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The economic value of the priceless: revealing the benefits of outdoor recreation in Finland

Doctoral Dissertation

Tuija Lankia

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Abstract

The benefits of outdoor recreation are numerous. By the everyman's right there is an abundant supply of outdoor recreation opportunities in Finland, and outdoor recreation is a popular way for Finns to spend free time. In this thesis the importance of the recreational use of nature in Finland was studied in economic terms.

First, the value of recreational use of nature in Finland was mapped. The number of recreation visits was estimated regionally and by three different area types 1) areas used under everyman's right, 2) state owned recreation and nature conservation areas, and 3) leisure homes. The monetary value of the visits is estimated using the travel cost method. The results of the mapping demonstrated the recreational value of ecosystems in monetary terms. In terms of the total number of visits and the value of visits the results emphasized the relative importance of close-to-home recreation compared to longer nature trips including overnight stays.

Second, the extent of the recreation benefits obtained from visits to leisure homes was estimated with the travel cost method. The results showed how location by a shoreline and an electricity supply of a leisure home increased the recreational value of a visit but presence of harmful algal bloom that prevents water recreation decreased it. The recreation value per visit was estimated to be €170–250 per trip. According to the results, the presence of algae that prevent aquatic recreation decreases the value per trip by 40 per cent, and the lack of a beach reduces it by 45 per cent; electricity supply in a leisure home increases the value by 3–5 per cent.

Third, the effect of hypothetical future changes in water quality on recreational benefits of swimming in Finland was assessed. Based on population level recreation demand survey and combined travel-cost contingent behavior model, the recreational value of swimming in natural waters in Finland in current state were estimated to be 16 euros per visit. A hypothetical decline in water quality to a level at which the water visibility would be less than 1 m and abundant slime would exist decreased the value to 9 euros. A water quality improvement to a level at which the perceived water visibility would be over 2 m and no slime would exist increased the value per trip to 22 euros.

Fourth, individual recreationists' willingness to pay to land owners for management practices that influence recreational quality was investigated. About 10 per cent of the recreationists who participated in the survey were willing to pay to direct the management of their typical recreation site on privately owned lands and about half were willing spend their own time on the practical work of the nature management. The mean willingness to pay was estimated to be 92 euros per year and the mean willingness to spend own time 3.5 days per year.

Key words: Ecosystem services, Outdoor recreation, non-market benefits, valuation, PES, travel cost method, contingent behavior, contingent valuation

Tiivistelmä

Luonnon virkistyskäytöllä on lukuisia tutkimuksissa osoitettuja hyötyjä ihmisen hyvinvoinnille ja se on tärkeä osa suomalaista vapaa-aikaa. Koska suuri osa luonnonvirkistyskäytöstä on maksutonta, sen merkitys ei heijastu markkinahintoihin. Tässä työssä arvioidaan luonnon virkistyskäytön taloudellista arvoa Suomessa markkinattomien hyötyjen arvottamismenetelmillä.

Työn ensimmäisessä osassa arvioidaan luonnon virkistyskäytön laajuutta ja arvoa ja niiden alueellista jakautumista Suomessa. Luonnon virkistyskäytön taloudellinen arvo lasketaan alueellisesti ja kolmelle eri aluetyypille: jokamiehen oikeuksien nojalla käytettävät alueet sisältäen kuntien ja kaupunkien omistamat alueet, valtion omistamat virkistys- ja suojelualueet sekä kesämökit. Tulokset tuovat esiin luonnon virkistyskäytön arvon rahamääräisesti. Tuloksissa korostuu erityisesti kodin lähellä tapahtuvan ulkoilun merkitys.

Työn toisessa osassa tutkitaan kesämökkimatkojen virkistysarvoa tarkemmin. Tutkimuksessa arvioidaan, kuina mökin sijainti rannalla, vedessä virkistäytymisen estävien leväkukintojen esiintyminen ja toisaalta mökin mukavuuksia kuvaava, mutta ympäristökuormaa energian kulutuksen myötä lisäävä mökin sähköistys vaikuttavat arvoon. Tutkimuksessa arvioidaan keskimääräisen kesämökkikäynnin arvoksi noin 170–205 euroa per käynti. Tulosten perusteella virkistäytymisen estävät leväkukinnot laskevat kesämökkikäynnin virkistysarvoa noin 40 prosenttia, rannan puute 45 prosenttia ja mökin sähköistys nostaa arvoa noin 3 prosenttia.

Työn kolmannessa osassa tutkitaan, kuinka muutokset vedenlaadussa vaikuttavat uintikäyntien virkistysarvoon. Tulosten mukaan luonnon vesissä uinnin käyntikohtainen arvo on nykyisissä olosuhteissa 7–16 euroa per käynti. Vedenlaadun huononeminen tasolle, jossa veden näkösyvyys olisi alle metrin ja limaa esiintyisi runsaasti, laskisi tulosten mukaan arvon 5–9 euroon. Vastaavasti vedenlaadun paraneminen tasolle, jolla näkösyvyys olisi yli kaksi metriä, nostaisi arvon 7–22 euroon.

Työn neljännessä osassa selvitetään suomalaisten halukkuutta osallistua virkistysarvokauppaan, jossa yksityisille maanomistajille maksettaisiin toimista, jotka parantaisivat metsän tai muun luontoalueen virkistysarvoa tai vastaavasti sellaisten toimien lykkäämisestä, joiden koetaan heikentävän alueen virkistysarvoa. Työssä selvitetään myös ulkoilijoiden halukkuutta käyttää omaa aikaa virkistysarvoa kohentavien toimenpiteiden käytännön toteuttamiseen. Noin puolet vastaajista oli halukkaita käyttämään omaa aikaansa ja reilu kymmenen prosenttia maksamaan ainakin yhden toimenpiteen toteuttamisesta tai lykkäämisestä. Keskimääräinen maksuhalukkuus vuodessa oli 92 euroa ja ajankäyttöhalukkuus 3,5 päivää vuodessa.

Avainsanat: Luonnon virkistyskäyttö, markkinattomat hyödyt, arvottaminen, maksut ekosysteemipalveluiden tuottamisesta (PES), matkakustannusmenetelmä, ehdollisen käyttäytymisen menetelmä, ehdollinen arvottaminen

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Helsinki, 28th of January 2020
Tuija Lankia

List of abbreviations

CB	Contingent behavior
CBM	Contingent behavior method
CE	Choice experiment
CICES	Common international classification of ecosystem services
CS	Consumer surplus
CV	Hicksian compensating variation
CVM	Contingent valuation method
EU	European Union
EV	Hicksian equivalent variation
HPM	Hedonic pricing method
LCM	Latent class model
LVVI	National outdoor recreation demand inventory
PES	Payment for ecosystem services
RP	Revealed preferences
RUM	Random utility model
SP	Stated preferences
TC	Travel cost
TCM	Travel cost method
WTA	Willingness to accept
WTP	Willingness to pay

List of original publications

This thesis is based on the following original studies

I	Lankia, T., Kopperoinen, L., Pouta, E., and Neuvonen, M. 2015. Valuing recreational ecosystem service flow in Finland. Journal of Outdoor Recreation and Tourism 19, 14–28.
II	Huhtala, A. and Lankia, T. 2012. Valuation of trips to second homes: do environmental attributes matter? Journal of Environmental Planning and Management 55, 733–752.
III	Lankia, T., Neuvonen, M., and Pouta, E. 2019. Effects of water quality changes on the recreation benefits of swimming in Finland: Combined travel cost and contingent behavior model. Water Resources and Economics 25, 2–12.
IV	Lankia, T., Neuvonen, M., Pouta, E, and Sievänen, T. 2014. Willingness to contribute to the management of recreational quality on private lands in Finland. Journal of Forest Economics 20, 141–160.

Contents

1. Introduction

The contribution of outdoor recreation to human well-being is well documented. Beyond the market-based economic impact of nature-based tourism including, jobs and tax revenues to local economies, studies have documented a range of physical, emotional, cognitive, social, educational and spiritual benefits from outdoor recreation to human wellbeing (Hartig et al. 2014). In recent years, the health benefits of outdoor recreation have gained an increasing amount of attention, and outdoor recreation is seen as a solution which may alleviate the health problems of modern urban life, such as lack of physical activity and obesity (Nilsson et al. 2011).

There is an abundant supply of natural areas for recreational purposes is in Finland, and recreational opportunities in natural areas and waterways are freely available to everyone by the everyman's right with few limitations regardless of who owns the land (Finnish Ministry of Environment 2013). In addition to municipal recreational areas providing recreational facilities in population centers (Sievänen and Neuvonen 2011) and state-owned national hiking areas and national parks (Metsähallitus 2018), recreational use of nature can also take place on other publically and privately owned natural areas. As 60 per cent of Finnish forests are privately owned (Natural Resources Institute Finland, 2017), also they are a significant recreation resource in Finland. Beyond these recreation opportunities which are available to everyone, every seventh Finnish household owns a leisure home (Mökkibarometri 2016) and approximately 40 per cent of Finns have regular access to one. Two thirds of Finns visit a leisure home at least once a year (Mökkibarometri 2016). Most leisure homes are located on the shorelines of lakes, rivers or the Baltic Sea and water recreation is an important part of life at a leisure home. Also water recreation itself is popular in Finland. For example, about two thirds of Finns swims at least once a year in natural waters (Sievänen and Neuvonen 2011). Recreation opportunities are widely utilized; nearly everyone in Finland (96 per cent of the population) participate in outdoor recreation and make on average three outdoor recreation visits a week. Every third Finn (31%) spends recreation time outdoors on a daily basis (Sievänen and Neuvonen 2011).

