Dissertationes Forestales 204

Contingent valuation and choice experiment of citizens' willingness to pay for forest conservation in southern Finland

Emmi Haltia

Department of Forest Sciences
Faculty of Agriculture and Forestry
University of Helsinki

Academic Dissertation

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Author: Emmi Haltia

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Thesis Supervisors:
Jari Kuuluvainen, Adjunct Professor (formerly Professor, 1997–2009)
Department of Forest Sciences, University of Helsinki, Finland
Eija Pouta, Professor
Unit of Economics and Society, Luke Natural Resources Institute Finland, Helsinki, Finland
Bengt Kriström, Professor
Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå, Sweden
Pre-examiners:
Artti Juutinen, Professor
Unit of Economics and Society, Luke Natural Resources Institute Finland, Oulu, Finland
Ståle Navrud, Professor
School of Economics and Business, Norwegian University of Life Sciences, Ås, Norway
Opponent:
Bo Jellesmark Thorsen, Professor
Department of Food and Resource Economics, University of Copenhagen, Denmark
Custos:
Olli Tahvonen, Professor
Department of Forest Sciences, University of Helsinki, Finland

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ABSTRACT

Environmental quality has a direct effect on citizens' welfare. To quantify this effect, the four articles of this thesis analyse Finnish citizens' willingness to pay (WTP) for increased forest conservation using the contingent valuation (CV) and choice experiment (CE) methods. These methods are based on neo-classical welfare economics augmented with the choice process framework originating from psychology and behavioural economics.

Using the CV method, we analyse how WTP is affected by respondents' uncertainty, by the share of nonrespondents and by the considerably high share of "yes" responses at the highest proposed costs to households. The CE data are used to study the effects of different conservation programme characteristics on WTP.

The results show that Finnish citizens support increased forest conservation. The median WTP in the contingent valuation was 72 EUR, i.e. 50% of respondents supported increased conservation if the costs per household did not exceed 72 EUR. The mean WTP estimates were sensitive to modelling assumptions and assumptions concerning the nonrespondent preferences. This emphasises the need for careful sensitivity analyses when results are used for welfare measurement and policy planning. Respondents' choices in the valuation questions were affected by the household costs of conservation and other socioeconomic characteristics. The results suggest that the choices in valuation tasks are affected by economic and psychological factors. The study gives important insights into the choice behaviour and lower and upper bound estimates of WTP. These estimates are somewhat lower than those in comparable earlier Finnish studies. In CV, respondents seemed insensitive to programme size while the extent of the proposed project had a significant effect on the choices in CE.

Keywords: stated preference methods, forest biodiversity and habitats, fat-tail problem, choice uncertainty, non-response bias

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LIST OF ORIGINAL ARTICLES

This doctoral dissertation is based on the following four articles, which are referred to by their Roman numerals in the text throughout this summary. Articles (I–II) are reprinted with the kind permissions of publishers and articles (III–IV) are the author versions of the submitted manuscripts.

I. **Lehtonen (Haltia) E.**, Kuuluvainen J., Pouta E., Rekola M., Li C-Z. 2003. Non-market benefits of forest conservation in southern Finland. Environmental Science and Policy 6(3): 195-204. http://dx.doi.org/10.1016/S1462-9011(03)00035-2

II. **Haltia E.**, Kuuluvainen J., Ovaskainen V., Pouta E., Rekola M. 2009. Logit model assumptions and estimated willingness to pay for forest conservation in southern Finland. Empirical Economics 37(3): 681-691. http://dx.doi.org/10.1007/s00181-008-0252-8

III. **Haltia E.**, Kuuluvainen J, Li C-Z., Pouta E., Rekola M. Preference uncertainty and its determinants in nonmarket valuation: the case of forest conservation in Finland. Manuscript.

IV. **Haltia E.**, Kriström B., Ranneby B. On the treatment of non-response in contingent valuation. Research note. Manuscript.

AUTHOR'S CONTRIBUTION

The author developed the article ideas and the research problems jointly with Jari Kuuluvainen, Eija Pouta and Mika Rekola (I, II and III), Chuan-Zhong Li (I and III) and Bengt Kriström (IV). The author gathered the data used in all articles together with Jari Kuuluvainen, Eija Pouta and Mika Rekola. The author was responsible for the data analysis of article (I) jointly with Jari Kuuluvainen, Eija Pouta, Mika Rekola and Chuan-Zhong Li. The author was mainly responsible for the data analysis of articles (II), (III) and (IV) and the writing of all four articles.

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1. INTRODUCTION

1.1 Policy background

Defining a socially and ecologically desirable level of forest conservation requires considering the ecological state of habitats and species as well as the economic and social consequences of conservation. Conservation level and ecosystem quality have a direct and indirect effect on the welfare of citizens. As taxpayers, citizens provide the funding for environmental policy and thus their opinion should be reflected in the decision process of the policy options. Valuation studies can provide information concerning citizens' preferences and reveal the magnitude of the conservation benefits.

Some valuation studies of the nature conservation benefits in Finland have been undertaken earlier, especially in connection with the European Union (EU) nature conservation project Natura 2000 network (Pouta et al. 2000, 2002; Rekola et al. 2000; Li et al. 2001). The benefits of forest conservation have also been examined (Siikamäki 2001; Horne 2008). The results of these studies were not applicable with the topic of this study, forest conservation in southern Finland, because their valuations of environmental benefits were targeted to different policy programmes and benefit estimates are case-specific.

Strictly protected forestland covered 1.6% of all forested land in southern Finland at the time of our data collection in 2002. Presently the strictly protected forestland area comprises 2.5% of all forested land in southern Finland. Valuable sites totalling approximately 2.1% of forested land area are protected by the Forest Act and the voluntary decisions of forest companies. Consequently, a total of approximately 4.5% of forests in southern Finland are protected in some way. In northern Finland, 16% of the forested land is strictly protected (Finnish Statistical Yearbook of Forestry 2013). However, most of the valuable biotopes and endangered species exist only in southern Finland. One reason for the small percentage of conserved areas in southern Finland is the high amount of privately owned forested land (72.8%) (Finnish Statistical Yearbook of Forestry 2013). Biodiversity protection is also taken into consideration during forest management planning, both in the information and education of forest owners' and in forest management. The number of endangered forest species has increased despite an increase in conservation area since the data collection of this study (Rassi et al. 2010; Finnish Statistical Yearbook of Forestry 2013).

According to Finland's National Forest Programme 2015, one aim of forest policy is to reach and maintain a favourable conservation level of species and valuable biotopes, using a suitable combination of strictly conserved forest areas and the sustainable management of commercial forests (Finland's National Forest Programme 2011). The national goals are in accordance with EU-level goals aiming to halt the deterioration in the status of all species and habitats by 2020 (EU Comission 2011). The Finnish government has implemented a forest biodiversity programme (METSO) since 2008, with the aim of halting the decline of forest biotopes and species in southern Finland. The pilot phase (2001–2007) and later the programme itself has used several conservation measures based on the initiative of forest owners' and on voluntariness.

1.2 Environmental valuation

The motivation for performing a cost-benefit analysis is to assess the proposed project in economic terms (Freeman 2003). The analysis includes all benefits and costs in question, including externalities. In the forest conservation context, the benefits are nonmarket i.e. an increased welfare of society due to a better state of the ecosystems. Increasing forest conservation creates nonmarket environmental benefits for society, but also generates costs. The costs are incurred via direct compensations to forest owners for setting their forests outside of commercial use and via the possible reduction in wood supply. If a forest conservation project is large enough, the reduction in timber supply increases timber prices and causes repercussion effects on related markets and affects industrial profits (Johansson 1993). As forest industry companies operate on the global competitive market, they have little chances to react to the raw material price increase with their prices. If a conservation programme is small and has only a small or no effect on timber prices, the conservation costs would be limited to forest owner compensations. Forest conservation is socially desirable in such situations if the forest owners' producers' surplus and the citizens' WTP for forest conservation combined exceed the direct costs of conservation.

Pareto optimal resource allocation means that the reallocation of resources cannot improve any individual's utility without decreasing the utility of someone else (Freeman 1999). Changing a pareto optimal situation can be considered socially desirable if potential gainers can fully compensate their losses and still be at the same or higher utility level. This condition for efficient policy is called the Kaldor-Hicks compensation principle (Hicks 1939; Kaldor 1939).

According to the neo-classical economic theory, value is a measure of contribution to human well-being, in other words it is an instrumental value. Another type of value concept, intrinsic value, means that all species, biodiversity and the entire natural world should be conserved for themselves, without any connection to human welfare. Intrinsic value cannot be measured or compared to other kinds of values (Mace and Bateman et al. 2011). This study is limited to economic values (Farber et al. 2002), and the other value systems are beyond the scope of this study.

Economic value can be presented using the total economic value framework (e.g. Bateman et al. 2002, p. 28). This framework divides the total value into use values and passive-use values. Market prices or methods based on observed behaviour cannot generate values for forest conservation or the protection of endangered species, because passive-use values form a major component of their total value. This particularly characterises large-scale conservation programmes instead of small local or regional cases, in which recreational use values usually also play an important role. If decision-making ignores the passive-use values, the value of environmental goods may be underestimated and decisions may not be optimal from the society's point of view. Such decisions could also lead to environmental degradation and loss of ecosystem values.

The neo-classical economic theory assumes that individuals have well-defined, stable preferences. This means that people can compare bundles of goods, and if one good is reduced, they can define, according to their preferences, how much of something else they need in order to stay at the same level of utility. This concept is called substitutability (Freeman 1999). In the case of an intended increase in some environmental benefit, people can be asked to define their willingness to pay (WTP) for that change. Or if a decrease occurs in the level of some environmental amenity, individuals could be asked for their

willingness to accept (WTA) compensation for the degradation. In these cases the change in environmental quality is substituted with money, and the amount of money indicates the monetary value of the welfare change.

Environmental valuation methods are based on the above-mentioned substitutability principle. Methods used to estimate environmental values can be divided into the revealed preference and stated preference (SP) methods. Revealed preference methods use data of actual behaviour such as market data. The most well-known methods are the travel cost method and hedonic pricing (e.g. Freeman 1999). The SP methods used in this study can also measure values in cases where market data are not available. The methods are based on different survey formats, in which respondents answer the valuation questions and thus state their preferences for the environmental changes presented in the questionnaire. SP methods make it possible to value non-use values and analyse the programs that have not yet been implemented.

The most commonly used SP method has been contingent valuation (CV). It often aims to value single environmental good. The choice experiment (CE) method instead aims to analyse the value of an environmental good's characteristics and thus allows defining the value of several alternative goods with different characteristics from the same data set. The same method has also been called conjoint analysis (CJA) (Smith 2006), Multiple choice – sequence (Carson and Louviere 2011) or stated choice method (Rose et al. 2011). The first study that proposed the use of hypothetical market and WTP questions in a survey was the study by Ciriacy-Wantrup (1947). Davis (1963) reported the first implementation of CV in his dissertation concerning outdoor recreation value. Krutilla (1967) recognised the importance of including existence values in the policy assessment. Existence value also includes other concepts, e.g. non-use values, bequest value, option value (Weisbrod 1964) and quasi-option value (Arrow and Fisher 1974). Each of the above-mentioned three studies indicated that there were values unexpressed by the market prices (Carson 2011). Randall et al. (1974) measured existence value in a study for the first time. The earlier studies typically applied the stated preference method to goods that could have been valued using the revealed preference methods. An important step in the development of discrete choice CV and also the travel cost method was the seminal paper by Hanemann (1984). In this paper he shows the connection between the econometric modelling and the random utility theory. In recent years, existence values have also been extensively discussed in the ecosystem services framework. Several international and national ecosystem service assessments have identified, measured and valued non-market goods alongside marketable goods (MA 2005; TEEB 2010; UK NEA 2011).

Research on the CV method became more common both in the US and Europe during the 1980s. Mitchell and Carson's (1989) book provided a coherent framework for the CV method. It also includes extensive typology of potential biases in the CV method that had been recognised in earlier literature. An adapted and updated version of this typology is presented in Bateman et al. (2002, p. 302).

The Exxon Valdez oil spill in Alaska in 1989 became an important event in the history of the stated preference methods (Carson et al. 2003; Smith 2006; Carson 2011). It raised a debate about the use of CV in defining damage values. Hausmann (1993) presented a very critical assessment of the CV method. The National Oceanic and Athmospheric Administration (NOAA) of the US established a panel to assess the use of CV results in the litigation concerning damage liability. The NOAA panel gave a cautiously positive evaluation of the method, in circumstances where a study is carefully conducted according to certain guidelines (Arrow et al. 1993). These guidelines have been quite restrictive and

may even have directed research away from directions that would have been beneficial from the viewpoint of welfare measurement and policy analysis (Smith 2006).

The CE method has become one of the most popular preference elicitation methods during the last fifteen years (Louviere et al. 2000; Carson 2011). Before its use for environmental benefit valuation, the CE method was applied in the fields of transportation research (Louviere and Hensher 1982) and marketing (Louviere and Woodworth 1983). The CE method has some properties that have made it appealing compared to the CV method. The choice task sequences collect copious information concerning respondents' choices, and using attributes to define the choice tasks enables the separate calculation of marginal WTP for each attribute. Offering respondents several alternatives and choice tasks to compare the CE method also makes responses more sensitive to the scope of the proposed project (Boxall et al. 1996; Adamowich et al. 1998).

An increasing number of literature suggests that actual choice behaviour and responses in stated preference surveys systematically violate the neo-classical utility model (Opaluch and Segerson 1989; Sugden 2005). Behavioural economics and psychological research have pointed out differences between the standard economic theory and human behaviour. These findings, e.g. the anchoring effect and scope insensitivity, are discussed in more detail in Section 2.1. One alternative for interpreting these findings is the constructed preferences approach (Lichetenstein and Slovic 2006). It assumes that people do not have stable, pre-existing preferences and respondents express attitudes instead of preferences in the stated preference surveys. The valuations of unfamiliar goods may particularly be very sensitive to arbitrary anchors and other distortions (Arielry et al. 2003). Another competitive approach, the discovered preference hypothesis (DPH) (Plott 1996), draws from the same empirical findings concerning choice behaviour as a constructed preference approach. However, the conclusion is different. DPH assumes that people have true underlying preferences, but they are unaware of them without experience. Many recent SP studies have adopted this assumption, as it enables the combining of economic theory and findings of behavioural economics and psychology (i.e. Braga and Starmer 2005; Bateman et al. 2008; McNair et al. 2012).

Despite the controversy regarding the stated preference methods (Carson 2012; Kling et al. 2012; Hausman 2012), they are still the only methods available for measuring passive use values. Following the discovered preferences hypothesis, this study also assumed that people are able to express their preferences when answering the survey, at least approximately.

1.3 Objectives and outline

This study was conducted to measure Finnish citizens' WTP for forest conservation. In 2002, when the data for this study were collected, there was an urgent need for welfare estimates concerning forest conservation in southern Finland and for insight on the effect that conservation means have on public opinion. This issue is still current, over 12 years after data collection. The conserved forest acreage has increased slowly, but the number of endangered species has also increased. Empirical results are also important for meta-analysis and benefit transfer, which need reliable primary results for their data.

The overall objective of this thesis is to provide an estimate for the nonmarket benefits of increased forest conservation in southern Finland using several different modelling options and considering the special characteristics of the data. This overall objective can be divided into five different sub-objectives.

The first objective is to analyse respondents' WTP for increased forest conservation and to evaluate the effect of the conservation programme characteristics on the citizens' opinions. The second objective is to compare the two methods for preference elicitation, CV and CE (Study I). The third objective of the thesis is to examine the modelling options for the CV data and their impact on the estimated WTP, zero WTP and "yes" responses (Study II). The fourth objective is to examine the reasons behind respondent uncertainty in CV and to include information concerning the certainty in WTP estimation (Study III). The fifth objective is to also take into account the possibility that nonrespondents differ from respondents and possibly impact the mean WTP, which is often excluded (Study IV).

The key contributions of this thesis are the information concerning citizens' opinions on increased forest conservation and the WTP results. WTP result estimation takes several issues into consideration that could affect the WTP estimates and that are common in stated preference studies. The socially optimal forest conservation level is constantly under consideration and the best possible information concerning the benefit estimates and issues that impact them are still needed.

The outline of this summary is following. The second section introduces the theoretical framework of the thesis, presents some methodological issues and introduces the earlier valuation literature. The third section presents the survey of forest conservation in southern Finland and the econometric methods used in the analysis. The fourth section presents and discusses the results of the studies and the fifth section concludes.

2. THEORETICAL FRAMEWORK AND EARLIER LITERATURE

2.1. Random utility model

Forest conservation is a pure public good and its consumers cannot vary the quantity they consume. Compensating surplus is the correct welfare measure in this case (Mitchell and Carson 1989; Freeman 1999). Compensating surplus is the change in a consumer's income that keeps the individual at the same utility level even after a change has occurred in environmental good.

