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ORIGINAL RESEARCH

Forest Owner Attitudes and Preferences for Voluntary Temporary Forest Conservation

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Abstract

This study explores attitudes and preferences of Finnish non-industrial private forest owners for voluntary temporary forest conservation. The survey data, collected with the best–worst scaling and discrete choice methods, focus on a conservation program that incentivizes forest owners for biodiversity conservation and carbon sequestration. Forest owners are willing to conserve simultaneously biodiversity and forest carbon. They prefer non-profit organization as implementer of program, suggesting alternative to current implementation of forest conservation by authorities. Forest owners' interest in forest conservation program increases with shorter contract and higher payment, both aspects being subject to preference heterogeneity. Forest owners differ in terms of the perceived importance of ecological, economic and social aspects of sustainability of forestry. Heterogeneity in attitudes and preferences stems from the size of forest land, gender, freetime home located on forest site, and place of residence.

Keywords Forest conservation · Non-industrial private forest owner · Best–worst choice method · Biodiversity · Climate change mitigation

Introduction

Boreal forests contribute to the provision of multiple ecosystem services, for instance serving as a source of raw material for forest industry, as a carbon sink and carbon storage, contributing to the climate change mitigation, and as a key ecosystem for safeguarding biodiversity (Grassi et al. 2017; IPCC 2018). Decisions of forest land owners concerning their land and its management reflect various objectives for forest management, values or motivations for owning forestland, and characteristics of forest land as well as of forest land owner.

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Forests cover a majority (86%) of land surface in Finland. Non-industrial private forest owners own 52% of the forestry land (that includes forest land, poorly productive forest land, unproductive forest land, forests roads and depots) (Finnish Statistical Yearbook of Forestry 2021). Non-industrial private forest owners provide 60% of the wood used in the forest industry (Finnish Statistical Yearbook of Forestry 2021). The forest industry contributes to the Finnish Economy by around 20% of exports, and in 2021, the forest industry sector used 72.2 million cubic meters of wood. (Luke Statistics 2021).

Forest legislation and guidance for good forest management spur forest owners in promoting biodiversity in commercial forests. Almost all forests in Finland are certified: 6% following the Forest Stewardship Council (FSC) certificate and 85% according to the programme for the endorsement of forest certification (PEFC). Besides combining timber production and biodiversity conservation, 7% of forest area is protected by environmental conservation law or forest law. Public funding is available for enhancing forest growth, adaptation of forests to climate change, or the implementation of nature management projects as well as subsidizing the income loss or additional costs due to preservation or management of habitats. (Temporary Act on the Financing of Sustainable Forestry 2015).

However, according to Kouki et al. (2018), it has been assessed, following the IUCN Red List of Ecosystems Criteria (Bland et al. 2017), that the majority (76%) of the 40 forest habitat types assessed in Finland are endangered. The main cause is the reduction in the ecological quality, represented by the reduction in dead wood, the reduction in old forests and trees and the changes in the structure of tree species (Kouki et al. 2018). As to climate change, in the European Union climate policy, forests form part of the land use, land use change and forests (LULUCF) sector and the associated regulation and carbon balance calculation, representing a sector element that provides a net sink of carbon (Official Statistics of Finland 2021).

An additional tool for forest conservation since 2008 has been voluntary forest conservation. The voluntary forest conservation program METSO, implemented jointly by the Ministry of Environment and the ministry of agriculture and forestry, consists of temporary conservation contracts, lasting either 10 or 20 years, and permanent contracts. The compensation payments for forest conservation for the forest owner base on timber value of the area. (Government of Finland 2014) While non-industrial private forest owners in Finland are familiar with combining biodiversity conservation with commercial forest use (Pynnönen et al. 2018), the topicality of climate issues will enhance the adoption of various climate change mitigation strategies in forestry (Vehola et al. 2022). For forest owners, maintaining biodiversity or enhancing carbon sequestration while being compensated for the associated loss in timber related income during the contract period may create an alternative for selling timber and earning forest income as selling timber is not possible when participating in the voluntary forest conservation program.

The acceptability of voluntary agreements for forest conservation among forest owners is affected by various factors. For instance, contract design, attitudes and socio-demographic characteristics of forest owner, forest characteristics, network of advisors and peer forest owners, sense of autonomy, justice and fairness, as well as trust and knowledge affect the willingness to enter into formal voluntary

conservation agreement (Miljand et al. 2021). For forest and environmental policy planners, information on the acceptability of alternative new designs of voluntary conservation programs is especially useful. Stated preferences methods (see Hensher et al. 2015) provide a tool for assessing ex-ante the willingness of forest landowners to participate in voluntary forest conservation programs and for gathering information on how selected design aspects of programs, such as contract length and payment, are associated with program acceptance. Information on attitudes and sociodemographic characteristics of the forest owner gathered with a stated preference survey provide a way to enrich the preference analysis.

This study focuses on non-industrial private forest owners in Finland, and explores the distributions of their perceptions on forestry and on sustainability of Finnish forestry. Moreover, the study estimates their willingness to enroll forestland on a voluntary temporary forest conservation program and the preferences for three program aspects: the length, the payment for forest owner and the implementer of the program.

