

Benefits of recreation in the “Nad Tanwią” nature reserve determined by the travel cost method

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Abstract

The quality and quantity of valuable natural areas is assessed through the prism of benefits derived from all the functions performed by them, among which tourist and recreational functions play an increasingly important role. The main purpose of this paper was to determine economic benefits obtained by tourists visiting the “Nad Tanwią” nature reserve located in the south-eastern part of Poland, calculated using the travel cost method, TCM. The survey method was used as part of the research. Surveys were conducted from May to September 2017 on a group of 341 respondents. Data regarding the length of the visit and the amount of costs related to the stay in the reserve were subject to statistical analysis using the CART method. The results of the survey showed that the respondents reported a need for 14 types of visits depending on their duration. The value of the consumer surplus amounted to PLN 986/person, and the value of the gross benefit amounted to PLN 1,069/person. The value of the consumer surplus, which was the share of tourists visiting the reserve during the year, amounted to PLN 108 million, and the gross value of non-market benefits for this group was PLN 118 million. The developed model of travel costs in the reserve allows for the assessment of recreational benefits of this place. The development of tourism and recreation in areas attractive in terms of nature contributes to improvement regarding meeting recreational needs of tourists and the existing transportation infrastructure.

Keywords: leisure, tourism, valuation, protected area, “Nad Tanwią” nature reserve, travel cost method, consumer surplus

Introduction

The most important function of forest areas is the production of wood and wood-based products. It should not be forgotten, however, that forests perform many other functions, the most important of which are: the protective one, the social one, they are also a resting site for the population, and they also provide ecosystem services in terms of: biodiversity, species richness, landscaping or carbon dioxide capture and generation (Bestard and Font 2010). Due to the non-market nature of tourist and leisure services, it is difficult to determine their economic value, including the size of their production (McKenney and Sarker 1994); however, Saraj et al. (2009) point out that the leisure value of forests is at least twice as high as the value of their timber grades. Non-productive functions of the forest have the characteristics of public goods

and are therefore not traded on local or national markets (Bestard and Font 2010). Marszałek (1992) indicates two main reasons for this situation, namely the technical and political aspects. The technical aspects result from the fact that tourist services are non-market goods and therefore their price cannot be shaped by the law of supply and demand on the market. The political aspects are the result of the forest policy in a given country (e.g. more or fewer public goods on the market) and result from the standard of living of the society. The richer the society is, the higher the amount of money it spends on leisure, which is also due to the tradition and culture of a given country (Płotkowski 1996). The mere fact that some goods do not have a price does not mean that they are not valuable. This only means that there are no market indicators to determine their price (Kaiser 1994). Due to the multi-functionality

of forests, their total value should include a valuation of all their functions, considering the economic and social perspective (Glura 2006). Tourism and recreation can also be a source of income for the local population (Grilli et al. 2014). When valuing tourism and leisure in the protected areas, leisure values shaping the forest landscape should be taken into account, as well as other factors influencing their attractiveness (Grilli et al. 2014). The total value of the protected areas consists of many elements, including valuable habitats, leisure value of the area, climate change regulation, as well as health properties (de Groot et al. 2010). It should be remembered that the valuation of non-market goods and services of the forest environment is based on the identification of preferences of individual tourists (Sarker and McKenney 1992, Gałązka 2017). The economic valuation pertains not only to naturally valuable areas that are important for people for many reasons but also, their components, e.g. valuable habitats located there (Pechanec et al. 2017). The measure of the economic value of non-market goods is also the economic benefits that tourists can gain from resting in the protected areas.

The purpose of the article is to determine the economic benefits obtained by tourists visiting the "Nad Tanwią" nature reserve, located in the south-eastern part of Poland, calculated using the travel cost method.