A utility function is used in economic theory to present individual preferences. The utility function can be expressed as $u=u(c,r)$, where c denotes market goods $c=[c_1, c_2, \ldots, c_j]$ and r environmental services.

Consumer choices are constrained by income, and they maximise their utility subject to the budget constraint y and the set of prices $p=[p_1, p_2, \ldots, p_j]$ for market goods:

$$\max u(\mathrm{c}, \mathrm{r}) \quad s.t.\ y = pc. \tag{1}$$

The indirect utility function is then

$$V_i = v(p, y, r), \tag{2}$$

and it expresses the maximum utility of consumer *i* that can be achieved given *p*, *r* and *y*.

According to the random utility model (McFadden 1974), this is the observable, deterministic part of the utility function. There is additionally an unobservable, random component. Consumer utility can thus be represented by the indirect random utility function (Hanemann 1984)

$$V_i = V(p, y, r) + \varepsilon_i \tag{3}$$

where ε_i is the random component, the value of which is unknown to the researcher, but which is assumed to come from some known distribution (McFadden 1974; Hanemann 1984).

In the context of this study, the indirect random utility function can be written as:

$$V_{ijk} = V(y_i, x_j, z_k, s_i) + \varepsilon_{ijk}, \tag{4}$$

where V_{ijk} is the welfare level of a consumer, *V* the observable, deterministic part of it, y_i represents the income of a consumer *i*. In Equation 4, environmental services, *r*, are divided into two components: x_j, the impact of a conservation project *j*, and z_k, conservation measures conducted in scale *k*. s_i represents the preferences and socioeconomic characteristics of the respondent. Finally, ε_{ijk} is the random component associated with this specific case.

In the case of an increased supply of environmental services, the value of the change can be measured using compensating surplus. The change from the initial state can be written as follows:

$$V(y_i, x_0, z_0, s_i) + \varepsilon_{i00} = V(y_i - CS, x_j, z_k, s_i) + \varepsilon_{ijk}, \tag{5}$$

where x_0 is forest conservation at the current level (status quo), z_0 the conservation means at the current state (status quo) and *CS* the compensating surplus (willingness to pay).

The binary choice CV questionnaire asks the respondent whether they are willing to accept a certain bid price if the forest conservation level is increased as proposed in the questionnaire. The probability for accepting the increased conservation can be written as:

$$\Pr(proj = j) = \Pr\left[V(y_i - Bid, x_j, z_k, s) + \varepsilon_{ijk} \geq V(y_i, x_0, z_0, s) + \varepsilon_{i00}\right], \tag{6}$$

where $V(.)$ is the deterministic part of the utility function. If the random component of the utility function is assumed to be an identically and independently distributed Gumbel variable, the choice probability can be written as:

$$\Pr(\text{proj} = j) = \frac{e^{V_j}}{\sum_{n \in C} e^{V_n}}, \tag{7}$$

where C is the set of choice possibilities (Louviere et al. 2000). If the choices are restricted to two, then the standard binomial logit model applies. The choice probability can also be modelled using a multinomial logit model in cases with more than two alternatives.

2.2 Decision process

The above-mentioned standard version of the economic model assumes rational decision-makers with stable, predetermined preferences. Empirical findings and experiments of behavioural economists show, however, that actual choices are often not in accordance with the economic theory. Psychological research has provided insights for understanding choice behaviour and preference anomalies (Sugden 2005). For example, phenomenon like the anchoring effect (Cameron and Quiggin 1994), availability bias (Tversky and Kahneman 1973), scope insensitivity (Kahneman and Knetsch 1992; Bateman 2011) and the observation that WTP appears to be a range of expected values rather than an exact monetary amount (Arielry et al. 2003; Hanley et al. 2009) are presently better understood.

The constructed preferences approach is based on these findings (Slovic 1995; Lichtenstein and Slovic 2006). The main difference to standard economic thinking is that in the stated preference studies people express their attitudes instead of their preferences (Kahneman et al. 1999). Attitudes and preferences are similar in many ways, but they also differ in some aspects. Attitudes are positive, negative or indifferent feelings towards something. They do not include a dimension of comparison like preferences do. Attitudes additionally do not behave according to the basic preference axioms (Opaluch and Segerson 1989). The constructed preference approach also claims that respondents construct their preferences while making the choices instead of acting according to stable, pre-existing preferences. Schkade and Payne (1994) showed empirical support for the construction of preferences, when a verbal protocol was used while respondents filled in the questionnaire. Because of a violation of preference axioms and the unstable nature of the attitudes, the value estimates from a preference survey may not be valid (Lichtenstein and Slovic 2006).

DPH (Plott 1996) takes into account the above-mentioned findings concerning human decision-making. In contrast to the constructed preference approach, it assumes that people have stable and context-free preferences that exist independently of the discovery process. The preferences are, however, not well known without experience and practice. Braga and Starmer (2005) introduced the terms institutional learning and value learning and found empirical evidence for DPH. Institutional learning refers to learning concerning the attributes, valued good and choice task structure that occur when a respondent goes through a sequence of choice tasks. Value learning refers to the process of finding underlying

preferences when making decisions in several slightly differing choice tasks. Evidence for DPH was also found when it was compared with the standard economic theory and with coherent arbitrariness that shares the assumptions of the constructed preference approach concerning the unstable nature of preferences (Bateman et al. 2008).

In this study, the choice process is assumed to follow the ideas of DPH. Figure 1 presents the applied framework that combines the choice elements according to standard economic model (heavy arrows) and according to knowledge concerning the psychological choice process (light arrows) (McFadden 2001). Experience, information, time and money budgets are input factors in a choice process, as are the questionnaire design and scenario-specific issues in the case of a stated preference study. In the standard economic model, memory affects the choice in both ways, via perceptions and beliefs and via preferences. These two are seen as main elements behind the decision process in the economic model. The psychological approach adds motivation and attitudes into the framework and shows more complex interdependencies between the elements.

Choices in the stated preference surveys are similar to actual market choices in many ways, but there is also the additional element of questionnaire design and choice task characteristics that affect a hypothetical situation in the decision process (Figure 1). The effects of these elements on the choices in stated preference studies have been studied extensively (e.g. Ajzen et al. 1996; Cummings and Taylor 1999; Madureira et al. 2011; Mahieu et al. 2012).

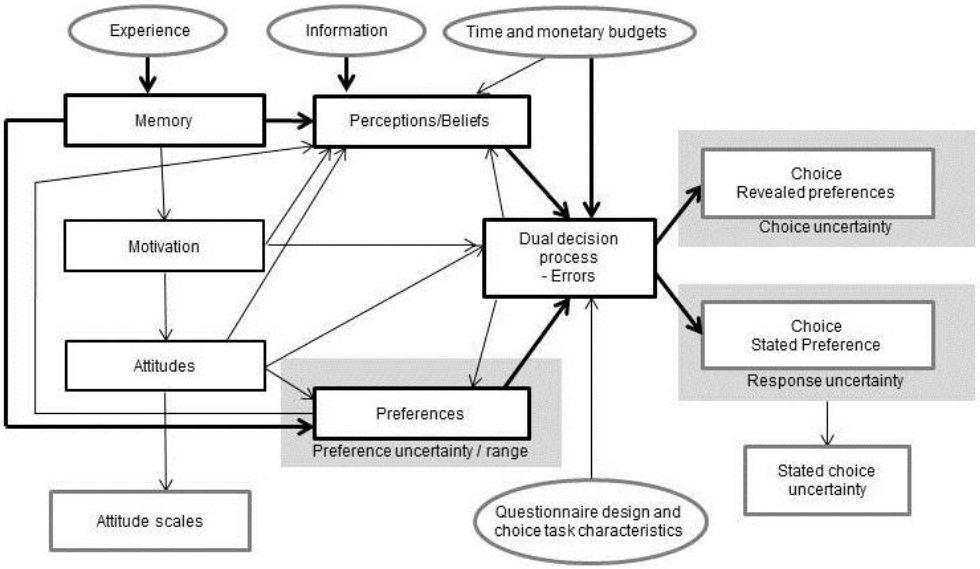

Figure 1. The choice process in the presence of preference uncertainty and choice uncertainty (Adapted from McFadden (2001), Study III).

According to psychological findings, people use two kinds of processes (the dual decision process, bounded rationality) in decision-making: heuristic-holistic and systematic-analytical information processing (Chaiken 1980; Kahneman 2003). The heuristic-holistic decision process is fast, effortless, intuitive, automatic and often emotional. The systematic-analytical process is in contrast slower, effortful, intentional and logic-based (Kahneman 2003; Frör 2008).

The decision process also affects the success of measuring preferences using SP methods. Participants who are motivated and able to process information are more likely to state their preferences in a study (Fisher and Glenk 2011). Less motivated and more confused respondents are more likely to use rules of thumbs and intuition (Frör 2008). The choice process framework presented in Figure 1 also justifies many of the explanatory variables that have been used to explain the choices in SP applications. These variables have included e.g. age, gender, attitudes and previous experience concerning the valued good. The use of attitudes as an explanatory variable for WTP has also been criticised (Morey et al. 2006), if responses to the attitude questions are assumed to directly reflect preferences. Respondent income is often included in the explanatory variables, although it is not in accordance with economic theory in the case of the linear utility function (Haneman and Kanninen 1999; Broberg 2010). A practical approach has been to include income because it has intuitive and empirical justification, while recognising that it has direct impact on household WTP but not on utility change like the other variables (Bateman et al. 2002).

The framework in Figure 1 can be used to clarify the problem setting and results from the four articles of this study. It justifies the inclusion of different explanatory variables in the estimated choice models in Study I, as they have direct connection to the determinants of WTP. It also shows that attitudes and motivation are connected to choices and offers an explanation for the empirical findings of Study II concerning respondent insensitivity to the high bid prices. The framework identifies the elements affecting the choice process and the post-decisional uncertainty in Study III. The framework additionally offers an explanation to the reasons behind sample selection and non-response in Study IV. These above-mentioned connections are discussed in more detail in the following.

2.3 Methodical issues and earlier research

2.3.1 Choice question formats

This study used two preference elicitation methods, CV and CE to estimate value for increased forest conservation. Bishop and Heberlein (1979) introduced the single-bounded dichotomous choice CV that is not so burdensome for respondents, simulates the market situation and is not prone to anchoring. This question format has dominated CV applications since the strong recommendations issued by the NOAA panel (Arrow et al. 1993; Smith 2006; Carson 2011). It has been connected to several desirable features, e.g. the familiar context of take-it-or-leave-it purchasing decisions (market similarity) (Freeman 1999), which is a relatively simple decision problem. It additionally contains no starting point bias (Arrow et al. 1993) and resembles a referendum situation when taxes are used as

a payment method. One of the most important claims has been the assumption of its incentive compatibility (Hoehn and Randall 1987; Arrow et al. 1993). The findings concerning incentive compatibility have been more ambiguous in recent years (Bateman et al. 2008).

The most common variant of the dichotomous choice question format is the double-bounded question format (Hanemann et al. 1991). It collects more information concerning respondent preferences compared to the single-bounded question format, but may suffer from the starting point bias and incentive incompatibility that may distort results. In addition to the dichotomous choice format, preferences have been elicited using the open-ended question format and payment card (e.g. Bateman et al. 2002), and more recently e.g. the payment ladder (Håkansson 2008).

In dichotomous choice CV, as well as CE, the choice of a bid vector is a crucial point in the questionnaire design (Cooper and Loomis 1992; Kanninen and Kriström 1993; Boyle 2002). Optimal designs require information concerning WTP distribution prior to the study that is usually non-existent (Alberini 1995b; Kanninen 1995). A practical approach has been to conduct a pilot study and based on that, place some bid levels around the expected mean WTP and some bid levels to both tails of the WTP distribution.

The discovered preference hypothesis suggests that the choice faced by a respondent in the first valuation choice task is not produced through stable and consistent preferences (Bateman et al. 2008), because goods may be unfamiliar and the respondent may also lack experience regarding the choice situation. A drawback of binary choice CV is thus that it does not give respondents the possibility for either value or institutional learning. In CV, it must be assumed that the information provided by the survey suffices for the respondent to gain knowledge of her underlying preferences.

The CE method has been suggested to overcome most problems inherent in the CV approach (Adamowich et al. 1998; Louviere et al. 2000; Bennett and Blamey 2001). For example, it has been claimed to be so complicated that respondents cannot behave strategically. The proposed scenario in the CE is described using the attributes and their levels, which vary according to certain design. The choice set usually contains several alternatives and a respondent chooses the most preferable alternative that is supposed to yield the highest utility. Respondents also face a sequence of choice tasks, which are defined by the attributes and their levels. Choice experiment data can be analysed using the conventional multinomial logit model. However, it makes strong assumptions concerning the independence of the choice task alternatives and the independence of each choice task in a sequence faced by an individual. Econometric modelling developments have solved many of these problems (Layton 2000; Carrasco and Ortúzar 2002) and CE has been suggested to overcome most of the potential biases that complicate the CV applications (Boxall et al. 1996; Adamowich et al. 1998; Smith 2006).

2.3.2 Fat-tail problem

The WTP distribution of the common logit model does not necessarily provide an accurate description of all respondents, and may therefore produce unrealistic results. This may occur e.g. if the data has a considerable amount of zero WTP responses (Kriström 1997) or a large amount of “yes” responses at the highest bid prices and thus suffers from the fat-tail problem (Ready and Hu 1995). The fat-tail problem analysed in Study II refers to the

situations in the binary choice CV during which a considerable share of respondents have supported the proposed policy at the highest bid levels, causing a WTP distribution with an unrealistically high density in the right tail (Ready and Hu 1995).

An explanation for the fat-tail problem can be the strong attitudes of respondents and their effect on the decision process (Figure 1). According to Kahneman and Sugden (2005), strong attitudes may impact the attention a respondent gives to the exact bid sum. A "yes" response would thus reflect a more positive attitude towards the proposed project than actual preferences. This phenomenon may also be connected to the "yes" responses (Blamey et al. 1999), a warm glow or buying moral satisfaction (Kahneman and Knetsch 1992; Fisher and Hanley 2007).

Fat tail and distribution skewness cause calculation difficulties in the welfare effects, because the mean is very sensitive to distribution shape (Haneman 1984). The median is relatively robust to the shape and the poorly known endpoints of the distribution. The choice among these is dependent on result application. Using the mean signifies the adoption of the Kaldor-Hicks potential compensation principle, while the median demonstrates a majority voting situation (Haneman and Kanninen 1999).

The fat-tail problem is also connected to the selection of the bid values that may affect the results (Boyle et al. 1998). A solution for this potential bias has been to choose the bid values that are close to the assumed mean WTP and exclude the bid values in the distribution tails (Alberini 1995a; Kanninen 1995; Madureira et al. 2011). However, this would require knowledge concerning the bid distribution before the study. An applied method has been to place some of the bid prices close to the assumed mean, but also to include bids in both tails of the expected distribution.

Some methods must be applied to take the fat tail into consideration when estimating the mean WTP from the skewed distribution. The truncated mean could be used for policy purposes according to Ready and Hu (1995). It is, however, highly dependent on the arbitrary upper limit set by the researcher. There is also the possibility of using a model that forces the probability of "yes" to zero at some point estimated from the data. This model specification has been called the pinched logit model (Ready and Hu 1995), and it is used in Study II.

2.3.3 Response uncertainty

Response uncertainty is analysed in Study III in the binary choice contingent valuation context. The perspective of this study is in accordance with the assumptions and findings of DPH, although learning in the task sequence has not been examined. This study uses the term *preference uncertainty* to express the uncertainties related to individual preferences. The term *choice uncertainty* is used for the uncertainty concerning the actual choice decision, and *response uncertainty* refers to uncertainty related to the answer of a valuation question in a stated preference study. This uncertainty may follow from preference uncertainty but also from other elements that affect the choice process.

The grey area behind the "preferences" in Figure 1 refers to preference uncertainty. This means that an individual has a true valuation of the good but is lacking certainty. This assumption is supported by several empirical studies on choice uncertainty (Ready et al. 1995; Li and Mattsson 1995; Loomis and Ekstrand 1998; Akter and Bennett 2013; Voltaire et al. 2013). It has also been suggested that individuals would not have exact valuations for

the different goods in their minds, but a range of excepted values instead (Arielry et al. 2003). A very similar phenomenon has also been called the vagueness band (Svento 1998; Mäntymaa and Svento 2000). In the empirical context this means that if the desired bid is well above or below that range, providing an answer is quite straightforward. If the bid price is within the range, the choice in binary question is much more difficult. According to Arielry et al. (2003), we do not know much about decision-making in such situations.

