Author(s): Erkki Mäntymaa, Eija Pouta & Juha Hiedanpää

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Forest owners' interest in participation and their compensation claims in voluntary landscape value trading: The case of wind power parks in Finland

Erkki Mäntymaa [a,*], Eija Pouta [b], Juha Hiedanpää [c]

[a] Natural Resources Institute Finland (Luke), Paavo Havaksen tie 3, FI-90014 Oulun, Finland
[b] Natural Resources Institute Finland(Luke), Latokartanonkaari 9, FI-00790 Helsinki, Finland
[c] Natural Resources Institute Finland (Luke), Itäinen Pitkäkatu 4a, FI-20520 Turku, Finland

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ABSTRACT

Although wind power is regarded as a sustainable way to produce electrical energy, wind turbines may cause harmful effects locally. A possible solution is to reduce the effects through forest management practices, for example leaving forest stands uncut as landscape shields to hide the turbines and stop them from spoiling the scenery. Using data from an online survey of landowners, we investigated whether voluntary mechanisms could encourage forest owners to change their forest management practices near wind farms to minimize the harmful effects. More precisely, we analyzed forest owners' willingness to participate in an initiative involving payment for ecosystem services called Landscape Value Trade (LVT) and studied the related compensation claims in southwestern Finland. We explained willingness to participate and the claims made with the characteristics of the landowners or their holding and with attitudinal variables. According to our results, 73.6% of the respondents would possibly or certainly participate in the mechanism. The average annual compensation requirement in this study was €298 per hectare. In addition, we found that low dependence on forestry and forest-related income tended to increase interest in participation in the LVT initiative and reduce the compensation claims. An important result related to the cost-effective application of the mechanism, is that the more interested the respondents were in cooperation with the LVT initiative the less compensation they would claim. Thus, the voluntary nature of the LVT initiative simultaneously acted as a cost-reducing element. The results could help in detecting some of the key features of the supply side of LVT initiatives.

1. Introduction

Compared to the use of fossil and biofuels, wind power is generally regarded as a sustainable way to produce electrical energy due to the possibility it provides to reduce carbon dioxide emissions into the atmosphere and help prevent climate change. Thus, investments in wind power are expected to increase in the future (Huttunen, 2017), which will lead to wind parks also being located closer to residential buildings and villages than currently, where they will be strongly present in the visual landscape of local people.

Although wind power is globally seen as environmentally friendly, wind turbines may cause harmful effects on a local level (Groothuis et al., 2008). Tall wind turbines near homes, holiday homes, or outdoor recreation areas may visually disturb the scenery. The shadows from the towers or the shadow flicker of the turbine blades may disturb people. The low frequency noise of the rotors may cause stress. In addition, people may worry about the effects on their health or that of family members (Zerrahn, 2017). Thus, in the building of wind turbines global and national environmental benefits come into conflict with some of the local environmental drawbacks (Warren et al., 2005).

Several studies have examined the externalities that wind turbines cause on the landscape and biodiversity. Using a data set from a choice experiment (CE) survey, Mariel et al. (2015), for example, analyzed the preferences of German citizens regarding wind farms and showed how preferences differed between inhabitants. Meyerhoff et al. (2010) investigated landscape externalities affected by onshore wind power with two CE surveys carried out in Westsachsen and Nordhessen, Germany. Specifically, the study analyzed how the surface area of wind parks, the maximum height of turbines, the influence on biodiversity (i.e., the hawk population), the shortest distance to inhabited areas and the monthly addition to the electricity tariff affected the acceptability of wind power. Using a spatial CE survey, Meyerhoff (2013) examined how

* Corresponding author at: Natural Resources Institute Finland (Luke), Paavo Havaksen tie 3, FI-90570 Oulu, Finland
E-mail addresses: erkki.mantymaa@luke.fi (E. Mäntymaa), eija.pouta@luke.fi (E. Pouta), juha.hiedanpaa@luke.fi (J. Hiedanpää).

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the respondents' experience of turbines, e.g., the distance from a dwelling place to the nearest turbine, affected the propensity to support wind power generation. Furthermore, the welfare effects were also measured using a willingness to pay (WTP) measure. Bartczak et al. (2018) examined whether preferences for avoiding externalities from wind energy development near places of residence are influenced by personal beliefs about the negative effects of wind energy production in Poland. Using an approach based on the willingness to accept compensation (WTA), Dimitropoulos and Kontoleon (2009) carried out a CE study to examine the factors affecting local acceptance of wind power in the Aegean Islands, Greece. Finally, Drechsler et al. (2011) constructed a model for optimizing the regional distribution of wind turbines, taking into account the social benefits and costs of wind energy production with the help of a CE survey of residents in West Saxony, Germany.

If it were possible to reduce the negative local externalities, the acceptability of wind power might increase and the identification of locations for wind parks might become easier. A possible solution in the forested landscape, which is typical in Finland, may be to reduce the disturbing effects of wind turbines through forest management practices. This means that forest owners would avoid clear cuttings and use more cautious regeneration practices, i.e., continuous cover forestry or prolonged rotation, between residential areas and wind turbines. The aim would be that the standing trees would hide the turbines and stop them from spoiling the scenery. Here, we refer to these forest stands as *landscape shields*. If forest owners were willing to refrain from cutting mature forests between residences and the turbines, the harmful effects of the turbines could be alleviated or at best completely avoided.

In recent years, the use of economic incentives for landowners, such as payments for ecosystem services (PES), has been presumed to help in environmental protection or the production of environmental benefits. Typically, in the implementation of these types of mechanisms, landowners make voluntary fixed-term contracts with a public authority or some other organization and receive monetary compensation for the protection or production of environmental benefits (Smith et al., 2013). In most cases, the funds for the compensation come from public sources (Mäntymaa et al., 2009; Gadaud and Rambonilaza, 2010). However, previous literature indicates that in some cases, private funding can additionally lead to landscape improvements (e.g., Tyrväinen et al., 2014). Some studies have also analyzed the acceptance of and conditions for the participation of private forest owners in relation to the mechanism of providing landscape or recreational values for compensation, i.e., Landscape Value Trade (LVT) (Gadaud and Rambonilaza, 2010; Mäntymaa et al., 2018b; Tyrväinen et al., 2020).