Material and methods

Study area

The questionnaire surveys were carried out in the "Nad Tanwią" nature reserve ("NT" NR), which was established by the Order of the Minister of Forestry and Wood Industry (Monitor Polski 1958) with the aim to preserve the picturesque and characteristic landscape of the Tanew and Jelenia river valleys with numerous waterfalls in the rocky channel of the stream and mixed forest with the participation of fir on the border of its natural habitat (OJ 62/1958, item 355). It is a strict reserve covering an area of 41.3 ha, located in the Józefów Forest District, which is part of the regional directorate of the LP (National Forests) in Lublin. The Józefów Forest District occupies an area of over 19.6 ha, and the main tree-forming species is the pine which accounts for 87% of the species composing the tree stands. In the immediate vicinity of the reserve, there are many forms of nature protection, including the following nature reserves: the "Nad Tanwią", "Czartowe Pole", "Nowiny" and Solska Forest Landscape Parks, two nature monuments. Natura 2000 areas constitute 87% of land managed by the State Forests of the Józefów Forest District. In the area of the reserve, there are several hiking, walking, and cycling routes, where one can admire the landscape and nature (Lipiec 2015). According to the Central Register of Nature Protection Forms (Generalna Dyrekcja Ochrony Środowiska 2019), the "NT" NR is a natural landscape reserve with elements of an aquatic ecosystem, situated along the course of the Tanew River.

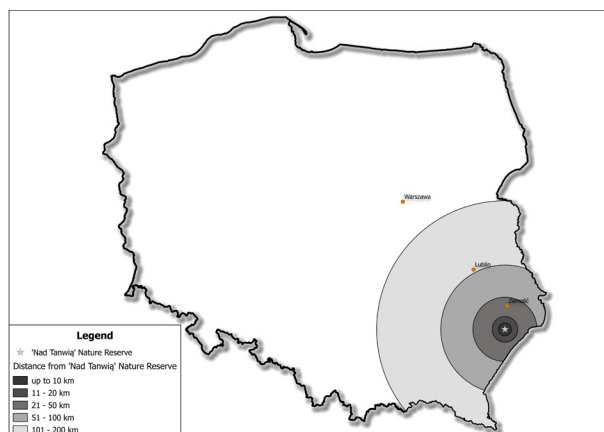


Figure 1. Map of Poland showing the distances from which respondents came to the "Nad Tanwią" nature reserve

The reserve is located in Lubelskie Voivodeship and is adjacent to Podkarpackie Voivodeship (Figure 1).

In the research, it was decided to employ the travel cost method (TCM), because it is one of the most frequently used methods of valuing non-market goods. The TCM is the oldest method used by environmentalists (Shechter 1996). It belongs to the group of indirect methods for the valuation of non-production forest functions (Liston-Heyes and Heyes 1999). The originator of the method is Harold Hotelling (1947) who suggested that actually incurred costs of a visit to a recreationally attractive place should be the price paid for access to such a place. The TCM was popularised in the world of science thanks to Clawson's and Knetch's research production (McKenney and Sarker 1994). The TCM allows to determine the individual activity of tourists and their need for various types of trips to tourist-attractive places, and to describe the travel costs they incur in such places (Riera et al. 2012). Accordingly, determining the individual travel needs consists in calculating the costs of travelling to such a place (Riera et al. 2012). As a result of application of this method, the TCM model is developed which determines access to free recreational places and also allows to measure changes in the quality of recreation of a given place (Riera et al. 2012). The travel cost method is a useful tool for valuing recreational benefits in situations, where places are visited clearly for recreational purposes by many people (Winpenny 1995). Using this method, a model of travel costs was developed for the "NT" NR. Afterwards, the demand for visits to the reserve of varying duration was specified, and the costs of the arrival and stay in it were calculated. After the demand curve for visits to the "NT" NR was developed, the researchers began to measure the benefits gained by tourists from having access to such a place. One of the methods used to determine the economic value of the benefits that consumers derive from consumption of forest environment goods, i.e. those having the nature of public goods, is to determine the consumer surplus (CS). The CS is "what the consumer is willing to pay for the goods in excess of what he/she has