All the elements in Figure 1 are processed simultaneously in the decision situation using either heuristic-holistic or systematic-analytical information processing (Chaiken 1980; Frör 2008). This process is not flawless; errors in information processing may lead to incorrect choices or even to a situation where despite the utility maximisation of a selected option, respondents may not be certain of this occurring. This may create a feeling of dissonance and lack of confidence. Cognitive dissonance (Festinger 1957; Blamey et al. 1999) is defined as an "emotional state set up when two simultaneously held attitudes or cognitions are inconsistent or when there is a conflict between belief and overt behaviour" (Reber 1985 as cited by Blamey et al. 1999). Cognitive dissonance is very similar to the concept of ambivalence in Opaluch and Segerson's (1989) article. They show how ambivalence is connected to strong opposing feelings and conflicting preferences. In some situations these can make the choice extremely difficult and lead to choices that are not in accordance with preference transitivity assumptions. Choice and response uncertainties arising from cognitive dissonance and ambivalence are illustrated in Figure 1 with a grey area encircling the choices.

Response uncertainty can lead a respondent to choose the wrong alternative in a discrete choice valuation task (Li and Mattsson 1995) and thus cause random response errors and increase the variance of WTP estimates. Allowing uncertainty in modelling should therefore provide more efficient WTP estimates (Hanemann 1984; Li and Mattsson 1995; Hanemann et al. 1998). However, the empirical findings of improved accuracy tests are contradictory (Shaikh et al. 2007). Considering a subjective confidence measure in modelling decreases the WTP estimate variances in some studies (Li and Mattsson 1995; Loomis and Ekstrand 1998) but increases them in others (Loomis and Ekstrand 1998; Samnaliev et al. 2006; Chang et al. 2007).

Some evidence shows that actual behaviour may be close to certain responses in the CV (Champ et al. 1997; Moore et al. 2010). However, incorporating uncertainty into choice modelling has also had very different effects on the mean WTP estimate size. Some model specifications allowing for uncertainty have decreased the WTP (Li and Mattsson 1995; Champ et al. 1997; Moore et al. 2010) while others have increased it (Chang et al. 2007; Moore et al. 2010; Lyssenko and Martínez-Espiñeira 2012). These contradicting results support the findings that the uncertainty elicitation method may have a significant effect on the WTP estimates (Shaikh et al. 2007; Akter et al. 2008; Akter and Bennett 2013).

The two most common approaches to eliciting respondents' choice uncertainty has been the use of follow-up questions after the binary choice CV choice task (Li and Mattsson 1995; Loomis and Ekstrand 1998; Berrens et al. 2002) and the polythocomous choice (PC) question with multiple categories (also called multiple bounded question format) (Ready et al. 1995; Welsh and Poe 1998; Alberini et al. 2003). Other uncertainty elicitation methods that have been suggested recently are the payment ladder (Håkansson 2008), randomised card sorting (Glenk and Fischer 2010; Fischer and Glenk 2011), payment card with a payment ladder possibility (Voltaire et al. 2013) and composite scale (Akter and Bennett 2013).

According to psychologists, a verbal scale is a better elicitation method compared to the numerical probability scale, because people often have a poor understanding of numerical probability (Akter and Bennett 2013). However, word subjectivity is problematic (Hanley et al. 2009). According to the literature, the PC format provides respondents with an easy way of answering without serious consideration of the options, resulting in less certain responses and a higher proportion of "yes" responses than the binary choice elicitation format (Ready et al. 1995; Alberini et al. 2003; Akter and Bennett 2013). When comparing the uncertainty elicitation methods, the composite scale generated a higher proportion of certain responses than other methods and the ordinal scale failed the construct validity tests (Akter and Bennett 2013). The strength of the payment ladder methods (Håkansson 2008; Voltaire et al. 2013) is that the researcher does not need to make assumptions concerning the degree of choice uncertainty, as it is directly stated in the monetary units.

The preference conflict has been observed to be an important source of choice uncertainty (Ready et al. 1995; Opaluch and Segerson 1989; van Kooten et al. 2001). Conflict occurs when an alternative is attractive in some sense but also involves costs or other disadvantages. Intermediate attribute levels additionally increase choice difficulty, while on the other hand extreme characteristics make the choice between alternatives easier (Fischer et al. 2000). This applies to the effect of bid price in the CV context. Together these mean that the choice task should be easy if the project is small and the price high (*no*) or the project large and the bid low (*yes*). On the other hand, if a project is large and the bid high, the systematic-analytical choice should be more difficult.

The bid price has affected uncertainty in several earlier studies (Wang 1997; Loomis and Ekstrand 1998; Lyssenko and Martínez-Espiñeira 2012; Akter and Bennett 2013). The higher bid levels have usually increased the uncertainty, but the quadratic transformation of a bid has associated negatively with uncertainty (Loomis and Ekstrand 1998; Akter and Bennett 2013). This means that the relationship is not linear and the certainty is stronger at the lowest and highest bid levels, and lower at the intermediate levels, presumably quite close to the actual mean WTP (Loomis and Ekstrand 1998; Brouwer 2011).

The knowledge level of the good being valued affects choice uncertainty (Loomis and Ekstrand 1998; Hanley et al. 2009; Brouwer 2011; Akter and Bennett 2013; Voltaire et al. 2013). Experience of the good should make the choices easier. In Figure 1, the experience is connected to motivation via memory. Some studies have found that only respondents with high motivation to process information are able to recognise and understand the elements of a CV scenario (e.g. Pouta 2002).

Attitudes as immediate emotional reactions of liking, disliking or indifference very likely affect decision-making (Fischer and Hanley 2007; Araña and León 2008, 2009; Akter et al. 2009; Voltaire et al. 2013). There is evidence that emotions may have a stronger effect on the choices in SP studies than socioeconomic characteristics (León et al. 2014) and that extreme emotions or attitudes expose the respondent to preference anomalies such as anchoring and the use of decision heuristics (Araña and León 2008, 2009). Extreme emotions were also suggested to have a negative impact on the adoption of systematic decision-making (Araña and León 2009).

The cognitive ability to process complicated information given in a CV choice task may also affect information processing (Fischer and Glenk 2011) and thus uncertainty (Lyssenko and Martínez-Espiñeira 2012; Mahieu et al. 2014). Earlier studies have operationalised cognitive ability using the education variable (Lyssenko and Martínez-Espiñeira 2012; Mahieu et al. 2014) and self-reported confusion (Fischer and Glenk 2011). Gender has been used in some studies as the explanatory variable for uncertainty (Lyssenko

and Martínez-Espiñeira 2012). Justification for the difference in the uncertainty level of men and women comes from empirical results showing that men exhibit more overconfidence in their choices than women (Croson and Gneezy 2009; Olsen et al. 2011). Women also exhibit positive attitudes towards environmental conservation more often (Karppinen and Hänninen 2000; McCright and Xiao 2014). Respondent age has had both negative and positive effects on respondent certainty (Loomis and Ekstrand 1998; Lyssenko and Martínez-Espiñeira 2012; Akter and Bennett 2013). Ageing may have negative impacts on information processing according to psychological literature, but on the other hand, older people may benefit from their knowledge and experience (Akter and Bennett 2013).

2.3.4 Sample selection and nonrespondents

Elements in the decision process (Figure 1) may also be important determinants for nonresponse in the stated preference surveys. For example, ambivalence may result in protests and nonresponsiveness (Blamey et al. 1999). There is thus a reason to assume that the elements of the choice process framework have also had an effect on nonresponse and that nonrespondents differ from respondents with respect to their attitudes and preferences. Empirical analysis of the unit nonresponse (respondents who have not returned or answered the questionnaire at all) determinants is out of the scope of this study. However, Study IV examines how the assumptions concerning nonrespondents affect WTP estimates and use the information regarding item nonrespondent (respondents who returned the questionnaire but answered only a part of the questions and left a valuation question without a response) characteristics to show how unit nonrespondents may differ from respondents.

The population can be assumed to consist of two subpopulations; those who respond to surveys and those who do not. Let H_1 denote the WTP distribution of the respondents and H_2 the WTP distribution of nonrespondents. This implies that the WTP distribution, F, of the whole population is given by

$$F = \alpha H_1 + (1 - \alpha) H_2, \tag{7}$$

where α is the proportion of the responding part of the population.

The analysis depends on the assumptions made about H_1 and H_2. Assuming that $H_1 = H_2$ implies that we can neglect the nonrespondents. This is equivalent to the standard assumption made in contingent valuation studies.

The nonrespondents in a CE study concerning forest conservation in Finland (Horne 2008) had similar background characteristics as the respondents, but were more content with current conservation, less willing to pay for increased conservation and did not want increase conservation at the cost of unemployment. Other studies have found that nonrespondents had similar attitudes to environmental issues in general as the respondents, but did not rank the valued good, in this case the existence of wolves in Sweden, as equally important as the respondents (Bostedt and Boman 1996). Nonrespondents had lower education levels (Messonnier et al. 2000; Harpman et al. 2004) and ranked the importance of economic growth in the area higher (Brox et al. 2003) than the respondents. In studies by Messonnier et al. (2000), Brox et al. (2003) and Harpman et al. (2004) respondents and nonrespondents also differed in respect to age and income. These findings indicate that nonrespondents and respondents differ from each other in respect to the elements of the

choice process, and they may have different preferences even if some basic sample characteristics did not differ from the population.

A simple method to utilise the information concerning nonrespondents is to use their characteristics to also estimate the WTP of the unit nonrespondents (Bostedt and Boman 1996). Another applied method has been the two-step Heckman model (Heckman 1979; Messonnier et al. 2000; Brox et al. 2003). It uses the respondent and nonrespondent characteristics, collected using a follow-up survey or some other information source if possible, to estimate the probability for responding to the valuation survey simultaneously with the WTP model, in which the probability for responding is an argument.

2.4 Empirical applications for the stated preference methods in forest conservation

Forest biodiversity valuation is challenging for several reasons. First, measuring biodiversity is not straightforward as it includes several aspects such as structural, species and functional diversity (Czajkowski et al. 2009). Second, ecologically sound measures for biodiversity may be difficult to use in valuation questionnaires in which the valued good should be as familiar and understandable as possible (Johnston et al. 2012). This sets requirements for the information given in the questionnaires, because generally people have poor knowledge and understanding of what biodiversity means (Christie et al. 2006). On the other hand, despite the low awareness of the scientific concept of biodiversity, the general public has had intuitive understanding of the concept (Bakhtiari et al. 2014). Personal interviews and group discussions revealed that values attached to biodiversity can be divided into two interlinking categories of a good itself and its regulatory functions (Bakhtiari et al. 2014).

Some earlier studies conducted in Finland and elsewhere have focused on the valuation of forest biodiversity in a quite similar fashion as this study (Table 1). Most of these applications have been carried out using the CV method, but also some CE applications exist. The listed studies mainly value passive use values and they are geographically concentrated on the boreal, hemiboreal and temperate zone forests.

Forest biodiversity non-use values also fit into the ecosystem services framework. Biodiversity has a central role as a final service in cultural services (e.g. recreation, education and aesthetic values), but it is also an essential supporting service providing e.g. ecosystem resilience and habitats for species. The value of biodiversity as a supporting service is thus reflected in the value of many final services. These complicated interactions require careful identification of possible double-counting (Fu et al. 2011). So far, to the best of our knowledge, the forest biodiversity non-use valuations in the ecosystem services framework and in a similar context as this study are nonexisting. Several forest conservation valuation studies were carried out in Finland around the turn of the millennium (Pouta et al. 2000; Siikamäki 2001; Kniivilä 2002; Horne 2008). All these studies analysed the issue from different methodological perspectives or included differences in the valued goods. This study was conducted for the demand on valuation results of a specific conservation programme in southern Finland. It adds to the literature by providing an estimate of aggregated welfare change resulting from increased forest conservation. It also estimates the marginal effects of policy attributes on the WTP.

Table 1. Earlier valuation studies on forest biodiversity

Reference	Year	Good	Method	Location
Walsh et al.	1984	Colorado Wilderness	CV	Colorado, USA
Kriström	1990	Preservation of virgin forests	CV	Sweden
Whitehead	1990	Preservation of hardwood forest wetlands	CV	Kentucky, USA
Hagen et al.	1992	Preservation of old-growth forests and the spotted owl	CV	Pacific Nothwest, USA
Hoen and Winther	1993	Preservation of virgin forests and management of commercial forests	CV	Norway
Aldy et al.	1999	Protecting Southern Appalachian Spruce-Fir Forests	CV	Southern Appalachian Mountains, USA
Reaves et al.	1999	Red-cockaded woodpecker and the restoration of its habitat	CV	USA
Pouta et al.	2000	Natura 2000 nature conservation programme	CV	Finland
Mäntymaa et al.	2002	Biodiversity hotspots in commercial forests	CV	Finland
Siikamäki	2001	Preservation of habitats and old-growth forests	CV, CR	Finland
Kniivilä et al.	2002	Maintenance of current conservation	CV	North Karelia, Finland
Veisten and Navrud	2006	Preservation of old-growth forests	CV	Norway
Horne	2008	Forest biodiversity conservation	CE	Finland
Broberg	2007	Old-growth forest protection	CV	Sweden
Boman et al.	2008	Forest biodiversity conservation	CV	Sweden
Meyerhoff and Liebe	2008, 2009	Forest biodiversity conservation	CV, CE	Germany
Czajkowski et al.	2009	Bialowieza Forest protection	CE	Poland
Lindhjem and Navrud	2009	Forest biodiversity conservation	CV	Norway
Moore et al.	2011	Forest protection programmes to protect Hemlock forests	CV	Eastern USA
Garcia et al.	2011	Preservation of forest biodiversity	CV	France
Bakhtiari et al.	2014	Preferences for forest biodiversity	CE	Denmark

Looking at the studies listed in Table 1, the studies by Horne (2008) and Boman et al. (2008) share some noteworthy methodological interests with this study. Horne (2008) uses the CE method to value the marginal WTP of increased forest conservation. The choice tasks included separate attributes for conservation located in northern and southern Finland and the impact of conservation on unemployment and different policy instruments. Conservation contracts increased WTP statistically significantly compared to land acquisitions, while WTP for nature management plans did not statistically significantly differ from acquisitions. Boman et al. (2008) examined forest conservation as a national environmental objective. The questionnaire was defined so that forest conservation value could be disaggregated from the value of all environmental benefits. The value of forest conservation was measured with WTP to prevent a shift towards a deteriorating path in the future. The study also examined the respondents' uncertainty with the multiple-bounded question format. According to the results, the aggregated WTP for forest conservation was slightly above the costs of conservation. Respondents were more sensitive to the scope of biodiversity protection when uncertainty was allowed.

The original valuation studies are expensive to conduct. The use of previous results from meta-analyses (Pouta and Rekola 2006; Lindhjem 2007; Barrio and Loureira 2010) and value transfer (Akter and Grafton 2010; Brander et al 2012) has therefore become more and more common. Large ecosystem service assessments for example have used these methods widely (Mace et al. 2011; Christie and Rayment 2012). Conducting complete environmental cost-benefit analyses is also seldom possible without results from nonmarket valuation studies (Wegner and Pascual 2011). Despite the increasing interest for meta-analysis and value transfers, primary valuation studies are necessary in some cases. Transfer errors could still be large even with similar methods, cultural and institutional conditions and meta-analysis with large explanatory power (Lindhjem and Navrud 2008).

3. MATERIAL AND METHODS

3.1. Forest conservation survey in southern Finland

Survey design is a critical step in obtaining reliable stated preference valuation results. This study was planned and implemented according to the guidelines issued for conducting surveys (Mitchell and Carson 1989; Dillman 2000).

The questionnaire in this study was tested in several ways prior to data collection. First, focus group discussions regarding forest conservation issues were carried out. Recorded think-aloud experiments were next performed with students, who filled in the questionnaire and voiced their thoughts on tape. Forest conservation experts also commented on the questionnaire. The questionnaire was developed based on the findings from these pre-tests. A pilot study was carried out with a sample of 300 respondents and the response rate of the mail survey was 52%.

The actual survey data was gathered in March 2002 as a mail survey with three contacts. The questionnaire was sent out to a sample of 3000 Finns, aged 15 to 74 years old, chosen randomly from the population register. Half of the respondents received the CV questionnaire and the other half the CE questionnaires.

Table 2. Comparison of the data and the population

	Sample of the study	General population[a]
Mean age, all	45.2	43.6
Women	44.6	44.1
Men	45.8	43.1
Gender, %		
Women	50.1	50.1
Men	49.9	49.9
Forestry or agriculture as main source of livelihood, %	5.9	5.6

[a]Source Statistics Finland (2014)

The CV questionnaire response rate was 50.4%. The CE questionnaires had a slightly higher response rate, 51.5%. The data was compared to the population with respect to sociodemographic characteristics (Table 2). The respondents, especially men, were slightly older than the population in general. The share of people for whom forestry or agriculture is the main livelihood source was also somewhat over-represented in the data. The distribution of men and women was similar in the data as in the population. Based on these numbers, the data adequately represent the population.

