VALUATION OF ECOSYSTEM NON-MARKET SERVICES: RECREATIONAL SERVICE IN ESTONIA

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Abstract

Determining the value of ecosystem services and developing the corresponding statistical standard is an important prerequisite for sustainable resource use from the point of view of society. The purpose of this research is to find out the financial equivalent of the recreational value of Estonian ecosystems, to determine the share of different ecosystems in the provision of recreation services and to find out the willingness of Estonian residents to pay for the infrastructure needed to use the recreation service. The work uses an extended contingent valuation study as a method. The results of the survey show that the average Estonian resident makes 17 nature trips a year for the purpose of recreation. Only 4.3 of these trips are with overnight stays. The time in contact with nature per year is 102 hours per inhabitant on average, the financial equivalent of which is 714 euros per year using the time value method. In total, the annual volume of recreation services of Estonian ecosystems using the time value method is 762 million euros, of which almost two-thirds can be attributed to forest and seaside ecosystems. The willingness to pay of the adult population of Estonia for the infrastructure supporting the use of recreation services is approximately 25 million euros per year, which exceeds the actual investments made for this purpose per year. In addition, the article discusses the suitability of data obtained by the contingent valuation method as a basis for statistics on the monetary value of non-market ecosystem services.

Keywords: value of ecosystem services, recreation, recreational ecosystem service, contingent valuation, statistics of ecosystem services.

JEL classification codes: Q5; Q51; Q56; Q57

Introduction

Nature, relatively little affected by human activity, is a valuable and scarce resource in the European Union. Thanks to its sparse population and the specifics of its socio-economic development, Estonia is one of the leading countries in the EU in terms of the natural state of the environment per inhabitant. Resting in nature and hiking are an integral part of life for many people. The possibilities for movement in nature are very diverse. Hiking and health trails can be found everywhere in Estonia, they pass through a wide variety of natural ecosystems and are equipped with information boards, campsites and campfires. Everyone can choose a hiking or health trail according to their abilities and preferences. In addition, one can also move around in nature by bicycle and

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even ride a horse. In order to spend time in nature, one does not necessarily need to go to a hiking trail. People can also walk in park forests in urban area, mushrooms and berries can be picked everywhere in public forests, even outside roads and hiking trails. Just as the existence of ecosystems is an essential prerequisite for movement and rest in nature (nature tourism), on the other hand, rest and hiking in nature is also an indicator that can be used to value ecosystems that provide recreation services and also enables monetary evaluation of ecosystems recreation services. Unfortunately, the recreational services of ecosystems are underestimated compared to several other services (such as providing habitats for biological species), which is also reflected in practice. The following example illustrates this.

An example can be the violation of ecosystem services of rivers as a result of the construction of hydro power plants. When the river is obstructed with a dam, the migration routes of migratory fish are melted, destroying the habitat services provided by the river ecosystem. In addition to this, welfare services (such as recreational and cultural services) are also lost due to the flooding of rapids and the drainage of waterfalls, resulting in a decrease in the welfare of visitors and potential visitors. While river habitat services are protected by both European directives and national nature conservation laws, recreational and cultural services lack equivalent protection. In this way, the closing of the river can be prevented with the argument of preserving fish habitats and migration routes, but not with recreational and aesthetic arguments that affect people's welfare. Therefore, the welfare of individuals is currently less protected compared to the welfare of other species (fish in this example) and the impact of construction development scenarios and activities on human welfare is neglected. Similar to the protection of habitat values, measures should also be planned to protect non-market recreational and cultural services and thus people's welfare. Of course, this should also be reflected in the statistics of the value of ecosystem's recreational and cultural services.

Economic accounting and statistics of ecosystem services is a new direction for which unequivocal and mandatory standards have not been established. In recent years, much attention has been paid to the development of standards for ecosystem services statistics. The System of Environmental Economic Accounting (SEEA) has created a new standard SEEA Ecosystem Accounting (SEEA EA) (https://seea.un.org/ecosystem-accounting). As a cooperation partner, the Estonian Statistical Office plays an important role in the development of the new standard (e.g. Statistics Estonia, 2020). The author has discussed the institutional side of developing ecosystem services statistics standards in previous articles (Ehrlich, Ü., 2021; Ehrlich, Ü., 2022).

The aim of the current study was to find out the volume and value of the recreation service of Estonian ecosystems. In addition to the total volume of the recreation service, the goal was to determine the share of different ecosystems (forest, swamp, grassland, coast) in the provision of the recreation service. Given that the official nature tourism statistics only consider overnight trips, the aim was to compare the total volume and value of ecosystem recreation service consumption with the service consumption and its volume and value during only overnight trips.
In addition, the goal was to find out people's demand for infrastructure related to the consumption of recreation services using the contingent valuation method and to

compare the determined willingness to pay for nature tourism infrastructure with actual investments in infrastructure.