The benefits people obtain from recreation in nature are among the wide range of benefits people derive from ecosystem services, i.e. from the aspects of ecosystems utilized to produce human well-being (Fisher et al. 2009). Common International Classification of Ecosystem services (CICES) groups ecosystem services into three categories: provisioning, regulating and maintenance, and cultural (Haines-Young and Potschin 2018). Provisioning services include the tangible products people obtain from ecosystems, such as food and raw materials. Regulating services involve processes that maintain favorable environmental conditions, such as nutrient cycling and flood protection. Recreation is one of the cultural services, which include the non-material benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experience. (Millenium Ecosystem Assessment 2005.)

The efficient management of natural resources and balancing the production of different and sometimes competing ecosystem services requires information on the costs of and benefits of their production. The value of ecosystem services that are traded in the markets, such as timber and agricultural crops, is reflected in market prices through market supply and demand (de Groot et al. 2010), but there is no such markets or price for recreation. According to the everyman's rights, recreation services are characterized with the public good features of non-excludability and non-rivalry (Perman et al. 1996, Brown et al. 2007), implying that markets do not have incentives to produce recreation services. Therefore, they are not traded in markets and the value of the recreational use of nature is not reflected in market prices and traditional financial accounts. This poses a risk of their undervaluation in decision-making that is based on costs and benefits that are measured using market prices (Perman et al. 1996, Costanza et al. 1997, Carpenter et al. 2009, Fisher al. 2009). Non-market valuation methods are therefore needed to estimate the value of non-market ecosystem services, such as the recreational use of nature in terms commensurate with other benefits and costs so that they can be fully incorporated in decision-making. Information is needed about the value of recreational use, for example, for balancing the costs and benefits of providing recreational opportunities, and to assess the effects of changes in environmental quality on the value recreational use (Loomis 2016).

While the information on the costs and benefits of different land uses and ecosystem services will provide information on the efficient allocation of land use to provide different goods and services, instruments and tools are needed to ensure the desired production level of non-market ecosystem services (e.g. De Groot et al. 2010, Plieninger et al. 2015, Whitten and Coggan 2013). In Finland, private landowners may manage the land based on their own objectives without considering the recreational use of the land, despite the everyman's right. Preserving the quality of the landscape and the recreational environment has a cost for landowners, and they probably have little interest in covering the costs if the area is not used for their own recreation. Taking into account the benefits of landscape preservation for recreationists might be socially profitable, however. One possible mechanism to make this kind of privately unprofitable but socially desirable practice become profitable to individual land owners, is the payment for ecosystem services (PES) scheme. It is a market-based instrument for enhancing the provision of public good that has been suggested as a flexible approach to guarantee the production of non-market ecosystem services (Engel et al. 2008, Pagiola and Platais 2007). To evaluate the feasibility of a PES scheme, it is essential to know whether the price recreationists would be willing to pay matches the price that land owners would demand for the preservation of recreational quality (Wunder 2007).

There are several methods for the economic valuation of non-market ecosystem services. In revealed preferences (RP) methods, such as the travel cost method (TCM), and hedonic pricing methods (HPM), the values are derived by observing behavior in markets that are affected by environmental goods and services, such as the housing market in the HPM, or travel to nature attractions in the TCM (Bockstael and McConnell 2007). In stated preferences (SP) methods, such as contingent valuation method (CVM) and choice experiment (CE), survey questions are used to elicit information that allows the values to be estimated (Bateman et al. 2002, Alberini and Kahn 2006). Benefit transfer and meta-analysis can be used to utilize values from existing valuation studies in other contexts (Champ et al. 2003).

Studies valuing the recreational use of nature in Finland (See Table 1a in Appendix) include both RP and SP applications, and have focused on valuing the recreational use itself, the effects of environmental quality on the value and on the value of environmental attributes of recreational areas for recreational users. Studies assessing the recreational value of visits have focused on the valuation of specific recreational areas, such as urban recreational areas (Ovaskaien et al. 2001, Tyrväinen 2001), national parks or national hiking areas (Huhtala and Pouta 2009, Kosenius and Horne 2016) or a popular recreational fishing destination (Pokki et al. 2018), and valuing recreation at a national level. National level studies include those on the recreational value of agricultural land (Pouta and Ovaskainen, 2006), close-to-home water recreation (Vesterinen et al. 2010), state-owned recreation and conservation areas (Huhtala and Pouta 2009), and the recreational value of the Baltic Sea (Czajkowski et al. 2015, Bertram et al. 2020).

Only four studies have assessed the effects of changes in environmental quality on the value of recreational visits. Kosenius and Horne (2016) measured the effects of mining on the recreational benefits of Oulanka National Park, and Vesterinen et al. (2010), Czjakowski et al. (2015), Bertram et al. (2020) estimated the extent to which water quality affects the benefits of water recreation. More research effort has been placed on valuing the environmental attributes of recreational areas. Horne et al. (2005) examined visitor valuations of forest scenery and species richness at five adjacent municipal recreation sites in the Helsinki region, Juutinen (2011) estimated the value that visitors of Oulanka national park placed upon biodiversity and national park recreation facilities, Grammatikopooulu et al. (2012) examined Finns' preferences for different characteristics of agricultural landscape in southern Finland, Tyrväinen et al. (2014) elicited tourists' valuations of landscape and the biodiversity characteristics of the Ruka-Kuusamo tourism area, and Juutinen et al. (2014, 2017) investigated the trade-off between recreation service provision and timber production in state-owned commercial forests. Only Tyrväinen et al. (2014) have investigated the willingness of recreationists to pay in a PES context.

The aim of the research presented in this thesis is to contribute to the literature by providing national level information on the economic value of recreational use of nature in Finland, and its relation to environmental quality. **Study I** provides an approach to assessing and mapping the use and economic value of recreational ecosystem services in Finland. The study demonstrates how the monetary value of the recreational use of nature can be estimated in a country where there is public right of access to natural areas for recreational purposes. **Study II** provides the first estimates of the extent of the recreational benefits of leisure homes in monetary terms and investigates whether algae blooming, a leisure home's location on the shoreline, and the supply of electricity at a leisure home has an impact on these benefits. **Study III** estimates how hypothetical future changes in water quality would impact the recreational value of swimming in natural waters. Finally, **Study IV** investigates whether and how much individual recreationists would be willing to pay or contribute labor to private landowners to enhance the recreational quality of their lands.

The results of the studies can be utilized in responding to the information needs of policy instruments that call for information on non-market benefits of environmental benefits, such as the EU Water Framework directive (2000/60/EC) (European Parliament 2000), the EU Marine Strategy Framework directive (2008/56/EC) (European Parliament 2008) and the EU Biodiversity Strategy (European Comission 2011). The studies also contribute to ecosystem service accounting, which aims to measure and illustrate the supply and value of ecosystem services in a similar manner to that of national accounting (e.g. Vallecillo et al. 2019, LaNotte et al. 2019). Finally, these national level valuation studies provide value information for decision-making about land use planning and management in smaller scale situations, where economic analysis is needed, but time and financial constraints do not allow new primary valuation study.

This thesis is organized as follows. The methods section presents the economic valuation methods and approaches used in the studies. Section Three presents the research data and the econometric methods used in the analyses of this thesis. Section Four summarizes the studies and their results. Section Five discusses the results and the final section concludes the thesis.

2. Methods

This thesis applies both stated and revealed preferences methods. In Studies I, II and III the objective is to evaluate the economic value of different kinds of outdoor recreation visits in Finland. In these studies, travel cost method (TCM) is applied, which is a revealed preferences method developed for the measurement of the value of recreational use of nature (Parsons 2003, Pearce et al. 2006). In Study III the traditional travel cost method is supplemented with contingent behavior (CBM) method. In Study IV the contingent valuation method (CVM) is applied to estimate recreationists' willingness to pay for management actions influencing recreational quality of landscape in privately owned lands. Both the CVM and the CBM belong to the stated preferences methods, which use surveys to elicit information that allows the economic value of non-market environmental goods to be estimated. This section first describes TCM and CBM and how they are applied in Studies I-III, after which CVM and its use in Study IV is described. Research data and econometric methods used in the studies are presented in Section 3.