actually paid" (Blaug 1997). Therefore, CS (Samuelson and Nordhaus 2009) defines the consumer's willingness to pay for a given service/goods less the amount actually paid by them. It is closely related to the demand curve for the given good and its price on the market. In order to determine the benefits and costs of the respondents visiting the "NT" NR, the Individual Travel Costs Method (ITCM) was applied, in which surveys with information about the number of visits and total travel costs of individual persons are used, and then the relation between the total of visits (or the number of persons) and total travel costs is presented in the graph (Bateman 1995). With the help of the ITMC, a model of individual travel costs was built for the "NT" NR. Then the demand for visits of different duration in the nature reserve was determined and the costs incurred for travel and stay were calculated. After developing the curve of demand (requirement) for visits, the determination of the benefits for tourists from having access to this place by means of a consumer surplus was initiated. In this case, the assumed price was the cost of travel declared by the visitors to the "NT" NR. The studies did not consider the time expense incurred on a travel to the reserve. In the case of survey questionnaires distributed within the reserve, respondents selected rest in this area as the sole purpose of their travel. Thus, in the case of travel during which respondents visit several places, the problem of sharing costs does not exist. The stages of building the TCM model included the division of the duration of tourists' visits into 7 groups: 1-day visits, 2-day visits, 3-day visits, 4-day visits, 5-day visits, visits 6–10 days and visits lasting longer than 10 days. To determine the benefits that tourists gain from visiting the reserve, the consumer surplus (net benefits) and gross benefits were calculated. The highest values of travel costs incurred as part of visits were treated as a measure of the maximum readiness of consumers to pay for specific non-market benefits. On the basis of data on the maximum readiness of consumers to pay for access to recreational goods and services derived from the "NT" NR and considering the demand function for various types of visits to the reserve, the gross value of all non-market benefits obtained by respondents (based on samples) and by visitors to this area during the year was determined. Gross benefit values attributable to respondents and visitors to the reserve area within the year were determined from the following formula:

$$K_{\text{general}}^{\text{B}} = \sum_{i=1}^7 K_i^{\text{B}} = x \sum_{i=1}^7 K_i^{\text{max}} \cdot \frac{R_i}{100}, \quad (1)$$

where:

$K_{\text{sample}}^{\text{B}}$ – the gross benefits per all interviewed people,

$K_{\text{general}}^{\text{B}}$ – the gross benefits per all visitors within the year,

K_i^{B} – the gross benefits for people declaring demand for a visit of given duration (e.g. 1-day, 2-day, etc.),

$i = 1 - 7$ – the number of determined visiting groups,

K_i^{max} – the maximum cost of travel and stay in given visit group,

R_i – the percentage of visitors in a group in total amount of visits,

x – the number of interviewed people.

Consumer surplus values attributable to respondents and visitors to the "NT" NR within the year were determined according to the formula below:

$$K_{\text{general}}^{\text{CS}} = \sum_{i=1}^7 K_i^{\text{CS}} (K_i^{\text{max}} - C_c) x \cdot \frac{R_i}{100}, \quad (2)$$

where:

$K_{\text{sample}}^{\text{CS}}$ – the consumer surplus per all interviewed people,

$K_{\text{general}}^{\text{CS}}$ – the consumer surplus per all visitors within the year,

K_i^{CS} – the consumer surplus for people declaring demand for a visit of given duration (e.g. 1-day, 2-day, etc.),

C_c – the "shadow price".

The other designations are as in formula (1). The "shadow price" was the amount of travel costs declared by visitors to the "NT" NR.

Survey research

To obtain the data needed to calculate the benefits of leisure in the "Nad Tanwią" nature reserve, a survey method was used. This is a standardized technique, which means that all respondents are asked standardized questions formulated in the same manner (Gruszczyński 2003). Due to the high return rate, a distributed survey questionnaire form was used (Babbie 1995). Surveys were carried out in two stages, as pilot and proper studies. The pilot studies were conducted in April 2017 on a group of 100 respondents spending their free time in the "NT" NR. The proper part of the research was conducted from May to September 2017 on a group of 341 adult tourists visiting the research area. On average, it took respondents ten minutes to complete the survey questionnaire form. All 341 completed survey questionnaires were returned. The questions of the survey questionnaire were used to determine the benefits and costs incurred by visitors to the nature reserve (What were the total costs incurred by you for your stay in the "NT" nature reserve? How much money did you spend on travel from and to your place of residence, accommodation and other expenses? What means of transport did you use for travelling to the "NT" nature reserve? The survey questions also concerned the determination of the frequency and length of visits (Have you been in the "NT" nature reserve and how many times have you been to visit it? How many days did your visit in the "NT" nature reserve last?). The respondents were also asked about the distance between their place of residence and the site of research (What is the distance from your place of residence from this site?). The survey questionnaire also included a metrics, which allowed for the determination of sociological characteristics of the respondents, including questions about their gender, age, place of residence, education, social status and income. Depending on the distribution variants of the two-layer variable, the average percentage error of the sample of 341 surveys was 7% (with a 95% confidence level) (Babbie 1995).