Choice set design requires carefully selecting the attributes and attribute levels (Johnson et al. 2006; Rose et al. 2011). Attributes should be reasonable in regards to the wanted information, but should also be easily combined into choice sets that respondents can compare. The CV and CE choice tasks used the same attributes to describe the conservation good. The attribute levels were also planned together, so that the results from both methods could be easily compared.

In our case, one of the interests was to explore the effect the various conservation means had on the WTP. A committee was appointed to prepare a forest conservation initiative in southern Finland and they introduced a new voluntary forest conservation method. We wished to compare the acceptability of the new voluntary methods and the establishment of conservation areas by redeeming private forests. Choice task attributes were chosen based on conversations with the appointed committee. These conservation means were formed into three different attributes: the share of forest owners who receive information and education, the percentage of forested land under voluntary conservation and the percentage of forested land in the state-owned conservation areas (Table 3). Conservation impacts were introduced into the choice sets as habitat improvements and as a decrease in the number of endangered species. These two attributes were fixed so that certain habitats at a favourable conservation level would cause a certain reduction in the number of endangered species. This fixing was performed to prevent any irrational combinations of these levels that are by intuition tied together. Habitats mentioned in the questionnaire and the number of endangered species were chosen in co-operation with ecological experts to form relevant combinations. The attributes are equivalent in both CV and CE. CV included two different forest conservation projects, the small project with lower attribute levels and the large project with higher levels. These attribute levels are marked in Table 3 with one or two stars. The status quo option was similar in all the choice tasks in both CV and CE.

Table 3. Attributes and their levels used in the choice questions.

		Status quo	Attribute levels			
1	*Information and education,* Reaches % of forest owners annually	30%	40%[a]	50%	60%[b]	70%
2	*Conservation contracts,* % of forested land	0,4%	2%[a]	4%	6%[b]	8%
3	*Conservation areas,* % of forested land	1,6%	2%[a]	3%	4%[b]	5%
4	*Biotopes at their favourable level of conservation*	Nothing	Broad-leaved forests, pasturage ridges[a]	Broad-leaved forests, pasturage ridges, rich coniferous forests	Broad-leaved forests, pasturage ridges, rich coniferous forests, dry coniferous forests[b]	Broad-leaved forests, pasturage ridges, rich coniferous forests, dry coniferous forests, marshes
5	*Number of endangered species* after 50 years	650	300[a]	200	100[b]	90
6	*Increase in annual income tax* 2003–2012 (EUR/year)	0	5	30	100	300

[a] refers to the small conservation project

[b] refers to the large conservation project

The numbers of the different questionnaire versions are presented in Table 4. In CV, the sample was split into two different projects of forest conservation, a small project with a lower level of conservation, and a large project with a higher level of conservation. The bid levels varied from 5 EUR to 300 EUR in both the small and large CV conservation projects and they were chosen based on the pilot study. The number of bids was the same in CV and CE to enable comparability.

Table 4. Sample division into subsamples.

	Contingent valuation N =1500		Choice experiments N = 1500
	Small project	Large project	
Number of versions	4	4	15
Questionnaires/ Version	185	190	100

The CE data allow the evaluation of the marginal effects of different attributes on household welfare and the willingness to support a project considering the incurred costs. A choice experiment typically uses a questionnaire that presents respondents with several choice tasks that require them to indicate their preference for the status quo as opposed to some alternatives (Boxall et al. 1996; Adamowicz et al. 1998). Here each choice task involved two alternative projects that increased the current level of biodiversity conservation and a status quo option. A pilot study was conducted to test the functionality of the questionnaire. The sample size was 300 and it was divided into two sub-samples. They included four and eight choice tasks. The corresponding response rates were 43.4% and 48.9%, respectively. Item response rate was also higher for the eight-task version than for the four-task version. Based on these findings, we decided to use eight choice tasks in our main data collection.

A minimum amount of the choice sets in this kind of orthogonal main effects design was (five attributes, four levels in each, two varying alternatives) $5\times4\times2 = 40$ (Louviere et al. 2000). The number of choice sets must equal or exceed this minimum. However, it is poor practice to use this minimum number of choice sets, because the statistical power improves by increasing the quantity *number of sets* × *alternatives* relative to the parameters to be estimated (Louviere et al. 2000). We chose to use 120 different choice sets that were divided so that each respondent received a questionnaire with eight choice tasks. This means a total of 15 different questionnaires, and while the sample size was 1500, there were 100 copies sent of each version (Table 3).

The levels of the attributes were chosen using the Sawtooth computer programme to obtain a randomised main effects design, which would enable us to statistically analyse the effects of the attribute levels (Sawtooth Software 2000). Complete enumeration was the design method implemented, which considers all possible profiles and chooses the ones conforming to the following principles: 1) Each attribute level is shown as few times as possible in a single choice task (minimal overlap), 2) each attribute level is shown approximately an equal number of times (level balance) and 3) attribute levels are chosen independently of other attribute levels, so that each attribute level's effect may be measured independently of all other effects (orthogonality). The criterion of minimal overlap is optimal for the efficiency of the main effects, but not for the measurement of interactions (Sawtooth Software, 2000).

This study used the single binary choice format for the CV method. This question format imitates a referendum situation in which a respondent chooses between two alternatives. The alternatives were the current state of forest conservation (i.e. status quo) and an alternative with increasing forest conservation and related costs to the consumer. Table 5 presents an example of a contingent valuation choice situation, where the respondent chooses between the current state and increased conservation.

The single CV choice task consisted of attributes and their levels similarly to CE choice tasks, where respondents choose between different combinations of attribute levels and a specific cost level (Table 6). The CV choice task was designed to enable the comparison of the CV and CE results.

Table 5. Example of contingent valuation choice task.

		Current state	Alternative A
Policy means	***Information and education***, (reaches % of the forest owners annually)	30%	60%
	Conservation contracts, (% of forested area)	0,4%	6%
	Traditional conservation areas, (% of forest area)	1%	4%
Impacts of conservation	***Biotopes at their favourable level of conservation***	Nothing	Broad-leaved forests, pasturages, ridges, rich and dry coniferous forests
	Number of endangered species after 50 years	650	100
Additional costs	**Increase in annual income tax of your household 2003–2012 (euros/year)**	**0 euros**	**300 euros/year**
I prefer		❑	❑

Table 6. Example of choice experiment choice task.

		Current state	Alternative 1	Alternative 2
Policy means	***Information and education***, (reaches % of forest owners annually)	30%	70%	40%
	Conservation contracts**,** (% of forested area)	0,4%	8%	2%
	Traditional conservation areas**,** (% of forest area)	1%	4%	2%
Impacts of conservation	***Biotopes at their favourable level of conservation***	Nothing	Broad-leaved forests, pasturages, ridges, rich coniferous forests	Broad-leaved forests, pasturages, ridges, rich and dry coniferous forests, marshes
	Number of endangered species after 50 years	650	200	90
Additional costs	**Increase in annual income tax of your household 2003–2012 (euros/year)**	**0 euros**	**5 euros**	**300 euros/year**
I prefer		❑ S	❑ 1	❑ 2

3.2. Methods and econometric analysis

All four separate studies of this thesis used parametric maximum likelihood methods (Table 7) to estimate the WTP models and models explaining uncertainty (e.g. Greene 2000). All estimations were performed using the LIMDEP 8.0 and NLOGIT software (Greene 2012). The dichotomous choice contingent valuation data in Study I were analysed using ordinary logit models (Greene 2000). In Study I, two different non-parametric WTP estimators, the Kaplan-Mayer-Turnbull (KMT) estimator (Turnbull 1976; Haab and McConnell 1997) and Ayer estimator (Kriström 1990a,b), were also calculated. The Turnbull nonparametric estimators for WTP were also calculated in Study IV. These non-parametric estimators were calculated because parametric models are very sensitive to distributional assumptions (Hanemann 1984) and non-parametric models offer more robust estimates.

The choice experiment data of Study I were analysed using the nested multinomial logit (MNL) model as the independence of irrelevant alternatives (IIA) assumption was not valid due to the stochastic component correlation with some forest conservation alternatives in the choice set. The correlation may occur because the different projects increasing the conservation level share the same unobserved variables, and therefore a nested model structure is more appropriate for analysing the choice experimental data (Carrasco and Ortúzar 2002). In the present case, the preferences for forest conservation seem to be strongly polarised into supporters of increased conservation and supporters of the status quo and thus invalidate the IIA assumption. Other estimation possibilities would have been e.g. mixed, or random coefficients, MNL (McFadden and Train 2000) that relaxes the IIA assumption, and allows respondent heterogeneity and the latent class model (LC) (Greene and Hensher 2003) that uses CE responses and respondent characteristics to group respondents into latent classes and estimates the models for the groups separately.

Earlier literature took zero WTP into account using the spike model by Kriström (1997). The Fat-tail problem has been solved parametrically with a pinched logit model (Ready and Hu 1995). Study II formulates a model for considering the fat-tail problem and zero responses simultaneously, and introduces a pinched spike model, which extends a spike model with a term that pinches the probability to zero at the estimated maximum WTP.

Table 7. Econometric analysis of different studies

	Study I	Study II	Study III	Study IV
Logit models	x			
Nested Logit	x			
Spike model		x		x
Pinched Spike model		x		
Random valuation model with uncertainty			x	
Non-parametric methods	x	x		x

Study III focused on analysing response uncertainty in the binary choice contingent valuation (Li and Mattsson 1995) part of the survey. The questionnaire asked for the respondents' certainty concerning the choice made using a word-scaled four-interval uncertainty question. These stated response uncertainty answers were used in the random valuation (RV) model of Wang (1997). Because we only presented a single valuation question to each respondent, our observations were independent, and we were able to apply the RV model without a correlation problem (Vossler and Poe 2005). This modelling approach makes it possible to explain the uncertainty intervals with the respondent and choice task characteristics and allows for the asymmetry of the intervals. Uncertainty was also explained separately using ordered probit models, in order to use bid as an explanatory variable for uncertainty, which is not possible in the RV model due to multicollinearity.

Study IV used the standard spike model (Kriström 1997) to analyse the effect of the nonresponse and calculated the WTP estimates based on different assumptions on the nonrespondents.

4. RESULTS AND DISCUSSION

4.1 WTP for forest conservation using the CV and CE methods

Increased forest conservation gained strong support according to the results of Study I. In CV, 74% of respondents were prepared to pay for increased conservation and 16% supported increased conservation but were not willing to pay for it. A further 5% were indifferent and 5% supported a decrease in forest conservation. Table 8, which collects all the calculated WTP values from the studies of this thesis, shows that the WTP calculated from the conventional logit model coefficients was 212 EUR per year per household for a ten-year period. If only certain "yes" responses were considered as support for the proposed programme and all responses expressing some uncertainty were recoded as "no", the mean WTP was 60 EUR. The median was 80 EUR. The mean WTP estimates in the CE ranged from 124 EUR to 223 EUR depending on programme size.

Table 8 shows how the WTP results are sensitive to the estimation method but also to the number of observations in the used data set. The observation number varies due to item nonresponse in the models using respondent characteristics as explanatory variables. WTP was higher in the models including covariates and a lower number of observations. It thus seems that the respondents who have filled in the questionnaire more completely have had a higher WTP. This can also be seen when comparing the two identical models without covariates but different sample sizes (models 13 and 16 in Table 8).

The respondent characteristics had a similar and expected effect on the WTP estimates in both CV and CE (Tables 5 and 8 in Study I). The respondent characteristics that increased WTP for forest conservation were: a negative attitude towards current conservation, income, engaging in nature-related activities, living in southern Finland and young age. Forest owners had lower WTP than citizens in general. Information and education attributes did not have a significant effect on the choices in CE, but conservation

contracts as well as conservation areas increased WTP significantly. Conservation means thus affected the WTP, and not only the outcome of the conservation programme. This result is in accordance with earlier findings (Pouta et al. 2002, Horne 2008, Czajkowski et al. 2009). The connection between respondent characteristics and WTP was examined in three of the earlier Finnish studies. In a study by Siikamäki (2001) the WTP for forest conservation was significantly increased by environmental attitudes, gender and education. Pouta et al. (2002) found that WTP for conservation was increased by positive attitudes towards conservation policy and income, and was decreased by higher age and living in a rural area. Horne (2008) did not use respondent characteristics as explanatory variables for WTP for forest conservation, but estimated WTP models separately for anthropocentric and ecocentric respondents. Ecocentric respondents were willing to pay for increased forest conservation, while anthropocentric respondents had negative WTP.

The responses were insensitive to the scope of the CV, but the attribute levels in the CE describing the conservation programme were statistically significant. Earlier studies have also found scope insensitivity in CV (e.g. Jacobsen et al. 2008). A reason for this may be presenting the attribute levels as percentage changes from the current state (Lindhjem 2007). Even in the large project the percentage differences were quite small (0.4% vs. 6% or 1.6% vs. 4%) and their size in hectares may not have been clear for the respondents, even if the total forest area was defined earlier in the questionnaire.

Only 14% of respondents in CE chose the present conservation level for all eight choice tasks, indicating zero WTP. The nested MNL model fitted the data better than the ordinary MNL model according to the likelihood ratio test. This means that respondents first decided whether they supported the status quo or increased conservation. If they supported increased conservation, they then chose the option they preferred. This phenomenon, observable in CE, was very likely also present in CV; the CV respondents also wished to support increased forest conservation and when faced with only one possibility for this, were not sensitive to the highest bid levels. In contrast to CV results, the respondents were sensitive to the scope in the CE. This is in accordance with experience and learning of the discovered preference hypothesis. Mean WTP estimates for the limited and extensive project differed from each other statistically significantly based on the confidence intervals. The confidence interval of the mean for the intermediate project overlapped with that of the limited project on the lower side and with the confidence interval of the extensive project on the upper side. It should be noted that using overlapping confidence intervals as a measure of statistical significance has been criticised (Poe et al. 2005).

The WTP estimates of this study were very close to earlier estimates concerning the value for forest biodiversity conservation (Siikamäki 2001; Mäntymaa et al. 2002), when the values were compared based on EUR per hectare per payment (Pouta and Rekola 2006). The mean WTP of some studies was somewhat higher than in our study (Pouta et al. 2000, 2002, Rekola et al. 2000, Horne 2008), but median estimates were very close to ours (Pouta et al. 2000, 2002; Horne 2008). Mean WTP was markedly higher in a study by Kniivilä (2004) than in our study, but the application was also quite different.

Table 8. Willingness to pay results[a] of this study with different econometric models and distributional assumptions.

	Method, econometric model (Article number)	WTP (€)	Standard deviation	N
1	CV, Logit model, mean (I)[b]	212	22	596
2	CV, Logit mean, only absolutely certain (I)	60	-	426
3	CV, Non-parametric median (I)	80	-	596
4	CE, Nested logit, limited(I)[b]	124	12	602
5	CE, Nested logit, intermediate (I)[b]	167	16	602
6	CE, Nested logit, extensive (I)[b]	223	22	602
7	CV, Non-parametric mean (KMT) (II)	124	-	723
8	CV, Non-parametric median (II)	72	-	723
9	CV, Spike model (II)	259	24	723
10	CV, Logit model (II)	158	29	723
11	CV, Pinched spike model[c] (II)	90	-	671
12	CV, Pinched spike model[d] (II)	120	-	671
13	CV, Probit model (III)	165	21	706
14	CV, Restricted symmetric RV (III)	163	22	706
15	CV, Restricted asymmetric RV (III)	179	26	706
16	CV, Probit model (III)	206	27	558
17	CV, Symmetric RV (III)	199	29	558
18	CV, Asymmetric RV (III)	227	37	558
19	CV, Spike[e] (IV)	147	16	1500
20	CV, Spike[f] (IV)	278	30	1500
21	CV, Spike[g] (IV)	262	25	722
22	CV, Non-parametric mean[e] (IV)	60	-	1500
23	CV, Non- parametric mean[f] (IV)	93	-	1500
24	CV, Non-parametric mean[g] (IV)	124	-	722

[a] Table presents the results reported in the separate studies of this thesis.
[b] The confidence intervals presented in Study I (Table 8) are false and should be [169;255], [100;148], [136;198] and [180;266], respectively.
[c] T is estimated from the data (T =estimated maximum WTP)
[d] T = yearly income (T =estimated maximum WTP)
[e] Unit nonrespondents' WTP is assumed to be zero
[f] Unit nonrespondents' WTP is assumed to be equal to the item nonrespondents' WTP
[g] Unit nonrespondents' WTP is assumed to be equal to the respondents' WTP

4.2 Zero WTP and fat tail

In CV, the respondents chose increased conservation at the highest 300 EUR bid in 40% of the choice tasks including this highest bid level. If the rather and completely uncertain "yes" responses were coded as "no" responses, 35% of respondents still approved of paying 300 EUR for increased conservation. This fat-tail problem (Ready and Hu 1995) was examined in detail in Study II, where the fat-tail problem and zero WTP were considered simultaneously. Using annual income as a maximum WTP slightly decreases WTP, but

does not change the assumed WTP distribution very dramatically (Figure 1 in Study II). Estimating the pinching term from the data rather than using income considers the "yes" responses to the highest bid as outliers. This model substantially decreases the WTP.