The application of PES to counter the negative externalities of wind power using landscape shields in an LVT initiative is new but not straightforward. In the case of wind power, forest owners would be paid for the maintenance of landscape shields if they postponed cutting the forest at economically optimal points of time and suffered monetary losses as a consequence. From the social point of view, postponing forest cutting is rational, as mature forest provides the majority of landscape ecosystem services (ES) (e.g., Gundersen and Frivold, 2008; Ribe, 2009). With the payments, the landscape benefits of local residents and people who use the area for recreation and the economic losses of forest owners should be balanced. If the forest owners' income losses are compensated for, then their attitude towards the provision of the landscape ES should be favorable. Of course, the case could also be that the compensation demanded by forest owners is higher than the benefits perceived by citizens. In this case, the program would not be feasible or worth implementing. Nevertheless, information is needed on the interest of landowners in taking part, as well as on their compensation requests. As far as we know, this theme has not been analyzed before. Thus, to ease the implementation of wind power plans, there is a clear need to investigate the determinants of participation in LVT, as well as the compensation requirements of forest owners.

Using survey data, we investigate the interest of landowners in providing a landscape shield. We study the mechanisms that would encourage forest owners to manage their forests near wind farms so that their harmful or disturbing effects could be minimized. Specifically, we examine whether forest owners are willing to reduce the negative effects by using a new mechanism termed Landscape Value Trade (LVT). In addition, we identify the background variables that affect the respondents' interest in participating in LVT initiatives, in particular the role of socio-demographic and attitudinal variables. Finally, we analyze the amount of financial compensation that landowners are likely to claim for being ready to manage their forests to minimize the harmful effects of wind turbines. The focus of this study is on producing a general feasibility evaluation for the planning of the mechanism at the regional level. We do not aim to go to the forest stand level, where the detailed planning and negotiation regarding the practical application of LVT would take place if the mechanism is found generally feasible.

2. Previous literature: landowner participation in PES

Scientific knowledge on the willingness of landowners to participate in ecosystem service provisioning is crucial when designing PES mechanisms. It helps to target those owner groups who are more willing to participate in such policies (e.g., Ross-Davis and Broussard, 2007). Understanding the factors underlying willingness is essential for the reasonable design and implementation of mechanisms and further tailoring of consulting and information services for landowners (Boon et al., 2004; Maybery et al., 2005; Kendra and Hull, 2005).

We assume that the choice of landowners to participate in a program that provides non-market ES takes place in two phases. First, the landowners make a general decision as to whether they are interested in participating in the program. They will decide to participate if their expectations for the utility gained from the land are higher with participation than without participation. Second, the landowners consider a compensation request that guarantees the utility level to be higher after participation in the program. If the landowners also benefit from the non-market ES that they provide, the compensation request may be lower than the economic loss from the management practices they have given up (Mäntymaa et al., 2009).

Previous landowner studies have indicated the empirical variables that associate with participation in providing ecosystem services and with the demand for compensation. Landowner characteristics, such as socio-demographics, values, attitudes and beliefs, the economic aspects of a holding as well as its other characteristics, have been shown to affect the willingness to offer environmental services (e.g., Knowler and Bradshaw, 2007; Grammatikopoulou et al., 2012). Socio-demographic characteristics, such as age (Wynn et al., 2001; Vanslembrouck et al., 2002; Langpap, 2004), educational background (Vanslembrouck et al., 2002), and on-farm as well as off-farm income (Wossink and van Wenum, 2003; Loftus and Kraft, 2003; Zbinden and Lee, 2005; Defrancesco et al., 2008), have predicted landowner behavior relatively well. Of the property characteristics, the size of the holding has proven to be an important determinant of participation (Vanslembrouck et al., 2002; Lynch and Lovell, 2003; Zbinden and Lee, 2005; Defrancesco et al., 2008). Geographical factors (Wossink and van Wenum, 2003; Lynch and Lovell, 2003; Jongeneel et al., 2008) have indicated that interest in participation may be spatially heterogeneous.

Valuation studies have provided information on the compensation requests of landowners following ES provision. Such studies have indicated that the compensation requests relate to the current management practices, the attributes of the new scheme, and landowner characteristics, knowledge, and perceptions (e.g., Ruto and Garrod, 2009; Espinosa-Goded et al., 2010; Christensen et al., 2011; Broch and Vedel, 2012; Vedel et al., 2015b; Villanueva et al., 2017). Broch and Vedel (2012) demonstrated that a compensation request is associated with the relevant ES, while the WTA of landowners is lower when the aim is to protect biodiversity or groundwater compared to opportunities for recreation. Several studies have shown (Espinosa-Goded et al., 2010; Aslam et al., 2017) that regardless of the offer of compensation, a considerable

group of landowners prefer to remain in a status quo state, showing an aversion to changing their present management practices. One reason for this may originate from the attitudes of many forest owners towards all forms of protection that have been found to be negative (Bergseng and Vatn, 2009; Nordlund and Westin, 2011). In addition, the transaction costs may decrease the interest of forest owners in participating. Moreover, this may be an indication of status quo bias, i.e., the tendency to choose an alternative reflecting the current situation, which is well known in the stated preference literature (Bonnichsen and Ladenburg, 2015; Kahneman et al., 1991). Furthermore, previous studies have revealed the challenges in using a WTA measure in valuation, specifically the disparity between WTP and WTA (Horowitz and McConnell, 2002; Tunçel and Hammitt, 2014), as well as low incentives to reveal true preferences, i.e., a low incentive compatibility.