The author's research hypothesis was that the actual consumption of ecosystem recreation services (ie the volume of nature tourism) is much higher than the consumption of recreation services that took place only during overnight trips. Another main research hypothesis was that the demand for infrastructure related to nature tourism exceeds the actual investments made for it.

The first chapter of the article gives an overview of the recreation service of ecosystems and the possibilities of its measurement. The second chapter gives an overview of the methodology used in the work. In the part dealing with the results of the research, the total volume of recreation service consumption and the volume of service consumption that occurred during only overnight trips are analyzed separately and compared with each other. The willingness-to-pay section analyzes the identified demand for nature tourism infrastructure and compares it with actual investments. The suitability of the contingent valuation method in the financial evaluation of ecosystem services is discussed separately. The article ends with a summary.

1. Recreational service of ecosystems

The question of how to define nature tourism and therefore recreational service of ecosystems is not only important from an academic point of view, but also from the point of view of economic accounting and statistics. After all, it depends on one way or another definition of nature tourism, which part of the activities of which institutions and people is taken into account when accounting for nature tourism and recreational service. The problem is more complicated than it first appears.

The United Nations World Tourism Organization (UNWTO) defines nature tourism as "a form of tourism whose main motivation is the observation and appreciation of nature". This definition, which is largely non-technocratic and based on the cognitive process of the individual, foregrounds the relationship between man and nature and the value arising from it, which would require the accounting and statistics reflecting nature tourism to also be based on the (largely non-market) value arising from the relationship between man and nature. Several Scandinavian authors (e.g. Fredman, P., Tyrväinen, L. ,2010; Fredman, P. et al, 2012) do not give a single definition of nature tourism, they characterize nature tourism with the help of four thematic features (conditions), the presence of which constitutes nature tourism: 1) visitors in the natural environment, 2) (visitor) experiences resulting from the natural environment, 3) participation in activities, 4) normative aspects related to sustainable development and consideration of local specificities. This work is also based on the broad concept of nature tourism. In the survey that was the basis of the research, the consumers of ecosystem recreation services were not rigidly told what criteria their contact with ecosystems during their recreation must meet.

In the case of services, there is always a service provider and a service consumer. Thus, from the point of view of the economics, services can be studied both from the point of

view of the service provider and the service consumer. This also applies to the ecosystem recreation service. In the case of approach to the provision of recreation services, it is possible to study the possibilities of recreation in nature and the costs incurred to create the corresponding infrastructure, to study the economic data of tourism companies and other such information on which data is already collected in statistics. The advantage of such an approach is the availability of economic data (statistics) and the absence of the need to make additional expenses in finding the monetary equivalent of the ecosystem recreation service. A service consumer base approach to the service requires counting or interviewing users of recreational services, which often requires extensive specialized research. The Estonian Statistics project (Statistics Estonia, 2020) has studied the ecosystem recreation services using the time value method, using visitors counting data of health trails and hiking trails.

The recreational service of ecosystem expresses through direct human contact with nature, for example, when a person crosses a health trail. For many urban people, spending leisure time in the nature is often the only way to stay in direct contact with nature. Therefore, recreational ecosystem service is in many cases the only ecosystem service which gives people an immediate idea of ecosystems and is therefore of great importance. As a rule, people do not pay for staying in nature for recreational purposes. This causes difficulties in estimating the monetary equivalent of the value of the service. In the economic context, the recreational service value is non-market by nature and therefore non-market valuation methods should be applied. The choice of a suitable method will depend largely on the availability of data related to the recreational service.

The most widely used method for the economic evaluation of ecosystem recreational service is the travel cost method (e.g. Champ et al. 2003), which is based on the individual expenditures of the recreational service users. The limiting factor of using the travel cost method is that the consistent implementation of the method requires a large number of users of the recreational services to be interviewed.

Another possible approach to estimate the ecosystem service value of a recreational service is time use based approach. This approach is based on the assessment of the monetary value of the time involved in using the service and assessing the monetary value of time for ecosystem service. The use of the time-based method requires data on the number of users of the recreational service and the time spent on using it. Both these conditions were fulfilled for the current study and the used time value based method was therefore applicable. A third option for estimating the economic value of a recreational service is a contingent valuation method which is based on a stated preferences.

For this study, a representative sample of service consumers has been interviewed, which enables an assessment of the volume and value of ecosystem recreation services from the service consumers' point of view.

