ORIGINAL ARTICLE
EXTREME SPORTS

The comparison of economic value of recreational assets of most popular Polish national parks with the travel cost method

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Abstract

Background & Study Aim: There are 23 national parks in Poland which are very valuable in terms of rare flora and fauna. Their terrain is particularly valuable in nature, but their value is difficult to assess using monetary measures. Out of the most popular Polish National parks, we decided to compare the value of recreational assets of two mountain parks: Tatra National Park (TPN) and Giant Mountains (Karkonosze) National Park (KPN). Due to many similarities in their richness and uniqueness of natural, cultural, historical and landscape values, we formulated the following hypothesis 'The economic values of recreational assets per km^2 for the TPN and the KPN are similar' – and the truth of this hypothesis is the aim of the work.

Material & Methods: To evaluate the examined national parks, we used the individual travel cost method. Then we compared values of TPN and KPN.

Results: Travel Cost Method value of the discussed parks amounted to almost 28 billion PLN (USD 7.7 billion) for TPN but for KPN it was only PLN 6.6 billion (USD 1.8 billion). However, the economic values of recreational assets per sq. km (PLN/USD) were similar: for TPN 132 million PLN (36.3 million USD) and 111.5 million PLN (30.7 million USD) for KPN. The annual stream of benefits amounted to almost PLN 420 million (USD 115.6 million) for the TPN and PLN 99.5 million (USD 27.4 million) for the KPN. Moreover, TPN's annual stream of benefits almost doubled since M. Giergiczny's valuation in 2001 (PLN 204.3 million / $ 56.24 million at 2016 prices).

Conclusions: We verified positively hypothesis 'The economic values of recreational assets per km^2 for the TPN and the KPN are similar'. In the future a valuation and comparative analysis of all Polish national parks is planned.

Keywords: Giant Mountains National Park • Karkonosze • sport economics • Tatra National Park • Tatry • tourism economics

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INTRODUCTION

There are 23 national parks in Poland which are very valuable in terms of rare flora and fauna. Their terrain is particularly valuable in nature, but their value is difficult to assess using monetary measures.

Polish national parks are visited annually by several million visitors. The most popular national parks are the Tatra National Park (Tatrzański Park Narodowy, TPN) and the Giant Mountains National Park (Karkonoski Park Narodowy, KPN). Almost two thirds of all tourists [1] visit these parks, although the total area of TPN and KPN is less than 0.1 of Poland's surface area. TPN and KPN bring tangible and tangible benefits to Poland and the communities where they are located, as well as to tourists who visit them (Photo 1). Sportsmen of various disciplines [2-5], representing various levels of sport, also train in these mountainous parks [6, 7]. In the areas of the TPN and KPN, tests of broadly understood physical fitness are carried out [8-10]. Part of the area of these parks is accessible to everyone, including people with disabilities [11] and seniors [12-14]. It has been proven that mountains relieve stress [15], and mountain activity can be classified as a habit [16, 17].

Due to the richness and uniqueness of natural, cultural, historical and landscape values [18-20] of TPN and KPN, we formulated the following hypothesis "The economic values of recreational assets per km^2 for the TPN and the KPN are similar" – and the truth of this hypothesis is the aim of the work (this hypothesis is the answer to the question: "are the values per km^2 for the TPN and the KPN similar?").

Giant Mountains (Karkonosze (Polish), Krkonoše (Czech)) – the highest mountain range of the Sudetes situated in the south-west of Poland and in the north of the Czech Republic. The total area of the Giant Mountains equals 639 km^2 [90, 122].

Giant Mountains National Park (Karkonoski Park Narodowy – KPN) – a national park sited in the Polish part of the Giant Mountains. KPN covers an area of 59.51 km^2 [90, 122].

Krkonoše National Park (Krkonošský národný park – KRNAP) – a national park placed in the Czech part of the Giant Mountains. KRNAP covers an area of 550 km^2 (with a buffer zone) [90].

Tatra Mountains (Tatry (Polish, Slovak)) – the highest mountain range of the Carpathian sited in the central-south of Poland and in the central-north of the Slovak Republic. The total area of the Tatra Mountains is 785 km^2. Marmots, bears and chamois are the most characteristic fauna of the Tatras [123].

Tatra National Park, TPN (Tatrzański Park Narodowy) – a national park placed in the Polish part of the Tatra Mountains. It covers an area of 211.97 km^2 [124].

Tatra National Park, TANAP (Tatranský národný park) – a national park situated in the Slovak part of the Tatra Mountains. TANAP covers an area of 738 km^2 [124].

PART I: LITERATURE REVIEW

The economic value of TPN has already been determined [21-23] – for the number of visitors in 2001, and recently for 2015 [24-26]; the value of KPN has not been estimated so far using the TCM method. Over 70 years ago, Hotelling [27] proposed the travel cost method (TCM) for estimating the value of national parks. Next, Clawson and Knetsch [28] valuated the recreational activity in Yosemite National Park.