2.1. Travel cost method and contingent behavior method

TCM is a revealed preferences method in which the goal is to reveal the value of the recreational use of nature from the number of visits people make to a recreational site and the costs of travelling to the site (Pearce et al. 2006) It is based on the idea, that even if there is no access fee for a recreation site, individuals have to bear costs incurred from travelling to the site as well as the opportunity costs of time spent on travelling. TCM was first proposed by Harold Hotelling in 1940s in the United States to measure the value of outdoor recreation so it can be taken into account in a comparison of the benefits of competing uses of public land (Ward and Beal 2000). Since then, it has been applied widley in valuation of the recreational use of nature (e.g. Martınez-Espineira and Amoako-Tuffour 2008; Egan et al. 2009; Ovaskainen et al. 2012)

TCM is based on the theory of the individual's utility maximization behavior, where the utility of an individual is assumed to depend on both goods sold on the markets and public goods and services such as outdoor recreation (Freeman 2003). In the single-site travel cost method, in which the objective is to evaluate the economic value of the recreational use of a single recreation area, it is assumed that an individual chooses the number of recreation visits r to site i that maximizes their utility u subject to budget constraint y (based on presentations by Freeman 2003 and Parsons 2003):

$$Max\ u(x, r, q, z)\ s.t.\ y = x + tcr \tag{1}$$

Where r is the number of recreation visits to site i, q is the quality of the recreation area, x are all the other goods and services an individual consumes, and z are an individual's socio-demographic characteristics. Utility maximization is constrained with the budget constraint. An individual can use their income y for recreation visits with round-trip travel costs tc and for other goods and services (in equation 1 prices of other normalized to 1). Travel costs include all relevant costs of travelling to the site including the cost of time spent on travelling (Parsons 2003). Utility maximization leads to an ordinary Marshallian demand function for outdoor recreation visits r to site i as a function of the travel costs tc to the site, quality of the site q, travel costs of other recreation sites tc_s, income y, and socio-demographic variables x:

$$r = f(tc, q, y, tc_s, z) \quad (2)$$

Higher costs are expected to decrease the number of visits, and better quality is expected to increase the number of visits. Higher income is expected to have a positive impact on the visit frequency. Lower costs of travelling to subsitute recreation aites are likely to decrase the number of visits (Parsons 2003). Socio-demographic variables that have been found to affect the visit frequency in previous studies include among others age (e.g., Norman et al. 2010, Laundry et al. 2012, Zhang et al. 2015) education and type of activities undertaken (e.g., Shrestha et al. 2007, Ovaskainen et al. 2012, Cho et al. 2014, Ezebilo et al. 2015) and gender (e.g., Zhang et al. 2015).

The economic value of the visits to the site can be estimated by integrating the area between the Marshallian demand function and the travel costs. This integration gives the economic value of the recreation visits to the site i as consumer surplus (CS) (Haab and McConnell 2002):

$$CS=\int_{tc^0}^{tc^c} r(\cdot)dtc \quad (3)$$

tc_c is the travel costs at which the number of visits r is zero, and tc_0 denotes to zero travel costs. CS represents the difference between visitors' total willingness to pay for the visits and the actual costs they are paying for the visits (Parsons 2003).

In this thesis the single-site TCM is used in country-level analysis: 1) to measure and map the economic value of the recreational services of nature in Finland (Study I), 2) to estimate the recreational value of leisure homes in Finland (Study II), and 3) to measure the value of water quality changes on a national level in Finland (Study III). Thus, the demand functions in this thesis are estimated for the number of day visits individuals make to their most recent close-to-home outdoor recreation sites, for the number overnight nature trips individuals make to their most recent destination of such visits a year, for the number of trips individuals make to their own leisure homes a year, and for the number of swimming visits individuals make to their typical swimming sites a year.

A similar approach to estimate regional or total demand for recreation has been used e.g. in Shrestha et al. (2007) and Englin and Moeltner (2004) and more recently in Ezebilo (2015) and Hynes et al. (2017). In a Finnish context the approach has been used in Vesterinen et al. (2010), Pouta and Ovaskainen (2006) and Czajkowski et al. (2015).

In Study II, this approach enables estimation of the extent of the recreational benefits of the Finnish summer house stock, as there is no single site that could be valued. In Study I and III the approach enables estimation of the recreational benefits of nature on a national level without need for benefit transfer (Vesterinen et al. 2010). In benefit transfer the valued good at the study site should correspond to the valued good in the policy site, both in biophysical terms and in the way the good affects individual wellbeing (Johnston et al. 2015). If the value estimates are scaled from single site studies to a national level, there is a risk that estimates of total benefits are biased upwards, because often single site valuation studies are conducted for environmental goods and services which are known to be valuable, or particularly interesting or important from a policy perspective (Hoehn 2006). This would be problematic in Finland where due to everyman's rights a considerable share of visits is made outside official recreation areas.

In Studies I and II this TCM approach also enables evaluation of the effect of environmental quality on the demand for leisure home and swimming visits, that requires data on how number recreation visits changes in response to changes in the environmental quality. Quality variation is rarely observed in single site travel cost analysis focusing on one season (Freeman, 2003). An alternative approach to estimating the effect of changes in environmental quality on recreation benefits would be to study recreational site choice based on site quality attributes using the random utility model (RUM) approach (Phaneuf and Smith, 2005) or Kuhn-Tucker demand model (Phaneuf and Siderelis, 2003). They require, however, definition of the set of alternative recreation sites recreationists visits (Bestard and Font 2010) which is difficult in the Finnish context where nearly all-natural areas are available for recreation.

The strength of TCM and other revealed preference methods is that they are based on the actual behavior and decisions of individuals (Pearce et al. 2006, Whitehead et al. 2008). This strength is, however, also a limitation as the method is unable to capture values related to environmental states that lie outside currently observed environmental quality (Whitehead et al. 2008). To overcome this limitation, the travel cost data is supplemented in Study III with contingent behavior data, and Study IV applies the contingent valuation method to investigate the willingness to pay for the recreational quality of privately-owned lands.

In CBM, survey questions are used to ask respondents about their future behavior if a specified hypothetical change in environmental quality had occurred (Englin and Cameron 1996, Freeman 2003, Whitehead et al. 2000).CBM can be used to extend a travel cost analysis to reveal changes in value of recreation visits due to hypothetical environmental changes that are not currently observable (Whitehead et al. 2008) and has been applied in numerous recreation demand analyses (e.g. Eiswerth et al. 2000, Hanley 2003, Alberini & Longo 2006, Laundry et al. 2012, Simões et al. 2013, Kipperberg et al. 2019). In CBM, a change in the environmental quality from q to q' is assumed to shift the Marshallian demand function (equation 2) for recreation so that the effect of the quality change on the recreation benefits can be measured as the change in CS (in Formula 3) due to the shift of the demand curve (Whitehead et al. 2000).[1]

A benefit of combining stated preferences and revealed preferences data instead of using stated preference data only is that it can alleviate the hypothetical bias problem linked to the stated preferences methods, as stated behavior is grounded in real behavior (Hanley et al. 2003. Whitehead et al. 2008). Even though assessing the number of intended trips under a certain future scenario might be demanding for respondents (Lienhoop & Ansmann 2011), it might be easier to predict what they would do in a hypothetical scenario than to assess how much they would be willing to pay (Englin and Cameron 1996).

[1] Even though change in consumer surplus does not exactly correspond to the theoretically correct CV and EV measures, the difference has been shown to be small if the income effect is small, relative to the measurement uncertainty related to the econometric estimation of the demand curve (Willig 1976, Haab and McConnell 2002). A challenge in the estimation of the CV and EV is that, that the they are not empirically observable (Just et al. 2004). Hence, revealed preferences studies including studies using the travel cost method usually estimate the welfare changes through changes in consumer surplus (Just et al. 2004).

2.2. Contingent valuation method

In Study IV CVM (Bateman et al. 2002, Alberini and Kahn 2006) is used to study willingness to contribute to the management of recreational quality on private lands. In the CVM individuals' WTP for a specific change in the quality or quantity of environmental good is elicited in a survey. Survey respondents are presented with a carefully formulated hypothetical market situation, with information about a specified environmental problem, the current state of the environment and a policy designed to alleviate the problem as well as the state of the environment after implementation of the policy (Whitehead et al. 2008, Bateman et al. 2002, Alberini and Kahn 2006.). After describing the environmental problem and the designed policy, respondents are asked about their willingness to pay for the policy and resulting change in environmental quality. Alongside the WTP question, respondents are given information on the timing of the payment, how the payment would be implemented and who will have to pay (Boyle 2003). In an answer to a contingent valuation question, respondents are assumed to be comparing their utility v at the current level of environmental quality q^0 with that at the improved (or worsened) environmental quality q^1 (Equations 4 and 5), p presents current prices and y current income. As a result, the economic value of a change in environmental quality can be measured as compensating variation (CV) or equivalent variation (EV):

$$CV: v(p, q^0, y) = v(p, q^1, y - CV) \tag{4}$$

$$EV: v(p, q^0, y + EV) = v(p, q^1, y) \tag{5}$$

CV gives the maximum amount of money an individual would be willing to pay in order to obtain the improved state of environmental quality while staying at the same initial utility level as before the improvement. EV measures the amount of money that should be given to an individual in order to reach the utility level they would attain under improved environmental quality q^1, even though that improvement would not be made.[2] Instead of aiming to estimate the total economic value of a specific change in environment, in Study IV the aim is to explore the potential of the PES scheme in the context of the recreational quality of privately-owned lands in Finland. We therefore assessed the willingness of recreationists to pay for forest management actions that improve recreational quality, and conversely for the postponement of actions that are found to be harmful to recreational quality. A number of studies have applied CVM to assess WTP for privately provided public goods or to avoid externalities. Studies have addressed

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[2] In the case of a decline in environmental quality CV gives the minimum amount of compensation an individual would be willing to accept to stay at the initial utility level, even if a decline in the quality occurred. EV gives the amount of money an individual would forgo to end at the utility level they would attain under decreased environmental quality, even though that decline would not occur.