2. Contingent valuation method in the evaluation of ecosystem services.

2.1 Contingent valuation method in the SEEA EA framework

Many ecosystem services they contribute to the increase in the well-being of individuals without their use being associated with an actual (described according to the rules of economic accounting) monetary turnover for the service. In economics, such good and services, that do not have a price on the market are called non-market benefits. Thus, many public goods are non-market. Among ecosystem services, regulating services and welfare services correspond to the characteristics of public goods.

If in assessing the monetary value of an ecosystem provisioning service, the main question is what part of the market price of an ecosystem service (for example, agricultural production) should be attributed to the ecosystem and what should be its methodological basis, then in the case of non-market services, the problem is how to quantify and evaluate the value of the service at all and on the basis of which data.

In the methodological handbook "System of Environmental-Economic Accounting—Ecosystem Accounting" (hereinafter CEEA EA), two groups of methods are referred to in accounting for non-market services: revealed preferences and stated preferences. According to CEEA EA (p 200) "Stated preference methods do not utilize information on the behaviour of people in existing markets but rather use information from questionnaires to elicit likely responses of people by asking them to state their preferences in hypothetical situations". At the same time, it is recognized that „*Stated preference methods do not directly reveal exchange values and hence require adjustment for use in accounting*" (United Nations et al. 2021).

CEEA EA (p. 200) places two broad types under stated preference methods: contingent valuation and choice experiment. The CEEA EA defines the contingent valuation method (hereinafter CV) as "a survey-based stated preference technique that elicits people's behaviour in constructed markets. In a contingent valuation questionnaire, a hypothetical market is described where the good in question can be traded. This contingent market defines the good itself, the institutional context in which it would be provided, and the way it would be financed. Respondents are asked about their willingness to pay for, or willingness to accept, a hypothetical change in the level of provision of the good, usually by asking them if they would accept a particular scenario. Respondents are assumed to behave as though they were in a real market".

Although the methodological material of the CEEA EA referred to above states that „the information obtained from contingent valuation methods and choice experiments is the willingness to pay (WTP) for an ecosystem service or willingness to accept (WTA) payment for its loss. This information is then used to assess changes in consumer and producer surplus and, as such, does not provide an estimate of the value required for accounting purposes". However, SEEA EA argues that "by combining information on WTP or WTA of a range of recipients of the service, it is possible to derive a demand function for the ecosystem service and such a demand function may subsequently be used to derive an exchange value using an SEV approach". Therefore, the use of the

contingent valuation method to find the monetary equivalent of non-market ecosystem service values is also according to the SEEA EA guidance report fully acceptable if the methodology is followed and the limitations related to the method are taken into account.

2.2 Applications of the contingent valuation method

Both internationally and in Estonia, the use of the contingent valuation method has long-term traditions. The first application of the technique was in 1963 when Davis (Davis 1963) tried to estimate the value hunters and tourists placed on a wilderness area. In the mid-1970s, the contingent valuation method started to spread rapidly. Since then the method has grown increasingly more popular and is widely used in all advanced democracies, being a good instrument for adopting democratic decisions and allowing to decide on the application of different scenarios of natural resource use, making non-market values one-dimensional with market values. Comprehensive accounts of the method may be found in Mitchell and Carson (Mitchell et al., 1989), Hanley and Spash (Hanley, et al., 1993) and Bateman and Willis (Bateman, et al., eds., 1999).

When applied methodologically correctly, the result obtained by the CV method (for example, the financial value of ES), unlike the methods based on market prices and revealed preferences methods, is directly related to the object under study and shows the increase in welfare associated with it, which is a measure of value. The CV also takes into account the consumer's price reserve, which is a problem for indirect methods based on belonging to the revealed preferences methodological group (e.g. travel costs).

In the assessment of the value of ecosystem services carried out in Estonia, the contingent valuation method was applied to find the monetary equivalent of different services of different ecosystems. The monetary equivalent of non-market services of grassland, wetland, forest and urban ecosystem services was determined as a result of several CV studies (Ehrlich, 2021; Ehrlich, 2022). Although original research was not provided for in the grant of Statistics Estonia, cooperation with environmental economics researchers of Tallinn University of Technology made it possible to carry out original research and use the results in reports (e.g. Eurostat Grants “Development of the land account and valuation of ecosystem services regarding grassland ecosystem” 831254-2018-EE-ECOSYSTEMS).

It provided valuable new information about the use of CV in the financial evaluation of ecosystem services, highlighted the strengths and weaknesses of the method, and made it possible to make practical recommendations for the future use of CV. Confidence in using CV gave us also the SEEA EA guidance material cited above, where CV was recommended as one of the Ecosystem servicesS evaluation methods.
A characteristic methodological feature of these studies was that within the framework of one survey, the authors wanted to find out the value of several services of the ecosystem under study. For this purpose, in addition to declaring willingness to pay, the respondents were asked to rank the services of the studied ecosystem according to their subjective preference. According to the subjective importance of the services, the total willingness to pay for the services of the ecosystem under study was divided between individual services.