TCM slowly evolved because it was conditioned by the uncertainty of treating the opportunity cost of time as an element of the price of the visit [29-34]. The economic valuation of environmental goods and services is not an easy task [35]. According to Famielec [36], TCM is the most commonly used method for estimating the value of environmental goods and services [37, 38]. It shows how valuable a given area is by estimating how much money and time people are willing to spend for traveling there [39, 40].

The TCM method makes it possible to estimate the value of ecosystem goods and services according to the costs that people are incurring to reach that particular area. This method is based on substitute markets. There are also considered the costs of lost benefits – the time that society must spend to reach the given destination. These are values that can be taken by tourists depending on the distance, and in this study – the distance from each of the examined national parks. It is the direct value of the money spent on the trip, whether in the form of a train/bus ticket or money spent on fuel for a car, and the intermediate value of travel, i.e., the time spent on travel. The value of the natural environment is estimated

Photo 1. a (left) Kasprowy Wierch (the Tatra Mountains); b (right) Śnieżka (the Giant Mountains). Photos by Zbigniew Piepiora.

by the number of visitors, the length of stay, the time and cost of the trip [41-46].

The disadvantages of the TCM are: limited data availability, difficulties in determining changes in the environment and their reception and valuation by the traveller, not including the value of travel as a pleasure in itself and not as a source of cost, difficulties with the application of wage rates to the valuation of travel time or the valuation of non-work-related travel time (traveling during the holidays), and finally the demand curve dependence on human behaviour [47-49].

The last disadvantage is also the main advantage of TCM, i.e. the real costs people have to face. It is also important to take into account the costs of lost benefits in the form of lost hours at work and, consequently, a reduced remuneration due to a journey. The fact is that most people go to places that are equally valuable to them, and most often these places have more value than the costs that people incur to visit, see, and use the place [50-52]. Therefore, it can be assumed that people who go to the examined national parks attribute the TPN and KPN more value than the price they will incur to get there (Photo 2).

Travel costs are related to the time and distance that a tourist must travel to reach the examined national park. An important element is also the frequency of visits. It depends on unfavourable conditions of environmental change, e.g. the deterioration of waters, destroyed tourist trails. It is also worth noting whether a traveller uses a car to reach the national park. Then, an important element is whether a tourist is traveling alone or with someone. Travel costs are distributed in proportion to the number of people traveling by car [53, 54].

The TCM takes into account two variants: individual travel cost method and zonal travel costs method [47]. The zonal travel cost method is to designate areas of the same distance from the examined object. For each area, the number of visits is calculated, for example, per year. Then the number of visits is compared to the number of inhabitants, and thus, the average number of visits for the area is calculated. The same travel costs are recognized for all people in the area (a simple criterion that makes a visit dependent is the cost of travel). In this way, a demand curve is created [55-57].

PART II. ORIGINAL RESEARCH

Material and Methods

After the literature review, we acquired the data concerning the number of visitors from TPN and KPN. Then we did two independent random surveys and analysed the results using an individual travel cost method.

To evaluate the examined national parks, we used the second variant of TCM, the individual travel cost method, because our research has to be comparable to the research done 16 years ago by Giergiczny [23], who used a travel cost method.

According to the name of this method, the individual travel cost method was based on individual

Photo 2. a (left) Mountain shelter by the Morskie Oko (the Tatra Mountains); b (right) The mountain shelter 'Samotnia' by the Mały Staw (the Giant Mountains). Photos by Zbigniew Piepiora.

statements, collected by conducting questionnaires containing relevant questions. The questionnaire included the questions about cost and travel time, cost of lost benefits, and distance travelled by respondents to reach the examined national park. From the data obtained, the demand curve for the given national park was estimated. The demand curve in this case consisted of the relationship between the number of visits and the total travel costs. The interpretation of the obtained results assumed that they are the lowest estimated value of the national park [58, 59].

During the estimation of demand curve, it was important to interpret the variable cost. It was influenced by: the purpose of travel, the cost of travel, the number of people travelling by car and the costs of lost benefits. After grouping the statistical data, it was necessary to examine the collected data whether they were a normal distribution of random variable. Next, the statistical series and demand function could be created. Finally, the integral of the obtained demand function was calculated [60-62].