Statistical analysis

For statistical analysis of survey data, the classification and regression tree method (CART) was applied. It is a method enabling us to construct models for solving regression problems, where the dependent variable is a quantitative characteristic, as well as classification problems, where the dependent variable is a qualitative characteristic. The classic CART algorithm was propagated by Breiman et al. (1984) and Ripley (1996). In the study, regarding the length of the visit to the "NT" NR and the amount of costs related to the arrival and stay in the reserve were subjected to statistical analysis using the CART method.

Results

The social characteristics of respondents are presented in Table 1.

Based on the statistical analysis carried out using the CART method, we may conclude that the strongest influence on the question regarding duration of the respondents' stay in the "NT" NR the distance from the reserve to the place of residence of the respondent (Figure 2). If the distance was less than 56 km, the second most important influence on the length of stay had the fact whether the respondents were accommodated at the reserve. There were 175 respondents who did not stay overnight in this area, and the average value of this answer was 1.2. There were 15 tourists who declared accommodation in the reserve, and the average value of this was 3.3. If the respondents came from a distance greater than 56 km, the second most important influence on the length of stay had the voivodeship from which they came. Analysis of the costs of a visit to this area indicates that the distance to the respondents' place of residence is the key factor in the variability of costs. There were 82 respondents whose place of residence was 142 km or more away from the reserve, and the average number of this answer was 70. However, in the case of responses quoting a distance less than 142 km, the second

most important influence on the variability of costs had fact whether the respondents had visited the reserve before and how many times done this (Figure 3).

The analysis of how many times the respondents visited the reserve in the past showed that for 10% of them it was their first visit to this area (Figure 4). The remaining respondents had a history of visits to the reserve in the past.

Table 1. Social structure of respondents

	Woman (%)	Man (%)	
Age (years)	16–25	17	13
	26–35	16	15
	36–45	27	27
	46–55	19	23
	56–65	14	15
	over 65	7	8
Place of residence	village	49	42
	cities up to 50,000 residents	25	29
	cities 50–100 thousand residents	8	8
	city over 100,000 residents	18	22
Education	basic	9	6
	basic vocational	9	15
	secondary	40	40
	higher	42	39
Profession	white collar worker	50	50
	workman	26	42
	unemployed	8	2
	student/pupil	20	18
	retired/pensioner	20	17
	other	2	1
Income per person (PLN)	do 500	4	3
	501–1,000	14	13
	1,001–1,500	14	13
	1,501–2,000	8	6
	2,001 3,000	5	6
	over 3,000	3	5
no data	2	6	

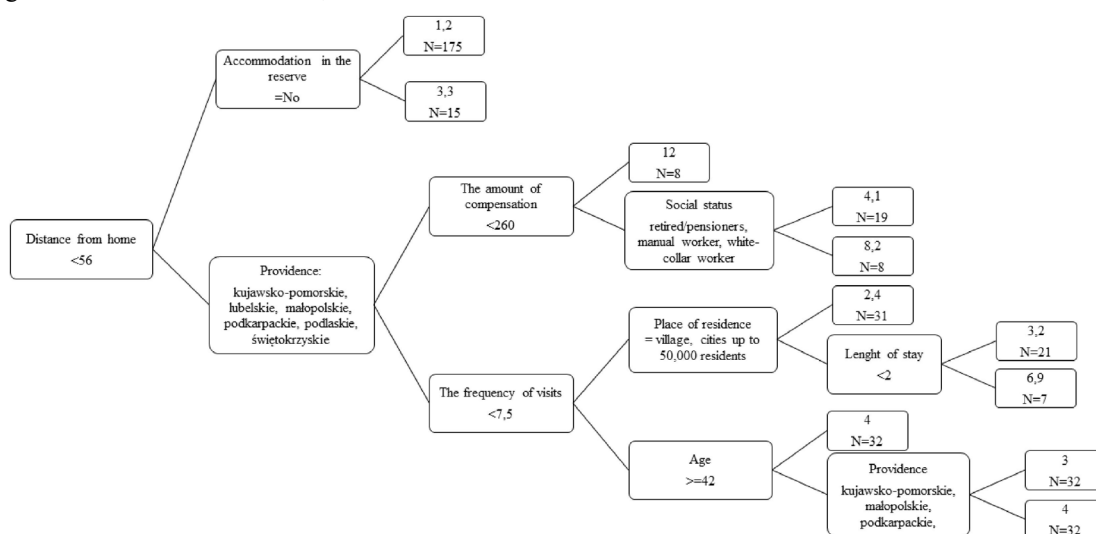


Figure 2. Length of stay in the "Nad Tanwiaz" nature reserve – statistical analysis