The studies conducted in Estonia allow us to conclude that it is not methodologically practical to try to cover all welfare services of one ecosystem with one CV study. It is difficult for many respondents to imagine many ecosystem services using a simulated market scenario, which ultimately leads to an easy underestimation of individual ecosystem services. Methodologically, it would be better to focus on one service in one CV study, as was done for the ecosystem recreational service value evaluated in Eurostat Grant-101022852-2020-EE-ENVACC.

2.3 Disadvantages and advantages of contingent valuation method

The strength of the method is the fact that it directly measures the increase in individual welfare due to the ecosystem service, making it possible to measure the values of such services, the use of which does not require direct physical contact with the ecosystem. Also, CV's strong point is the consideration of the number of consumers of the service when measuring the value of ecosystem welfare services. The method is based on the individual`s welfare changes (increase) and the value of the ecosystem service depends on the number of consumers of the service. Also, the use of the CV allows taking into account the subordination of the value of ecosystem services to the principle of marginal value which is often a disadvantage when using benefit transfer.

The disadvantage of CV is that the monetary equivalent of the ES value obtained by the contingent valuation method has no connection with the actual (i.e. „accounted“) turnover. Therefore, it is difficult to place the monetary equivalent of the service obtained using CVM in the existing system of accounting and statistics, which is why the corresponding values are also called non-SNA values. The result obtained with the contingent valuation method is sensitive to the details of the applied methodology. Therefore, in order to use the CV to find the values of ES services and use it in statistics, a standard must be developed that the CV studies on which the data are based must meet. also, a serious disadvantage of the method is the need for large-scale special studies from the point of view of statistics. Given that a methodologically serious study requires a sample of 1,000 individuals and the fact that an independent study should be done for each service, the use of CV as a basis for ES value statistics is a real challenge.

The suitability of the CV method for assessing the value of ecosystem services depends on what we actually want to evaluate. If the object of evaluation is the increase in welfare of individuals due to the consumption of ecosystem services, CV is a very suitable method for identifying the value of ecosystem welfare services. However, if the purpose of evaluation is to identify the share of the ecosystem in actual (described according to the rules of financial accounting) turnover, then this contingent valuation is not measured and identified. But regardless of the definition of the value of ecosystem services, CV remains indispensable for quantifying the values of welfare services that do not require physical contact with the ecosystem and therefore can not be measured using time value approach (for example, existence value and future value).

3. Methodology

The methodology used in the work is based on the requirements established for the contingent valuation methodology, which are thoroughly discussed by Mitchell and Carson (Mitchell, R., Carson, R. T., 2009). The method has been used to determine the financial equivalent of various non-market goods and services for more than half a century, and it has been widely applied in the evaluation of non-market ecosystem services and other non-market goods in Estonia (Nõmmann, et al., 2021; Ehrlich, Ü., 2021; Ehrlich, Ü. , 2022) as well as in other parts of the world (e.g. Yoo, S.-H., Kwak, S-Y., 2009; Armbrecht, J., 2014).

The study to find out the recreational behaviour of the Estonian population and monetary value of recreational service of ecosystems was conducted in 2022. The questionnaire was longer and more comprehensive than the usual CVM questionnaire. The purpose of the questionnaire was to obtain information about the time people spend in nature, the proportion of contact with different ecosystems and the annual willingness to pay for the the results were extrapolated to the adult population of Estonia. A total of 992 properly completed questionnaires were received. The survey was representative of basic sociometric indicators. All questionnaires were conducted in the form of personal contact and completed on paper.

Considering the goals set for the research, an extended contingent valuation study was conducted. The study differs from classic contingent valuation studies in that, while typically other questions asked in addition to the willingness to pay question have less weight from the study's point of view (so-called secondary questions), in this study, the additional questions had the same weight as the willingness to pay question. The econometrics software E-Views was used for data processing.

The main questions in the questionnaire were as follows:
1. How many visits/trips to spend time in nature do you make on average in one year?
2. How long does one of your visits/trips with the purpose of spending time in nature last on average?
3. If you use a means of transport, how many kilometers do you travel on average for recreation in nature?
4. Think about your visits to nature last year. Which ecosystems do you come across while häving recreation in nature? Please tick all ecosystems from the list below that you have come across while out in nature.
5. Please try to estimate how much you have come into contact with the ecosystems you mentioned in the previous question while being in nature. Please indicate the share of these ecosystems in percentage so that the total is 100% (for example, forest 60%, swamp and bog 25%, other 15%).
6. How much would you be willing to pay per year for the preservation of opportunities for recreation in nature (hiking trails, signs, campfires, etc.)?