Beyond the landowner, holding, and environmental characteristics, which are easily observable, previous literature has highlighted the strong role of values, attitudes, beliefs, and perceptions in the background of conservation and management decisions (e.g., Vanslembrouck et al., 2002; van Putten et al., 2011; Grammatikopoulou et al., 2012; Defrancesco et al., 2008), the importance of production objectives, or the intrinsic and social values of owning land (Emtage and Herbohn, 2012; de Young, 2000), in addition to bonds with the land (Ryan et al., 2003). The owners of small-scale forests are a heterogeneous group with a wide range of objectives and values that affect their decisions regarding conservation and land management (Karppinen, 1998; Kline et al., 2000; Bolkesjø et al., 2007; Butler et al., 2007; Finley et al., 2006; Ingemarson et al., 2006; Becker et al., 2013). Previous studies have revealed perceived trade-offs between producing timber and non-market services such as maintaining the landscape and recreation opportunities (Gordon et al., 2010; MEA, 2003; Power, 2010; Rodríguez et al., 2006).

Previous forest owner studies concerning the willingness to produce amenity values via PES schemes have especially focused on the conservation of biodiversity (e.g., Horne, 2006; Mäntymaa et al., 2009; Boon et al., 2010; Lindhjem and Mitani, 2012; Vedel et al., 2015a, 2015b). There has been much less research on the willingness of forest owners to provide scenic and leisure values in PES schemes (Ovaskainen et al., 2014; Gadaud and Rambonilaza, 2010; Mäntymaa et al., 2018a; Tyrväinen et al., 2020). Ovaskainen et al. (2014) observed heterogeneity in forest owners' preferences towards ecosystem services. Many forest owners already provide some of these services spontaneously on their holdings, bearing the loss of income from timber sales themselves. They may benefit from the produced ES so much that the benefits compensate for the loss in timber sales. If, instead, they were to make a formal contract on the provision of these services for a fixed time period within a mechanism, LVT for example, they would lose not only income but also a part of their self-determination, which would imply a need for additional compensation. Depending on the magnitude of the perceived benefits and the self-determination cost, WTA may be under or over the loss in timber. Gadaud and Rambonilaza (2010) valued the compensation requests of forest owners for providing open access to nature-based recreational activities on private lands, and they introduced indicators of the fire risk as a factor affecting the financial compensation requirements of forest owners. Mäntymaa et al. (2018a) found that more restrictive guidelines regarding forest management practices reduced the interest in participating and increased forest owners' compensation requests in the proposed landscape value trading scheme. According to Tyrväinen et al. (2020), the largest marginal compensation requests were related to an extensive contract length and strict "no cutting" restrictions.

Compared to holding characteristics or socio-demographic variables, previous studies have demonstrated the relative importance of attitudinal factors in explaining the participation of land owners in PES schemes (Grammatikopoulou et al., 2012). Their interest in participating in a PES initiative can be interpreted as a behavioral intention following the attitude-behavior model presented by Ajzen and Fishbein (1980), in which actual behavior is preceded by behavioral intentions. In the causal sequence, a behavioral intention is a composite of attitudes towards a specific behavior. Attitudes towards an object are a composite of more detailed beliefs. The target of attitudes that significantly influence participation in a voluntary environmental scheme has been found to be quite broad (e.g., Grammatikopoulou et al., 2012). The probability of participation has been significantly and positively associated with attitudes towards the environment (Vanslembrouck et al., 2002; Langpap, 2004), the perceived environmental benefits, and their state with and without a program (Söderqvist, 2003; Mäntymaa et al., 2009). Additionally, policies concerning current management practices and the perceived threat of regulation of landowner activities have been found to influence the decision to participate in PES schemes (Langpap, 2004). Attitudinal factors that concern environmental governance have also been considered as elements in the participation decision (Defrancesco et al., 2008; Wauters et al., 2010). In addition, participation may be driven by attitudes towards the voluntary scheme itself, beliefs concerning its design and its implementation (Mäntymaa et al., 2009; Moon and Cocklin, 2011), as well as beliefs concerning the benefits to be obtained with the scheme and the perceived difficulty of applying it (Defrancesco et al., 2008; Wauters et al., 2010; Moon and Cocklin, 2011; Reimer et al., 2012).

This study contributes to the literature by applying the concept of PES to forest landscape services. Our application is novel, as it aims to reduce the harmful effects of other land uses, i.e. wind power. We show the strong role of attitudes in forest owners' interest in participating in the suggested mechanism. We group the attitudinal factors into five categories while analyzing their effect on participation: 1) beliefs about the environmental good (landscape) and 2) about changes in the landscape due to wind power, 3) beliefs concerning the current governance of wind power externalities and 4) the governance of landscape issues in general, and 5) beliefs related to the introduced scheme, i.e., the LVT mechanism.

We are interested in the relative importance of the two following types of variables: first, the characteristics of the landowner or their holdings, and second, attitudinal variables. This is because their roles in explaining participation have very different policy implications. If the landowner and holding characteristics are more important in explaining participation, the role of consultation and information services will be to find the right type of landowners. If attitudes based on information-driven factors are emphasized in participation decisions, the role of consultation and information services will be to target the beliefs behind the attitudes while providing information and designing counselling campaigns directed towards landowners.

3. Case study area, materials and methods

3.1. Case study area: two counties in southwestern Finland

The case study area of this research comprises two counties, i.e., Varsinais-Suomi and Satakunta (Fig. 1), in southwestern Finland, where the wind power industry will be rapidly developed in the coming years (Huttunen, 2017). The regional land use plan presents an inventory of areas that are feasible for the development of wind power parks (Regional Council of Southwest Finland, 2011). The Regional Council of Southwest Finland chose to designate 20 larger areas for wind power parks allowing 10 or more turbines and 13 smaller parks with 6–9 turbines, located either inland or on the coast of the Gulf of Bothnia. For wind power parks that are important on a county level, the Regional Council of Satakunta has designated 17 important areas comprising a target area of 128 km^2. The designated areas, mostly located in sparsely populated, but not uninhabited, rural regions, will allow more than 300 wind turbines to be constructed with a total electric power output of 3.1 terawatt-hours (Regional Council of Satakunta, 2014). In the Finnish land use legislation, defining an area in a regional land use plan is a precondition for starting the detailed planning and building of a wind