The result of integration equalled the total consumer surplus of respondents. In order to receive an amount for one visitor, it should be divided by the number of respondents. Then the result was multiplied by the number of tourists visiting an examined natural area for one full year. The amount received corresponded to the annual stream of recreational benefits that a national park brought. Due to the examined area which is a strictly protected, natural and culturally valuable territory, we assumed that the popularity of visiting and interest in the national parks would remain unchanged in the future and would not be lower. Therefore, it was not possible to directly calculate the future value, thus it is necessary to calculate the perpetuity [63-65].

$$PV = \frac{A}{i} \qquad \text{Eq. 1}$$

Present value, where:

PV – the present value of perpetuity at the end of a given period;
A – the amount of instalments – the previously calculated annual stream of benefits;
i – the interest rate in the payment period (source: [65]).

By substituting the data for equation 1, we obtain the present value of the given natural environment. To get the best result we need to receive as many answers as possible. Moreover, the surveyed population should be a cross-section of the entire Polish society, from different regions in Poland. The difficulty is also that some people treat the trip as a pleasure in itself and not just a tool to reach the destination. Some people travel when they are off work, thus we cannot take into account the loss of remuneration at that time. In addition, the value of existence of examined national park is not taken into account, for those who never visit it [63]. Therefore, the demand curve in the TCM depends on human choices. Regarding the number of visitors, in the study, we have set a confidence level of 95%, a maximum error of 8%, and a fraction of 0.5 and the minimum; random sample size for each national park is 150 visitors. We have set the interest rate at the reference rate of the NBP: 1.5% [66]. Due to the low level of deflation in 2015, we have set a constant price level between 2015 and 2016 [67]. The US dollar exchange rate is set at USD 1 = 3.6323 PLN (NBP 2017b).

The Examined Area

The area of Tatra National Park and the Giant Mountains National Park is covered by the study. The TPN is located in the south part of Poland in the Małopolskie Province, and the KPN in the south-west part of Poland in the Dolnośląskie Province (Photo 3).

Tatra National Park was created in 1954 and started operating in 1955. The area of TPN is 211.97 km^2. It represents 0.07% of Poland's surface area (Rozporządzenie 1954). TPN is located in the Tatra Mountains which is a mountain range forming part of the Carpathians. The Tatras lie on the border of Poland and Slovakia [68-74].

The area occupied by the entire Tatras is 785 km^2, with only 175 km^2 on the Polish side. The Tatras is the only alpine mountain range in Poland and Slovakia. Geographically, the Tatras are divided into the Bielskie Tatras, the High Tatras and the Western Tatras. Some authors distinguish also the Siwy Wierch Massif as the mesoregion from the Western Tatras [75-79]. In the Tatras, next to the TPN located on the Polish side of the mountains in the Małopolskie Province [80], there is also the Tatranský národný park – on the Slovak side.

Photo 3. a (left) Suche Czuby Kondrackie and Goryczkowa Czuba from Suchy Wierch Kondracki in the Western Tatras; b (right) Kozí hřbety (the Giant Mountains – outside KPN but in the area of KRNAP). Photos by Zbigniew Piepiora.

The area of TPN lies within four municipalities: Zakopane, Poronin, Kościelisko and Bukowina Tatrzańska [81-83]. The TPN has been designated as a UNESCO Biosphere Reserve. Moreover, the habitat of all species present in the TPN and the biological diversity of the Tatra region are protected by the Natura 2000 program created in 2004. The status of the UNESCO Biosphere Reserve guarantees the creation of conservation sites and ecosystems [84]. Of course, as with any national park, strict protection is ensured by the Polish Act on the Protection of Nature [85]. The number of tourists visiting TPN has grown significantly in the period analysed (Figure 1). This applies both to the number of tickets sold and to the estimated number of visitors, which in 2016 was 3,689,743 persons (Photo 4).

The second area examined is the Giant Mountains National Park. The KPN is situated in the Giant Mountains (Karkonosze) [87-90]. These mountains are located in south-western Poland and north-eastern Czechia. The Giant Mountains are the highest part of the Sudetes [91-93]. The Giant Mountains National Park was created on January 16, 1959 [94]. Presently, the KPN on the Polish side occupies 59.51 km^2 [95]. The terrain of KPN located in the Dolnośląskie Province and represents 0.02% of Poland's area. The KPN has correspondent on the Czech side – the Krkonošský národní park (KRNAP). It was established in 1963 and occupies 38.5 thousand hectares [96, 97]. The area of KPN lies within six municipalities: Jelenia Góra, Karpacz, Kowary, Piechowice, Podgórzyn, Szklarska Poręba [98-102]. In order to better protect of the