WTP for green electricity (e.g., Zoric et al. 2012, Wiser et al. 2007, Longo et al. 2008), the CO_2 emissions of private cars (Achtnicht 2012), and voluntary carbon offsets in air travel (MacKerron et al. 2000, Brouwer et al. 2008). CVM has been also applied to evaluate the willingness of tourists (Stithou and Scarpa 2012, Wang and Jia 2012, Biénabe and Hearne 2006) as well as local residents' (Biénabe and Hearne 2006) to pay for biodiversity and nature conservation. Some studies have assessed willingness to contribute to ecosystem service conservation (Casado-Arzuaga et al. 2013) and common pool resources provisioning (Cavalcanti et al. 2010), without measuring the amount that respondents would be willing to contribute.

In addition, to the assessment of the willingness to pay, Study IV also investigates whether recreational visitors to privately owned lands would be willing to contribute their own time to recreation-oriented management actions. In developing countries, the use of labor or other in-kind payments, such as rice has been suggested to be a more appropriate measure of non-market benefits than money in situations where tight budgets prevent households from giving any part of their income for public projects (Asrat et al. 2004, Tilahun et al. 2011). Although the problem of excessively tight budget constraints is not likely to be present in Finland, it is still interesting to examine whether individual recreational visitors would be willing to contribute labor to the recreation-oriented management of privately-owned lands, as it might be culturally more accepted to exchange services than money in rural areas (Pacione 1997). Furthermore, while contributing time and labor instead of money has been an issue in stated preferences studies in the developing world (Asrat et al. 2004, Tilahun et al. 2011), it is a less commonly studied topic as related to PES.

3. Research data and econometric methods

The studies in this thesis apply three different valuation methods and are based on two survey data sets. The data sets, valuation methods and econometric estimation methods used in the studies are summarized in Table 1.

Table 1 Data and methods used in the studies

Study	Focus of valuation	Data	Method	Econometric model
I	Close-to-home recreation visits and nature trips lasting longer than a day	LVVI	TCM	Zero truncated negative binomial model
II	Leisure home visits and environmental attributes of the leisure homes	Leisure home owner survey	TCM	Negative binomial model
III	Swimming visits and water quality	LVVI	TCM-CBM	Negative binomial model, Random effects Poisson model
IV	Recreational quality of privately owned nature areas	LVVI	CV	Logistic regression, interval regression, latent class regression

3.1. Research data

Finnish recreation demand inventory

Studies I, III and IV are based on the Finnish National Outdoor Recreation Demand Inventory data (LVVI), which is representative population data on outdoor recreation by the Finnish Forest Research Institute collected in 2009 and 2010 in cooperation with Statistics Finland (Sievänen and Neuvonen 2011). The data was collected in six separate survey rounds from a random sample of 15–74 year-old Finns. The sample was drawn from the Finnish population register. In each round, 4000 respondents (in total 24,000 in the six rounds) were contacted and invited to fill in an internet or a mail questionnaire. In total 8895 responses were received. The response rate was 37 per cent. A short telephone interview to a sample of non-respondents revealed that they did not differ significantly from respondents in terms of their participation in outdoor recreation (Sievänen and Neuvonen 2011).

In the questionnaire, outdoor recreation was described to respondents as all sorts of exercises and activities pursued in green spaces outside a respondent's own yard in their free time. In each of the six survey rounds, the questionnaire consisted of a general section collecting information on respondents' socio-demographic characteristics and general outdoor recreation behavior, such as the outdoor recreation activities undertaken and the frequency of participation and a theme questionnaire that varied between the six survey rounds. In rounds 1–4 more detailed information was elicited on close-to-home recreation visits lasting less than a day (n=6131, 69% of the sample) and in rounds 5–6 on nature trips lasting longer than a day (n=2761, 31% of the sample). In both of the questionnaire versions, respondents were asked whether they had made at least one close-to-home recreation visit or nature trip during the previous 12 months. If the respondent had made such a visit or trip, more information was requested about the latest trip including the questions needed for the travel cost method. Study I is based on this part of the data.

The special theme surveys were implemented as follows. Rounds 1 (n=1623) and 2 (n=1485) included a theme section on health effects of outdoor recreation and rounds 3 (n=1644) and 4 (n=1379) a section on the impacts of environmental changes on the outdoor recreation and how respondents will adapt to the changes. Round 3, which was conducted in autumn 2009, focused on water recreation and water quality and round 4, collected in winter 2010, focused on cross-country skiing and climate change. Rounds 5 (n=1376) and 6 (n=1385) collected information on outdoor recreation in privately owned lands. Study III is based on a theme survey on water recreation and water quality that was collected in the third survey round (n=1644) in autumn 2009, and Study IV on the theme surveys of rounds 5 (n=1376) and 6 (n=1385), which collected information on outdoor recreation on privately owned lands The data and data collection is described in detail in Sievänen and Neuvonen (2011.)

Data on leisure home owners and their leisure homes

Study II uses data collected from Finnish summer house owners, who had purchased a summer house in Finland in 2004 (in total 2547 individuals). The summer house purchasers were identified from the official real estate market price registry of the National Land Survey of Finland. A pilot survey was conducted in late autumn 2008, and the actual data collection was conducted in December 2008. The respondents could choose to participate in the survey by filling out a mail or internet questionnaire. A reminder note was sent to the respondents in January 2009, with a paper questionnaire enclosed. A total of 1350 respondents participated in the survey, representing a response rate of 49.1 per cent. Since the question on the frequency of summer house visits was only included in the mail survey, the sample analyzed in this thesis was limited to questionnaires submitted by mail. The final sample consisted of 343 respondents. In addition to the travel cost method questions, the survey included choice experiment and contingent valuation questions and questions on the attitudes and socio-demographic characteristics of the respondents. The questionnaire also included questions related to a respondent's summer house, its features and surrounding environment.

3.2. Econometric methods

From an econometric modelling standpoint, the studies in this thesis can be divided into two groups according to the type of data used. Studies I, II, and III applied travel cost method or combined travel cost-contingent behavior approach and are based on recreation visit frequency data. The contingent valuation method was used in Study IV.

3.2.1. Count models of recreation visit frequency

Since the number of recreation visits can only have integer values greated than or equal to zero, travel cost models are recommended to be estimated with count data regression models instead of linear models (Hellerstein 1991). In count data models the dependent variable is assumed to follow a discrete distribution in which only non-negative integer values are possible (Hellerstein 1991.). Therefore, the Poisson model and the negative binomial model for count data have became standard models in the econometric estimation of the travel cost models. The Poisson regression model can be used when the variance of the trip distribution equals its mean (Cameron and Trivedi 1998). However, in recreation trip frequency data, the variance often exceeds the mean, implying over-dispersion of the data, which leads to underestimation of the standard errors of the estimated coefficients (Haab and McConnell 2002). For this reason, travel cost studies often use the negative binomial model, which allows variance to differ from the mean (e.g., Martinez-Espiñeira and Amoako-Tuffour, 2008, Ovaskainen et al. 2012, Hynes and Greene, 2013) and is also applied here in Studies I and II. In both the negative binomial model and the Poisson model, the expected number of visits an individuall i makes is assumed to be a function of the travel costs, respondent's socio-demographic characteristics and other variables affecting the trip frequency. To ensure positive values for the trip frequency y, the expected number of visits can be specified as an exponential function $E(y_i|x_i)=\exp(x_i'\beta)$ where x_i are the independent variables that explain the trip frequency and β are the unknown regression coefficients to be estimated. The β parameters are estimated by using the maximum likelihood method (Haab and McConnell 2002, Cameron and Trivedi 1998).

The estimated expected demand function for recreation visits E(yi) = $\exp(x_i'\beta)$ can be used to calculate the CS of the visits by integrating the area under the expected demand function (Englin and Shonkwiler, 1995, Haab and McConnell 2002):

$$CS=\int_{TC^0}^{\infty} e^{\beta_0+\beta_1 TC+x'\beta} dTC = -\frac{y}{\beta_1} \quad (6)$$

where β_1 is the coefficient for travel cost variable, TC_0 is the current travel cost, for the exponential function the choke price at which the the number of vistis is zero is infinite (Haab and McConnell 2002). Based on this, CS per trip can be calculated as:

$$CS/y = -\frac{1}{\beta_1} \quad (7)$$

In study I, the data consists of number of visits to the most recently visited close-to-home outdoor recreation site and number of visits to the most recently visited destination for overnight nature trips, and hence the data does not include any obersrvations with zero visits. To take this into account in the modelling, a zero-truncated version of the negative binomial model is used in Study I. Zero-truncated negative binomial model restricts the values of the dependent variable to be greater than zero (Creel and Loomis, 1990). Other studies that have applied a zero truncated negative binomial model include for example Zhang et al. (2015) and Windle and Rolfe (2013) and a detailed presentation of the model can be found for example in Cameron and Trivedi (1998). In Study III, pooling real and hypothetical visit frequency data together generated a panel data with multiple observations for each respondent. Since the panel structure of the data may cause correlation in the error terms between the observations (Cameron and Trivedi, 1998), the random effects specification of the Poisson model was used in the combined TC-CB model following for example the TC-CB models by Whitehead et al. (2010) and Bhat (2003). The random effects Poisson model takes into account the over-dispersion as well as the individual unobservable characteristics causing the correlation in the error terms (Whitehead et al. 2010, Cameron and Trivedi 1998). A detailed description of the random effects Poisson model can be found in Cameron and Trivedi (1998).