The rest of the paper is structured as follows: Sect. "Previous Literature on Program and Forest Owner Characteristics" reviews the previous scientific literature on forest owner behaviour in the forest conservation program setting. Sect. "Material and Methods" introduces the methods and data collection of this research. Sect. "Results" describes the data and presents the results, followed by Sect. "Discussion" and Sect. "Conclusion".

Previous Literature on Program and Forest Owner Characteristics

Regarding design aspects of voluntary forest conservation programs, the program length typically has a negative effect on the acceptance (Horne 2006; Layton and Siikamäki 2009; Dickinson et al. 2012; Miller et al. 2012; Rabogyatov and Lin 2013; Soto et al. 2016; White et al. 2018). The forest owners may favour preparing for unexpected expense by keeping the opportunity of generating financial income from harvesting timber (Kittredge and Thompson 2016), or they may wish not to make a conservation decision on behalf of the next owner but to leave the standing forest stocks to their heirs. Regarding the studies that report a statistically insignificant effect of the program length on the participation, the research designs are subject to the lack the variation in the program length. The range have been limited to either the short extreme end, varying between 10 and 20 years (Klosowski et al. 2001; Stevens et al. 2002), or the long extreme end, varying between 30 and 99 years (Kelly et al. 2015).

The effect of the payment or the compensation on the likelihood of the enrollment on the program has been unambiguously positive, but forest owners are heterogeneous in their sensitivity for the effect of the payment. The heterogeneity stems from economic reasons and from varying personal motivations for forest ownership and forest management. For instance, the financial incentives affect less the participation of absentee landowners than those with permanent residences on site or adjacent to the protected properties (Farmer et al. 2015). The preferences for both the contract length and the payment are associated with other characteristics of temporary

programs, such as the flexibility. Forest owners prefer, on average in comparison to binding contracts, the programs that allow withdrawal from the contract without penalty or even accompanied by a penalty (e.g. Horne 2006; Soto et al. 2016). However, the effect of whether the payment is paid a lump sum or as annual payments is ambiguous (Kelly et al. 2015).

According to White et al. (2018), forest owners prefer a non-profit organization as an implementer of the carbon off-setting program over governmental organization and for-profit organization. Without taking a stand on the implementer per se, Torabi et al. (2016) emphasize a good reputation of the provider of the program as an important factor in participation in programs that promote forest biodiversity and carbon sequestration. Horne (2006) underlines the importance of a voluntary nature of forest conservation and a strong sense of property rights concerning one's forests, and argue that private forest owners prefer themselves as the initiators of the biodiversity conservation contracts to forest organization, conservation trust, and environmental organization.

Regarding forest owner characteristics, the enrollment in the habitat preservation program relates positively with the lack of the importance of non-forest income for the forest owner and the residence elsewhere while having relatives residing close to forestland (Layton and Siikamäki 2009). In contrast, farmers, males, relatively old and forest owners with a degree in forestry less likely participate in the forest conservation program. (ibid.) Existing set-aside areas in the property increase the likelihood to enroll on the program (ibid.), while a loss of timber production value has a negative positive effect (Klosowski et al. 2001). The opportunity cost of the forest use (Horne 2006), the economic value of the forest (Kilgore et al. 2008) or the returns from the forest (LeVert et al. 2009) have no significant effect. Forest based returns as motivation for forest ownership may increase the willingness to join the program when a reasonably high compensation in comparison to the loss of income from timber harvesting is offered and the program length is short (Mäntymaa et al. 2009).

Material and Methods

Forest Owner Survey

A 15-min online questionnaire for forest owners started with inquiring information on the characteristics of the forest property of the respondent and the motivations for forest ownership. The respondents, who owned more than one forest holding, were supposed to consider the largest or the otherwise most important forest holding when answering the subsequent questions. Next, the questionnaire examined the acceptability of temporary voluntary forest conservation program by presenting the respondents with potential new programs and asking them in these choice tasks to state whether they would enroll their land in the program. The programs were described in terms of the implementer of the program, the length and the payment for the forest owner. The survey ended with questions about the attitudes on forest

management in general and on the sustainability of Finnish forestry, and background questions on forest owner characteristics.

As attitudinal measurements, five attitudinal statements on forestry concerned the perceptions of forest owner on conserving biodiversity and sequestrating carbon, providing non-market services for the society, the importance of harvest potential of one's forest holding and worry for damages due to climate change. The statements were assessed on 5-point Likert scale ranging from totally agree to totally disagree. To examine attitudes to sustainability, seven statements representing environmental, economic and social aspects of the sustainability of Finnish forestry were assessed with the 5-point Likert scale, ranging from important to not at all important. In both statement patterns, a "cannot say" option was available.

In the pilot phase in December 2018–January 2019, the survey questionnaire was tested in iterative way with seven forest owners who represented females and males, various sizes of forest properties and forest owners residing on forest site and absentees. The forest owner interviews led to re-organization and rephrasing of questions and the reduction of the number of choice tasks as well as the re-specification of the program length attribute. The first wave of data collection, conducted by the professional polling company (Kantar TNS) by selecting a forest owners from their nationwide consumer panel, included 46 responses from forest owners living in different parts of the country. Based on this preliminary analysis, revealing in a high share of non-participation in the proposed programs, the higher end of the payment range was adjusted upwards. The questionnaire is available from the author by request.