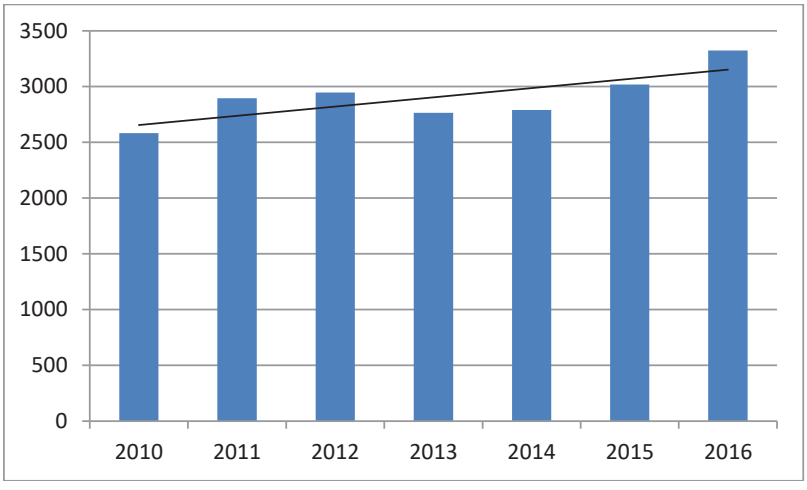

Figure 1. The number of tourists (number of sold tickets) that visited TPN in the years 2010-2016 in thousands.
Source: based on [86].

Photo 4. a (left) Tourist traffic at Giewont (the Tatra Mountains); b (right) Tourist traffic at Śnieżka (the Giant Mountains). Photos by Zbigniew Piepiora.

biodiversity of habitats, Natura 2000 area was created [103]. In 1992, the Giant Mountains became the first transboundary biosphere reserve in the world [104]. In 2010, the Giant Mountains National Park and its buffer zone were awarded the National Geopark Certificate [105].

The number of visitors in the KPN is growing every year (Figure 2). However, the tourist traffic is greater – several categories of people were not included: entering the KPN from the Czech side, outside the opening hours, inhabitants of the municipalities neighbouring KPN (who are exempt from the fee), and persons who deliberately did not buy the ticket [106, 107]. The average annual number of KPN visitors is estimated at 2 million visitors. According to KPN employees, 2 million people also visited KPN in 2016 [108, 109].

The examined national parks are natural assets, classified as non-market and public goods. They can deliver both tangible and intangible benefits, satisfaction of being in their area and such satisfaction that an unique area and environment exists (Photo 5). Therefore, TPN and KPN bring usable and unusable value [110, 111].

The tangible benefits include, i.e., the possibility of earning money as a tour guide, or as a skiing or snowboarding instructor. Tangible benefits are also reached by the authorities of the TPN and KPN which charge entrance fees for some of the many tourist trails. The municipalities in which the examined national parks are located also benefit financially, for example, from the tourist fees paid by tourists in hotels and boarding houses. We can also include the following things as intangible benefits: staying in clean climate, interactions with nature (Photo 6), opportunities for recreation. Although it is not possible to directly assess the price of TPN and KPN, it is known that they have their value – the economic value of nature [112-116].

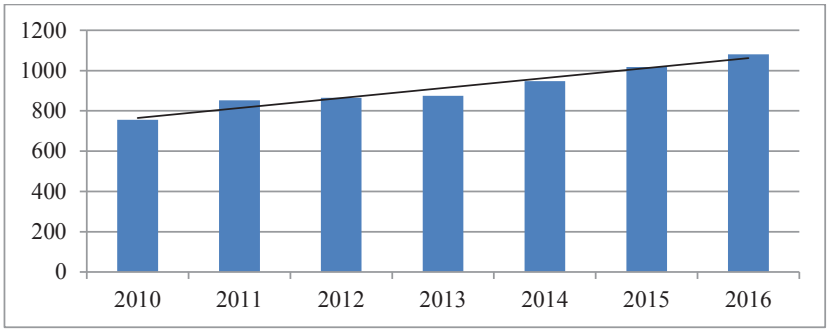

Figure 2. The number of tourists (number of sold tickets) that visited KPN in the years 2010-2016 in thousands. Source: based on [107].


Photo 5. a (left) Dolina Małego Szerokiego in the Tatra Mountains; b (right) Kocioł Łomniczki in the Giant Mountains. Photos by Zbigniew Piepiora.


Photo 6. a (left) Chamois in the Tatra Mountains; b (right) Common kestrel in the Giant Mountains. Photos by Zbigniew Piepiora.


Photo 7. a (left) Snowstorm in the Tatra Mountains; b (right) Ground blizzard in the Giant Mountains. Photos by Zbigniew Piepiora.

It is worth to notice that the KPN value have not been estimated so far using travel cost method. As we wrote in the introduction to this article, 16 years ago [21] TPN was valuated using the travel cost method. In 2001, 2.5 million tourists visited TPN (32% less than in 2016). The stream of recreational benefits of the Tatra National Park generated annually was equal to PLN 144 million ($ 39.64 million) at 2001 prices [21] and PLN 204.3 million at 2016 prices ($ 56.24 million).