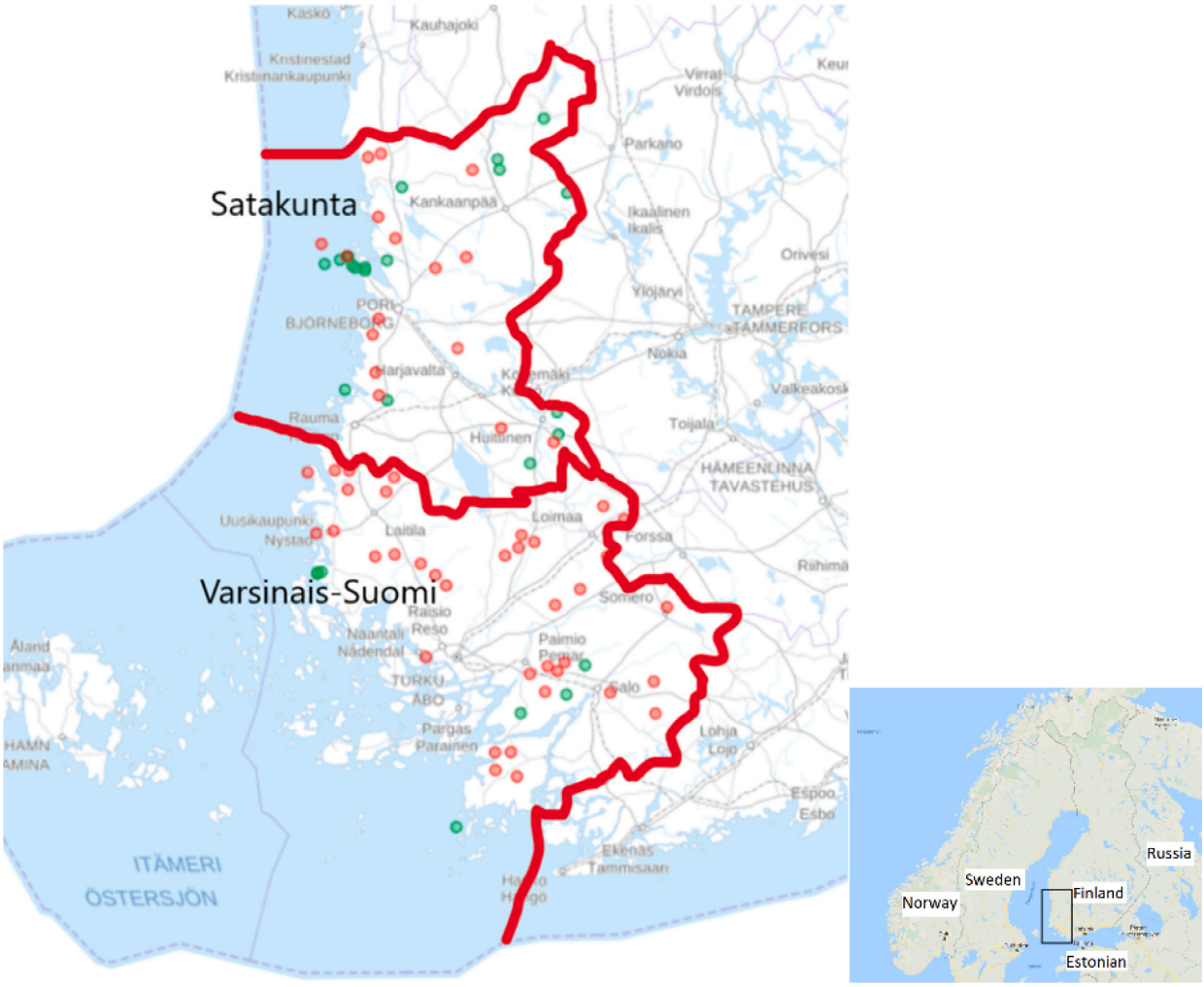

Fig. 1. Case study area: the counties of Satakunta and Varsinais-Suomi. Legend: red points = existing wind parks, green points = planned wind parks. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

power park (Land Use and Building Act 132/1999, 1999). Municipalities have the right to decide on detailed land use planning in their areas. After the master plans have been prepared, private energy companies are responsible for the permit processes and other practical aspects of building the wind turbines.

3.2. Questionnaire, data collection, and sample representativeness

Data on interest among landowners in producing a landscape shield and participating in an LVT initiative to reduce the landscape disturbance caused by wind turbines were collected via an Internet survey. The questionnaire of the survey had four sections. The first section inquired about the respondents' perceptions concerning the different types of changes in the landscape, their attitudes towards wind turbines and their impacts, as well as the respondents' attitudes towards compensation for the externalities of wind turbines. In addition, the section included a map (Fig. 1) presenting the locations of current operating and planned future wind power parks. The zoomable map increased the spatial explicitness of the survey by allowing respondents to locate their homes, forest holdings, and summer cottages in relation to the wind power parks.

The second section briefly described the idea of a landscape shield. Respondents were told that the harmful effects of wind turbines could be reduced with the certain types of forest management practices. This would mean that, between residential areas and wind turbines, forest owners would avoid clear-cutting or would use lighter management practices, e.g. continuous cover silviculture. In this way, narrow belts of forests would remain and hide the wind turbines. After this information, the section constructed a scenario for a claim for compensation. The respondents were asked to imagine a hypothetical situation in which a wind power park was planned to be built in the neighborhood of their forest parcel near other people's homes or vacation homes. Then, the respondents were asked their opinions about the functionality of a landscape shield to reduce the harmful effects of wind turbines and to preserve the benefits of ES. Furthermore, the section asked the respondents about their own interest in providing a shield and their perception of other forest owners' interest in providing a shield. In these questions, respondents were asked to imagine that a possible landscape shield could prevent a wind turbine from being visible from local homes or vacation homes. The aim was that the scenario would be applicable to all the respondents, allowing them to imagine a hypothetical situation in which their own standing forest belt would hide a turbine. There was also a question about their interest in discussing forest management related to a landscape shield with neighboring residents.