Acceptance of Conservation Programs

To explore the acceptability of the forest conservation program and to assess the willingness to enroll forestland in the program, the hybrid of best–worst scaling (BWS) and discrete choice experiment (DCE) method was applied. The best–worst scaling approach (Louviere et al. 2015) aims at providing more statistical information on trade-offs and forest owners' choices and to distinct the influence of attributes and levels. The discrete choice analysis (Hensher et al. 2015) bases on a survey in which the respondents state their preferences in a hypothetical experimental setting. A respondent faces a series of choice questions, i.e. potential new forest conservation programs. In the hybrid best–worst choice (BWC) questionnaire, the respondents first chose which aspect of the forest conservation program increases their interest the most and which one the least, and second, they choose whether they would enroll to that specific program (binary choice).

The BWS data, focusing on the effect of design aspects in the interest of forest owner to participate, allows for the estimation of unconditional demand utility associated with a given level of an attribute, i.e., the selected features of a forest conservation program, and for modelling the decision making and trade-offs with the conditional logit model. The binary random effects modelling of the participation decisions allows for estimation of the willingness to accept (WTA) compensation for participations in the programs characterized with various design aspects.

Before the choice questions, the respondents were informed about the conditions and requirements of a new voluntary forest conservation program. During the contract period, no forestry activities are allowed, no withdrawal option exists, and the contract is binding also for the subsequent forest owner. Enrolling the area on the program may require some forest management actions or the area may be eligible to the program in its current condition. The payment varies according to the logging value of the site, the quality of biodiversity and the potential for carbon sequestration.

Three program attributes studied (Table 1) were the organization in charge of the implementation of the program (authorities, a for-profit company or a non-profit organization), the contract length and the annual payment for the forest owner. The selection of the attributes based on the literature review on previous studies on forest owners' willingness to participate in forest conservation. As to the implementer, the authorities represent the present way of organizing the forest biodiversity program METSO and the program length of 10 years is the shortest option of METSO conservation contracts. The longest contract option in the survey, 40 years, exceeded the currently longest option of temporary contracts (20 years) and was specified based on interviews during the pilot stage.

The annual per-hectare payment levels were selected based on exemplifying calculations of the per-hectare payments for actual conservation contracts in the METSO biodiversity conservation program. The calculations performed with the MOTTI software are based on forest area, forest type, forest age, the amount of deadwood and broad-leaved trees as well as the location of the forest. The software calculates the economic loss due to the conservation in comparison to the most profitable management option. Further, the payment for carbon sequestration was estimated using the carbon sequestration potential (0.7 tonnes of CO2 per cubic meter), the growth of the average forest type (5 cubic meters per hectare per year) and the price of carbon (30€), and varying the payment levels below and above. The best–worst choice tasks followed an orthogonal full factorial main effects design with nine choice tasks. The programs were presented to the respondents in three randomly distributed sets of three programs.

Table 1 Attributes and levels in the best–worst-choice design

Attribute	Level
Implementer	authorities
	for-profit company
	non-profit organization
Program length	10 years
	25 years
	40 years
Payment / ha / year	110 €
	210 €
	310 €

Analysis Methods

Attitudinal statements were analyzed by testing the differences in attitudinal responses between two sociodemographic groups using the Mann–Whitney test for the equality of distributions of attitudinal scales. For categorical variables, the Pearson's Chi squared test was used for comparing two groups and their similarities, and *t*-test for continuous variables. Statistical analysis was conducted with SPSS 26.0.

The best–worst scaling data on the program attributes and their contribution to the acceptability of forest conservation program was analyzed with the Nlogit 6 econometric software, using the paired conditional logit model, treating each best–worst pair as one choice outcome. Each scenario S of J (J = 3) attributes would have (J(J-1)) = 6 possible outcomes, that is, best–worst combinations. In the paired conditional logit model, $P_{ij}\left|S\right.$ is the probability of choosing i as the best attribute level and j as the worst attribute level in scenario S. On a latent scale of utility, $\delta_{ij} + \varepsilon_{ij}$ is the distance between i and j where ε_{ij} is a random disturbation term. $Max(\delta_{kl} + \varepsilon_{kl})$ is the largest difference of all other paired differences in scenario S. The probability model is the following, assuming the IID Gumbel distribution of ε_{ij}:

$$P_{ij}\left|C = \exp\left(\delta_{ij}\right) / \sum\nolimits_{kl \in C} \exp\left(\delta_{kl}\right)\right. \tag{1}$$

In the analysis, the dependent variables takes the value of 1 if the attribute was chosen and 0 if not, and the model is expressed as:

$$U^i_{diff} = \sum\nolimits_{j=1}^{n} \beta^i_j D^i_j + \sum\nolimits_{j=1}^{n} \sum\nolimits_{k=1}^{m} \beta^i_{jk} D^i_{jk} + \varepsilon^i \tag{2}$$

where U^i_{diff} is the difference in utility of each best–worst combination for the forest conservation program, n is the total number of attributes, j refers to attributes, k to attribute levels, and m to the total number of attribute levels of an attribute. Further, β^i_j refers to attribute impact and β^i_{jk} to an attribute level scale value, to be estimated, and D^i_j takes the value of 1 if any level of attribute j is chosen as the best, -1 if chosen as the worst and 0 otherwise. The variable D^i_{jk} is coded similarly.