We state that too much tourist traffic and inappropriate use and exploitation of tourist attractions in the area of studied national parks can lead to environmental degradation and, therefore, to the loss of their values. It is not possible to eliminate all the hazards associated with tourism (Photo 7), but actions can be taken to minimize them.

RESULTS AND COMMENTS

The value of Tatra National Park and the Giant Mountains National Park

We conducted the survey in the Tatra National Park between October 2015 and May 2016 [25]. We divided the survey questionnaire into 3 trials: field work (a survey on tourists directly staying in the Tatra National Park), a railway survey and an Internet survey. We considered 48 respondents from the field work (5 people lived or worked in the TPN area and therefore we omitted them due to the lack of costs in order to reach the TPN), 58 people participated in the railway survey and 247 people took part in the Internet survey. A total of 358 people participated in our study.

We conducted the survey in the Giant Mountains National Park between 30-31 July 2016 and 29-30 December 2016; the survey questionnaire is available on request [120]. We divided the survey questionnaire into 2 trials: field work (the survey with tourists staying directly in the Giant Mountains National Park), the Internet survey which was posted at http://naszesudety.pl/ankieta-o-kpn-plecamy-uwadze.html from 6 December to 31 December 2016 [121]. A total of 180 people participated in the survey.

We considered five elements to characterize the respondents: the name of province from which the person came from, the age, the education level, the employment status, and the monthly income per person given in PLN (Tables 1-5). We determined the number of tourists participating in the study according to the province from which they come to the two national parks.

The largest percentage of tourists came to the TPN from the Małopolskie Province (24%). The Śląskie Province (15%) was the second largest province with (15%). The third province, which in total was 13%, was the Dolnośląskie Province (Table 1). The distance of these three provinces to the Tatra National Park is quite small, and the road and technical infrastructure between them is highly developed. It was easy to get to TPN from these provinces and there were a number of rail and bus connections and the A4 highway. All three provinces also belong to the top five most inhabited provinces in Poland [117]. It is worth noting that 4 foreigners took part in the Internet survey.

As for KPN, the highest percentage of tourists came from the Dolnośląskie Province (24%) because the KPN is located in this region, thus it is easily accessible to tourists coming from this province. The second source of respondents was the Opolskie Province (16%) and the third was the Wielkopolskie Province (13%). These provinces are neighboring with the Dolnośląskie Province and have a well-developed transport infrastructure: a large number of rail and bus connections and, above all, very good road transport accessibility. We did not record tourists from provinces: Podkarpackie, Pomorskie, and Zachodniopomorskie. These regions are far from the KPN. It should also be noted that the route of arrival of respondents was not always the shortest, for various reasons.

The largest share among TPN respondents have young people up to 24 years (37%). The second largest group in the study was people between 25 and 34 (36%). The least numerous group (0.56%) was people over 65 years of age (Table 2). This age distribution of respondents corresponds to the general distribution of the population in Poland [117]. Furthermore, Tatra National Park is a mountainous area that is physically challenging for the elderly. In contrast, young people are very interested exploring and travelling, also in less accessible places (Photo 8).

Table 1. The number of tourists taking part in the study according to the province from which they came to the TPN and the KPN.

Province	TPN respondents		KPN respondents	
	n	%	n	%
Dolnośląskie	45	13	43	24
Kujawsko-pomorskie	6	2	3	2
Lubelskie	20	6	2	1
Lubuskie	6	2	12	7
Łódzkie	26	7	19	11
Małopolskie	86	24	5	3
Mazowieckie	25	7	10	6
Opolskie	10	3	28	16
Podkarpackie	11	3	0	0
Podlaskie	13	4	6	3
Pomorskie	16	4	0	0
Śląskie	55	15	18	10
Świętokrzyskie	9	3	4	2
Warmińsko-mazurskie	7	2	6	3
Wielkopolskie	13	4	24	13
Zachodniopomorskie	6	2	0	0
outside Poland	4	1	0	0
Total	**358**	**100**	**180**	**100**

Table 2. The number of TPN and KPN tourists taking part in the study according to the age.

Age [years]	TPN (respondents)		KPN (respondents)	
	n	%	n	%
under 24	134	37	40	22
25 to 34	128	36	46	26
35 to 44	57	16	35	19
45 to 54	24	7	22	12
54 to 64	13	4	28	16
65 and above	2	1	9	5
Total	**358**	**100**	**180**	**100**

As for the KPN respondents, the largest share was by people in the age from 25 to 34 years old (26%). Second place was occupied by the youngest age group of people up to 24 (22%). The next place was occupied by people aged 35 to 44 (19%). The least numerous group were (as in the case of the TPN) the respondents aged 65 and over (5%).