A part of the "yes" responses to the 300 EUR tax are probably "positive protests" (Jorgensen et al. 1999) for forest conservation, meaning that these respondents have supported forest conservation in a single valuation question regardless of the cost, which is unrealistically high for them. This phenomenon is closely related to the warm glow effect and to buying moral satisfaction (Kahneman and Knetsch 1992). If a considerable share of the "yes" responses at the highest bid level are seen as protests, the pinched spike model is likely to give a more realistic picture of WTP distribution than conventional models.

4.3 Uncertainty in CV

The random valuation model used in Study III takes respondent uncertainty into account and produces wide but symmetrical uncertainty intervals. Symmetricity was analysed by estimating two models in which uncertainty was restricted to be symmetric or allowed to be asymmetric. The symmetric model fitted the data better according to the likelihood ratio test. As the preference uncertainty interval is large, it should be taken into account in cost-benefit analyses and in other applications of CV with careful sensitivity analyses and estimating the lower and upper bounds for WTP. The WTP estimates of the random valuation models varied from 163 EUR to 227 EUR. The uncertainty in our data was symmetric for "yes" and "no" responses, which means that conventional modelling also produced unbiased estimates, but with wide uncertainty intervals.

Several respondent characteristics had statistically significant effects on subjective uncertainty. A low bid price, extreme attitudes towards environmental or economic aspects of nature conservation, high education and professional status, a large number of nature-related activities and age between 25 and 44 reduced the uncertainty. On the other hand, uncertainty was increased by the large project associated with a high bid price and by the respondents' female gender.

The data did not allow grouping the respondents into categories according to their assumed decision process, but the significant explanatory variables explaining uncertainty give some idea about how the uncertainty is associated with choice processing. For example, the uncertainty-reducing effect of the extreme attitudes may relate to the use of heuristic-holistic decision strategy. The effects of the project size and bid price, high education and professional status and nature-related activities are very likely associated with the systematic-analytical decision processing. The effects of age and gender are not so easily associated with the decision processing, but with other elements affecting the choice. The gender effect is in accordance with earlier results (Lyssenko and Martínez-Espiñeira 2012) and with assumptions that female respondents are not as confident about their choices as men are (Croson and Gneezy 2009; Olsen et al. 2011).

The age between 25 and 45 years had a significantly negative effect on the uncertainty. Similar results have also been found earlier (Akter and Bennett 2013), but many contradictory earlier results also exist. The result supports the assumption of a U-shaped relationship between age and uncertainty; respondents in the middle age groups have been more certain than the youngest or older age groups. According to the psychology literature, the youngest respondents may not have so much experience and knowledge for making

decisions as the older ones (Marsiske and Margrett 2006), but some findings show that information processing becomes slower with age (Hartley 2006). In our data this uncertainty already increased in the age groups above 45 years, so a change in information processing capacity is probably not the correct explanation for this result. Intuitively, it could be connected to understanding the gaps in individual knowledge and recognising the aspects that drive the decision into different directions.

4.4 Nonrespondents

Study IV analysed the effect of the assumptions concerning nonrespondents on the estimated mean WTP and found that they strongly affected the WTP estimates. If all unit and item nonrespondents were assumed to have the same WTP as the respondents, the mean WTP with the spike model was 262 EUR. This estimate can be seen as an upper bound for WTP and is very likely affected by the unrealistically high share of the "yes" responses at the highest bid levels (Study II). If unit nonrespondents' WTP is assumed to equal zero, the mean WTP was 147 EUR. The respondents who did not answer the choice question but otherwise filled out the questionnaire (N = 33) (the item non-response group) differed from the respondents statistically significantly with respect to age, education, income and living in a rural area. The characteristics of the item nonrespondents were used to represent the entire group of nonrespondents. We used the WTP model parameters of the same data as reported by Lehtonen et al. (2003) to calculate the expected WTP for each respondent in the item nonresponse group. We compared this expected WTP to the bid price and, based on that, generated choice variables for each respondent. Item nonrespondents' observations were multiplied to represents all unit nonrespondents. This procedure means that all nonrespondents are assumed to exhibit similar choice behaviour as the item nonrespondents. The mean WTP with this assumption was 278 EUR. This value is actually higher than the earlier estimate assuming the same WTP for nonrespondents and respondents, i.e. the "upper bound" estimate, although the difference is not statistically significant. The reason for this high value is the WTP distribution of this model that has a fat right-hand tail (Study II, Fig 1. in Study IV).

The small sample of item nonrespondents does not necessarily represent the unit nonrespondents. However, the intermediate model was estimated assuming that the characteristics of unit nonrespondents would be similar to the item nonrespondents. We also calculated the nonparametric Turnbull estimates (Turnbull 1976) for WTP with similar assumptions about the WTP distribution of the unit nonrespondents than in the spike models. The corresponding nonparametric WTP estimates are substantially lower than those from the spike models. The explanation for this is the fat right-hand tail of the WTP distribution that is truncated at the highest bid in the Turnbull estimate. This estimation provides the conservative, minimum estimate for the WTP with the applied bid design (Haab and McConnell 1997).

These results indicate the notable effect that the treatment of nonrespondents may have on the survey results. The survey for nonrespondents would be essential for increasing the certainty concerning nonrespondent profiles. The differences between respondents and item nonrespondents in Study IV and some earlier findings (Bostedt and Boman 1996; Messonnier et al. 2000; Brox et al. 2003; Horne 2008) suggest that nonrespondents differ from respondents in respect to the attitudes and motives that also affect the choice process

(Figure 1). In the future, the estimation method presented in study IV should be further tested using other data sets. For example, the similarity of the item and unit nonrespondent characteristics should be analysed further. Because of the strong assumptions made concerning respondents in this procedure, this inexpensive method should be used only when results of the nonrespondents follow-up survey are not available.

4.5 Benefit and cost comparisons

Aggregate WTP measures for different biodiversity conservation programmes were compared with the suggested costs of the programmes in Study I (Table 10 in Study I). The aggregate benefit values were calculated from the CE data, as they offer the possibility of calculating the project values that are combinations of different attributes and their levels. The benefits were calculated for the programmes that increased conservation contracts and conservation area, but did not change the information and education from the status quo. The costs were based on a study by Leppänen et al. (2000). The lower limit for the costs refers to a situation in which all additionally conserved forests have a normal forest structure. For the upper bound it is assumed that all additional conservation is carried out in old-growth forests, yielding higher costs for conservation.

If conservation was increased to the level of the limited programme, the aggregate benefits (2321 million EUR) were clearly higher than the upper bound of the conservation costs. The aggregate benefits for the intermediate conservation programme were slightly below the upper bound, but well above the lower bound. The aggregate benefits for the extended programme were also within the cost interval. According to these results, the limited programme and very likely the intermediate conservation programmes were beneficial from the viewpoint of society. The extended programme would pass the benefit-cost test only if the conserved forests are not entirely old-growth forests, which have the highest opportunity cost. However, it should be remembered that both the benefits and costs are estimates, which may be sensitive to different assumptions and uncertainties.

Only a few studies have conducted benefit cost analyses of large-scale forest biodiversity conservation programmes, at least in the Nordic countries. In a recent Norwegian study (Lindhjem et al. 2015), the benefits of forest conservation substantially exceed the costs. A Finnish study (Kniivilä et al. 2002) compared the costs and benefits of increased forest conservation in North Karelia. According to their results, welfare gains exceed the costs at the regional and nationwide level, but the costs outweighed the benefits at the local level.

The METSO programme has conserved 28 797 hectares during 2008–2013. This is one third of the programme goal set for 2016. The total strictly protected forest area in southern Finland in 2013 was approximately 290 000 hectares, or 2.5% of the forested land. The total area of the limited conservation project of this study combining conservation contracts and conservation areas was 4% of the forested area, or 516 800 hectares. The current conservation level is therefore substantially lower than what was presented in the lowest increased forest conservation scenario of this study.

4.7 Result reliability and validity

The concepts of reliability and validity provide a frame for critically assessing the results of Studies I–IV. Reliability means result replicability (Bateman et al. 2002). An aspect of replicability can be assessed with a sequence of choices in CE. Several studies have examined how stable the responses are in repeated choice tasks (Brouwer et al. 2010; Brouwer 2012; McNair et al. 2012; Carlsson et al. 2012). These studies have found that self-reported uncertainty has decreased during the choice sequence (Brouwer et al. 2010) and the error variance has also been lower in the latter part of the choice sequence (Carlsson et al. 2012). These studies suggest that improved accuracy and lower uncertainty result from learning and that the repeated choices generate more stable and consistent preferences than single choice task methods. It can be conjectured that CE is a better survey method in this respect compared to CV, where choice task is presented only once, and learning must be assumed to take place based on the other parts of the survey and information given in the questionnaire. Reliability has not been a major concern in the stated preference studies, but the critics of the method have challenged result validity (Hausman 1993, 2012; Lichtenstein and Slovic 2006).

The three most often applied conceptualisations and strategies for assessing the validity of the SP study are content validity, criterion validity and construct validity (Mitchell and Carson 1989). Content validity is also called face validity or internal validity. It is based on the subjective assessment regarding the questionnaire and its ability to produce clear and unbiased responses (Bateman et al. 2002). It also means that the applied method measures the correct concept, i.e. the utility change value in the stated preference studies. An important aspect concerning content validity is how well the applied valuation task corresponds to the ecological indicators concerning the valued change (Johnston et al. 2012). Often the biodiversity level is described using a verbal scale that is informative enough for the respondents, but does not give precise ecological information that would be needed in the further use of the results. In this study the outcome of the conservation programme was described by indicators that were also used in the ecological background report (Metsien suojelun tarve 2000) and they have clear interpretation in ecological terms and thus this validity aspect should not be a problem.

Criterion validity in the SP context assesses how well the hypothetical study reflects actual behaviour. It has also been called predictive validity. In this case the precise assessment of criterion validity is impossible, because no data exists concerning the real WTP for increased forest conservation. Earlier studies and meta-analyses additionally support the assumption that certain responses will predict behaviour in an actual situation (Champ et al. 1997; Moore et al. 2010; Loomis 2014). Survey consequentiality has also been found to reduce the hypothetical bias in SP studies (Poe and Vossler 2011; Loomis 2014), as well as task familiarity and contextual cues (Schläpfer and Fischhoff 2012). Forest conservation was on the political agenda at the time the study survey was conducted and it gained considerable media attention. Considering this context and the information given in the questionnaire, it is reasonable to assume that the respondents have realised the consequentiality of the results. The question format and the payment vehicle used in this study are also in accordance with current knowledge; the hypothetical bias can be reduced *ex ante* by using the binary choice referendum question format and a compulsory payment e.g. a tax or mandatory fee (Carson and Groves 2007; Loomis 2014).

Construct validity is the third important validity measure in the SP method. It can be divided into convergent validity and expectation-based validity (Bateman et al. 2002). Convergent validity means that the results from the SP studies should converge with the results obtained e.g. with the revealed preference methods. Non-use existence value is the valued good in this study, and thus it is impossible to compare the results with the revealed preferences or market behaviour. When results of the CV and CE methods (different samples from the same population) are compared, they were numerically quite similar although the convergence of the results was not statistically tested. This suggests that the underlying choice processes of these two subsamples may have been similar, which would support the criterion validity of the results. The results of the earlier studies have, however, been mixed (Adamowicz et al. 1998; Foster and Mourato 2003; Mogas et al. 2006). Another option is to compare the results to the findings of the meta-analyses. Meta-analyses concerning the value of forest conservation (Pouta and Rekola 2006; Lindhjem 2007; Barrio and Loureiro 2010) have not used the same explanatory variables to explain WTP as this study and thus such comparisons are not possible.

Expectation-based construct validity requires the results to be in accordance with the expectations derived from the economic theory as well as with the expectations that rest upon earlier research. The results of this study are in accordance with earlier findings.

Construct validity, defined as a resemblance with the economic theory, has been the most important and critical tool in SP result validation. The most fundamental expectation in this category is that choices should react to the price of the good, as they did in this study. The high approval share of the highest bid price in CV was somewhat troubling (Study II), but all other results were in accordance with the theoretical expectations. Another basic test is to look at how WTP responds to respondent income. Respondent income had a positive, significant effect on the WTP in this study. Social psychology and psychology theories can be used in addition to economic theory for the assessment of construct validity. The results of Studies I and III show that the attitudes had a logical effect on the WTP amount and also on response uncertainty in the valuation question.

The issue that has probably raised the most controversy is sensitivity to scope and embedding (Hausman 2012; Kling et al. 2012; Carson 2012). Scope insensitivity means that respondent valuation is the same for goods differing in size. Embedding refers to a situation where the changes in two arguments of the utility function do not change the responses in the expected way (Bateman et al. 2002). A recent meta-analysis suggests that respondents are sensitive to project scope if the change is given in absolute values instead of the percentage change compared to the baseline scenario (Ojea and Loureiro 2011). The emotional intensity involved in the valuation task also affected the degree of scope sensitivity (Araña and León 2008). According to these findings scope insensitivity is not an issue that invalidates the SP methods altogether, which has also been the conclusion of other studies (Hausman 1993, 2012). The recent reviews have found several arguments that suggest that the scope sensitivity test is not a sufficient validation test for valuation results (Bateman 2011; Carson 2012). For example, no theoretical basis exists for knowing the correct marginal WTP for the change in project size. One conclusion even suggests that the only theoretically sound scope-based validation test would be that the WTP should not decrease with increasing good size (Bateman 2011). This condition applies to the normal goods that increase welfare, i.e. have income elasticity of demand above zero. In this study the income had a positive effect on WTP and overall support for the increased forest conservation was strong. According to a review of several data sets (Kriström and Riera 1996), the income elasticity of WTP for the environmental benefits is usually below one.

In the CV part of this study, the respondents were not sensitive to the size of the proposed conservation programme. However, the programme size had an effect on choice uncertainty when attached to a high bid price (100 EUR or 300 EUR). The choice tasks presented the conservation level as a percentage of the forested area in southern Finland. The total acreage was given in the questionnaires, but in an information section several pages before the valuation task. It is very likely that the respondents have not perceived the actual magnitude of the conservation, as the numbers were so low when given in percentages (Ojea and Loureiro 2011). CE respondents were sensitive to the size attributes. These results thus provide information regarding the welfare effects of different-sized conservation schemes, although CV cannot be used for that purpose.

5. CONCLUSIONS AND FUTURE RESEARCH

The results of the four papers in this study show that increased forest conservation had strong support from Finnish citizens. The quantitative results are, however, very sensitive to the modelling assumptions and assumptions concerning nonrespondent preferences. This emphasises the need for careful sensitivity analysis and the use of lower and upper bounds when results are used for welfare measurement. The simultaneous use of different modelling assumptions could also provide more realistic bounds for WTP, but that is left for future research.

The empirical results of this study are directly utilisable for the valuation of non-use ecosystem services of the METSO conservation programme. The results of the meta-analysis, together with other biodiversity valuation studies, offer useful information also for other ecosystem service valuations. So far, the Finnish ecosystem service assessments have only included the value of recreational forest services (Jäppinen and Heliölä 2015).

Earlier literature and the CV results of this study suggest that the single binary choice CV question may not be the best way to elicit preferences. Especially when the valued good is unfamiliar, practice rounds can offer respondents the possibility of discovering their preferences and gaining experience in responding to such questions (Plott 1996; Braga and Starmer 2005). Learning has been suggested to also reduce the value disparity of WTP and WTA (Kingsley and Brown 2013), which has been a source of criticism against the SP methods (Hausman 2012). Based on the results of this study, the learning design CV suggested by Bateman et al. (2008) is a direction towards which the CV method should be taken.

Preference uncertainty has been the topic of many recent studies. This study introduced new factors that are potentially important in explaining response uncertainty. However, further analysis of the uncertainty determinants is still needed and their connection to the theory should be strengthened. Analysis of the uncertainty determinants in the choice sequence would provide insights to the reasons of uncertainty and learning.