In addition to the estimation of the probabilities for choices and the preference parameters, the latent class model allows for the estimation of willingness-to-accept (WTA) measures for various types of forest owners. The probability P_{ni} that the forest owner n makes the observed sequence of choices i is unconditional on the actually estimated parameters and takes the following form:

$$\mathrm{P}_{ni} = \int \mathrm{L}_{ni}(\beta) f(\beta) d\beta \tag{3}$$

where the logit formulas $\mathrm{L}_{ni}(\beta)$ are averaged by weight given by the density $f(\beta)$. In the latent class model, the density is specified as discrete, as in the model

the forest owner population consists of the specified number of segments in which the individuals have similar preferences. For the model with C classes, β takes C possible values, e.g. in the case of two classes: b_1 and b_2, and the probability that $\beta = b_c$ is S_c, that is, the share of the population in each class C.

The marginal WTA estimates are calculated as the ratios of the attribute's or the constant's marginal effects coefficient to the payment coefficient,

$$MWTA = \left(\frac{\beta_k}{\beta_p}\right) \tag{4}$$

where β_k is the parameter estimate of program attribute or a constant k and β_p is the parameter estimate of the payment attribute. To achievement of reliable WTA estimates requires both β_k and β_p to be statistically significant.

Results

Descriptive Statistics of the Data

The survey was administered in February 2019 by the professional polling company (Kantar TNS) by selecting a forest owner sample from their nation-wide consumer panel. The data collection resulted in 405 observations. The responses were divided roughly equally to three questionnaire versions: 35%, 30% and 35% to versions 1, 2, and 3.

Table 2 presents the comparison of the data with the corresponding statistics from a large nation-wide forest owner survey conducted a year later (Karppinen et al. 2020), serving the best available up-to-date characterization of Finnish forest owners. The share of male respondents (64%) was slightly smaller than in the reference study (75%). Around a third (36%) has a freetime home on forest site and a fifth (21%) resides permanently on site. Almost a half (44%) of the respondents had no housing relationship to the forest holding. The corresponding shares in the reference study were 19%, 37% and 35%, respectively. The share of city dwellers in the data (64%) is larger than in the reference study (29%). Regarding average age, education and professional status, the sample represents well the Finnish forest owners. As to the importance of forests as the source of income, for the majority (58%) of respondents, forestry revenues make less than 5% of their annual household income, followed by 6–25% (25% of the respondents), and more than 25% (5%).

About two thirds of respondents (63%) own one forest holding, 19% own two holdings, and 18% at least three holdings. On average among all respondents, the size of forest property is 51 hectares (73 hectares for those residing on site and 43 hectares for absentees), and the size of the largest or the most important forest site is 36 hectares (52 hectares for those residing on site and 31 hectares for absentees). Regarding the average site size, the figures of the this study (36 hectares) and the reference study (48 hectares) not fully comparable as the reference study focused on forest holdings selected randomly on location-basis.

Table 2 Descriptive statistics of the data and a reference study

Variable	Data (N = 405)	Reference study (N = 6542)
Forest owner characteristics		
Gender: male	64	75
Housing: holiday home on site	36	19
Housing: residential house on site	21	37
Housing: none	44	35
City dweller	64	29
Average age	59	62
High education (university or polytechnic)	47	45
Professional status: employee	32	37
Professional status: agricultural entrepreneur	6	9
Professional status: other entrepreneur	6	6
Professional status: retired	48	47
Professional status: other	8	2
Income source: < 5% of household income	58	*n.a.*
Income source: 6–25%	25	*n.a.*
Income source: > 25%	5	*n.a.*
Forest land characteristics		
Owns one forest holding	63	*n.a.*
Average size of all forest property (total ha)	51	*n.a*
Average size of forest holding	36	48
Forest holding size, ha: 5–9.9	16	16
Forest holding size, ha: 10–19.9	29	23
Forest holding size, ha: 20–49.9	35	33
Forest holding size, ha: 50–99.9	13	17
Forest holding size, ha: 100-	7	12
Ownership: alone or with spouse	68	72
Acquired: Inherited or as gift	55	53
Acquired: Bought from parents or relatives	31	28
Acquired: Bought from markets	14	12
Timber production: Sold logs or pulpwood	50	48
Timber production: Sold fuelwood	23	16
Timber production: Forest management plan	66	*n.a*
Conservation: Current METSO area on site	6	*n.a*

(*n.a.refers to not applicable*)

Regarding the ownership structure, the way of acquiring the holding and wood selling during the past three years, the data are rather well representative. The majority (68%) of forest holdings is under family ownership (72% in the reference study). Most often the forest site has been inherited or been a gift (55% vs. 48% in the reference study), followed by being bought from parents or relatives (31% vs. 28%) or

from markets (14% vs. 12%). Half of respondents (50%) have sold logs or pulpwood and a fourth (23%) fuelwood at least once during the past three years. The corresponding shares in the reference study were 48% and 16%. In addition, regarding forest management activities during 2016–18, 60% of respondents have afforested (either seeds or saplings), 12% fertilized, 18% ditched and 16% performed nature management. A fifth of respondents (20%) has not performed any of the aforementioned management activities or sold wood during 2016–18. Two thirds (66%) of forest sites are subject to an operational forest management plan. A few respondents (6%) have currently a METSO conservation area on their site, referring either to as permanent conservation areas or temporary contracts of either 5 or 10 years.