When determining the monetary value f the recreation service of ecosystems, it was important to assign a monetary value to time in this work. Estimations of monetary value of time are most often encountered in cost-benefit analysis of transport projects where

time saving is an important factor (Meunier, Quinet, 2014). Various studies have quantified travel time unit costs and the value of travel time savings, based on analysis of business costs, travelers surveys, and by measuring behavioral responses by travelers faced with a trade-off between time and money. For example, when offered the option of paying extra for a faster trip. However, the use of the monetary value of time is not limited to transport projects, but is also applicable to the evaluation of other time consuming activities and associated values. When evaluating a recreational ecosystem service, using time value, the monetary value of the leisure (non-working) time must be first determined. While the value of working time is generally related to the individual's income, different approaches are used to determine the value of leisure time. There are two approaches for monetary valuation of leisure time, which are either subjective valuation of people to the value of their leisure time or a fixed percentage of the value of working time which is associated with income. For finding the average time value, the used data is from the European Union conducted study within the Heatco project analyzing the practice of cost-benefit analysis in 25 EU countries (Heatco, 2006). The corresponding value for Estonia is 5 €. The calculations in current study are based on the value of Heacto's recommended time plus one-third due to GDP growth during last ten years. Thus, the monetary value of one hour leisure time used in this study is equal to 7 €. A similar approach to the value attributed to time has also been used by the Estonian Statistical Office in the report Grant Agreement 881542— 2019-EE-ECOSYSTEMS (Statistics Estonia, 2019).

4. The total value of the recreational service of Estonian ecosystems

The basic data revealed by the research are presented in Table 1. An adult resident of Estonia makes an average of 17 nature trips with recreational purposes per year. The duration of one trip is 6 hours on average. Thus, a person spends an average of 102 hours in nature (in contact with ecosystems) annually. A separate question was asked about overnight trips. On average, a person makes 4.3 overnight trips a year, spending an average of 2 nights on the trip.

Table 1. The main indicators of the use of the recreation service

Indicator	
The number of recreational nature trips made by one person per year	17
Average duration of one trip	6,0 hours
Time per year spent in nature trip for recreational purposes by one person	102 hours
Average number of overnight recreational trips per person per year	4,3
Average number of nights spent on overnight trips	2

In the questionnaire, the respondents were asked to estimate the proportion of contact with different ecosystems during the time spent in nature for recreational purposes. The individual's average share of contacts with different ecosystems and the hours of contact with different ecosystems per year are shown in Table 2.

Table 2 Recreational contact of one individual with different ecosystems per year

Indicator	Forest	Swamp and marsh	Grass-land	Sea coast	Rivers and lakes	Other	Total
How many % of the time spent in nature does a person come into contact with which ecosystems, **%**	37,6	12,0	6,6	25,8	14,9	2,7	100 %
How many hours in nature do an individual come into contact with different ecosystems, **hours/year**	38,9	12,2	6,7	26,3	15,2	2,7	102 Hour/year
Monetary value of contact time with ecosystems, **1 hour=7EUR**	272,3	85,4	46,9	184,1	106,4	19,9	714 EUR/year

As expected, people were in contact with the forest most of the time, 37.8% of the total. Sea coast followed with 25.8 percent and inland water bodies with 14.9 percent. People were in contact with grassland the least (6.6%). Considering the popularity of hiking trails through swamps and marshes, the small proportion of contacts with swamps and marshes in the total contact with ecosystems is somewhat surprising.

Finding a monetary value for ecosystem recreational service based on time in contact with ecosystems requires first assigning a monetary value to time. In this study, the value assigned to time is 1 hour=7 euros. With such a monetary value of time, it can be said that ecosystems provide the average Estonian adult resident with a recreational service for 714 euros per year.

In Table 3, the recreational service of ecosystems provided to one individual is extrapolated to the adult population of Estonia. Extrapolating the recreational service provided to the average individual to the working-age population of Estonia, we get the result that Estonian ecosystems provide a recreational service for a total of 762 million euros per year. The service is divided between different ecosystems in proportion to the time vacationers (recreational service consumers) were in contact with the respective ecosystem.

Table 3. Recreational contact of Estonian adult population (1072458 individuals) with different ecosystems per year.