The participation of people depending on education was important because the TPN is perceived in different way by a person who is unaware of its significance and threats of nature conservation, and otherwise by e.g. a land manager. The largest group of TPN respondents was people with secondary education (42%), and with higher education (39%). The least numerous group were respondents with primary education (2%) (Table 3). It corresponds to the structure of people's education is in Poland [117]. This result indicates that well-educated people are more likely to travel and rest in the valuable and natural landscape of the TPN. In the case of KPN respondents the largest group were people with secondary education (45%). The next place was occupied by people with higher education (32%) – similarly to TPN. Only 1% of the respondents graduated from junior high school. The results suggest that people with higher and secondary

Photo 8. a (left) The Tatra Mountains: Orla Perć; b) (right) Outside KPN. White-out in the Giant Mountains. Photos by Zbigniew Piepiora.

Table 3. The number of TPN and KPN tourists taking part in the study according to their education.

Education	TPN (respondents)		KPN (respondents)	
	n	%	n	%
primary school	8	2	4	2
junior high school	13	3	2	1
basic vocational school	49	14	35	19
secondary school	149	42	81	45
higher education	139	39	58	32
Total	**358**	**100**	**180**	**100**

education felt a greater need to interact with nature, relax, travel, and admire the landscapes (Photo 9).

The employed were the largest group in the studied population (46%) of TPN respondents. They were immediately followed by students and pupils, representing 42%. The smallest group were the unemployed and 'other' (2% each) (Table 4). It confirms our opinion that people who are in working age are active and like active recreation; also students and pupils have more free time, which they willingly spend on trips.

In the case of the KPN respondents, more than half of the surveyed population (57%) was employed. The second largest group is students and pupils (30%). Only 11 people declared that they were unemployed (6%). The sample included 5% of retired people/pensioners and 2% of those who defined their employment status as 'other'. As in the case of the TPN, the large number of students in the KPN can prove that they have more free time which they are willing to use for active rest in the mountains. The large percentage of

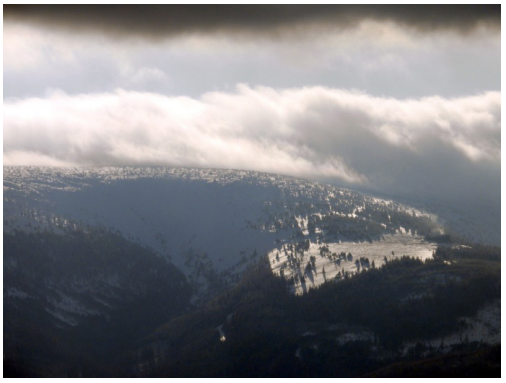

Photo 9. a) (left) The Tatra Mountains: fragment of the Dolina Roztoki and Dolina Pięciu Stawów Polskich from Orla Perć; b) (right) The Giant Mountains: Biały Jar and Strzecha Akademicka. Photos by Zbigniew Piepiora.

Table 4. The number of TPN and KPN tourists taking part in the study according to their employment.

Status	TPN (respondents)		KPN (respondents)	
	n	%	n	%
employed	165	46	102	57
unemployed	8	2	11	6
pupil/student	159	44	54	30
retired/pensioner	18	5	9	5
other	8	2	4	2
Total	**358**	**100**	**180**	**100**

employed people suggest that in their spare time from work and with the earnings they earn, the employed also can afford to leave in an attractive area of the Karkonosze National Park.

The monthly income in PLN and US per person in the household of the travelling person. It is worth noting that the average monthly income per person in Poland in 2016 amounted to PLN 1,475 [118] and a year earlier: PLN 1,386 [119]. The TPN respondent's income was fairly evenly distributed above and below the average income level. The largest group was people who earned PLN 750-1249 (28%). The second place was occupied by people in the range PLN 2250 and above (25%). The next group of people with monthly income 1250-1749 PLN (18%). 16% of respondents declared their monthly income within the range below 750 PLN and 13% of persons: 1750-2249 PLN. The monthly income per person among KPN visitors. The largest group was people who earned PLN 2,250 and above (34%). It is worth noting that these tourists had also higher or secondary education. The second place was occupied by people in the range of 750-1249 PLN (23%). They were mainly students. The next group of people with monthly income below 750 PLN (18%). 13% of respondents declared their monthly income within the range of 1750-2249 PLN and 12% of persons: 1250-1749 PLN (Table 5).

Among the 358 people surveyed, 12 were not considered 12 because they incurred no costs to reach the TPN. Other people have declared 1645 visits to the TPN. Approximately one person had 5 visits per year. As we can see in the table 6, the average distance from the TPN to all respondents was 333.28 km, and average driving time was 5 hours 11 minutes. Most of the respondents declared that they were coming to the TPN by car. Approximately 3 people travelled by one car, including drivers. The cost of fuel per person was 56.08 PLN. The price of entrance ticket to the TPN was 5 PLN. Among the respondents, no one stated that he did not want to return to the TPN.