The section described a hypothetical possibility of making a contract to provide a landscape shield for a limited period of time and asked for the lowest possible amount of annual compensation per hectare respondents would accept for this type of agreement. The question regarding compensation asked whether the respondent had indicated interest in providing a shield or not. Here, we reminded the respondents

that overly large compensation claims may prevent a contract from being agreed. A payment card contingent valuation method was used to determine a value for the compensation. The respondents were presented a list of incremental monetary amounts and asked to indicate the lowest amount of their compensation requirement. The bid vector was €0, €5, €7, €10, €15, €20, €25, €35, €50, €75, €100, €140, €200, €300, €400, €550, €750, €1000, and more than €1000 per year per hectare; that is, the predicated WTA was revealed in 18 interval classes. Before the main survey, we conducted a pilot survey which demonstrated that the bid vector worked well. The section also included measures of attitudes towards governance on landscape issues in general and towards the introduced LVT mechanism.

The third section asked about details related to forest ownership including the total forest area owned, the amount of final felling over the previous few years, the amount of mature forest and the forest area a respondent would possibly be willing to provide as a landscape shield. Finally, the fourth section asked for some background features of the respondents.

The survey was directed at private non-industrial forest owners in the counties of Varsinais-Suomi and Satakunta, in southwestern Finland. We received the names and e-mail addresses of possible survey respondents from the Register of Forest Owners managed by Suomen Metsäkeskus (the Finnish Forest Centre). The number of private non-industrial forest owners owning forest in the case study area was 7200 persons. Most of the forest owners lived in the region. The sample of the study was a total sample, i.e., we sent the questionnaire to all forest owners in the area. After testing the questionnaire with a pilot survey of 100 respondents in January 2019, we conducted the main survey of 7100 respondents in February 2019. The practical data collection was organized by a commercial survey company, Taloustutkimus Oy, and the survey was conducted online by sending out a call and an internet link to the survey in e-mail messages. After two reminders, we received 1165 responses meaning a response rate of 16.4%.

We evaluated the representativeness of our data in relation to the data from the same area in the national survey of forest owners conducted by Hänninen et al. (2011) (Table 1). In our data, the respondents were slightly more often male, but concerning their age, we only found differences in the two oldest age groups. The lower level of participation in our study may reflect the fact that older generations less often respond to online surveys than younger ones. On the other hand, the distributions of the types of living environment, i.e. countryside or a city, were statistically equal in the two studies (chi-squared test of consistence, $p = 0.996$). The fact that the surface area of forest holdings was more extensive in our study than in that by Hänninen et al. (2011), specifically 48.4 ha vs. 30 ha, respectively, appears to show that in the present study the PES scheme was more often interesting for those who owned above-average acreages of forested land (compare this to Mäntymaa et al., 2018a). These differences indicate that those owners who were more concerned than average about the connection between forestry and wind turbines may be over-represented in our data.

Table 1
Socio-demographic features of the respondents in the counties of Satakunta and Varsinais-Suomi in the wind turbine study and in the same area in a national study by Hänninen et al. (2011).

		Satakunta and Varsinais-Suomi in wind turbine study	Satakunta and Varsinais-Suomi in national study[a]
Sample size[b]		1381	
Gender (%)	Female	21.4	24
	Male	78.6	76
Age (years, %)	Below 45	16.0	15
	45–54	22.3	18
	55–64	29.8	31
	65–74	26.2	21
	75 or above	5.7	14
	Mean	57.6	59
Type of living environment (%)	Countryside	63.4	64
	Town or city	36.6	37
Area of forest holding (%)	Below 10	21.0	32
	10–19.9	18.5	28
	20–49.9	31.3	27
	50–99.9	17.2	10
	100 or above	11.9	4
Acreage of forest holding (ha)	Mean	48.4	30

[a] Source: Hänninen et al. (2011).
[b] The number of observations varies between questions.

Table 2
Distribution of compensation claims across the bid vector ($n = 1381$).

WTA, €/year/ha	%	WTA, €/year/ha	%
0	1.2	75.01–100	13.6
0.01–5	0.2	100.01–140	3.6
5.01–7	0.1	140.01–200	13.1
7.01–10	0.7	200.01–300	13.6
10.01–15	0.1	300.01–400	10.2
15.01–20	0.4	400.01–550	9.0
20.01–25	1.2	550.01–750	3.9
25.01–35	0.4	750.01–1000	8.5
35.01–50	3.7	More than 1000	14.9
50.01–75	1.6		

3.3. Econometric models and variables

The first task of the study was to explain the respondents' interest in participating in LVT. As the interest was measured with a three-step scale, where 0 = no, 1 = maybe, and 2 = yes, we analyzed the dependent variable (INTEREST) with an ordered probit model. The corresponding distribution of the variable was 26.4%, 44.1%, and 29.5%, respectively. Analyzing more carefully those who were not interested in participation in LVT, we constructed a binary probit model in which those who responded "no" (26.4%) were compared to the rest of the respondents (73.6%) (NOINTEREST).

The second task was to ask the respondents about possible compensation claims. As we used a payment card as an elicitation technique, the survey did not provide exact monetary amounts but ranges within which the WTAs are located. Table 2 presents the distribution of WTAs across the bid vector. To explain WTA, i.e., the smallest annual monetary compensation per hectare for providing a landscape shield in the LVT scheme for 5 or 10 years, we constructed a grouped data model. In the analysis, the monetary amounts larger than €1000 were deleted from the data as outliers, because the amounts were probably unrealistically large for a practical implementation of the mechanism.[1] Computed from the category centers of the bid vector of the payment card, the annual mean WTA was €297.6 per hectare (std dev. €248.8/ha/year, median class €200.01–300/ha/year) (Table 4).