Findings concerning the respondents' different decision processing strategies suggest the use of econometric models that allow a sufficient amount of heterogeneity (Fischer and Hanley 2007; Fischer and Glenk 2011; McNair et al. 2012). In CE research, much progress has been made in the methods for including preference heterogeneity, scale heterogeneity,

decision heuristics and attribute non-attendance into the analysis (McFadden and Train 2000; Greene and Hensher 2003; Colombo et al. 2013). If a considerable share of respondents appears to make their decisions based on heuristic decision rules, the use of these results should be judged carefully. Decision processes may also be complementary and the respondents use both strategies interactively in their decision-making (Harrison 2008). Welfare measurement could in some situations be based on the responses of the systematic-analytical respondents, corrected with the demographic characteristics of other respondents and nonrespondents. In any case, behavioural economics is needed to supplement economic theory to produce a more realistic description of human behaviour, to understand the background of the choices and to assess validity without compromising the possibility of using welfare economics for policy analysis and other practical purposes.

Debate over the use of the stated preference method for damage assessment and policy evaluation has been going on for over 20 years (Arrow et al. 1993; Hausman 1993, 2012; Kling et al. 2012; Carson 2012; Haab et al. 2013). Many issues still need to be carefully considered in each SP study and when using their results for policy purposes. But there is also a massive amount of research on the topic (Carson 2011) and researchers currently have a good knowledge base to improve the quality of the studies and to assess the reliability and validity of the results.

The conclusions of this study can be condensed in the following quotation from McFadden (2001): “Many psychologists argue that behavior is far too sensitive to context and affect to be usefully related to stable preferences. However, if there are underlying preferences, then even if the link from preferences to rules is quite noisy it may be possible to recover these preferences and use them to correctly evaluate economic policies, at least as an approximation that is good enough for government policy work."

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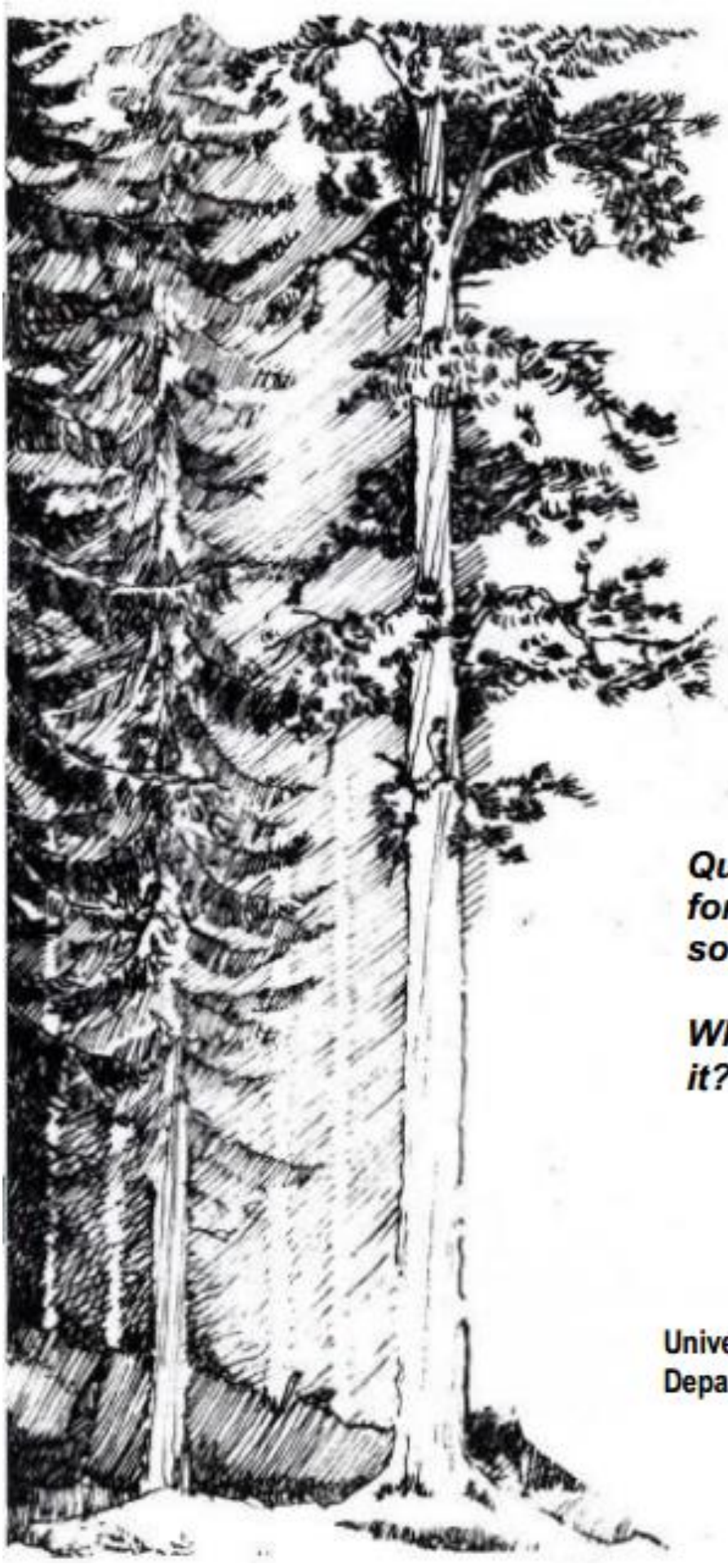
Appendix I Contingent valuation questionnaire



Questionnaire concerning forest conservation in southern Finland

What do you think about it?

University of Helsinki
Department of Forest Economics

Please, answer the following questions as carefully as possible. Filling the questionnaire takes about ten minutes.

1. How often have you been out in forests during the last month?

1 ❑ daily
2 ❑ several times per week
3 ❑ about once a week
4 ❑ several times a month
5 ❑ I have not been there during the last month

2. Which of the following things have you done at least once during the last 12 months?

1 ❑ walked or jogged in a forest at leisure time
2 ❑ picked mushrooms
3 ❑ picked berries
4 ❑ hunted
5 ❑ fished
6 ❑ visited a national park or other nature conservation area
7 ❑ camped spending the night
8 ❑ watched birds
9 ❑ collected or identified plants
10 ❑ done forestry work
11 ❑ reconditioned meadows
12 ❑ read nature or nature conservation related literature, periodicals or articles
13 ❑ watched or listened to nature conservation related TV or radio programmes
14 ❑ been in a forest because of work
15 ❑ paddled or rowed
16 ❑ observed nature
17 ❑ none of the above mentioned activities

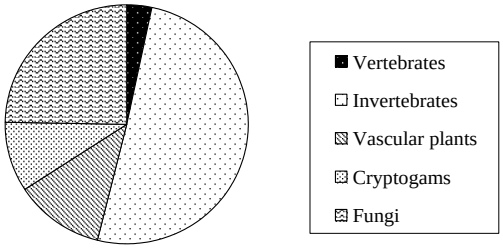
Information of the forest conservation is given in the several sections of the questionnaire. Please, familiarise yourself with it while filling the questionnaire.

REASON FOR FOREST CONSERVATION

In the southern Finland, the long history of forestry has diminished the area of intact **habitats** of broad-leaved forests, ridges, pastures, heaths and marshes. The most harmful changes have been the strong decrease of forest fires, drying of marshes and loss of diversity in tree stand, especially decrease of the old deciduous decayed trees. Intact, or close to intact, forests have been spared almost only in the conservation areas. Conservation level of the any of these habitats is, however, adequate to confirm the preservation and functioning structure in the long run.

There are about 43 000 animal and plant species in Finland, of which one third were explored in the study made in year 2000 and 1500 of these species were found to be endangered. **Endangered species** are species that are under the threat of becoming extinct in Finland in future unless the level of their conservation is increased. Almost 650 (43 %) of these endangered species live primarily in the forests, especially in the broad-leaved forests, pastures and ridge forests.

The number of endangered species in different families of organisms



3. In your opinion, what of the following aspects need to be considered when the forest conservation decisions are made?

			very much	much	neither little or much	little	not at all	
1	Preservation endangered animal and plant species	very much	❑	❑	❑	❑	❑	not at all
2	Fair division of the costs of the conservation	very much	❑	❑	❑	❑	❑	not at all
3	Forest owners rights to decide about the their forests	very much	❑	❑	❑	❑	❑	not at all
4	Impact on national economy	very much	❑	❑	❑	❑	❑	not at all
5	Preservation of the habitats of the endangered animal and plant species, like broad-leaved forests and marshes	very much	❑	❑	❑	❑	❑	not at all
6	Quality recreation environment and scenery	very much	❑	❑	❑	❑	❑	not at all
7	Impact on employment	very much	❑	❑	❑	❑	❑	not at all
8	Impact on operational preconditions of forest industry	very much	❑	❑	❑	❑	❑	not at all
9	Livelihood of rural areas	very much	❑	❑	❑	❑	❑	not at all
10	Nature tourism	very much	❑	❑	❑	❑	❑	not at all
11	Possibilities for multiple use of forests, like hunting, berry and mushroom picking	very much	❑	❑	❑	❑	❑	not at all

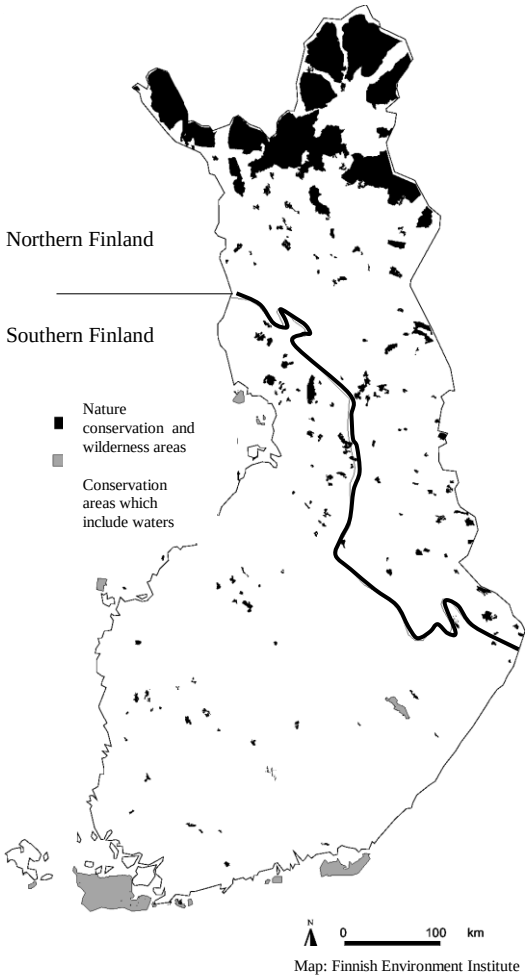
Some endangered forests species:

Pisarahelttahelokka

Shaw's Bristle-moss

white backed woodpecker

"old growth sap beetle"



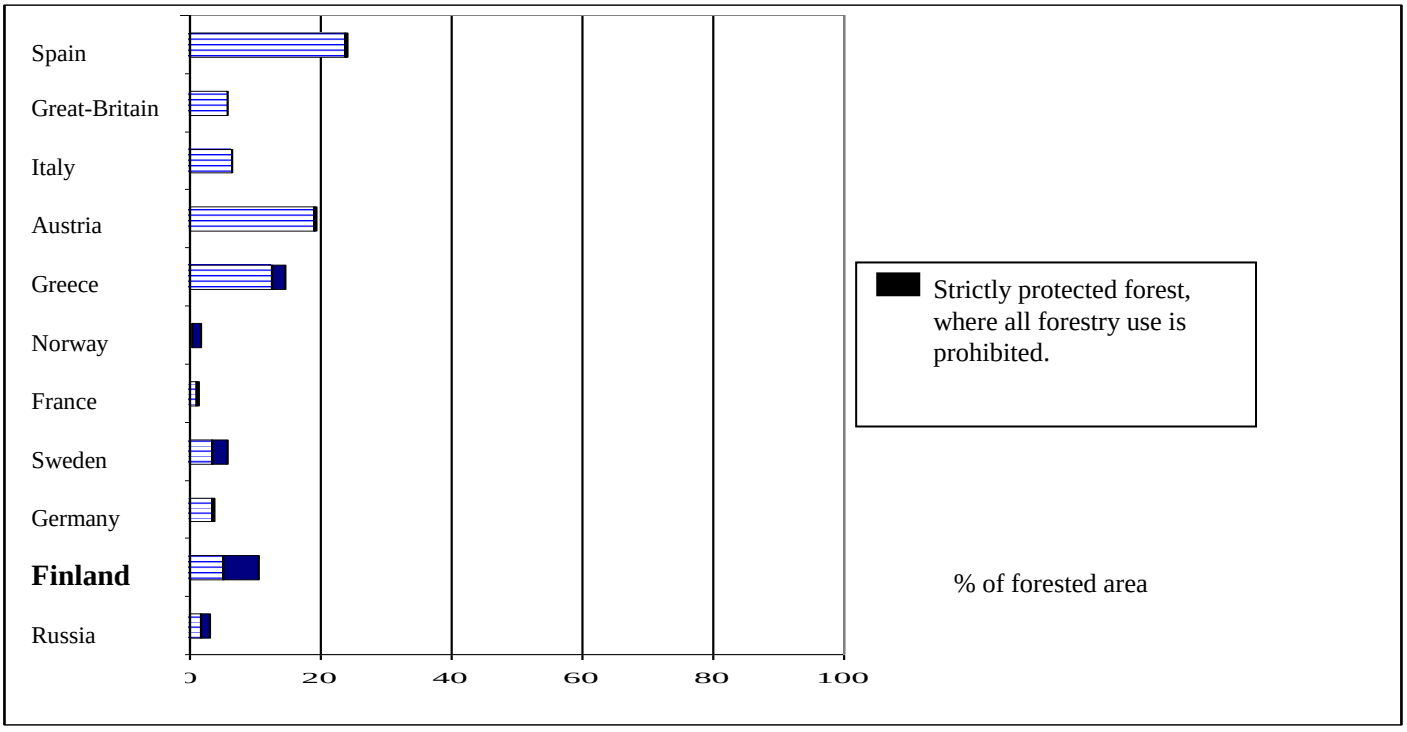
Map: Finnish Environment Institute

CURRENT FOREST CONSERVATION IN SOUTHERN FINLAND

In the northern Finland, the strictly protected forests cover 17 % of the forested land. Large amount of the nationally significant endangered habitats and species occur only in southern Finland. About **1.6 %** of the forested area of southern Finland is either national or nature preservation parks or other way **strictly protected** areas, where all forestry use is prohibited.

In addition to strictly protected areas of southern Finland, valuable sites totalling about 0.4 % of forested land area are protected by the Forest Act. Furthermore, forest companies have decided to leave valuable habitats of 0.5 % of all forested land out forestry use. Biodiversity protection is also taken into consideration in forestry planning, information and education of forest owners and in silviculture. Forest owners may be subsidised for maintaining biodiversity and forest ecology. Though, total of 2.5 % (323 000 ha) of the forests in southern Finland are under some kind of protection.

Percentage of the protected forests of forested land in Finland and in some European countries.



4. Consider the current state of the forest conservation in southern Finland.

		completely	fairly	rather	neither	rather	fairly	completely	
		7	6	5	4	3	2	1	
Forests of southern Finland have been conserved	sufficiently	❑	❑	❑	❑	❑	❑	❑	insufficiently

5. Evaluate *the current forest conservation in southern Finland* through the following statements. Respond according to your own feeling, even if you are not fully aware of the issue.

			fully	fairly	rather	neither	rather	fairly	fully	
			7	6	5	4	3	2	1	
1	Current conservation ensures the survival of rare animal and plant species.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
2	Current conservation costs are not divided justified way.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
3	Currently, forest owners' rights to decide about their own forest are taken into consideration well in forest conservation.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
4	Current forest conservation causes substantial costs to the state.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
5	Current conservation preserves the valuable sites.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
6	Current forest conservation improves the quality of recreation environment and scenery.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
7	Current conservation diminishes employment markedly.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
8	Current conservation worsens operational preconditions of forest industry.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
9	Current forest conservation makes livelihood of the rural areas worse.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
10	Current forest conservation contributes to nature tourism.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
11	Current conservation makes the multiple use of the forests more difficult.	agree	❑	❑	❑	❑	❑	❑	❑	disagree

INCREASING FOREST CONSERVATION IN SOUTHERN FINLAND

The following means, among others, can be used to increase forest conservation in southern Finland:

Information and education

Forestry regulation, education and guidance of forest owners and, as an important part, forestry plan of the forest estate, have impact on the forest conservation. Currently, the information and education reaches about 30 % of the forest owners annually. **Information given to forest owners about nature conservation would be increased. State would pay the costs of information and education by tax income.**

Conservation contracts

In southern Finland, valuable sites totalling about 0.4 % of forested land area are protected by the Forest Act. Conservation contracts, for which the forest owners would take the initiative, would increase the conserved area. **State would pay environmental subsidy or rent for some period of time to forest owner.**

Conservation areas

In southern Finland, law of conservation areas preserves currently 1.6 % of forested land. This area could be increased if **the state would buy or redeem for conservation the areas with the most valuable habitats**, owned currently by private forest owners, companies, counties or congregations. In addition, conservation areas could be founded to forest areas currently owned by the state.