In the case of the KPN, among 180 people surveyed, we disregarded 10 questionnaires because 10 people incurred zero costs to reach the KPN. They live in the area of the KPN. Eight other persons also declared zero costs, thus they were excluded. The remaining visitors declared 566 visits to the KPN. Approximately one person had 3 visits per year. The average distance from the KPN to all respondents was 253.75 km and average driving time was 4 hours 10 minutes. Among the respondents, 94% (152 people) declared that they came to the KPN by car. Approximately 3 people travelled by one car, including drivers.

Table 5. The number of TPN and KPN tourists taking part in the study according to their monthly income per person.

Monthly income		TPN (respondents)		KPN (respondents)	
in PLN	in USD	n	%	n	%
below 750	below 206.5	56	16	33	18
750 to 1249	206.5 to 343.9	101	28	42	23
1250 to 1749	344 to 481.5	65	18	21	12
1750 to 2249	481.6 to 619.2	46	13	23	13
2250 and above	619.3 and above	90	25	61	34
Total PLN	**Total USD**	**358**	**100**	**180**	**100**

Table 6. Data compilation for the TCM estimation.

Feature	TPN	KPN
number of respondents	346	162
total number of visits per year	1645	566
number of visits per respondent	4,75	3,33
average distance from the national park (km)	333.28	253.75
average travel time	5 h 11 min	4 h 10 min.
average travel cost per 1 person travelling by car (PLN / USD)	56.08/ 15.43	38.12/ 10.49
average number of people travelling in 1 car	4	3
entrance ticket price (PLN / USD)	5 / 1.38	6 / 1.65

The cost of fuel per person was 38.12 PLN. None of the tourists paid the cost of overnight accommodation on the road, reaching the KPN. Five respondents incurred the costs related to absence from work, totalling PLN 580. The price of entrance ticket to the KPN was 6 PLN. Among the respondents, no one stated that they did not want to return to the KPN.

Then, we estimated the demand function for TPN: $y = 1685{,}1e^{-0.009x}$ ($R^2 = 0.987$). The consumer surplus amounted to 187 233 PLN for 1645 visits, that is 113.82 PLN per 1 visit. As we know, the number of visits in 2016 totalled 3689743. Therefore, the stream of recreational benefits generated annually by the TPN equals 419 965 277 PLN (Table 7).

After substituting data for the perpetual annuity formula: we get almost 28 billion PLN (7.7 billion USD):

$$PV = \frac{419{,}965{,}277}{1.5\%} = 27{,}997{,}685{,}148 \text{ PLN } (7{,}707{,}977{,}080 \text{ USD})$$

It is worth noting that this is an estimated, lower, and partial value of the Tatra National Park, due to its calculation taking into account the recreational aspect of functioning of the TPN. The total value of TPN does not consist only of a recreational function. The recreational function is one of many that Tatra National Park has (Photo 10)

The demand function for KPN was estimated: $y = 253{,}63e^{-0.009x}$ ($R^2 = 0.9599$). The consumer surplus amounted to 28 181 PLN for 566 visits: 49.79 PLN per 1 visit. As we know, the number of visits in 2016 totalled 2 million. Therefore, the stream of recreational benefits generated annually by the KPN is 100 million PLN (Table 7).

Photo 10. a (left) The Giant Mountains: a fragment of Karpacz can be seen in the weather window; b) (right) The Tatra Mountains: Kasprowy Wierch from Orla Perć. Photos by Zbigniew Piepiora.

After substituting data for the perpetual annuity formula, we get almost 6.6 billion PLN (1.8 billion USD):

$$PV = \frac{99{,}579{,}898}{1.5\%} = 6{,}638{,}659{,}861 \text{ PLN } (1{,}827{,}673{,}887 \text{ USD})$$

It is worth to notice, as in the case of the TPN, the estimated value was lower that the value of the whole park, as this is only the partial value of the Giant Mountains National Park, due to its calculation taking into account the recreational aspect of functioning of the KPN. The total value of the KPN does not consist only of the recreational function; the recreational function is only one of several functions of the Park.

In the case of the TPN, the largest group was persons with income in the range 750-1249 PLN (28%). For the KPN, people with income of 2250 and above predominated (34%) (Table 7). In the period 2001-2016, the number of visitors to the Tatra National Park increased by 1.2 million. The number of tickets sold to the TPN in the period 2010-2016 increased by 742,622. The number of tickets sold to the KPN in the period 2010-2016 increased by 325 thousand. The density of tourist traffic was higher for the KPN and was 33,605 persons per 1 km^2 and, in the case of the TPN: 17,407 persons per 1 km^2. The consumer surplus totalled PLN 187,233 for the TPN and PLN 28,181 for the KPN. Thus it was higher for the TPN. The situation was similar in the case of consumer surplus per 1 visit. It amounted to PLN 113.82 for the TPN, and – to PLN 49.79 for the KPN. The annual stream of benefits totalled 420 million PLN for the TPN and PLN 100 million for the KPN. Thus, it was also higher for the TPN.