Indicator	Forest	Swamp and marsh	Grass-land	Sea coast	Rivers and lakes	Other	Total
How many % of the time spent in nature does an Estonian adult population contact with different ecosystems, **%**	37,6	12,0	6,6	25,8	14,9	2,7	100 %
How many hours in nature do Estonian adult population come into contact with different ecosystems**,** Million hours/year	41,1	13,1	7,2	28,2	16,3	2,9	108,9 Million hour/year
Monetary value of contact time with ecosystems, 1 hour=7EUR, Million EUR	287,6	91,6	50,4	197,7	114,2	20,6	762,1 Million EUR

4.1 Value of recreational service related to overnight trips only

Current chapter focuses on data related to overnight nature tourism trips. (Overnight here means staying in for at least two days where accommodation was used during the trip.) The main data related to overnight trips are given in Table 4. In order to separately treat individuals who made overnight trips, an extract was made from the database containing all the information of the survey, which only contained the data of individuals who made overnight trips. As a second step, trips with overnight stays had to be separated from all trips of the respective individuals.

Table 4. The main data of nature tourism trips with overnight stays

Indicator	
The proportion of persons who made nature trips with an overnight stay compared to all persons who made nature trips.	66%
The number of such trips per year by persons who made trips with an overnight stay, during which no overnight stay was taken.	13 trips
The number of overnight trips per year by persons who made overnight trips	6 trips
Average contact time of one person with nature (ecosystems) during one overnight trip.	8,0 hours
Time per year in contact with nature (ecosystems) during overnight trips by one person.	48 hours

As can be seen from the data (table 14individuals who made overnight trips make 19 trips per year (13 without overnight stays and 6 with overnight stays), which is two trips more than the average of the entire sample. Of these, only 6 trips (32%) are where overnight stays were made during the trip. This clearly shows that the total volume of nature tourism cannot be understood only based on the statistics of overnight stays during the trip. In total, an individual is in contact with nature for an average of 48 hours a year during overnight trips. Compared to the average individual who spends a total of 102 hours a year in contact with nature, this is only 47%. If we take into account that only about 66% of those surveyed have made trips with an overnight stay, the difference between the time spent in contact with nature compared to the total time spent in nature is amplified even more.

Table 5 shows the time spent in contact with nature (ecosystems) by one individual during overnight trips and its financial equivalent, where the monetary value of one hour of contact is 7 euros. The share of contacts with different ecosystems during nature tourism trips with overnight stays does not differ much from the share of contacts made during all nature trips.

Table 5. Recreational contact of one individual with different ecosystems during overnight trips per year.

Indicator/ Ecosystem	Forest	Swamp and marsh (wetland)	Grass-land	Sea coast	Rivers and lakes	Other	Total
Proportion of time in contact with different ecosystems during overnight trips, **%**	36,7	12,0	7,2	25,4	15,9	2,8	100 %
Time per year the individual was in contact with different ecosystems during overnight trips, hour/year	17,6	5,8	3,5	12,2	7,6	1,3	48 Hour/year
Monetary equivalent of contact time with ecosystems, EUR/year. 1 hour=7EUR	123,2	40,6	24,5	85,4	53,2	9,1	336 EUR/year

In relative terms, nature tourists have been in contact with the forest the most (36.7% of the total time in contact with the ecosystem), followed by the sea coast (25.4%) and rivers and lakes (15.9%). The average individual spent 48 hours per year in contact with ecosystems on overnight nature trips. Taking the value of the time spent in contact with nature as 7 euros per hour, the monetary equivalent of the time spent in contact with nature during one individual's overnight trips is 336 euros. This value can be based on extrapolating the value of time spent in contact with ecosystems during overnight nature trips to the adult population of Estonia.

In order to find the monetary equivalent of the value of the time spent in contact with nature (ecosystems) during overnight trips, the results of the sample of this study who made overnight trips must be extrapolated to the adult population of Estonia (1072458 individuals). Overnight trips were made by 66.6% of the population, that is 714257 individuals. Considering that one individual's time in contact with nature during overnight trips is 48 hours a year, we can get the time spent in contact with nature during overnight trips of all individuals who made overnight, which is approximately 34,2 millions hours (34284336 hours).
In total, people spent more than 34 million hours per year in contact with ecosystems during overnight trips annually, the monetary equivalent of which is approximately 240 million euros. According to the time value method, this amount can be transferred to the ecosystems in proportion to the time in contact (which is done in Table 6), thereby deriving the monetary equivalent of the value of individual ecosystems.

Table 6. Contact with different ecosystems during overnight nature trips of the Estonian adult population, time spent in contact with ecosystems and its financial equivalent.