The study data set is biased towards female forest owners, freetime home owners, city dwellers and forest owners with small forest holdings. The differences likely result from the use of a consumer panel in the data collection. In the analysis that follows, these socio-demographic characteristics are paid specific attention to.

Attitudes on Forestry and its Sustainability

Regarding perceptions on forestry, biodiversity and climate change (Table 3), the majority of forest owners agree on the importance of forestry in curbing the climate change (82%), the potential of simultaneous protection of biodiversity and carbon storage (79%) and the concern on the increase in the forest damage risk with the climate change (75%). Concerning distributions of answers to these statements, there are no statistically significant differences among socio-demographic forest owner groups.

However, while the majority of the forest owners (75%) are proud to provide benefits for the society, this aspect of forest ownership is more important for forest owners who own large forest holdings (85%), in comparison to small forest holding (74%). The size of forest holding is associated also with the importance of keeping a cutting potential stable, underlined by a larger share of forest owners who own large forest holding (83%), in comparison to small forest holding (66%). Similarly, a larger share of forest owners who do not have a freetime home on the forest site (77%) consider a stable cutting potential important, compared to forest owners whose freetime home is located in the forest site (62%).

The distributions of forest owner perceptions on sustainability of forestry (Table 4) differ statistically significantly between sustainability aspects and socio-demographic characteristics. On average, the most important aspects for sustainability in Finnish forestry are a reasonable price for timber for forest owners, considered important by 80% of the respondents, and the use of by-products of forest industry in the production of biofuels (79%). Regarding the latter, the freetime home owners are less supportive for the use of by-products than the forest owners who do not own a freetime home located at forest site. The same applies to city dwellers in comparison to rural residents.

The majority of forest owners (76%) consider the replacement of fossil materials and fuels by forestry products important, as well as the employment provided by the forestry sector (73%). However, freetime home owners, females and city dwellers

Table 3 Forest owners' attitudes on forestry. Statistically significant differences (0.05 level) between subgroups

		Average	Freetime home		Female		City dweller		Small size	
		N = 405	Yes n = 147	No n = 258	Yes n = 144	No n = 261	Yes n = 258	No n = 147	Yes n = 274	No n = 103
I understand the importance of forestry in curbing the climate change	Agree	82	80	83	83	81	79	86	82	84
	Neutral	13	16	11	16	11	16	8	14	8
	Disagree	5	4	6	1	8	5	6	4	8
A simultaneous protection of both biodiversity and carbon storage is possible	Agree	79	76	80	80	78	76	83	79	84
	Neutral	18	21	16	18	18	21	13	19	12
	Disagree	3	3	3	2	4	3	4	2	4
I am proud to know that my forests provide benefits to the society along with my own benefits	Agree	75	72	77	74	76	74	78	**74**	**85**
	Neutral	18	21	17	23	16	19	17	**19**	**11**
	Disagree	6	7	6	3	8	7	5	**7**	**4**
I am worried that the climate change could significantly increase the risk of forest damages	Agree	75	73	77	80	73	74	77	76	76
	Neutral	16	18	15	16	16	17	14	15	18
	Disagree	9	10	8	4	11	8	10	9	6
It is important to keep a stable cutting potential of the forest holding	Agree	71	**62**	**77**	69	73	71	72	**66**	**83**
	Neutral	22	**28**	**19**	24	21	23	20	**27**	**10**
	Disagree	7	**10**	**5**	7	7	6	7	**7**	**7**

(Yes and No) in bold

Table 4 Forest owners attitudes for different aspects of sustainability of forestry

		Average	Freetime home		Female		City dweller		Small size	
			Yes	No	Yes	No	Yes	No	Yes	No
		N=405	n=147	N=258	N=144	N=126	N=258	N=147	N=217	N=103
Reasonable price for timber	Important	80	78	81	79	80	78	82	82	79
	Neutral	17	17	17	19	16	18	14	15	18
	Not important	3	5	3	2	4	3	3	3	4
By-products used for biofuels	Important	79	**72**	**82**	76	80	**76**	**83**	81	80
	Neutral	17	**21**	**15**	19	16	**19**	**14**	16	17
	Not important	4	**7**	**3**	4	4	**5**	**3**	3	4
Fossil materials and fuels replaced	Important	76	**68**	**80**	**71**	**78**	**73**	**80**	74	82
	Neutral	18	**23**	**14**	**22**	**15**	**20**	**14**	19	12
	Not important	7	**9**	**6**	**8**	**7**	**7**	**6**	7	7
Forestry employs many people	Important	73	**67**	**76**	**68**	**75**	**69**	**78**	**70**	**80**
	Neutral	22	**27**	**20**	**28**	**19**	**26**	**16**	**24**	**17**
	Not important	5	**5**	**5**	**3**	**6**	**5**	**5**	**5**	**4**
Increased forest reserves	Important	52	**58**	**49**	**63**	**47**	54	50	53	50
	Neutral	33	**29**	**36**	**30**	**35**	32	35	34	35
	Not important	15	**14**	**15**	**8**	**18**	14	16	14	16
Decreased cuttings for BD	Important	36	39	34	44	31	37	34	35	41
	Neutral	32	35	30	38	28	35	27	34	24
	Not important	32	25	36	17	40	28	40	32	35
Decreased cuttings for CC	Important	32	36	30	**46**	**25**	34	30	31	33
	Neutral	31	38	26	**31**	**31**	33	27	32	27
	Not important	37	26	43	**24**	**44**	33	44	37	40