For those who responded "zero" or "don't know" to the question related to compensation, we requested a rationale for the response with a follow-up question. Overall, the number of such responses was low, i.e. only 41 (Table 3). The actual number of respondents was even lower, as the answers were overlapping, with 17 respondents of 1381 giving these answers, meaning only 1.23% of all respondents. The rationale that "My forest is not suitable for a landscape shield", for example, was only chosen by three respondents (0.22%). These results suggest that protest responses or outliers were not a serious problem in this survey.

The potential socio-demographic and forest holding variables for the

[1] The number of deleted observations of WTA above €1000 was 205. We conducted a sensitivity analysis with and without the deleted observations and found that the models changed only marginally but they fitted the data much better without these observations.

Table 3
Rationale for "zero" or "don't know" response for a compensation claim related to a possible landscape shield in the respondents' forest ($n = 1391$).

Rationale for a "zero" or "don't know" response for a compensation claim	Abs.	%
My forest is not suitable for a landscape shield.	3	0.22
I would probably not cut my forest anyway.	7	0.51
It is an obligation of wind power companies to minimize landscape effects.	1	0.07
In the landscape, wind turbines do not disturb me.	6	0.43
I would offer a landscape shield without compensation.	7	0.51
I do not believe that a landscape shield would work.	4	0.29
Despite compensation, I do not want any restrictions on the management of my forests.	3	0.22
I do not believe that landowners would gain any compensation for a landscape shield.	2	0.14
I have not received enough information.	1	0.07
Other problems are more important.	2	0.14
I do not believe that it would be possible to make an agreement for a landscape shield.	3	0.22
Do not know.	2	0.14
All rationales	41	2.97

models were selected based on a literature review. For the independent variables of the participation models and the compensation claim models, we selected 10 socio-economic variables, which are presented in Table 4.

To analyze the role of the attitudinal variables and the landowner and holding characteristics in the participation decision, we modelled the decision on participation and the WTA in two types of models.[2] As regressors in the first models, we used socio-economic and forest holding variables, and in the second type, socio-economic and holding variables together with attitudinal variables. While we received the socio-economic variables more or less straightforwardly from the original data set, the construction of the attitudinal variables was slightly more complex. In the questionnaire, we measured five attitudinal concepts with beliefs about the following: 1) landscape changes with a list of 10 items focused on the landscape effects of diverse economic activities, mostly in rural areas (Table A.1 in Appendix); 2) wind power with 17 statements related to local disadvantages and local, national, or global advantages of wind turbines and wind power (Table A.2); 3) the governance of wind power externalities with 9 statements (Table A.3); 4) governance concerning landscape issues with 11 different statements (Table A.4); and 5) the LVT mechanism with 7 statements (Table A.5). The respondents were requested to evaluate the statements on a five-step Likert scale from *very negative* to *very positive* in the first set of statements and from *strongly disagree* to *strongly agree* in the four latter sets.

We used principal component analysis (PCA) to analyze whether the statements in these five sets measured unified concepts that could be combined in the same variable (e.g., Afifi and Clark, 1996). We based the explanation of the PCA results on the statements that had the highest loadings on each component (see Tables A.1–A.5). Based on the PCA, we selected statements that measured the same dimension.

From the principal components of Tables A.1–A.5, we found 11 statistically significant variables concerning respondents' attitudes and perceptions. From the first PCA, which included beliefs about landscape changes in general, we found three significant variables, i.e., "Economic development in rural areas" (ECONDEV), "Decline of rural areas" (DECLINE), and "Land or soil use in rural areas" (LANDUSE) (Table A.1). In the second PCA, including beliefs related to the advantages and disadvantages of wind power, two significant variables were detected, namely "Local disadvantages of wind turbines" (WPDISAD) and "Advantages of wind power" WPADVAN (Table A.2). Table A.3 presents the results of the PCA related to the governance of wind turbines' externalities, where we found one significant variable, "Public compensation for the landscape externalities of wind power" (PUBCOMP). The fourth PCA condensed information on statements regarding the governance of landscape issues and produced three significant variables for the analysis (Table A.4). We named them "Mistrust in land use planning" (MISTRUST), "Freedom of entrepreneurship" (ENTREP), and "Recreational-ecological compensation" (RECOMP). The final analysis related to attitudes towards the LVT mechanism produced two variables: "Interest in cooperation and LRV" (COOPER) and "Takes landscape values into account in forest management" (MANAGE) (Table A.5). As a basis for the regressors, we did not directly use the loadings of PCA. Instead, we calculated the variables using the original Likert scale assessments of the attitudinal statements and computed an average value of the assessments included in each principal component. Thus, the observations of attitudinal variables are average values combining the original assessments of each respondent with several statements selected with the help of PCA. The statistically significant independent variables used in the second regression analyses explaining the respondents' interest in participating in LVT schemes and explaining compensation claims for providing a landscape shield are summarized in Table 4.

We also tested whether the total forest area owned by a respondent or several other socio-demographic characteristics, such as age, main living environment (town or city, or rural area), household structure, or the respondent's personal income, could explain the interest in participation or the compensation claims. However, we did not find a significant relationship, and neither did we find that attitudes related to private compensation for landscape externalities of wind turbines or attitudes towards and experiences of participation in local land use planning could significantly explain the dependent variables. Consequently, we left these regressors out of the models.

4. Results

4.1. Interest in participation in LVT

Table 5 shows how the socio-economic variables in the ordered probit model explained the forest owners' interest in leaving a forest patch as a landscape shield, i.e., their interest in participating in an LVT scheme (INTEREST). Interest increased if other family members than the husband or wife or the responsible person in a co-ownership arrangement made forest management decisions (OMEMBER), or if the respondent's level of education was higher (EDUC). On the other hand, interest decreased if the area of commercial cutting in the respondent's forest during the previous five years increased (CUTTING) or if the respondent's occupation was in agriculture or forestry (AGRIFOR). A very significant and positive coefficient for a constant term indicates that the participation interest without regressors was positive. A very significant coefficient for a threshold parameter suggests that the categories of the dependent variable should not be combined into one, i.e., the use of the ordered probit model was justifiable instead of a binary model, for example.