Indicator	Forest	Swamp and marsh	Grass-land	Sea coast	Rivers and lakes	Other	Total
How many % of the time spent in nature does an Estonian adult population contact with different ecosystems, **%**	36,7	12,0	7,2	25,4	15,9	2,8	100 %
How many hours in nature do Estonian adult population come into contact with different ecosystems**,** Million hours/year	12,582	4,114	2,468	8,708	5,451	0,960	34,283 Million hour/year

Monetary equivalent of contact time with ecosystems, Million EUR; 1 hour=7EUR	88,074	28,798	17,276	60,956	38,157	6,720	239,981 Million EUR

Comparing the volume of contacts with ecosystems during overnight nature trips (34,3 Million hours/year) to the total time spent in contact with ecosystems during nature trips by Estonian adults (108,9 Million hours/year), it must be recognized that the time spent in contact with ecosystems during overnight trips only accounts for about 31,5% of the total time people are in contact with ecosystems. This clearly demonstrates that nature tourism statistics based only on overnight trips greatly underestimates the total amount of time spent in contact with nature (ecosystems) during nature tourism and leads to an underestimation of the monetary equivalent of the value of ecosystems using the time value method.

5. The contingent valuation study

The empirical basis of this work is an extended contingent valuation study, which is described in the methodology chapter.In the study, the willingness to pay question was worded: „How much would you be willing to pay per year for the preservation of opportunities for recreation in nature (hiking trails, signs, campfires, etc.)“? The aritmetic distribution of individuaal willingness to pay according to the sociometric indicators of the respondents in presented in Table 7. In the table is also given the relative difference from the total average.

Table 7. The arithmetic distribution of individual WTP and difference from average

		Number of respondents	Average WTP, EUR	Relative difference from the total average, per cent
Gender	Man	455	21.6	108.0
	Woman	537	19.5	97.5
Education	Basic	42	12.5	62.5
	Secondary	511	17.1	85.5
	Higher	439	25.1	125.5
Age	18-24	190	15.5	77.5
	25-34	162	21.5	107.5
	35-44	155	23.6	118.0
	45-54	166	23.4	117.0

	55-64	147	22.5	112.5
	65 and older	172	17.6	88.0
Average net income in month, EUR	Less than 500	115	13.4	67.0
	501-800	184	15.2	76.0
	801-1000	126	19.0	95,0
	1001-1300	191	18.6	93.0
	1301-2000	216	22.6	113.0
	Over 2000	160	32.1	160.6

Based on the arithmetic data, it can be stated that different sociometric indicators affect the williness to pay to a different degree. Gender does not have a very significant effect on willingness to pay, men's willingness to pay was 108 percent and women's willingness to pay 97.5 percent of the average. The willingness to pay is significantly influenced by education, the willingness to pay of individuals with basic education is 62.5 percent of the average, and 125.5 percent of individuals with higher education. Respondents belonging to different age groups also have different willingness to pay, the difference between the willingness to pay of the youngest and the oldest group from the average is worth noting (77.5 and 88.0 percent, respectively). The data show that the willingness to pay increases with increasing income, ranging from 67.0 percent for individuals with the lowest income to 160.6 percent of the average for individuals with the highest income group. This is the largest difference of all sociometric indicators.

OLS regression analysis was performed to find out the significance of the influence of sociometric indicators on willingness to pay. The main results of the analysis are presented in table 8.

Table 8. The dependence of willingness to pay on sociometric indicators, OLS model.

Variable	Coefficient	Std. Error	t-Statistic	Probability
CONSTANT	2.419232	3.048058	0.793696	0.4276
GENDER	-1.276988	1.139282	-1.120871	0.2626
EDUCATION	4.244301	1.089981	3.893924	0.0001
AGE	0.063832	0.308685	0.206786	0.8362
INCOME	2.599690	0.383548	6.778006	0.0000
Summary statistics	Adjusted R-squared=0.096184; Number of observations=922			

From the results of the analysis, it can be concluded that the amount of willingness to pay is most positively correlated with income. There is also a strong positive correlation with education (see table… column probability), the higher the level of education , the higher the amount of willingness to pay. The sociometric factors gender and age did not

reveal a statistically significant effect on the willingness to pay amount. From the results of the analysis, it can be concluded that the willingness to pay for the construction and maintenance of nature tourism infrastructure is positively influenced by both education and income. Although they cannot be considered completely independent indicators, it can still be argued that the demand for infrastructure is positively dependent on both wealth and education level.

5.1 Estimation of total demand

The estimation of the aggregated demand curve for the preservation of opportunities for recreation in nature of Estonian`s adult popilation is based on the actual distribution of willingness to pay amount is represented in Figure 1. The results are- generalised to the proportion of the with positive willingness to pay, which is approximately 920000 individuals. In calculations, 1 respondent corresponds to 1081 inhabitants.

Based on the distribution of WTP (discrete choice), the exponential model is the most appropriate form form for presenting the demand curve is

$$WTP=\alpha e^{-\beta x}$$

Where WTP is the monetary value of willingness to pay, x is the number of people in thousands willing to pay this amount, and a and b are the parameters under estimation.