IMPACTS OF FOREST CONSERVATION

Goal of increasing forest conservation is to reach the **adequate level of conserved habitats**. Forest conservation increases, for example, amount of decayed and charred wood and number of deciduous trees, which is important for many endangered species. Increasing these characteristics of forest, **the number of endangered species decreases**. There is, however, no precise knowledge of the size of the decrease effect. The number of endangered species is, for example, estimated based on the explored species which covered about one third of all animal and plant species in Finland.

The costs to state to buy or redeem strictly protected forested land can be estimated rather precisely. There is instead lack of research in the area of impact of increased conservation on forestry and forest industry.

Like areas used for forestry, also conserved areas are free for picking berries and mushrooms and for other outdoor activities, and these areas can have positive impact, among other things, on tourism. Furthermore, increasing the number of living and decaying old trees affects the scenery.

6. How good or bad do you consider the above mentioned conservation means?

		completely	fairly	rather	neither	rather	fairly	completely	
		7	6	5	4	3	2	1	
Information and education	good	❑	❑	❑	❑	❑	❑	❑	bad
Conservation contracts	good	❑	❑	❑	❑	❑	❑	❑	bad
Conservation areas	good	❑	❑	❑	❑	❑	❑	❑	bad

7. Increasing forest conservation in southern Finland by buying conservation areas and paying subsidies would create costs to the state. These costs could be directed towards taxpayers. Do you agree or disagree with the following statements about the costs of forest conservation?

			fully	fairly	rather	neither	rather	fairly	fully	
1	It is always important to consider the benefits and costs when the extent of the forest conservation is decided.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
2	I am ready to give in my income to some extent if forest conservation can be increased even a little.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
3	I do not have enough money for nature conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
4	Any amount of increasing of forest conservation could not compensate the decrease of income.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
5	Forest owners should pay *the most* of the costs of increased conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
6	Forest industry and the users of forest products should pay *the most* of the costs of increased conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
7	Taxpayers should pay *the most* of the costs of increased conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree

8. Compare the potentially implemented combination of conservation means and their impact on the current state of forest conservation in southern Finland presented in the following table. Please, note that covering the costs of conservation is presumed to cause a tax increase, mentioned in the table below, to your household in next ten years, beginning in 2003. Your opinion is important. Please, choose the alternative you prefer.

		Current state	**Alternative A**
Policy means	**Information and education**, percentage of forest owners reached	30%	60%[1]
	Conservation contracts, percentage of forested land	0,4 %	6 %[2]
	Conservation areas, percentage of forested land	1 %	4 %[3]
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pastures, ridges, rich and dry coniferous forests[4]
	Number of endangered species after 50 years (about)	650	100
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**30 €**[5] **(about FIM 180) per year**
I prefer		❑	❑

9. How certain are you about your choice?

- ❑ absolutely certain
- ❑ quite certain
- ❑ quite uncertain
- ❑ completely uncertain

If you chose the alternative A in question 8, continue to question 11.

10. If you chose the Current state in question 8, what of the following alternative describes the best your opinion? Mark <u>one</u> of the following.

- ❑ I support *decreasing* forest conservation.
- ❑ I am *indifferent* about increasing forest conservation and I would not be willing to pay for it.
- ❑ I support increased forest conservation but I am *unwilling* to pay for it.
- ❑ I support increased forest conservation and I am *willing* to pay for it, *but less than 30 €.*

[1] Level in limited project was 40%
[2] Level in limited project was 2%
[3] Level in limited project was 2%
[4] Biotopes in their favourable level in limited project were broad-leaved forests, pasturage and ridges. Corresponding number of endangered species after 50 years was 300.
[5] Varying bid levels were 5, 30, 100 and 300 €.

11. Consider the proposed Alternative A.

			completely	fairly	rather	neither	rather	fairly	completely	
1	Implementing forest conservation as proposed in Alternative A is in my opinion	positive	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	negative
2	My participation to the costs of Alternative A is in my opinion	necessary	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	unnecessary

12. Consider *forest conservation implemented according to Alternative A* in following statements. Respond according to your own feeling, even if you are not fully aware of the issue.

			fully	fairly	rather	neither	rather	fairly	fully	
1	Alternative A protects animal and plant species from extinction well.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
2	Costs of A are not divided justifiably.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
3	A considers well the landowners' rights do decide about their own forest.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
4	A creates considerable costs to the state.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
5	With A, a survival of different biotopes, like broad-leaved forests and marshes, can be assured.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
6	A improves substantially the quality of recreation environment and scenery.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
7	A diminishes employment substantially.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
8	A weakens the operational preconditions of forest industry.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
9	A increases livelihood of rural areas.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
10	A contributes to multiple use of forests.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
11	A contributes to nature tourism.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree

13. Let us assume that increased forest conservation would be carried out and, instead of increasing taxation, decreasing other public expenditure would finance it. Choose <u>three</u> primary targets for decrease of funds. Mark the primary with one (1), and the next ones with two (2) and three (3), respectively.

health care	_____
education	_____
culture	_____
physical exercise and sports	_____
social security	_____
unemployment security	_____
enterprise subsidies	_____
national defence	_____
police and rescue services	_____
traffic	_____
development co-operation	_____
subsidies for agriculture	_____
other nature conservation than forest conservation	_____

Finally, some background information about yourself

14. Year of birth _____

15. Gender

1 ❑ Woman
2 ❑ Man

16. Living environment in childhood

1 ❑ Rural area
2 ❑ Population centre or small town
3 ❑ Town, 20 000 – 100 000 inhabitants
4 ❑ City, over 100 000 inhabitants

17. Current living environment

1 ❑ Rural area
2 ❑ Population centre or small town
3 ❑ Town, 20 000 – 100 000 inhabitants
4 ❑ City, over 100 000 inhabitants

18. Education

1 ❑ Lower elementary or elementary school
2 ❑ Vocational school
3 ❑ High school
4 ❑ Vocational college
5 ❑ College or university
6 ❑ Other education

19. Occupation (previous occupation for pensioners and unemployed)

1 ❑ Farmer
2 ❑ Entrepreneur
3 ❑ Upper-level employee
4 ❑ Lower-level employee
5 ❑ Manual worker
6 ❑ Student
7 ❑ Taking care of own household or other

21. Are you currently employed?

1 ❑ Yes
2 ❑ No

22. What is your field of occupation (previous occupation for pensioners and unemployed, coming for students)?

1 ❑ forestry or timber industry
2 ❑ agricultural field
3 ❑ field related to environmental conservation
4 ❑ other field related to environment
5 ❑ another field

23. Number of household members?

totalling_____persons, of whom _____are under 18 years of age.

24. What province do you live in?

1 ❑ Province of Southern Finland
2 ❑ Province of Western Finland
3 ❑ Province of Eastern Finland
4 ❑ Province of Oulu
5 ❑ Province of Lapland

25. Are you a member of any nature or environmental organisation?

1 ❑ Yes
2 ❑ No

26. **Do you or someone in your household own forest (forested area over 1 ha)?**

1 ❑ No
2 ❑ Yes, about _____ ha, (if joint ownership, the share of your household)

What is the significance of forestry income to your economy?

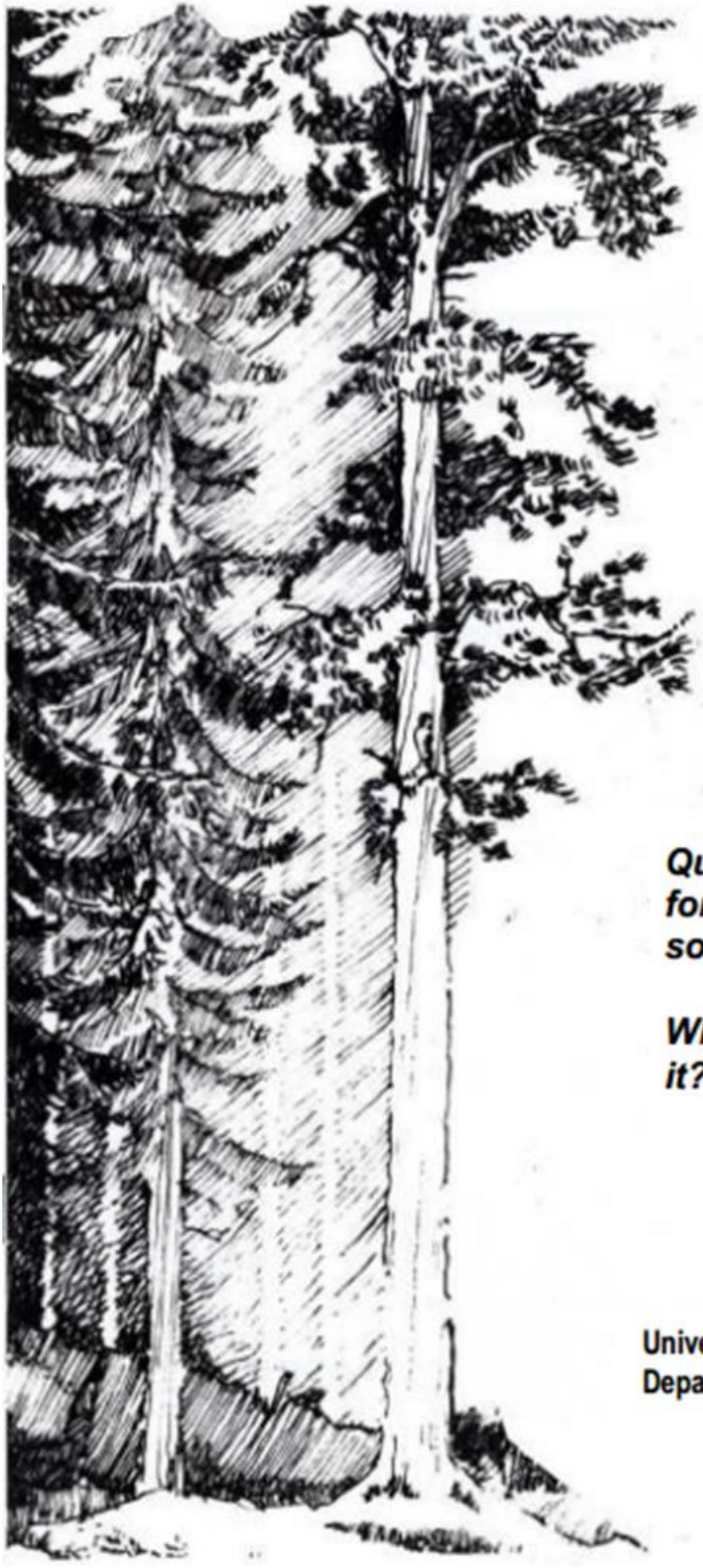
A ❑ No significance
B ❑ Some significance
C ❑ Quite important
D ❑ Very important

26. Monthly income of your household put together before taxation?

1 ❑ Under 500 € (under FIM 3000)
2 ❑ 501 – 1000 € (about FIM 3000 – 6000)
3 ❑ 1001 – 1500 € (about FIM 6000 – 9000)
4 ❑ 1501 – 2000 € (about FIM 9000 – 12 000)
5 ❑ 2001 – 2500 € (about FIM 12 000 – 15000)
6 ❑ 2501 – 3000 € (about FIM 15 000 – 18 000)
6 ❑ 3001 – 4000 € (about FIM 18 000 – 24 000)
7 ❑ 4001 – 5000 € (about FIM 24 000 – 30 000)
8 ❑ 5001 – 6000 € (about FIM 30 000 – 36 000)
9 ❑ 6001 – 7000€ (about FIM 36 000 – 42 000)
10 ❑ over 7001 € (over FIM 42 000)

THANK YOU FOR YOUR ANSWERS

Appendix II Choice experiment questionnaire



Questionnaire concerning forest conservation in southern Finland

What do you think about it?

University of Helsinki
Department of Forest Economics

Please, answer the following questions as carefully as possible. Filling the questionnaire takes about ten minutes.

1. How often have you been out in forests during the last month?

1 ❑ daily
2 ❑ several times per week
3 ❑ about once a week
4 ❑ several times a month
5 ❑ I have not been there during the last month

2. Which of the following things have you done at least once during the last 12 months?

1 ❑ walked or jogged in a forest at leisure time
2 ❑ picked mushrooms
3 ❑ picked berries
4 ❑ hunted
5 ❑ fished
6 ❑ visited a national park or other nature conservation area
7 ❑ camped spending the night
8 ❑ watched birds
9 ❑ collected or identified plants
10 ❑ done forestry work
11 ❑ reconditioned meadows
12 ❑ read nature or nature conservation related literature, periodicals or articles
13 ❑ watched or listened to nature conservation related TV or radio programmes
14 ❑ been in a forest because of work
15 ❑ paddled or rowed
16 ❑ observed nature
17 ❑ none of the above mentioned activities

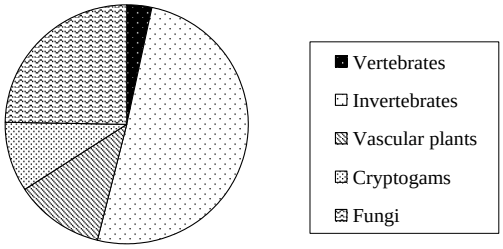
Information of the forest conservation is given in the several sections of the questionnaire. Please, familiarise yourself with it while filling the questionnaire.

REASON FOR FOREST CONSERVATION

In the southern Finland, the long history of forestry has diminished the area of intact **habitats** of broad-leaved forests, ridges, pastures, heaths and marshes. The most harmful changes have been the strong decrease of forest fires, drying of marshes and loss of diversity in tree stand, especially decrease of the old deciduous decayed trees. Intact, or close to intact, forests have been spared almost only in the conservation areas. Conservation level of the any of these habitats is, however, adequate to confirm the preservation and functioning structure in the long run.

There are about 43 000 animal and plant species in Finland, of which one third were explored in the study made in year 2000 and 1500 of these species were found to be endangered. **Endangered species** are species that are under the threat of becoming extinct in Finland in future unless the level of their conservation is increased. Almost 650 (43 %) of these endangered species live primarily in the forests, especially in the broad-leaved forests, pastures and ridge forests.