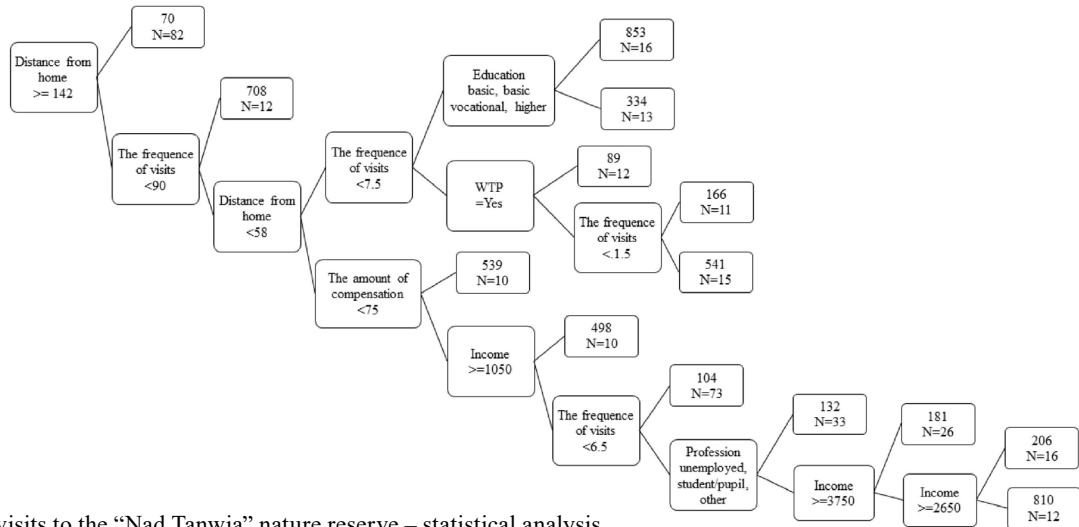


Figure 3. Costs of visits to the “Nad Tanwiał” nature reserve – statistical analysis

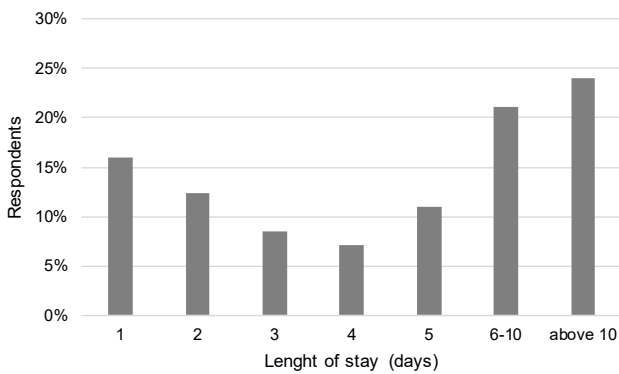


Figure 4. The frequency of visits to the “Nad Tanwiał” nature reserve

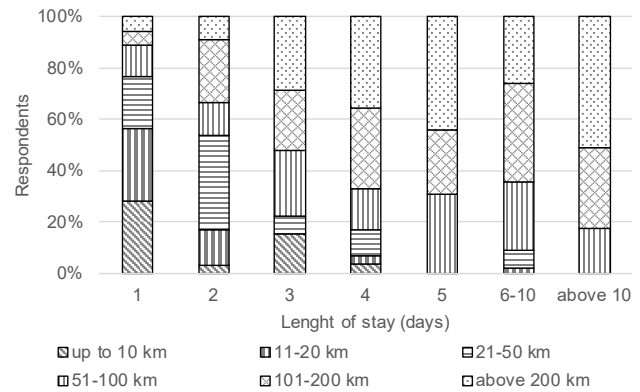


Figure 5. Percentage of visits due to the distance to the place of residence

24% had visited the “NT” NR more than 10 times, and the least numerous groups of tourists were those who had visited the reserve just 4 times. In turn, on the basis of answers given by respondents about the distance from their place of residence to the reserve (Figure 1), the responses were divided into 6 groups: up to 10 km, from 11 to 20 km, from 21 to 50 km, from 51 to 100 km, from 101 to 200 km, and above 200 km (Figure 5). The closer they lived to this area, the shorter their stay and vice versa. Most of the respondents did not stay in the immediate vicinity of the “NT” NR. This was the case with all those who lived within 10 km of the reserve. In the group of people who declared accommodation in the immediate vicinity of the reserve, 38% stayed overnight in agritourism farms, and those were people whose distance to the reserve ranged between 101 and 200 km. A few respondents stayed overnight in agritourism farms and under a tent. The respondents were also asked about their transportation (means of transport they used to get) to the research area. In the questionnaire form, they could select several answers; accordingly, the total of individual response options exceeded 100%. Most respondents travelled to the reserve by car, and the further the distance from their place of residence, the higher the percentage of this means of transport.