DISCUSSION

Comparing the survey results of both national parks, it should be noted that in both cases, almost one quarter of the visitors were residents of the provinces where the parks were located. In the case of the TPN, they were inhabitants of the Małopolskie Province, in the case of the KPN – the Dolnośląskie Province.

Among the visitors to the TPN were predominantly people over 24 (37%). This group, together with persons aged 25-34, represented nearly three quarters of the TPN visitors. It was a bit different for the KPN. There were predominantly 25-34 year olds (26%). Together with people under 24 years of age, this group represented nearly half of visitors.

Table 7. Summary of the valuation results by TCM.

Feature	TPN	KPN
creation date	1.01.1955	16.01.1959
area in ha/km^2	21,197 / 211.97	5,951.4236 / 59.514236
% area of Poland	0.07	0.02
number of visitors in 2016	3,689,743	2,000,000
density of tourist traffic (number of visitors in 2016 per km^2)	17,407	33,605
increased number of tickets sold during the period 2010-2016	742,622	325,000
demand function	$y = 1685{,}1e^{-0.009x}$	$y = 253{,}63e^{-0.009x}$
R sq.	0.987	0.9599
consumer surplus	187,233 / 51,546.68	28,181 / 7,758.45
consumer surplus per 1 visit (PLN/USD)	113.82 / 31.34	49.79 / 13.71
annual stream of benefits (PLN/USD)	419,965,277 / 115,619,656	99,579,898 / 27,415,108.33
TCM value (PLN/USD)	27,997,685,148 / 7,707,977,080	6,638,659,861 / 1,827,673,887
TCM value / sq. km (PLN/USD)	132,083,244 / 36,363,528	111,547,426.4 / 30,709,861

In the case of visitors to both national parks, people with secondary education were predominant – over 40%. Second place went to people with higher education (more than 30%). The majority of visitors to both parks were employed. In the case of the TPN, it was almost half of the respondents, and in the case of the KPN more than a half. The second most popular group were students in both national parks. In the case of the TPN, it was almost half of the respondents and, in the case of the second national park, almost one third.

The number of surveyed respondents visiting both national parks was 346 for the TPN, and 162 for the KPN. The number of visits declared by the respondents was 1645 for the first national park, and 566 for the second national park. Therefore, there were 5 visits for the TPN and 3 visits for the KPN. The average distance from the national park was 333.28 km for the TPN and 253.75 km for the KPN. This gave an average travel time of 5 h 11 min and 4 h 10 min respectively. The average travel cost per person was PLN 56.08 ($ 15.43) for the TPN and PLN 38.12 ($ 10.49) for the KPN. The average number of passengers in the car was 4 people for the TPN and 3 persons for the KPN. In both cases most visitors came by car. Ticket prices were 5 PLN ($ 1.38 USD) for the TPN and 6 PLN ($ 1.65) for the KPN.

We cannot compare the annual stream of benefits with previous years in the case of the KPN. In the TPN the annual stream of benefits almost tripled since 2001 (PLN 144 million at 2001 prices). This is influenced by the price ratio from 2001 to 2016 and a significant increase in interest in the Tatra National Park. As we mentioned earlier, over the past 15 years, the number of tourists visiting the park has increased by approximately 1.2 million. After adjustment for the price index of consumer goods and services of the M. Giergiczny's valuation (PLN 204.3 million at 2016 prices), the value of annual stream of benefits brought by the TPN has doubled.

The TCM value amounted to 28 billion PLN (7.7 billion USD) in the TPN case, and in the case of KPN – only 6.6 billion PLN (1.8 billion USD). Interestingly, the TCM values per 1 km^2 were similar for both national parks, with a predominance of 20 million PLN (5.5 million USD) in favour of the TPN. In the future shall be done valuation and comparative analysis all Polish National Parks.

CONCLUSIONS

We verified positively hypothesis 'The economic values of recreational assets per km^2 for the TPN and the KPN are similar'. The Tatra National Park and the Giant Mountains National Park provide tangible and intangible benefits. The tangible are i.e. earning money as a tour guide or a ski instructor. Intangible benefits include a leisure, an ability to live in a clean environment or to interact with a nature. In the period 2001-2016, the number of visitors to the Tatrzański Park Narodowy increased by about 1.2 million. Every year the number of visitors to the national parks is increasing, as it is shown by the number of tickets sold. This number for the TPN in the period 2010-2016 increased by 742,622. The number of tickets sold to the KPN in the period 2010-2016 increased to 325 thousand.

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