Table 6 presents an extended model in which in addition to socio-economic variables, attitudinal variables also explain forest owners' interest in participating in LVT. Due to mutual correlations, bringing attitudinal variables into the model also changed the significance of some of the socio-economic variables. With respect to the socio-economic variables, if a respondent her/himself made forestry decisions (MYSELF), if a family member other than the husband or wife or the responsible person in a co-ownership arrangement made forest management decisions (OMEMBER), if the respondent was male (GENDER), or if the respondent was working instead of being retired or unemployed (WORKING), the more often she or he was interested in

[2] We also considered using a sample selection model with a two-phase estimation method suggested by Heckman (1979) (Mäntymaa et al., 2009; Mäntymaa et al., 2018a). However, the first step of the model uses a binary dependent variable. Thus, in this study with a three-step dependent variable, we would lose the information for respondents with "maybe" answers.

Table 4
Description and descriptive statistics of the variables used in the analysis.

Variable	Description	Mean	Std dev.
Dependent variables			
INTEREST	Forest owner's interest in participating in LVT; ordinal variable: 0 = no (26.4%), 1 = maybe (44.1%), 2 = yes (29.5%).	1.03	0.747
NOINTEREST	Forest owner's interest in participating in LVT; binary variable: 0 = maybe or yes (73.6%). 1 = no (26.4%).	0.26	0.441
WTA	Forest owners' stated compensation request within an LVT for 5 (10) years; disclosure technique: payment card; bid vector: €0, €5, €7, €10, €15, €20, €25, €35, €50, €75, €100, €140, €200, €300, €400, €550, €750, €1000/year/ha. WTAs are coded into 1, 2, …, 18 categories; the first category (zero WTAs) equals the interval $y^* < 1$; the second category (€5): $1 \leq y^* < 5$; the third category (€7): $7 \leq y^* < 10$ and so on; the 18th category: $750 \leq y^* < 1000$.	297.6[a]	248.8[a]
Socio-economic independent variables			
Characteristics of the forest holding			
MATURE	Area of mature forest in the respondent's holding (ha)	10.09	19.742
MYSELF	Respondent him/herself makes forestry decisions; binary variable: 0 = no (40.3%), 1 = yes (59.7%)	0.60	0.491
OMEMBER	A family member other than the husband or wife or the responsible person in co-ownership makes forest management decisions; binary variable: 0 = no (84.9%), 1 = yes (15.1%)	0.15	0.359
Financial characteristics of the respondents			
CUTTING	Area of commercial cutting in one's forest in the last 5 years; ordinal variable: 1 = 0 ha (36.8%), 2 = 0–1 ha (8.8%), 3 = 1–5 ha (36.0%), 4 = 5–10 ha (12.7%), 5 = 10–20 ha (3.4%), 6 = 20–30 ha (1.3%), 7 = more than 30 ha (0.8%)	2.72	1.779
METSO	Respondent voluntarily restricted cutting in his/her forest within the METSO program; binary variable: 0 = no (93.3%), 1 = yes (6.7%)	0.07	0.251
Socio-demographic characteristics of the respondents			
GENDER	Respondent's gender; binary variable: 0 = female (21.4%), 1 = male (78.6%)	0.79	0.410
EDUC	Level of education; ordinal variable: 1 = primary school (5.9%), 2 = vocational school (19.6%), 3 = high school (5.0%), 4 = polytechnic (41.2%), 5 = university (28.2%)	3.66	1.241
WORKING	Respondent working; binary variable: 0 = no (34.0%), 1 = yes (66.0%)	0.66	0.474
AGRIFOR	Occupation in agriculture or forestry; binary variable: 0 = no (78.4%), 1 = yes (21.6%)	0.22	0.412
ENVPRO	Occupation in environmental protection or related areas; binary variable: 0 = no (97.0%), 1 = yes (3.0%)	0.03	0.170
Attitudinal independent variables[b]			
Landscape changes			
ECONDEV	Economic development in rural areas[c] (C1.1[e])	3.43	0.622
DECLINE	Decline of rural areas (C1.2[e])	1.68	0.637
LANDUSE	Land or soil use in rural areas[c] (C1.3[e])	3.10	0.806
Wind power			
WPDISAD	Local disadvantages of wind turbines[d] (C2.1[e])	3.00	1.051
WPADVAN	Advantages of wind power[d] (C2.2[e])	3.50	0.966
Governance of wind turbines' externalities			
PUBCOMP	Public compensation for the landscape externalities of wind power[d] (C3.2[e])	2.83	1.078
Governance in landscape issues			
MISTRUST	Mistrust in land use planning[d] (C4.1[e])	3.62	0.815
ENTREP	Freedom of entrepreneurship[d] (C4.2[e])	3.73	0.886
RECOMP	Recreational-ecological compensation[d] (C4.3[e])	2.38	0.991
LVT mechanism			
COOPER	Interest in cooperation and LVT[d] (C5.1[e])	3.07	1.110
MANAGE	Takes landscape values into account in forest management[d] (C5.2[e])	3.32	0.815

[a] Computed from the category centers of the bid vector of the payment card.
[b] Average value variables for the statements included in each principal component.
[c] Originally calculated from observations of 5-step Likert scale, 1 = very negative … 5 = very positive.
[d] Originally calculated from observations of 5-step Likert scale, 1 = strongly disagree … 5 = strongly agree.
[e] Refers to the interpretation of principal components shown in Tables A.1–A.5 in the Appendix.

Table 5
Ordered probit model of socio-economic variables explaining the interest of forest owners in leaving a forest patch as a landscape shield.