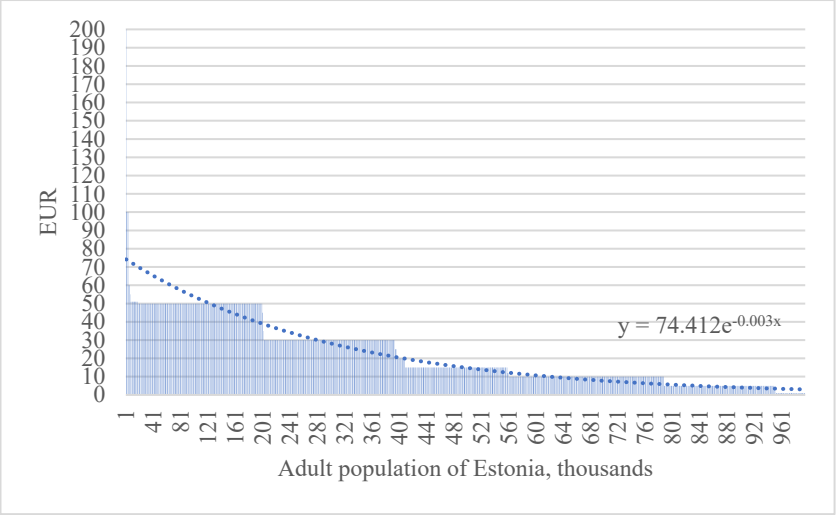

Figure 1. The demand curve of Estonian adult population for the development and preservation of opportunities for recreation in nature.

By integrating the curve the curve one can find the total demand of the adult population for the preservation of opportunities for recreation in nature:

$$CS = \int_{x_1}^{x_2} WTP(x)dx = \int_{x_1}^{x_2} \alpha e^{-\beta x} dx = -\frac{\alpha}{\beta}(e^{-\beta x_2} - e^{-\beta x_1}) \cong \frac{\alpha}{\beta}$$

Where $x_1 = 0$ and x_2 are the number of people with positiive WTP i.e. about 920000
Replacing the value of parameters α and β, the estimated aggregated WTP amount (i.e. consumer surplus CS) is calculated as

CS= α/β = 74,412/0,003 = 24804 thousand EUR/year.

The annual demand (total willingness to pay) for nature tourism infrastructure by Estonian adult population is approximately 24,80 million euros.
The actual identified expenditures on infrastructure supporting recreation were less than 10 million euros. Thus, it can be stated that the willingness to pay for the infrastructure supporting nature tourism (the use of the recreational service of ecosystems) is more than twice higher than the investments made for this purpose in reality.

Conclusion

Valuing ecosystem services and assigning a monetary value to them is of great importance in competitive resource use. Without economic valuation, non-market ecosystem services remain undervalued and there is no problem in their reduction or even destruction by competing development scenarios. Also, without financial valuation of ecosystem services, it is not possible to use their value as an argument in a social cost-benefit analysis. Financial valuation of ecosystem services is also the basis for statistics on these services. Currently, the development of a global ecosystem service statistics standard under the auspices of the United Nations is underway, with the Estonian Statistics Office as an important partner.

The purpose of this work was to find out the volume and value of the recreation service of Estonian ecosystems and the demand of the Estonian population for the infrastructure supporting the consumption of the recreation service. Financial evaluations of the ecosystem recreation service, as a non-market service by nature, are based on the time cost and contingent valuation method. Obtaining the data necessary for the work was based on an extended contingent valuation survey.

As a result of the survey, it was found that on average, an adult resident of Estonia takes 17 nature trips for recreation purposes, of which only 4.3 are trips with an overnight stay. Thus, the first research hypothesis is true, that the actual volume of ecosystem recreation service consumption is much higher than considering only overnight trips. Thus, taking into account only overnight trips as the basis of recreation service statistics gives a very distorted picture of the value of the service. It turned out that an Estonian resident spends an average of 102 hours in nature for recreational purposes, which is 714 euros per year using the time value method. Thus, it can be stated that according to the time value method, the financial equivalent of the recreational service of Estonian Ecosystems is 762 million euros per year. The recreational service of the forest ecosystem accounts for 37.6 percent of the total volume and the sea coast for 25.8

percent. If only overnight trips are taken into account, the value of the recreation service would be 336 euros per year, which is more than twice the total volume of the recreational service.

The results of the contingent valuation study showed that the annual willingness to pay of the Estonian population for infrastructure supporting the consumption of ecosystem recreation services as a public good is 24.7 million euros. On the other hand, the actual identified expenditures on infrastructure supporting recreation were less than 10 million euros. Thus, the second research hypothesis also holds true, that the willingness to pay for the maintenance of the infrastructure supporting the use of ecosystem recreation service exceeds the actual investments made for this purpose.

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