Statistically significant differences (0.05 level) between subgroups (Yes and No) in bold

are less supportive for these two sustainability aspects. In addition, the larger the forest holding, the more supportive the forest owner is for the importance of the forestry as the employer.

Alongside social and economic aspects of sustainability of forestry, ecological aspects refer to the increased forest reserves, decreasing cuttings for biodiversity and decreasing cuttings to mitigate the climate change. These aspects are considered important by 52%, 36%, and 32% of the respondents, respectively. Females (63%) and freetime home owners (58%) are more supportive for increased forest reserves, in comparison to males (47%) and forest owners who do not own a freetime home located on the forest site (49%). Moreover, the larger share of females (46%) in comparison to males (25%) consider the decreased cuttings to mitigate the climate change an important aspect of sustainability of forestry.

Perceptions on Program Attributes

Out of the program attributes, the payment for the forest owner is most often stated increasing the forest owner's interest in the program the most (52% of the responses), followed by the implementer (36%) and the contract length (12%). On the contrary, most often specified as increasing the interest the least is the contract length (57% of responses) is, followed by the implementer (26%) and the payment (17%). The exclusion of the respondents who stated the same order of attributes in all three presented programs, regardless of attribute levels, do not change the results qualitatively: the payment is still most often identified as increasing the interest in the program the most (49%), followed by the implementer (38%) and the contract length (13%). Regarding the attribute that increase the interest the least, the corresponding percentages for contract length, implementer, and payment (20%) are 54%, 26%, and 20%, respectively.

Table 5 Attribute level scale impacts

Attribute		
Level	Coefficient	St.e
Implementer		
Authorities	*0.128*	
For-profit	−0.689***	0.063
Non-profit	0.562***	0.063
Length		
10 years	*0.360*	
25 years	−0.068	0.062
40 years	-0.292***	0.062
Payment		
110 euros	*−0.452*	
210 euros	−0.027	0.062
310 euros	0.479***	0.063

Tables in italics are calculated as a negative sum of coefficients of two other levels *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The conditional logit model (Table 5) accounts for the effects of attribute levels in the best–worst data. The reference levels of effects coded attributes are the authorities as a program implementer, the contract length of 10 years and the payment of 110 euros per hectare per year. The longest contract period is the least preferred level of commitment to the program and the highest payment was the most preferred amount of compensation.

All attribute levels, except for the length of 25 years and the payment of 210 euros per hectare per year, affect the attractiveness of conservation program statistically significantly at 1% level. As to the implementation of the program, a non-profit organization increases the most the forest owners' interest in the conservation program. A negative and significant coefficient of a for-profit organization as an implementer of the conservation program indicates that the forest owners prefer authorities to a for-profit organization.

As to the payment and length, only the highest payment (310 euros) increases and the longest contract period (40 years) decreases the forest owners' stated interest in the forest conservation program, as the coefficients of the lowest and second lowest levels are not statistically significantly different from each other.

Heterogeneous Preferences for Enrolling Land on Forest Conservation Program

Before the analysis of preference heterogeneity, the choice data were inspected for those respondents who chose not to enroll their land on any of three forest conservation programs presented in the survey. Regardless of the levels of program attributes, a half of the respondents (50.1%) rejected all three proposed programs while the rest of the respondents accepted at least one of the three proposed programs. According to Chi squared tests for similarities between two groups, a forest owner not willing to consider a conservation program is statistically significantly more likely older than 35 years old (26% vs. 7%), not in work life (53% vs. 34%), not a member of nature conservation organization (8% vs. $< 1\%$) and does not have METSO conservation area (13% vs. 6%). However, the willingness to consider forest conservation program is not associated with university education, gender, urban residency, having a freetime home on the forest site, household income, having an operational forest management plan or the share of forest income out of household income.

To explore preference heterogeneity, the choice data were analyzed with a latent class binary logit model, characterizing the class membership with statistical tests (Table 6). The implementer of the program and the length of the program are effects coded and the payment is a linear continuous variable. The analysis reveals two types of non-industrial private forest owners that differ in terms of preferences. On average, to Class 1 were assigned 72% of survey respondents, while 28% were assigned to Class 2.