3.2.2. Econometric estimation of the WTP model

Study IV applies the contingent valuation method to study the willingness of recreationists to pay or willingness to contribute labor for the management of the recreational quality of privately-owned lands. The data consists of two parts. Respondents were first asked whether they would like to pay to land owners for management practices or contribute labor to implementation of the practices. Those respondents who expressed willingness to contribute to at least one action were tasked how much they would be willing to contribute.

Logistic regression (e.g. Haab and McConnell 2002) was used to explain the overall willingness to participate either by paying or contributing labor, to identify the characteristics of the potential buyers in a PES scheme. Latent class multinomial regression (LCM) was used to investigate whether the different management actions affect the contribution form chosen. It was also used to investigate potential heterogeneity in the respondents' preferences regarding the contribution intentions. The idea underlying latent class models is that individuals' choices depend on both observable variables, in this application the eleven management practices, and idnvididual factors that cannot be observed. In latent class models this unobserved heterogeneity is modelled with a nominal variable that divides individuals into k discrete subgroups each subgroup with different preferences for willingness to contribute (Greene and Hensher 2003, Boxall and Adamowicz, 2002). In study IV, the dependent variable in the LCM is the choice of contribution form by an individual, and has four possible values, 1= I do not want to participate, 2= I would pay for carrying out the action, 3 = I would participate by contributing labor, and 4=I would pay for postponing the action. The eleven management practices are used to explain the choice. The probability that an individual i chooses contribution form j in choice situation t, where the are J alternatives to choose from, given that they belong to a latent class s is defined as:

$$\text{Prob}(y_{it} = j \,|\, \text{class} = s) = \frac{\exp(\boldsymbol{z}'_{it,j}\beta_s)}{\sum_{j=1}^{J}\exp(z'_{it,j}\beta_s)}, \qquad (8)$$

where z_{it} are the management practices that are used to explain the contribution decision. The number the management actions corresponds to the number of choice situations t, since each management practice provided a separate choice situation. Paremetres β_s are the regression coefficients to be estimated. The coefficients are same for all individuals withn one class but vary across the classes. The joint probability that individual i belongs to class s and chooses the choice sequence y_i is:

$$\text{Prob}(y_i) = \sum_{s=1}^{K} P(s) \prod_{t=1}^{T} \frac{\exp(z'_{it,j}\beta_s)}{\sum_{j=1}^{J}\exp(z'_{it,j}\beta_s)}, \qquad (9)$$

where P(s) is the probability that an individual i belongs to class s and the latter part is the probability of the choice set y_i of an individual i (Greene and Hensher 2003, Vermunt and Magidson 2005). The class memebership can be allowed to depend on invidual's characteristics proability can be a function of socio-economic covariates. However, we did not use socio-deomographic covariates in forming the latent classes but based the classification solely on the choises of contribution form the respondets made. Instead, the variables associated with class membership were empirically examined after forming the classes by comparing the distributions of variables between classes with the chi-squared test.

The amount of money or time the respondents were willing to pay or contribute was modelled with interval regression (Cameron and Huppert 1989). In the questionnaire WTP was elicited using the payment card survey format in which respondents are presented with a series of ordered payment amounts and asked to circle the maximum amount they would pay for the actions. The interval regression model assumes that an individual's true maximum WTP y_i locates somewhere between the selected amount t_l and the next highest amount t_u on the payment card. The model assumes that WTP follows the normal distribution and that the expected WTP is a linear function of the independent variables xi: $E(y_i|x_i) = x_i'\beta + \varepsilon_i$, where ε_i is a normally distributed error term with mean 0 and standard deviation σ. The probability that a respondent's i true WTP falls within the reported interval is given by:

$$\Pr(t_l<y_i<t_u) = \Pr\left(\frac{t_l - x_i'\beta}{\sigma} < y_i < \frac{t_u - x_i'\beta}{\sigma}\right) = \Phi\left(\frac{t_l - x_i'\beta}{\sigma}\right) - \Phi\left(\frac{t_l - x_i'\beta}{\sigma}\right) \quad (10)$$

Φ is the standard normal cumulative distribution function. Parameters β for the independent variables are estimated with the maximum likelihood method and the expected WTP for an individual i given the independent variables xi is given by $x_i'\beta$.

4. Summaries of the studies

Study I: Valuing recreational ecosystem service flow in Finland

In this study, the spatial allocation of recreational visits and their benefits in Finland was estimated and mapped to assess and demonstrate the value of the recreational benefits provided by ecosystems in monetary terms in Finland. The Finnish National Outdoor Recreation Demand Inventory data collected in 2009–2010 was used to estimate the annual number and value of close-to-home recreation visits lasting less than a day and over-night nature trips to three different area types, and finally allocated regionally. The three different area types were: 1) areas used under everyman's right including municipal recreation areas and state-owned commercial forests, 2) state-owned recreation and nature conservation areas, and 3) leisure homes and their surroundings.

The per trip values of the visits to each region and each area type were estimated with the travel cost method. For close-to-home recreation, the per trip values were found to be highest to visits made to leisure homes (regional values ranging between €5.1–97/visit) and lowest to visits made to state owned land (regional values ranging between €2.0–7.4/visit). For visits made to everyman's rights areas the estimated value per visit varied regionally between €4.3–7.4/visit.

The high value of summer cottage visits is also evident in the value of nature trips. The CS per trip for trips to leisure homes was found to vary regionally between €104.8–252.3/trip. For trips to everyman's rights areas the value varied between €28.5–104.8/trip, and to state owned land between €28.5–103.1/trip. CS estimates for nature trips to state owned lands are clearly the highest for trips to Eastern and Northern Finland, which may be due to the attractiveness of popular national parks in Eastern and Northern Finland. There are also popular national parks in southern Finland, but it may be that they attract more day visits than overnight-stays as they locate close to the country's most populated areas. However, the sample sizes of Nature trip TCM models were relatively small (number of observations 85–200 per region), so there were also relatively few observations from different destination types. Larger data would allow more accurate analysis.

Based on data it was estimated that a total of 369.2 million close-to-home visits and 3.4 million nature trips a year was made in Finland during the study period 2009-2010. The total annual numbers of close-to-home recreation and nature trips in Finland were calculated based on the time span between the most recent and next intended close-to-home recreation visit and nature trip reported by the survey respondents. The regional pattern of numbers of close-to-home visits was found to follow the population distribution of Finland. The highest total number of close-to-home recreation visits was estimated to be made in Uusimaa (77.3 million visits per year). According to the data, the majority of the close-to-home recreation visits (91%) were made to areas used based on the everyman's rights, including urban green areas and state-owned commercial forests.

Areas used according to everyman's rights were the most popular destination type throughout the country.

Lapland was found to be the most popular nature trip destination with 0.7 million trips a year, the number being almost twice that of the second highest number of trips (0.32 million) made to the other northern region Pohjois-Pohjanmaa. About half of the nature trips (53 percent) were directed to the areas used based on the everyman's right, 36 percent to leisure homes and 11 per cent to state owned areas, but the pattern appeared to vary across the regions. In Lapland, the state-owned areas attracted nearly 40 per cent of the trips and in the popular leisure home areas around half of the trips were made to leisure homes.

The regional pattern of the aggregate benefits of close-to-home recreation followed the population distribution the value being highest in Southern Finland. The regional pattern of the total value of nature trips followed the pattern of the number of trips to the regions. The value was highest in Northern Finland. The areas used under everyman's right were found to be the most important in value. Further, the he high total value of the trips to leisure homes was particularly visible in the central and eastern parts of the country as well as the value of the state-owned areas in Lapland.

To further study the drivers of regional total values of recreation, correlation analysis was used to investigate the importance of the regional population, the number of visits and trips, and finally the supply of ecosystems as the drivers for regional recreation value. From the supply of ecosystems regional figures for share of forests of total land area, share of inland waters of total area, share of sea of total area and share of other natural land areas (e.g. fells) of the land area was used. Also share of everyman's right areas, and amount of state-owned protected areas and leisure homes in the regions were included in the analysis. The value of close-to-home recreation was significantly correlated only with the population and the number of leisure homes. The value of nature trips correlated with the number of trips, per trip value of visit, and share of other natural land areas (e.g.,.fells) or the total land area.

