norway<sup>29</sup>. The researchers asked respondents about their willingness to pay for improved water quality in the lakes, firstly by one, and then by two purity classes. In the Lake Łęgowskie case, average WTP amounts were estimated at USD 13 (improvement by one class) and USD 18 (improvement by two classes). The results were the lowest among all surveyed lakes (maximum WTP = 401 USD for lake Orre in Norway for improving the water quality by two classes, price level from the year 2005). In 2007, in Poland, a study was conducted to determine the willingness to pay for improving the tap water (drinking

<sup>27</sup> T. Żylicz, *Wycena usług ...*, op. cit., s. 31-45.

<sup>28</sup> A. Markowska, T. Żylicz, *Costing an international public good: the case of the Baltic Sea*, "Ecological Economics" 1999 No. 30, s. 301-316.

<sup>29</sup> M. Czajkowski et al., *Lake water quality valuation – benefit transfer approach vs. empirical evidence*, "Ekonomia" 2007 No. 19, p. 156-183.

water) and surface water quality. In the first case, the respondents were willing to pay an average of 21 PLN/month, while in the second, an average of 14 PLN/month<sup>30</sup>. The study also showed that the average annual rate for holidays by the water in adult urban population was formulated on the level of 16 visits. It is worth noting that the frequency of leisure travels for the lakes and rivers located in the Krajenka municipality was estimated at a similar level of 17 visits per year.

Due to the different nature of research (scale, object, aims) the results obtained by the mentioned authors are difficult to be compared with the results of research on Krajenka municipality. Their study involved the willingness to pay for improving the quality of one good, whereas in this study, the question concerned the declaration of payment for the possibility of using all recreational values of the municipality's natural environment and the prevention of their degradation. This could be the direct cause for the higher average *WTP* value.

Panasiuk<sup>31</sup>, who in 2000 valued the recreational value of Pieniny National Park, conducted interesting study regarding TCM. He estimated the cost of a one-day trip to the PNP at the level of 16 PLN/visit, and of 215 PLN/visit for trips including an overnight stay. In 2003, a modified travel costs method was used to estimate the economic value of Elbląg Canal<sup>32</sup>. The average cost for a Polish tourists visit ranged between 33-38 PLN, while in the foreign tourists' case it ranged between 147-155 PLN. At the turn of 2005 and 2006, Bartczak<sup>33</sup> estimated the value of a single recreational trip to Polish forests at an average level of 26,92 PLN/person with an average 41 visits a year. Giergiczny's<sup>34</sup> research with the use of TCM proved in turn, that the benefits provided by the Białowieża Forest can be almost three times greater than the revenue from sales of wood harvested in the area. In reference to the Giergiczny's research's results, the estimated recreational value of the Krajenka municipality's forests was compared with the potential revenue from the harvested wood sales<sup>35</sup>. As a result, the average recreational value of forests in the whole municipality accounted for only 7% of the timber sales revenue. At the same time, large local variations, which ranged between 5% and over 40%, were noted for this share.

<sup>30</sup> A. Bartczak, *Wycena korzyści z poprawy jakości wody kranowej i powierzchniowej w Polsce*, „Ekonomia i Środowisko” 2010 No. 2 (38), p. 123-141.

<sup>31</sup> D. Panasiuk, *Problemy wyceniania środowiska w ocenie zbiornikowych inwestycji gospodarki wodnej*, Ph.D. Thesis, Politechnika Warszawska, Warszawa 2002.

<sup>32</sup> T. Liziński, M. Bukowski, *Wycena wartości ekonomicznej zasobów przyrodniczo-kulturowych na przykładzie Kanału Elbląskiego*, „Woda. Środowisko. Obszary wiejskie” 2008 vol. 8 No. 1(22).

<sup>33</sup> A. Bartczak, *Wartość funkcji rekreacyjnej lasów w Polsce*, „Ekonomia i Środowisko” 2006 No. 2 (30), p. 23-41.

<sup>34</sup> M. Giergiczny, *Rekreacyjna wartość Białowieskiego Parku Narodowego*, „Ekonomia i Środowisko” 2009 No. 2 (36), p. 116-128.

<sup>35</sup> Studies on the production of wood in the forests of the municipality were carried out in 2011 using one of the InVEST models (managed timber production model) and data obtained from The State Forests National Forest Holding (see: P. Lupa, *Zastosowanie narzędzi InVEST do wyceny produkcji drewna jako świadczenia ekosystemów leśnych. Przykład Nadleśnictwa Złotów*, „Badania Fizjograficzne” 2012, R. III A – Geografia Fizyczna (A61) [in press]).

Krajenka municipality's natural environment's recreational value's research results obtained using the travel costs method are lower compared to the results of mentioned authors' analyzes. This is probably caused by the significant differences in the touristic and recreational rank of the individual research areas. Pi-eniny National Park, Bialowieza Forest or Elblag Canal are nationally and internationally important tourist destinations, while the analyzed municipality is characterized by local recreational values (less travel costs associated with travelling short distances from place of residence to the leisure area). The respondents' population, limited to residents of the selected municipality, used in this study, was also a factor which determined the results. Therefore, the recreational value, which is assigned to the municipality's natural environment by persons who are not its citizens, was not taken into account (underestimation).

## Conclusion

In accordance with the stated research objective, the cultural services value of the Krajenka municipality's natural environment, connected with the possibility of leisure and recreation was calculated. In the case of contingent valuation method, the local recreational benefits value has been calculated as less than 1,36 million PLN. In the case of travel costs method, total recreational value of three ecosystem groups: forests, lakes and rivers, was calculated as about 2,1 million PLN. The results obtained through the travel costs method should be interpreted more as a lower estimate of the desired goods value, therefore the lower estimated WTP value is puzzling. This discrepancy could be caused by using different populations in the surveys, depending on the economic valuation method used. In addition, the hypothetical scenario presented in the study could be too general and unrealistic for the respondents, which in turn could lead to the insincere responses. It is worth noting at this point that the travel costs method is applicable to revealed (actual) respondents' preferences, which may make it more reliable in comparison to the contingent valuation method based on the subjects' potential behaviours in relation to a hypothetical scenario.

The results obtained during the study confirmed the author's initial assumptions, connected inter alia with the declared WTP level. There was a relation between the level of the declared amount and the household income, which, in the examined case, varied depending on the respondents' place of residence. Declaring higher amounts more frequently by residents of the city resulted probably not only from their high income. It could also be related with the availability of land valuable in terms of nature and recreation. Availability is usually lower for town residents than for people living in rural areas, therefore the former can place higher value on the cultural benefits, connected with the possibility of leisure and recreation in open areas, which are less available for them.

The results of this study characterize the natural environment's recreational services' value in the Krajenka municipality, and pose as premises for the protection and rational use of its assets. They can be used in the assessment of environmental impact in order to reduce the risk of making wrong decisions which could affect maintaining the analyzed area's natural balance.