Demand for visits to the “Nad Tanwiał” nature reserve

Respondents reported demand for 14 types of visits to the reserve depending on their duration. The individual lengths of stay were considered as separate tourism products provided by the recreational function of the “NT” NR. Due to their nature, all types of selected visits were divided into 7 groups, i.e. 1-day, 2-day, 3-day, 4-day, 5-day, 6–10-day visits and visits exceeding 10 days. More than half of the respondents (54%) came to the research area only for 1 day. A graphic illustration of the compensated demand curve, characterising the demand for the tourist function of the reserve (Figure 6).

Benefits from recreation in the “Nad Tanwiał” nature reserve

The value of benefits gained by tourists visiting the “NT” NR was defined as gross benefits and consumer surplus (net benefits). The total value of the gross benefits amounted to PLN 364,625, and per capita this figure amounted to PLN 1,069 (Table 2). The gross value of non-market benefits for a group of tourists visiting the reserve within the year (110 thousand people) amounted to PLN 117,620,968. The value of the consumer surplus,

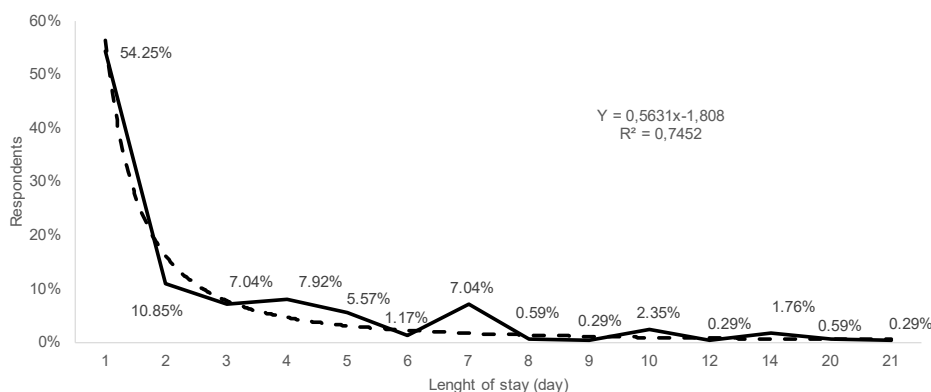


Figure 6. Declared duration (number of days) for one visit – real (-) and smoothed (- -) demand curve

Table 2. Gross value of non-market benefits accruing to interviewed visitors

Visit duration (days)	Visitors (%)	Number of visitors declaring different durations of visits	Gross benefit (PLN/person)	Total value of gross benefits (PLN)
1	54	185	665	123,025
2	11	37	280	10,360
3	7	24	1,000	24,000
4	8	27	2,000	54,000
5	6	19	2,000	38,000
6–10	11	39	2,160	84,240
above 10	3	10	3,100	31,000
Total or mean	100	341	1,069	364,625

which is a measure of the recreational value of an area valuable in terms of nature, was PLN 336,280, and PLN 986 per capita (Table 3). Thus, the net benefits of individuals visiting the reserve during the year amounted to PLN 108,477,532.

Costs of visits incurred by tourists visiting the “Nad Tanwiaz” nature reserve

The list of general costs of visits is presented in Table 4 and broken down into groups of visits in Table 5. The comparison of the costs of travel to the area of the “NT” NR, including maximum, actual and compensated costs within the allocated visit lengths, is presented in Table 6. The amount of compensated costs per single day of stay in this area, depending on the duration of the visit, was calculated based on the regression equation with the following formula: $K_j = 134.048x^{-66.391}$.