The average recreational value per year per hectare for areas used based on everyman's rights across the regions was estimated to be €179 per hectare, for state –owned areas €194 per hectare, and €1789 per leisure home per year. The recreational value per hectare of areas used under everyman's rights was found to be highest in the most populated part of the country such as the Uusimaa region. Also the recreational value per hectare of state owned protected areas was found to be highest in the areas where the visit frequency per hectare was the highest.

Study II: Valuation of trips to second homes: do environmental attributes matter?

Study II conducted a travel cost analysis using a national sample of Finnish leisure home owners to estimate the economic value of the recreational benefits obtained from leisure home visits. It also estimated how the supply of electricity to a leisure home, location at a shoreline and disruptive algal blooming affect recreational benefits. Estimates of the welfare effects of these features increase understanding of the complex relationship that leisure homes have with the environment. On the other hand, the better the quality of the environment near the leisure home is, the more enjoyable it is to spend time there. For example, water quality has been shown to have an effect on the benefits obtained from water recreation (Vesterinen et al. 2010), which is a popular way to spend time at leisure homes. On the other hand, the growth in the number and size of leisure homes and their standard of equipment, means that the pressure on the environment has increased.

On the basis of the estimated negative binomial regression model, the average consumer surplus of a visit to a representative leisure home with electricity and where algae never prevent water recreation was €205/visit and falls to €125/visit if algae prevent water recreation at least once in the summer. The corresponding per trip values of visits to a leisure home with no electricity are €194/visit and €121/visit. If there is no electricity nor a shoreline at the leisure home, the value per trip decreases to €108. In relative terms, the occurrence of algae that prevents recreation decreases the value approximately 40 per cent, and a lack of shoreline approximately 45 per cent. An electricity supply increases the value of a visit to a shoreline leisure home, where there are no disruptive algae by approximately 5 per cent. These results suggest that the environmental attributes are more important for the recreation at leisure homes than the standard of equipment of the houses.

Given the total number of leisure home trips in Finland in the summer season 2008 was 2.6 million (Statistics Finland, 2009a), the aggregate annual value of visits to shoreline leisure homes with no disruptive algae becomes €430–530 million per summer season. The estimated figure seems reasonable in relation to the estimated amount of money spent on leisure home travel which according to Statistics Finland was €330 million in 2007 (Statistics Finland 2009b).

According to the research data, algae bloom prevents recreation at least once in a typical summer at approximately 18 per cent of the leisure homes. On an aggregate level this means an annual loss of €30 million in the recreation benefits obtained from leisure home visits compared to a scenario where algae blooming would not restrict water recreation. Even if the per-trip effect of harmful algae is quite high, the aggregate effect is smaller because relatively few leisure homes had encountered the problem when the data was collected. In contrast, even though the benefits of electricity were very limited on a per trip basis, the aggregate benefits were at about the same level as those obtained from better water quality, that is, €20–30 million annually, since approximately 82 per cent of summer houses had an electricity supply.

Study III: Effects of water quality changes on the recreation benefits of swimming in Finland: Combined travel cost and contingent behavior method

This study estimated the effects of water quality changes on recreation benefits of swimming in Finland. The combined travel cost and contingent behavior method allowed us to study the welfare effects of water quality scenarios that are not currently observable.

The contingent behavior questions in the survey were addressed to two different water quality scenarios. The first asked how many times respondents would to go swimming at their typical swimming site in the next twelve months if the water quality of the water system improved to a level where the bottom of the water body could be seen from the surface at a depth of over 2 m and no slime was present. In the second CB question the respondents were asked how many swimming visits they would make in the next twelve months if the water quality decreased so that the bottom could be seen from a depth of less than 1 m and there was abundant slime on rocks and piers. These questions were not posed to those respondents whose typical site currently corresponded to that quality level.

Two models were estimated, a travel cost model based on the actual visits taken in the last 12 months and a combined TC–CB model based on both the actual and hypothetical number of visits. Water quality was included in the models using two dummy variables, one indicating good and another poor water quality, as defined above. The reference quality was intermediate water quality, i.e. water quality between these two descriptions. In both of the models, the travel cost variable had a negative and statistically significant effect on the trip frequency and thus supported a downwards-sloping demand curve for swimming visits. Also water quality was found to impact the visit frequency as expected in both of the models.

Based on the estimated negative binomial TC model, under current average water quality the recreation value of a swimming visit was estimated to be approximately €16.1 for those travelling with a car to a swimming site and €6.8 for those walking or cycling to the swimming site. Based on the TC–CB model, the value was estimated to rise to €22.1 for car travelers and to €7.3 for walkers and cyclists if water clarity is over two meters and there is no sliming on the piers and rocks. If water clarity was less than one meter and slime was abundantly, the value would decrease to €9.0 for car travelers and €4.9 for walkers and cyclists. The mean predicted number of visits in the TC–CB model was 19. Improved water quality increased it to 28, and decreased water quality, in turn, reduced it to 11 when holding other variables constant.

Given that according to the data 82 per cent of the Finnish 15–74 year-old population (4 036 025 in 2009) had swum at least once during the previous 12 months and assuming that 71 per cent of all swimming visit are made by foot or bicycle and the rest by a car, the total annual value of swimming visits to typical swimming sites in Finland under current water quality was estimated to be €600–630 million. If all water systems used for swimming in Finland were in such a condition that water clarity was over 2 m and there was no slime on the piers and rocjs, the aggregate annual consumer surplus would be €960–1070 euros. If the water systems were in such a poor condition that water clarity was less than 1 m and slime was abundant, the aggregate consumer surplus would be €220 million. Attaining this improved water quality level in all the typical swimming sites in Finland would increase the recreation benefits from swimming by €330–480 million (53–80%) annually. A deterioration in water quality to a poor level would, in turn, decrease the recreation benefits of swimming by €380–410 million euros (63–65%) annually.

Study IV: Willingness to contribute to the management of recreational quality on private lands in Finland

To study whether the payment for ecosystem services approach could be a feasible alternative to guarantee recreational quality on privately owned lands in Finland, this study examined whether individual recreationists on privately owned lands would be willing to pay or contribute labor to land owners for management actions that enhance the recreational quality of the lands, or on the other hand, for a postponement of actions that decreases the recreational quality of the lands. The management actions included in the questionnaire were: clear-cutting of forest, forest thinning, reforestation of forests, storing stumps and logging residues in the forest, clearing young stands and thickets, removing trees and bushes to open the landscape, collecting logging waste and sticks from terrain, removing deadwood and decayed wood, the management of fields and meadows, management of shores and water systems and restoring trails.

Clear-cutting was found to be undesirable by most of the respondents who had rated it. Storing stumps and logging residue in the forest, and reforestation of fields were also more often found undesirable than desirable. The management of shores and water systems, clearing young stands and thickets, management of fields and meadows, collecting logging waste and sticks from terrain and restoring trails were found to be desirable by respondents. Removing deadwood and decayed wood divided respondents' opinions as approximately as many found it desirable as undesirable.

Only about 10 per cent of the respondents were willing to pay for the management actions, but about half were willing to contribute labor to at least one of the actions. Respondents were most commonly willing to pay for the management of shores and water systems, but the proportion of respondents willing to pay for this was only 6 per cent of those who rated the action as desirable. Paying for the postponement of undesirable practices appeared to be slightly more popular, about 10 per cent were willing to pay for a delay in clear-cutting. Approximately 40 per cent of respondents were willing to contribute labor to remove logging waste and sticks from the terrain, to remove deadwood and decayed wood, and to remove trees and bushes to open the landscape. These are probably actions that respondents perceived important and relatively easy to take part in.

According to a logistic regression analysis, respondents who had access to leisure home were more likely to be willing to participate either by paying or contributing labor. Also higher number of different activities in at typical privately owned area used for recreation and positive attitude towards landowner compensation turned out to increase the willingness to participate. An opinion that the landowner has the right to decide how the area is managed or that there is no need for landscape management decreased the participation probability. The mean willingness to pay for the actions was found to be €92 per year per person and the mean willingness to contribute labor was 3.5 days per person per year.

The latent class multinomial regression model revealed three classes of recreationists who expressed a varying tendency to contribute. Non-participants comprised 62 per cent of the sample and were the most reluctant to contribute, 95 per cent of them were not willing to contribute at all. Labor contributors comprised 32 per cent of the sample and were most willing to contribute labor to management practices. About half of them were willing to contribute labor, but at the same time almost half was not willing to contribute at all. The third class, money-contributors, was the smallest class and included 6 per cent of the respondents in the sample. They were most favorable towards the program, as only 28 per cent were not willing to contribute at all. Labor contributors knew the landowner more often than others and also owned forest by themselves more often than others. There were also more middle-aged respondents in this class than in the other two classes. Both the participants who were willing to contribute labor and those who were willing to pay money had greater regular access to a recreational home than the rest, and they were more active than others in outdoor recreation in the area. Respondents who were willing to pay money were slightly younger than others.