Based on the magnitudes of coefficients, forest owners in Class 1 are more sensitive to the level of payment for forest owners for conserving their land and the length of the contract period, and have overall a less positive perception towards participation in conservation program. Forest owners in Class 2 are indifferent between the program lengths of 10 and 25 years, while forest owners in Class 1 would require a

Table 6 Binary latent class model for enrolling on the conservation program and factors explaining class membership

Program attributes	Class 1		Class 2	
	Coefficient	St. error	Coefficient	St. error
For-profit	***− 0. 181***		***0.160***	
Authorities	0.013	0.223	− 0.338	0.440
Non-profit	0.157	0.211	0.178	0.291
Lenght 10 years	***1.299***		***1.455***	
Length 25 years	− 0.644 *	0.332	0.020	0.361
Length 40 years	− 0.655 **	0.275	− 1.475 ***	0.374
Payment	0.007 ***	0.002	0.014 ***	0.003
Constant	− 4.006 ***	0.504**	− 1.135	0.555
Number of observations	1215			
Log likelihood	− 578.93			
Log likelihood (0)	− 342.17			
McFadden Pseudo R2	0.313			
Average class probabilities	72.1		27.9	

Willingness to accept compensation (in euros)	Class 1	Class 2
For-profit	***n.s***	***n.s***
Authorities	n.s	***n.s***
Non-profit	***n.s***	***n.s***
Lenght 10 years	n.s	***n.s***
Length 25 years	95.3	***n.s***
Length 40 years	97.0	107.1
Enroll on conservation program	592.6	82.4

Class membership classification (%)	Sample	Class 1	Class 2
Member: forest mgmt association	66	69**	57
Member: forest owne r association	5	4**	8
Member: nature cons association	4	2***	10
Leasing land for hunters	35	38**	26
Age: < 36	17	10***	35
In work life	44	38***	61
Household income: > 501€	***47***	55***	71
City residence	64	60**	75
Freetime house on site	36	33**	46
Bought site from free markets	14	16**	7
Sells wood at least once in 5 years	40	37***	52
Has METSO area on site	9	***7******	16

Tables in italics is calculated as a negative sum of coefficients of two other levels. *** $p < 0{,}01$, ** $p < 0{,}05$, * $p < 0.1$ n.s. refers to nonsignificant

relatively high payment for participation in a program for 25 years. As an example, forest owners assigned to Class 1 are willing to accept a 40-year forest conservation contract for an annual payment of 690 € per hectare, and forest owners in Class 2 for 190 € per hectare. For a 25-year contract, the difference in the amounts of willingness to accept compensation is even larger.

Statistical analysis characterizes two forest owner types in terms of socio-demographics and forestland characteristics. A forest owner assigned to Class 1, requiring a higher payment per hectare, is more likely a member in a forest management association. Moreover, forest owner in Class 1 more likely leases land for a local hunting association or has bought the forest site from markets instead of inheriting it or buying it from the relatives. However, forest owner in Class 1 is less likely a member in a forest owner association (such as local associations for absent forest owners) or a nature conservation organization, young (less than 35 years old), in work life or resides in an urban environment. Finally, forest owner in Class 1 has less likely an annual household income over 50,000 euros, has a freetime house located on forest site, sells wood from the site at least once in 5 years, or has currently a METSO conservation area on site.

Discussion

This study explored the Finnish non-industrial private forest owners' perceptions of forestry with attitudinal statements and, to study a new incentive for small scale forest owners, applied the best–worst-choice method to provide novel information on the heterogeneity of forest owners' preferences for the implementer of temporary forest conservation as well as for the contract length and the compensation for biodiversity and carbon, the latter serving as a recent issue in Finnish forest policy. In addition to forest and environmental policy design in Finland, the results may be applicable to other Northern European countries (Sweden and Norway) that have developed voluntary forest conservation schemes (Storrank 2018). Moreover, the voluntary forest conservation program in which enhancing forest biodiversity is combined with carbon sequestration and storage is aligned with the potential of forests to mitigate climate change, innovations in provision of regulating and cultural ecosystem services, and increasingly heterogeneous objectives of non-industrial private forest owners, identified as three opportunities of forest ecosystem services provision in European forest policy. (Winkel et al. 2022).

Regarding the program attributes that increase the interest in enrolling land on the program the most and the least, preferring shorter contracts and higher payments are in line with the previous literature. Strong preference for the non-profit organization as a program implementer provides new valuable information for policy planning, while the need for a trustworthy organizer of the conservation program and the importance of autonomy, that is, forest owners' decisions concerning one's forestland (Horne 2006; Miljand et al. 2021) have been recognized earlier.

The payment and the contract length are subject to considerable preference heterogeneity, revealed by the latent class enrollment model that identified two forest owner types. One is, on average, less willing to enroll the land and requires more

compensation for accepting the program. Concerning the validity of the willingness to accept estimations, it is worth keeping in mind that the sample was not probability-based and the preferences of respondents may not mimic the preferences of non-respondents. For instance, the choice analysis may have provided overestimates of the enrollment probability and, related to it, underestimates of the levels of willingness to accept compensation for enrolling. The willingness to accept estimations for two forest owner types estimations are to be considered rather as indicative figures, not exact compensation claims. Further, the bias in the sample towards females and absentee forest owners may overestimate the share of the low-compensation forest owner type in the forest owner population. Regarding the sources of preference heterogeneity for a new forest conservation program, introducing the class membership function into a latent class binary logit model did not produce meaningful results. An alternative procedure, that is, to compare the respondents assigned in the classes with statistical tests provided interpretable and statistically significant differences between forest owner groups, originating from the socio-demographics and forest related characteristics.