The list of percentage values of costs incurred by tourists for their stay in the “NT” NR, by duration of the stay, is shown in Figure 7. The costs were divided into three categories, i.e. costs related to travel, accommodation and other costs. The longer the visit, the higher the share of costs related to accommodation, from 27% in the case of a 2-day visit to 54% in the group of visits more than 10 days. The amount of other expenses related to resting at the reserve is similar for all types of visits and amounts to approx. 30% of total costs.

Table 3. Consumer surplus value (net benefit) accruing to interviewed visitors

Visit duration (days)	Gross benefit (PLN/person)	Cost of visit “Shadow price” (PLN/person)	Consumer surplus (PLN/person)	Number of visitors declaring different durations of visits	Total value of consumer surplus (PLN)
1	665	68	597	185	110,508
2	280	101	179	37	6,628
3	1,000	112	888	24	21,314
4	2,000	117	1,883	27	50,829
5	2,000	121	1,879	19	35,705
6–10	2,160	69	2,091	39	81,537
above 10	3,100	124	2,976	10	29,759
Total or mean	1,069	83	986	341	336,280

Table 4. A comparison of costs of the visits to the “NT” NR – general data (PLN)

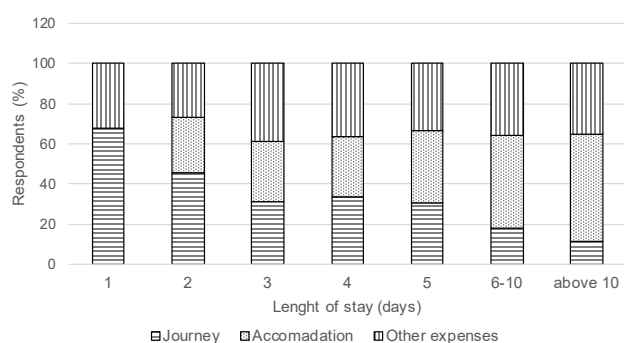
	Total cost of the visit		
	Travel	Accommodation	Other expenses
All	21,758	33,095	28,698
Average	99	309	239
Modal	20	300	200
Max	500	2,000	1,400
Min	3	10	3

Table 5. A value of costs of the visiting groups (PLN)

Visit duration (days)	Average	Max	Min	Stand. error
1	62.85	665	3	91.35
2	128.24	280	20	82.13
3	356.67	1,000	50	261.21
4	560.20	2,000	100	404.86
5	703.89	2,000	250	415.24
6–10	919.17	2,160	100	580.22
above 10	2,078.75	3,100	1080	694.81

Table 6. A compilation of mean travel costs: real and smoothed ones

Visit duration (days)	Maximum cost (PLN)	Real cost (PLN)		Smoothened cost per day of stay (PLN)
		total	per day	
1	665	42.02	42.02	67.66
2	280	117.84	58.92	100.85
3	1,000	312.08	104.03	111.92
4	2,000	518.70	129.68	117.45
5	2,000	630.00	126.00	120.77
6–10	2,160	674.62	113.90	122.84
above 10	3,100	1,663.00	105.92	129.82
Mean	1,069,28	259.64	69.93	89.41

**Figure 7.** The cost of the visits to the "Nad Tanwią" nature reserve

Discussion and conclusions

The need to evaluate the leisure function of forest areas, including the protected areas, stems from the fact that the population of many regions or countries is spending more and more time and money on resting in the forests (Sikora and Wartecka-Ważyńska 2017). In many countries, much of the population now lives in the cities, where the air quality is not satisfactory, with the lack of space for active leisure, and the health of the population is deteriorating (Pieńkos and Kozikowska 2007). Therefore, forest areas, including nature reserves, are potential resting places (Gadaud and Rambonilaza 2010). Special care should be taken here because their leading function is to protect and support science (Radecki 2011). In compliance with the provisions of the Act on Nature Conservation (ISAP 2004), these areas are defined as the areas preserved in their natural or little changed state, ecosystems, refuges and natural habitats, as well as plant, animal and fungus habitats and inanimate nature's creations and components, distinguished by specific natural, scientific, cultural or landscape values. There are numerous tourist attractions in nature reserves, which is why they are often visited by tourists (Radecki 2011).