5. Discussion

This dissertation provides information on the benefits of outdoor recreation in monetary terms in Finland and about how environmental quality affects the recreational benefits of swimming and leisure home visits. It also examined Finns' willingness to contribute to the recreational quality of privately-owned areas. The national recreation inventory data that includes a representative sample of the Finnish 15- to 74-year-old-population enabled estimation of the economic value of the recreational benefits on the national level. The national data allowed accounting for the extremely wide supply of recreation opportunities provided by the everyman's rights. Similarly, the data on visits to leisure homes throughout the country enabled estimation of the recreational value of summer house visits and the impact of environmental attributes on the value. Study III presents an example of using national recreation inventory data in combination with contingent behavior data and water quality perceptions to assess the welfare effects of water quality changes at the national level. Study IV studied Finn's willingness to contribute to the recreational quality of those privately-owned land areas that they visit for recreation.

Even though the country-level approach has several strengths, its limitations should also be acknowledged. The results of Study I are based on respondents' visits to their most recent close-to-home recreation sites and trips to their most recent nature trip destinations, as well as the travel costs associated with travelling to those destinations. Study II is based on the data on respondents' visits to their own leisure homes, and Study III on the data on respondents' swimming visits to their typical swimming sites and the travel costs to that site. Thus, the estimated TC and CBM models represent demands for visits to typical most recent close-to-home and nature trip destinations, leisure homes, and typical swimming sites in Finland. This means that estimates of aggregate benefits rely on the assumption that the estimated per trip values are representative of Finns' swimming, outdoor recreation and leisure home visits. Unfortunately, the data did now allow us to test how well the most-recent recreation destinations and typical swimming sites represents Finns' recreation areas and swimming sites in general. Still, as the data used in Study I consisted of representative survey data on the Finnish population and were collected for two years at different times of the year, it is plausible that the data provide a comprehensive picture of Finnish outdoor activities and swimming visits. In Study II, it was found that the holiday homes of the respondent were relatively similar to the overall stock of leisure homes in Finland.

Comparison of the results with each other and with previous and subsequent studies shows that the results of this dissertation are of the same order of magnitude as other studies in the field. The CS per visit estimates for close-to-home recreation in Study I (€5.1−97/visit/person for visits to leisure home, €2.0−7.4/visit/person for visits to state-owned areas, and €4.3−7.4/visit/person for vistis to areas used by the everyman's rights) are close to the values estimated for the visits to typical swimming sites in Study II (€4.9−22.1/visit/person). Also, the CS per trip estimates for nature trips in Study I

(€28.5−252.3/trip/person) are similar in magnitude to the per trip CS estimates for visits to leisure homes estimated in Study II (€104.8−252.3/trip/person). However, it is worth noting that in Study 1, the cost of accommodation for the nature trips, which may be a significant part of the total cost of the trip, was not included in the analysis; therefore, the values can be considered as conservative estimates for the economic value of nature trips.

There are no previous estimates of the recreational value of leisure home visits, but other forms of outdoor recreation have been investigated in Finland. Huhtala and Pouta (2009) used TCM to assess the recreational benefits of all state-owned protection and recreation areas in Finland and reported an average per trip CS of €30.19−44.27/trip/person, which is close to the lower end of the CS per trip for nature trips estimated in Study I. Because Huhtala and Pouta's (2009) model included both day trips and longer trips, it is expected that the estimated values fall between the value of close-to-home visits and the value of nature trips of Study I. In a CVM study, Tyrväinen et al. (2001) estimated the per trip values to Urban parks in Salo in Finland to be €2−3 per visit per peson. In Sweden, Ezebilo (2016) used a country-level TC model to assess the monetary value of close-to-home outdoor recreation in Sweden and estimated the per-visit value be around €50 (526 SEK) per visit, which is clearly higher than the values estimated in Study I. One reason that can explain the difference is the differences in the model specification. The dependent variable in Ezebilo's (2016) study was the total number of recreation visits per individual to any natural area near home, and the travel cost variable was based on a respondent's self-reported travel costs; moreover, the opportunity cost of time was included in the travel cost variable.

In a single-site CBM study, Kosenius and Horne (2016) estimated the CS per trip to Oulanka National park in Finland to be €323−355 per trip per person. Pokki et al. (2018) estimated with TCM the CS of recreational angling trips to river Teno to be €235−338/trip/person. Our estimates for the CS per nature trip to Northern Finland are somewhat lower (€103−252/trip/person). Beyond factors relating to the specification of the travel cost model, the higher values in Kosenius and Horne (2016), and Pokki et al. (2018) might be explained by the fact that they estimate the values of single unique popular tourist destinations. A meta-analysis of TCM studies would be beneficial to study of whether the results of regional models that pool data on visits to multiple destinations in the same data tend to differ from the results of single-site TCM studies.

The per visit CS estimates for the current water quality of Study III (€6.8−16.1/visit/person) fit the range of the CS estimates by Vesterinen et al. (2010) for water recreation in Finland but are considerably lower than the CS per visits to the Baltic Sea measured by Czajkowski et al. (2015) and Bertram et al. (2020). Using TCM Czajkowski et al. (2015) estimated the CS per visit to the Baltic Sea to be €80.7/person in Finland. Bertram et al. (2020) used CBM to assess the effects of potential future water quality changes on the recreational benefits of the Baltic Sea and estimated the average CS per trip to the Baltic Sea in Finland to be €366.2 per person. The higher values in Bertram et al. (2020) and Czajkowski et al. (2015) were expected, as they measured the value of Baltic Sea recreational visits in general, including any kind of activities, as well as trips by tourists staying longer than a day at the destination.

Regarding the effect of water quality changes, the estimated aggregate changes in benefits in Study III are clearly higher than those in Vesterinen et al. (2010) and Czajkowski et al. (2016) but of similar magnitude to the results of the CBM study by Bertram et al. (2020). In Study II, the estimated annual loss of 30 million Euros in recreational benefits of leisure home visits due the occurrence of algal blooms that prevent water recreation is of same magnitude as the estimates in Vesterinen et al. (2010). However, due to differences in geographical areas, recreation activities included in the modes, water quality variables, and methods, the results are not directly comparable. Beyond other differences between the studies, the differences in the results between TCM and CBM studies may result from the fact that variation in water quality levels in the TCM models might be smaller than in a CBM model. It is also possible that the hypothetical nature of CBM will produce different results from TCM if the respondents' answers to the hypothetical questions differ from their actual behavior (Whitehead et al. 2008).

One limitation of the TC-CB analysis of Study III is that it does not take into consideration potential substitution patterns of swimming site choices due to changes in water quality. It is likely that if the water quality decreased in one’s typical swimming site, they would go swimming at some alternative site, given that a suitable alternative site was available within a reasonable distance. Hence, the results on aggregate welfare effects of water quality changes present change in the recreational benefits of swimming at typical swimming sites. Another approach would have been to investigate how a change in water quality in a given water body would affect the value of water recreation in the area using a multiple-site demand system (Phaneuf & Siderelis 2003) that simultaneously predicts demand for several sites in a region. However, due to the extremely wide supply of recreation opportunities in Finland that are not limited to official recreational areas, collecting data on the demand system is a challenge for future recreation studies.

Study IV took a step forward to recreationists’ willingness to contribute to the recreational quality of the areas they visit and investigated whether Finns would be willing to pay or to contribute labor to private landowners in order to enhance the recreational quality of their lands. The mean willingness to pay for the actions was found to be €92 per year per person, and the mean willingness to contribute labor was 3.5 days per person per year. The WTP is slightly higher than WTPs for recreational quality of state-owned commercial forests in Finland measured in a CE study by Juutinen et al. (2014). Juutinen et al. (2014) reported WTPs of €13.5−55.7 per year per household for improvements in attributes of the recreational quality of forests and willingness to accept (WTA) of €29−76 per year per household for reductions in the levels of recreational quality attributes. In a CE study, Tyrväinen et al. (2014) measured tourists’ WTP to private landowners for recreational quality attributes of the landscape in the Ruka-Kuusamo tourism area in Finland. Respondents were willing to pay €10.24−12.17 per person per week for improved biodiversity and landscape. Respondents' WTTA for extinction of 10 per cent of species was €36.83 per visitor per week and €9.99 for reduction in the total length of outdoor routes.

Study IV also examined Finn's preferences for a range of forest and other land-use management practices from a recreational standpoint. With regard to preferences for different management practices, Study IV supports previous findings that people often perceive intensive forest regeneration practices as detrimental to the recreational value of forests and prefer mature forests with easy passage, good visibility, sparse undergrowth, a green and uniform ground floor, and little residue or logging waste (Ribe, 2009. Silvennoinen et al. 2002, Tyrväinen et al. 2014, Karjalainen, 2006, Gundersen and Frivold, 2008, Gundersen et al. 2017, Tyrväinen et al. 2003). Study IV, however, also showed the heterogeneity of preferences for different environmental characteristics and forest management practices, as some practices may be preferred by some while being disliked by others.

6. Conclusions

The results of this dissertation show that the economic value of the outdoor recreation benefits in Finland is considerable. The results also demonstrate the effect of water quality on the recreational benefits of water systems in monetary terms and provide information on Finns' willingness to contribute to the management of recreational services of privately-owned lands. The studies provide evidence-based estimates of recreational value to raise awareness, and to inform debates, policy planning and decision-making concerning the recreational use of nature. In addition to providing value estimates for recreational benefits at national level, the results of the present studies can also be used in regional land use planning, for example to illustrate the economic value of outdoor recreation in different land use scenarios.