The high-compensation forest owner type perceives differently program lengths of 25 and 40 years in relation to the reference level, the shortest 10-year contract. For another forest owner type, only the longest contract length has a statistically significant effect on the willingness to enroll. Comparing these with the corresponding study conducted two decades ago in a preparation phase of the METSO biodiversity conservation program (Horne 2006) allows for the conclusion that, in average, forest owners are nowadays willing to enroll to longer temporary conservation contracts. Two decades ago a 15-year contract was considered too long by many forest owners, while some forest owners in the present study would accept even a 25-year or a 40-year contract. In comparison to the currently available voluntary temporary contracts of 10 and 20 years, a 40-year program is more binding, but from the nature conservation perspective, longer and permanent contracts are favorable as the development of successful conditions for biodiversity takes time.

In the best–worst scaling, about every eighth respondent (12.8%) stated the same order of importance for attributes in all presented programs, regardless of attribute levels. This may indicate either high importance of one attribute over other attributes or lack of understanding the task to compare attributes separately in different programs. Excluding these respondents from the analysis did not affect qualitatively the model results, and the group of respondents ignoring the attribute levels were not statistically significantly associated with any socio-demographic characteristics.

Half of the respondents rejected all three programs presented to them (50.1%). One potential reason is that forest owners considered the payments per hectare too low for enrolling, implied also by the statistical significance of only the highest level of payment in the model. In addition to high compensation requirements, the so-called serial non-participation may imply protests against the scheme (Villanueva et al. 2017), but the lack of follow-up question hinders the identification of protest responses in this study. However, the range of annual payments used in the survey (up to 310 euros per hectare, estimated based on standard approximations of carbon sequestration rates) is quite well in line with the actual forestry profits and the payments in conservation contracts. The annual profits from

forests, verified by the Finnish tax administration, vary between 0 and 183 euros per hectare. The estimated annual profit depends on the location of the forest, the most productive forests being located in southern, eastern and middle Finland. Moreover, in the pilot program for biodiversity conservation (Trading of Nature Values), the annual per-hectar payment to landowners varied from 20 to 300 €, the average compensation payment being 170 euros (Juutinen et al. 2008).

The respondents showed relatively high familiarity for the topic of the survey as, in attitudinal questions on forestry and sustainability aspects, the share of uncertain responses was lower than 4%. The highest shares of uncertain answers related to statements concerning rather new concepts in the forestry scene at time of the survey, that is, the simultaneous protection of biodiversity and carbon storage and the increase in forest reserves. Forestry and its sustainability is clearly a complex issue, implied by the comparison of attitudes of forest owner groups differing in terms of gender, location of residence and free time house and the size of forest holding. While forest owners mostly agree on issues regarding biodiversity conservation and climate change in forestry, they lay emphasis on the importance of different sustainability aspects of Finnish forestry.

Regarding the generalizability of the study results to the forest owner population in Finland, the sample is more female-dominated and more absent-forest-owner-dominated. The differences may stem from a slightly biased panel membership. As consumer panels typically are biased towards educated and citizens, it could be assumed that the same holds also for forest owners who are panel members. As a suggestion for further research, a nationwide survey targeted to forest owners, using a probability sampling, would allow for drawing insights on the association of attitudes as well as forest site characteristics with voluntary forest conservation. For deeper insights on the association of choices, attitudes and the characteristics of the forestland and its owner, the hybrid choice analysis provides a useful tool. Preliminary testing of the hybrid choice model with this data set failed to provide robust results, probably due to a simple experimental design and small amount of data.

From the policy design perspective, a useful research topic to expand this analysis would be the acceptability of permanent forest conservation contracts, and a more detailed analysis of the sensitivity of forest owners for the payment. As the study results clearly demonstrate that part of forest owners are very unwilling to enroll their land to forest conservation, the more-in-detail exploration of the factors associated with the rejection of program would serve useful information on the barriers of voluntary forest conservation among forest owners. As the quality of conservation depends on the quality of forest sites, one valid question from the point of biodiversity conservation policy is whether the forest sites offered to a conservation program are qualified enough from the viewpoint of biodiversity conservation. As a pilot study with a limited amount of consumer panel data and a relatively simple experimental design, this analysis serves the future research of forest owner behaviour with guidelines for building the experimental setting, to gather more information on the acceptable payment levels for conservation areas of different qualities and the perceptions of forest owners for permanent conservation contracts.

Conclusion

In conclusion, this empirical study shows the potential among non-industrial private forest owners to enroll land to voluntary temporary forest conservation. To enhance the acceptability of forest conservation, the analysis recommends a compensation system with a non-profit organizer in a main role. For likely participation in forest conservation program, the study suggest contacting young forest owners, urban residents, forest owners with a free-time house located on their forest site, as well as regular sellers of timber and forest owners experienced in biodiversity conservation. Also owners of large forest holdings provide a potential group for temporary forest conservation as while they value stable cutting potential and sell timber regularly, they are proud of providing benefits for the society.

Conserving simultaneously biodiversity and forest carbon is congruent with attitudes of many private non-industrial forest owners. Offering guaranteed financial returns for conservation is one way to enhance forest biodiversity and carbon sequestration, challenging the forests regarded primarily as a source of timber production and timber-related income.

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Declarations

Conflict of interest No competing interests.

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