Scientific research related to the determination of non-market value of goods and services of forest ecosystems, including the protected areas has been carried out in the forestry sector for many years, which is evidenced by numerous research studies (Willis and Garrod 1990,

Christie et al. 2004, de Groot et al. 2010, Czajkowski et al. 2015, Borzykowski et al. 2017, Borzykowski 2018). The economic valuation of the leisure function of the forests and areas of natural value using the TCM in the European countries was also presented in the form of a meta-analysis (Zandersen and Tol 2009, De Salvo and Signorello 2015). Research in this area was also conducted in Polish forests (Płotkowski 1996, Mandziuk 2014, Kronenberg and Giergiczyński 2014). The benefits of leisure in the "NT" NR area were determined as a result of developing a travel cost model for this area. The results obtained are lower than in other facilities of this type in Poland. The CS value for the "NT" NR was 986 PLN/person, and the value of gross benefits was 1,069 PLN/person, while in the "Łasy Janowskie" Forest Promotion Complex ("LJ" FPC) it was 1,439 PLN/person/year (CS) and 1,620 PLN/person/year (gross benefits) (Mandziuk 2014) and for the Białowieża Forest area (BF) it was 1,455 PLN/person/year (CS) and 1,646 PLN/person/year, respectively (Płotkowski 1996). The total recreational value calculated using the TCM results from the number of tourists visiting a given tourist area during the year. For the area of the "NT" NR it amounted to 109 million PLN (net benefits) and 118 million PLN (gross benefits). These results are like the BF recreational value, which amounted to PLN 94 million (CS) and PLN 107 million (gross benefits) (Płotkowski 1996). On the other hand, they differ significantly from the values of other areas valued in terms of leisure in Poland, among which the lowest total value was determined for the stork village in Kłopot, which is a local tourist attraction in the south-western part of Poland, PLN 1.71 million (Kronenberg and Giergiczyński 2014), and also for the "LJ" FPC area, PLN 29 million (CS) and PLN 32 million (gross benefits) (Mandziuk 2014). When comparing the value of the consumer surplus and the value of the gross benefits, as well as the cost of visits, for the purpose of research originating from Poland, the inflation rate was applied (Wikipedia: The Free Encyclopedia 2019).

The great diversity of the leisure value of forest areas can also be seen in European research. Blaine et al. (2015) analyzed the causes of significant differences in the CS value determined with the TCM model. They stated that the creation of demand for leisure is mainly due to the size of the respondents' income and their travel costs. The CS values analyzed by them ranged from USD 76.75 to USD 558.66. This is also confirmed by other studies on the leisure value of areas with natural value in Europe, the CS of which ranged from EUR 0.66 (Glück and Kuen 1977) to EUR 111.98 (Luttman and Schröder 1995, Zandersen and Toll 2009). This is also confirmed by research on the value of the CS in Italy, which ranged from 0.9 EUR/day in the Dolomiti Bellunesi National Park to 39.84 EUR/day in Abetina Reale (Gatto 1998) and the Madonna Park (Signorello et al. 2009, De Salvo and Signorello 2015). This trend can also be seen in the UK, where the CS of the Dartmoor National Park was set

between GBP 63 and GBP 253.3 (Liston-Heyes and Heyes 1999), and in Germany, where Bertram and Larondelle (2017) set the average value of the CS for leisure in the urban forests of Berlin (Grünwald) at EUR 14.95. For comparison, the non-market value of the Centennial Park in Australia (determined through the use of the ITCM) was USD 33 million (Lockwood and Tracy 1995).

Apart from the CS, the measure of recreational value of a site visited by tourists is the average cost of travel to that site. Based on the analyses of data obtained from the literature sources on this issue, tourists spend different amounts of money on leisure in forest areas. The price of a visit to the "NT" NR was the lowest among the analyzed studies in Poland and amounted to PLN 260, while the average cost of a trip to the BF was PLN 311 (Płotkowski 1996) and the average cost of a visit to the "LJ" FPC was PLN 389 (Mandziuk 2014). The cost of visiting areas with natural value for leisure purposes in Europe between 1997 and 2001 also varied greatly, ranging from GBP 0.66 to GBP 4.52 (Zandersen and Tol 2009).

The calculation of the economic value of areas attractive for tourists is a big challenge, due to the lack of complete data on the number of tourists visiting the area during the year. For the nature reserve, the annual volume of tourist traffic, based on the passage meter, was estimated at 110 thousand persons, so the total leisure value of the "NT" NR amounted to PLN 108 million (CS) and PLN 118 million (gross benefits). The very fact of valuing all the benefits provided by forests is very important from a practical point of view, as it allows choosing the best line of forest management.

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