Using a representative population survey on outdoor recreation demand in Finland and the travel cost method, Study I provided an overall picture of the economic value of the recreational benefits provided by ecosystems in Finland. The high value of close-to-home recreation relative to the value of longer nature trips and the spatial distribution of close-to-home visits and their value following the population distribution reflects the importance of outdoor recreation opportunities close to where people live. The economic value of nature trips including overnight stays in Study I and the value of leisure home trips estimated in Study II also reflect the recreational value of nature as a desired element of a weekend and holiday destination. According to the results of the mapping, the value of overnight nature trips is highest in Northern Finland, signaling the high value of the northern landscape. The value of nature trips in the most water rich areas of the country and the value of leisure home visits reflect the importance of the lakes and coastal areas as recreational destinations, as well as the importance of the leisure home culture for Finns.

Study II provided the first estimates of the recreational benefits of leisure homes in economic terms. Study III estimated the effects of water quality changes on the recreational benefits of swimming in natural waters. The results of both Study II and Study III demonstrate the high value of good water quality for Finns and contribute to the information base of the monetary value of non-market benefits of water quality changes. The information enables comparing the cost and benefits of different water protecttion measures. The importance of shores and water systems can also be seen in the results of Study IV, where the management of shores and water systems was found to be the action most commonly found desirable among the respondents.

Study IV investigated Finns' willingness to pay or to contribute labor to land owners for enhancing the recreational quality of privately-owned lands and waters, and examined Finn's preferences for a range of forest and other land-use management practices from a recreational standpoint. The results suggest that the demand for this kind of recreational quality PES would be relatively limited, as only 10 per cent of the respondents expressed a willingness to pay for such improvements. This implies that the willingness to pay might not be enough for implementing a PES scheme covering all private lands in a sparsely populated country such as Finland. PES may, however, provide a method that targets the efforts to enhance recreational quality at locations that have most importance for recreation, such as in the vicinity of nature tourism attractions and in popular leisure home areas. Further, as almost half of the respondents of Study IV expressed willingness to contribute labor at least to one action, their willingness to participate in the implementation of desirable management might help to maintain and improve the recreational services of the private lands. However, by focusing on demand, the study provided only half of the picture. To complete the picture, it is essential to acquire information on landowners' willingness to produce recreational ecosystem services in a ecosystem service trade.

In future research, linking spatially explicit data on the recreational facilities and characteristics of natural areas and water systems with recreation visit data would enable analysis of the effects of changes in these characteristics on outdoor recreation visit frequency and their value. It could also help to reveal potential local shortage of recreational areas as well as to identify areas with particularly high recreational values. This would be particularly important in urban areas, where land-use planners are facing the challenge of balancing the construction needs of growing populations, economic development, climate change mitigation measures and securing sufficient amounts of green space for residents (Tyrväinen et al. 2007, Bomans et al. 2010). Of course, the benefit estimates should also be compared with the cost of recreational areas and water protection and with the opportunity costs of land use. Identifying areas of particular value as recreational areas, knowledge of the sufficient amount and size of recreational areas and knowledge of the natural characteristic that enhance the recreational value would facilitate land use planning and management aiming to support residents' well-being.

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Appendix

Table A1 Literature on the economic value of recreatioal use of nature in Finland

Study and the study site	Method/Data	Estimated economic values
Ovaskainen et al. 2001: Three recreation sites near Helsinki	TC/A visitor survey	FIM 70-72/trip/person (€12/trip)
Pouta and Ovaskainen 2006: Recreation in agricultural landscape	TC/LVVI 1998-2000*	Visits to agricultural land at destination: € 22/day trip/person, €51/over-night trip/person. Visits to other destinations: € 20/day trip, €57/over-night nature trip/person.
Vesterien et al. 2010: Water recreation	TC/LVVI 1998-2000* + The State of Finland's Surface Waters -data	€6–19 /visit/person
Ovaskainen et al. 2012: Teijo National hiking area	TC/A visitor survey	€25-59/visit/person
Czajkowski et al. 2015: Recreation by the Baltic Sea coast	TC/Household survey	CS/trip/person in Finland: €80.7 Annual aggregated value in Finland 1.04 billion. +8,4% if perceived water quality increases by one Likert scale unit
Pokki et al. 2018: Recreational salmon angling at River Teno	TC/A visitor survey	CS/trip/person: €235-338/trip/person Estimated total value of salmon in 2011: €2.6-3.7 million.
Kosenius and Horne 2016: Effects of mining externalities on the recreational benefits of Oulanka National Park	TC-CB/A visitor survey	CS/trip in current conditions: €323-355/trip CS/year/visitor: - in current conditions: €668/year/visitor - with mine in the area without any noticeable impacts: €472/year - with mine that can be seen from the highest peaks of the area €408/year - with mine that is visible to the highest peaks of the area with impacts on traffic, endangered species, and recreational possibilities in one river €91/year - with mine that is not visible to the highest peaks with traffic effects and impacts on endangered species and recreational possibilities in two rivers: €167/Year
Huhtala 2004: Recreation at Finnish national parks and state-owned recreation areas	CV/LVVI 1998-2000*	Average WTP/person/year: FIM 111 (€ 19)
Tyrväinen 2001: Recreation in urban forests in Salo and Joensuu	CV/Resident surveys	In Joensuu: FIM 42-53/month/person (€7-9/month). In Salo: FIM 9-17/visit/person (€ 2-3/visit)

Horne et al. 2005: Land-scape and biodiversity in five outdoor areas	CE/Visitor interviews	Average WTP for management practice with two of the sites left unmanaged to enhance biodiversity and three remaining under the present management regime to focus on recreational use -€10/person/year
Huhtala and Pouta 2009: State-owned protected and recreation areas	TC, production function/ LVVI 1998-2000*	Travel cost method: Average €30.19-44.27/trip/person Production function method: Average: €47.09/trip/person
Huhtala and Pouta 2008: State-owned recreation and conservation areas in Finland	CV/LVVI 1998-2000*	Users of the areas: FIM 128/year/person (€ 21.5/year) Non-users: FIM 107/year/person (€18/year)
Juutinen et al. 2011: Recreational facilities and biodiversity in Ou-lanka National Park	CE/A visitor survey	WTP, €/person/visit State of endangered species (Current state: number of en-dangered species 150: €5.4): - 15 species extinct in the park: -€12, - 10% increase in populations of endangered species: €6.7 Expected number of visitors (Expected increase: a visitor encounters 40 people during a 1 km walk:€4.22): - A visitor encounters 10 people: €5.43, - A visitor encounters 70 people: -€9.65 Size and number of resting places in the area (Current state: a resting place after every 2km: €2.89): - 2 new camp fire places on the most crowded places: €1.68 - A resting place after every 1km: -€4.57 Information boards in English in the area (Current state: no information boards: -€2.15): - A board after every 3km: €3.04, - A board after every 1km: -€0.89
Grammatikopoulou et al. 2012: Agricultural landscape attributes in Nurmijärvi	CE/A house-hold survey	WTP €/person/year Uncultivated landscape: - €0.10-0.58 Plants: € 0.5-0.74 Horses: €63.7-79.38 Horses and cattle: €82.52-102,69 Water buffer, mowed, 15m: €2.77-4.37 Water buffer, natural, 15m: €6.94-10.58 Buildings, torn down: -€5.47 -21.02 Buildings, renovated: € 35.78-56.62

Tyrväinen et al. 2014: Landscape and biodiversity at Ruka-Kuusamo tourism area	CE/A visitor survey	Outdoor routes in private forests (No change: 100 km of routes): - 80 km of routes: -€9.99/visitor/week Traces of intensive forestry operations (No change: visible on 20% of the sides of routes): - Visible on 10% of the sides of routes: €10.82/visitor/week - Not visible on the sides of routes: €12.17/visitor/wee Endangered species (No change: 200 endangered species): - 10% of species extinct: -€36.83, - Populations increase by 10%: €10.24 Carbon sequestration by forests (No change: corresponds to emissions of 100 000 tourists): Statistically non-significant
Juutinen et al. 2014: Recreational quality of state-owned commercial forests	CE/Resident surveys	Scenic buffer zones along lakes and rivers (current level: buffer width 20 meters): - 40 meters €34-55.7/year/household - 5 meters -€74-76//year/household Habitats for game birds (current level: 2000 managed courting grounds for capertcaillie): - 100 managed courting grounds -€29--39.5/year/househ. - 3000 managed courting grounds €15.7-21.1/year/househ. Frequency of clear-cut areas along hiking trails (current level: visible traces on 10% of trails): - no visible traces €13.5-15.4/year/household - on 20% of trails -€32.4-30.4/year/household Estimated aggregated welfare effect of the current recreation oriented management: € 149 million per year
Juutinen et al. 2017: Recreational use and preferences for management of state-owned commercial forests	CE/Resident surveys	Does not provide WTP estimates but investigates preference heterogeneity among the respondents in the data analyzed in Juutinen et al. 2014

*) Finnish National Outdoor Recreation Demand Inventory data collected in 1998-1999

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