The number of endangered species in different families of organisms



3. In your opinion, what of the following aspects need to be considered when the forest conservation decisions are made?

			very much	much	neither little or much	little	not at all	
1	Preservation endangered animal and plant species	very much	❑	❑	❑	❑	❑	not at all
2	Fair division of the costs of the conservation	very much	❑	❑	❑	❑	❑	not at all
3	Forest owners rights to decide about the their forests	very much	❑	❑	❑	❑	❑	not at all
4	Impact on national economy	very much	❑	❑	❑	❑	❑	not at all
5	Preservation of the habitats of the endangered animal and plant species, like broad-leaved forests and marshes	very much	❑	❑	❑	❑	❑	not at all
6	Quality recreation environment and scenery	very much	❑	❑	❑	❑	❑	not at all
7	Impact on employment	very much	❑	❑	❑	❑	❑	not at all
8	Impact on operational preconditions of forest industry	very much	❑	❑	❑	❑	❑	not at all
9	Livelihood of rural areas	very much	❑	❑	❑	❑	❑	not at all
10	Nature tourism	very much	❑	❑	❑	❑	❑	not at all
11	Possibilities for multiple use of forests, like hunting, berry and mushroom picking	very much	❑	❑	❑	❑	❑	not at all

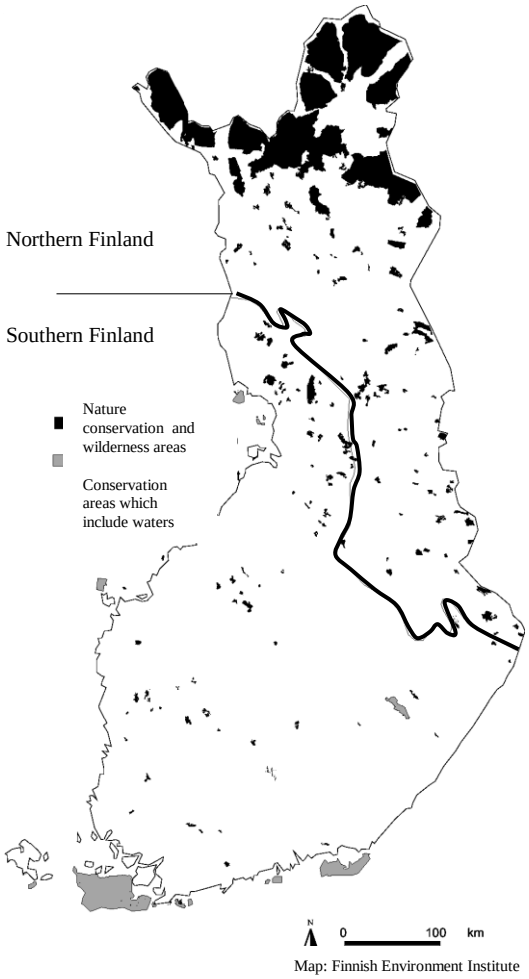
Some endangered forests species:

Pisarahelttahelokka

Shaw's Bristle-moss

white backed woodpecker

"old growth sap beetle"



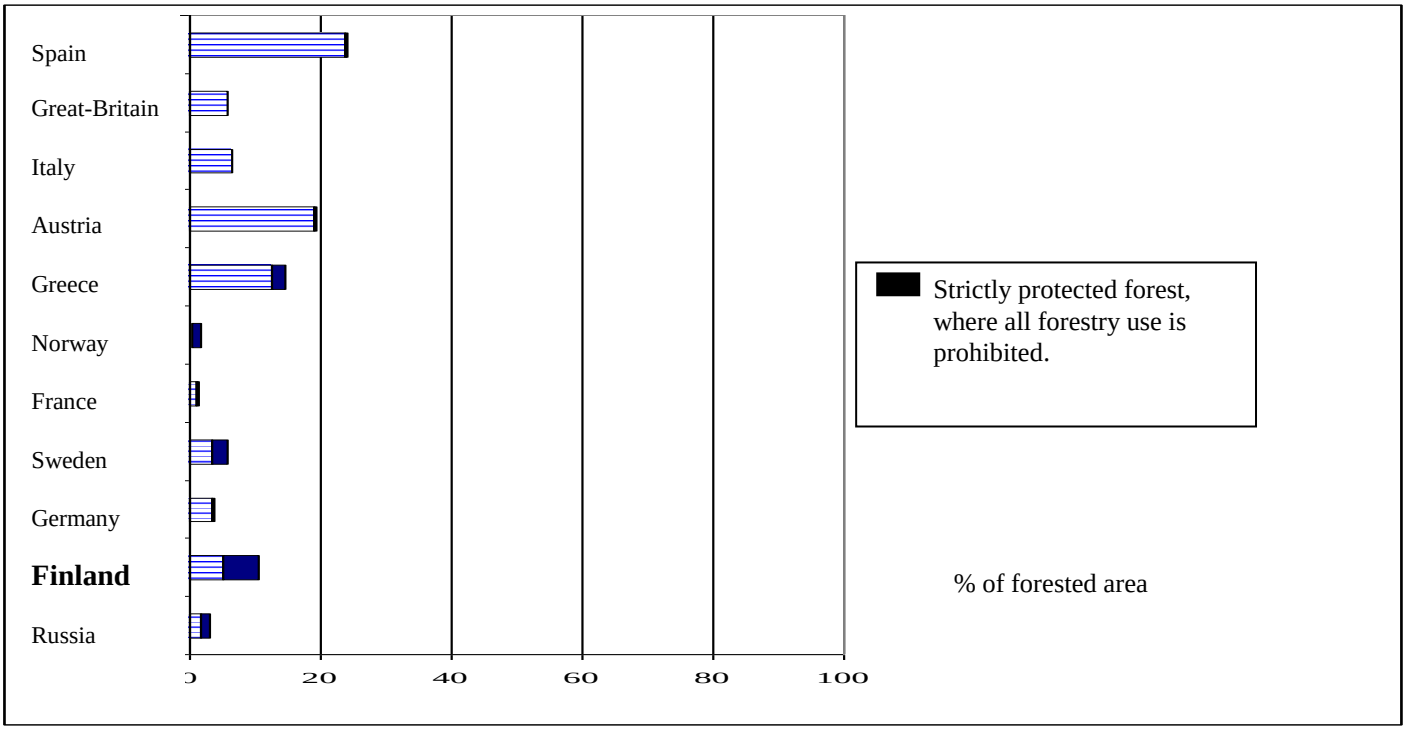
Map: Finnish Environment Institute

CURRENT FOREST CONSERVATION IN SOUTHERN FINLAND

In the northern Finland, the strictly protected forests cover 17 % of the forested land. Large amount of the nationally significant endangered habitats and species occur only in southern Finland. About **1.6 %** of the forested area of southern Finland is either national or nature preservation parks or other way **strictly protected** areas, where all forestry use is prohibited.

In addition to strictly protected areas of southern Finland, valuable sites totalling about 0.4 % of forested land area are protected by the Forest Act. Furthermore, forest companies have decided to leave valuable habitats of 0.5 % of all forested land out forestry use. Biodiversity protection is also taken into consideration in forestry planning, information and education of forest owners and in silviculture. Forest owners may be subsidised for maintaining biodiversity and forest ecology. Though, total of 2.5 % (323 000 ha) of the forests in southern Finland are under some kind of protection.

Percentage of the protected forests of forested land in Finland and in some European countries.



4. Consider the current state of the forest conservation in southern Finland.

		completely	fairly	rather	neither	rather	fairly	completely	
		7	6	5	4	3	2	1	
Forests of southern Finland have been conserved	sufficiently	❑	❑	❑	❑	❑	❑	❑	insufficiently

5. Evaluate *the current forest conservation in southern Finland* through the following statements. Respond according to your own feeling, even if you are not fully aware of the issue.

			fully	fairly	rather	neither	rather	fairly	fully	
			7	6	5	4	3	2	1	
1	Current conservation ensures the survival of rare animal and plant species.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
2	Current conservation costs are not divided justified way.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
3	Currently, forest owners' rights to decide about their own forest are taken into consideration well in forest conservation.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
4	Current forest conservation causes substantial costs to the state.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
5	Current conservation preserves the valuable sites.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
6	Current forest conservation improves the quality of recreation environment and scenery.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
7	Current conservation diminishes employment markedly.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
8	Current conservation worsens operational preconditions of forest industry.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
9	Current forest conservation makes livelihood of the rural areas worse.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
10	Current forest conservation contributes to nature tourism.	agree	❑	❑	❑	❑	❑	❑	❑	disagree
11	Current conservation makes the multiple use of the forests more difficult.	agree	❑	❑	❑	❑	❑	❑	❑	disagree

INCREASING FOREST CONSERVATION IN SOUTHERN FINLAND

The following means, among others, can be used to increase forest conservation in southern Finland:

Information and education

Forestry regulation, education and guidance of forest owners and, as an important part, forestry plan of the forest estate, have impact on the forest conservation. Currently, the information and education reaches about 30 % of the forest owners annually. **Information given to forest owners about nature conservation would be increased. State would pay the costs of information and education by tax income.**

Conservation contracts

In southern Finland, valuable sites totalling about 0.4 % of forested land area are protected by the Forest Act. Conservation contracts, for which the forest owners would take the initiative, would increase the conserved area. **State would pay environmental subsidy or rent for some period of time to forest owner.**

Conservation areas

In southern Finland, law of conservation areas preserves currently 1.6 % of forested land. This area could be increased if **the state would buy or redeem for conservation the areas with the most valuable habitats**, owned currently by private forest owners, companies, counties or congregations. In addition, conservation areas could be founded to forest areas currently owned by the state.

IMPACTS OF FOREST CONSERVATION

Goal of increasing forest conservation is to reach the **adequate level of conserved habitats**. Forest conservation increases, for example, amount of decayed and charred wood and number of deciduous trees, which is important for many endangered species. Increasing these characteristics of forest, **the number of endangered species decreases**. There is, however, no precise knowledge of the size of the decrease effect. The number of endangered species is, for example, estimated based on the explored species which covered about one third of all animal and plant species in Finland.

The costs to state to buy or redeem strictly protected forested land can be estimated rather precisely. There is instead lack of research in the area of impact of increased conservation on forestry and forest industry.

Like areas used for forestry, also conserved areas are free for picking berries and mushrooms and for other outdoor activities, and these areas can have positive impact, among other things, on tourism. Furthermore, increasing the number of living and decaying old trees affects the scenery.

6. How good or bad do you consider the above mentioned conservation means?

		completely	fairly	rather	neither	rather	fairly	completely	
		7	6	5	4	3	2	1	
Information and education	good	❑	❑	❑	❑	❑	❑	❑	bad
Conservation contracts	good	❑	❑	❑	❑	❑	❑	❑	bad
Conservation areas	good	❑	❑	❑	❑	❑	❑	❑	bad

7. Increasing forest conservation in southern Finland by buying conservation areas and paying subsidies would create costs to the state. These costs could be directed towards taxpayers. Do you agree or disagree with the following statements about the costs of forest conservation?

			fully	fairly	rather	neither	rather	fairly	fully	
1	It is always important to consider the benefits and costs when the extent of the forest conservation is decided.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
2	I am ready to give in my income to some extent if forest conservation can be increased even a little.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
3	I do not have enough money for nature conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
4	Any amount of increasing of forest conservation could not compensate the decrease of income.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
5	Forest owners should pay *the most* of the costs of increased conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
6	Forest industry and the users of forest products should pay *the most* of the costs of increased conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree
7	Taxpayers should pay *the most* of the costs of increased conservation.	agree	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑	disagree

ALTERNATIVES FOR FOREST CONSERVATION IN SOUTHERN FINLAND

A goal of following conservation alternatives is to explore the attitude of citizens towards conservation means, impacts and costs for households. Choose the best alternative in your opinion in all choice tasks, even if some alternatives may seem confusing. In addition, please note that covering the costs of conservation is presumed to cause a tax increase, mentioned in choice tasks, to your household **for next ten years**, beginning in 2003.

8. In the following eight choice tasks you are asked to choose the preferred one among two optional forest conservation programmes. You may also choose the current state, if you consider it to be better than any of proposed alternatives.

Choice task 1

		Current state	**Alternative 1**	**Alternative 2**
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	50 %	40 %
	Conservation contracts, percentage of forested land	0,4 %	4 %	8 %
	Conservation areas, percentage of forested land	1,6 %	3 %	4 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges, rich coniferous forests	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests, marshes
	Endangered species after 50 years (about, number)	650	200	90
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**300 € (FIM 1800) per year**	**30 € (FIM 180) per year**
I prefer		❑	❑	❑

Choice task 2

		Current state	**Alternative 1**	**Alternative 2**
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	70 %	40 %
	Conservation contracts, percentage of forested land	0,4 %	8 %	4 %
	Conservation areas, percentage of forested land	1,6 %	4 %	5 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests, marshes	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests
	Endangered species after 50 years (about, number)	650	90	100
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**5 € (FIM 30) per year**	**30 € (FIM 180) per year**
I prefer		❑	❑	❑

Choice task 3

		Current state	Alternative 1	Alternative 2
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	50 %	70 %
	Conservation contracts, percentage of forested land	0,4 %	4 %	2 %
	Conservation areas, percentage of forested land	1,6 %	4 %	3 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests, marshes
	Endangered species after 50 years (about, number)	650	300	90
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**100 € (FIM 600) per year**	**30 € (FIM 180) per year**
I prefer		❑	❑	❑

Choice task 4

		Current state	Alternative 1	Alternative 2
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	60 %	40 %
	Conservation contracts, percentage of forested land	0,4 %	8 %	6 %
	Conservation areas, percentage of forested land	1,6 %	5 %	2 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges, rich coniferous forests	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests
	Endangered species after 50 years (about, number)	650	200	100
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**300 € (FIM 1800) per year**	**5 € (FIM 30) per year**
I prefer		❑	❑	❑

Choice task 5

		Current state	Alternative 1	Alternative 2
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	50 %	60 %
	Conservation contracts, percentage of forested land	0,4 %	8 %	2 %
	Conservation areas, percentage of forested land	1,6 %	8 %	5 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests	Broad-leaved forests, pasturage, ridges
	Endangered species after 50 years (about, number)	650	100	300
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**30 € (FIM 180) per year**	**5 € (FIM 30) per year**
I prefer		❑	❑	❑

Choice task 6

		Current state	Alternative 1	Alternative 2
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	70 %	40 %
	Conservation contracts, percentage of forested land	0,4 %	6 %	4 %
	Conservation areas, percentage of forested land	1,6 %	3 %	4 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests, marshes	Broad-leaved forests, pasturage, ridges, rich coniferous forests
	Endangered species after 50 years (about, number)	650	90	200
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**300 € (FIM 1800) per year**	**100 € (FIM 600) per year**
I prefer		❑	❑	❑

Choice task 7

		Current state	Alternative 1	Alternative 2
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	50 %	60 %
	Conservation contracts, percentage of forested land	0,4 %	2 %	6 %
	Conservation areas, percentage of forested land	1,6 %	3 %	4 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges, rich coniferous forests	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests
	Endangered species after 50 years (about, number)	650	200	100
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**5 € (FIM 30) per year**	**30 € (FIM 180) per year**
I prefer		❑	❑	❑

Choice task 8

		Current state	Alternative 1	Alternative 2
Policy means	**Information and education**, percentage of forest owners reached annually	30 %	40 %	70 %
	Conservation contracts, percentage of forested land	0,4 %	8 %	4 %
	Conservation areas, percentage of forested land	1,6 %	5 %	2 %
Impacts of conservation	**Biotopes at favourable level of conservation**	Nothing	Broad-leaved forests, pasturage, ridges, rich and dry coniferous forests, marshes	Broad-leaved forests, pasturage, ridges
	Endangered species after 50 years (about, number)	650	90	300
Additional costs to your household	**Increase in annual income tax of your household 2003-2012 (€/year)**	**0 €**	**100 € (FIM 600) per year**	**300 € (FIM 1800) per year**
I prefer		❑	❑	❑

Finally, some background information about yourself

14. Year of birth _____

15. Gender

1 ❑ Woman
2 ❑ Man

16. Living environment in childhood

1 ❑ Rural area
2 ❑ Population centre or small town
3 ❑ Town, 20 000 – 100 000 inhabitants
4 ❑ City, over 100 000 inhabitants

17. Current living environment

1 ❑ Rural area
2 ❑ Population centre or small town
3 ❑ Town, 20 000 – 100 000 inhabitants
4 ❑ City, over 100 000 inhabitants

18. Education

1 ❑ Lower elementary or elementary school
2 ❑ Vocational school
3 ❑ High school
4 ❑ Vocational college
5 ❑ College or university
6 ❑ Other education

19. Occupation (previous occupation for pensioners and unemployed)

1 ❑ Farmer
2 ❑ Entrepreneur
3 ❑ Upper-level employee
4 ❑ Lower-level employee
5 ❑ Manual worker
6 ❑ Student
7 ❑ Taking care of own household or other

21. Are you currently employed?

1 ❑ Yes
2 ❑ No

22. What is your field of occupation (previous occupation for pensioners and unemployed, coming for students)?

1 ❑ forestry or timber industry
2 ❑ agricultural field
3 ❑ field related to environmental conservation
4 ❑ other field related to environment
5 ❑ another field

23. Number of household members?

totalling_____persons, of whom _____are under 18 years of age.

24. What province do you live in?

1 ❑ Province of Southern Finland
2 ❑ Province of Western Finland
3 ❑ Province of Eastern Finland
4 ❑ Province of Oulu
5 ❑ Province of Lapland

25. Are you a member of any nature or environmental organisation?

1 ❑ Yes
2 ❑ No

26. **Do you or someone in your household own forest (forested area over 1 ha)?**

1 ❑ No
2 ❑ Yes, about _____ ha, (if joint ownership, the share of your household)

What is the significance of forestry income to your economy?

A ❑ No significance
B ❑ Some significance
C ❑ Quite important
D ❑ Very important

26. Monthly income of your household put together before taxation?

1 ❑ Under 500 € (under FIM 3000)
2 ❑ 501 – 1000 € (about FIM 3000 – 6000)
3 ❑ 1001 – 1500 € (about FIM 6000 – 9000)
4 ❑ 1501 – 2000 € (about FIM 9000 – 12 000)
5 ❑ 2001 – 2500 € (about FIM 12 000 – 15000)
6 ❑ 2501 – 3000 € (about FIM 15 000 – 18 000)
6 ❑ 3001 – 4000 € (about FIM 18 000 – 24 000)
7 ❑ 4001 – 5000 € (about FIM 24 000 – 30 000)
8 ❑ 5001 – 6000 € (about FIM 30 000 – 36 000)
9 ❑ 6001 – 7000€ (about FIM 36 000 – 42 000)
10 ❑ over 7001 € (over FIM 42 000)

THANK YOU FOR YOUR ANSWERS