Independent variable	Coefficient	Std Error	z	p
Constant	*****0.73918	0.11769	6.28	0.0000
OMEMBER	***0.23837	0.09079	2.63	0.087
CUTTING	***−0.09087	0.02422	−3.75	0.0002
EDUC	*0.04825	0.02562	1.88	0.0596
AGRIFOR	***−0.24537	0.07789	−3.15	0.0016
Threshold parameter	***1.20727	0.04277	28.23	0.0000
Fit statistics				
Log likelihood function	−1329.228			
McFadden Pseudo R^2	0.0168			
Inf. cr. AIC	2670.5			
AIC/n	2.114			
n	1263			

*** Significant at the 0.01 level.
** Significant at the 0.05 level.
* Significant at the 0.10 level.

participation. Concerning attitudinal variables, the more positively the respondents perceived economic development in rural areas (ECONDEV), or possibilities to receive public compensation (PUBCOMP) or recreational-ecological compensation (RECOMP) for the landscape externalities of wind power, or the more often they independently took landscape values into account in their forest management decisions (MANAGE), the more likely they were to be interested in participation. In contrast, the more positively they perceived the land or soil use in rural areas (LANDUSE) or the freedom of entrepreneurship (ENTREP), or the more often they identified local disadvantages of wind turbines (WPDISAD), the less likely they were to be interested in participation. The highly significant estimate of the threshold parameter justified the use of the ordered probit model.

A comparison of the two models of participation interest shows that the value of the log-likelihood function and the McFadden Pseudo R^2 both increased, from −1329.228 to −1161.266 and from 0.0168 to 0.1623, respectively, and the Akaike Information Criterion (AIC) decreased from 2670.5 (AIC/n = 2.114) to 2348.5 (AIC/n = 1.821) if we added the attitudinal variables into the analysis. Thus, the goodness of fit of the latter model with the attitudinal variables is considerably

Table 6
Ordered probit model of socio-economic and attitudinal variables explaining the interest of forest owners in leaving a forest patch as a landscape shield.

Independent variable	Coefficient	Std. Error	z	p
Constant	***0.24306	0.32788	3.79	0.0001
MYSELF	*0.12239	0.07149	1.71	0.0869
OMEMBER	*0.16652	0.09614	1.73	0.0833
GENDER	**0.17221	0.08569	2.01	0.0445
WORKING	***0.24365	0.07071	3.45	0.0006
ECONDEV	***0.15199	0.05873	2.59	0.0097
LANDUSE	***−0.29760	0.05351	−5.56	0.0000
WPDISAD	***−0.36357	0.03540	−10.27	0.0000
PUBCOMP	***0.13488	0.03446	3.91	0.0010
MANAGE	***0.23614	0.04334	5.45	0.0000
ENTREP	***−0.27993	0.04341	−6.45	0.0000
RECOMP	***0.21359	0.03886	5.50	0.0000
Threshold parameter	***1.44783	0.05200	27.84	0.0000
Fit statistics				
Log likelihood function	−1161.266			
McFadden Pseudo R^2	0.1623			
Inf. cr. AIC	2348.5			
AIC/n	1.821			
n	1290			

*** Significant at the 0.01 level.
** Significant at the 0.05 level.
* Significant at the 0.10 level.

better.

Combining socio-economic and attitudinal variables in a probit model, Table 7 analyzes more carefully those who were not interested in participation in LVT, i.e. those who responded "no" to the interest question compared to the rest of the respondents (NOINTEREST). In the model, the plus sign of the coefficient means that the increase or the realization of the variable increased the probability of not being interested in participation, and vice versa. Thus, related to socio-economic variables, the positive and significant sign for CUTTING means that the larger the area where forest owners had conducted commercial final felling during the previous 5 years, the more likely they were to not be interested. On the other hand, the probability of not being interested in participation decreased if a family member other than the husband or wife or the responsible person in a co-ownership arrangement made forest management decisions (OMEMBER), and if a respondent was working instead of being retired or unemployed (WORKING). Related to attitudinal variables, the more positively they perceived the land or soil use in rural areas (LANDUSE) or the freedom of entrepreneurship (ENTREP), the more likely they were to not be interested in participation. In contrast, the more negatively the respondents perceived

Table 7
Ordered probit model of socio-economic and attitudinal variables explaining the lack of interest of forest owners in leaving a forest patch as a landscape shield.

Independent variable	Coefficient	Std Error	z	p
Constant	*0.63851	0.37157	1.72	0.0857
CUTTING	*0.06004	0.03329	1.80	0.0713
OMEMBER	**−0.32103	0.13263	−2.42	0.0155
WORKING	***−0.24624	0.09094	−2.71	0.0068
ECONDEV	***−0.25377	0.07280	−3.49	0.0005
DECLINE	*−0.12643	0.07046	−1.79	0.0728
LANDUSE	***0.25748	0.06741	3.82	0.0001
WPADVAN	***−0.57657	0.04391	−13.13	0.0000
ENTREP	***0.24513	0.05624	4.36	0.0000
Fit statistics				
Log likelihood function	−591.887			
McFadden Pseudo R^2	0.2029			
Inf. cr. AIC	1201.8			
AIC/n	0.920			
n	1306			

*** Significant at the 0.01 level.
** Significant at the 0.05 level.
* Significant at the 0.10 level.

Table 8
Interest of forest owners in participating in LVT and WTA compensation for leaving a forest patch as a landscape shield.

Interest	Mean WTA	Std dev.	n
No	407.4	289.2	222
Maybe	294.2	238.7	563
Yes	240.4	216.3	392
Total	297.6	248.8	1177

Table 9
Grouped data regression model of socio-economic variables explaining forest owners' WTA compensation for leaving a forest patch as a landscape shield.

Independent variable	Coefficient	Std Error	z	p
Constant	***225.377	18.97441	11.88	0.0000
CUTTING	***15.9082	3.99353	3.98	0.0001
EDUC	**−10.4422	4.21215	−2.48	0.0132
AGRIFOR	*20.7768	11.59918	1.79	0.0733
ENVPRO	**−60.8641	30.15006	−2.02	0.0435
Disturbance standard deviation	***157.395	3.82922	41.10	0.0000
Fit statistics				
Log likelihood function	−2383.01852			
Inf. cr. AIC	4778.0			
AIC/N	4.8451			
n	985			

*** Significant at the 0.01 level.
** Significant at the 0.05 level.
* Significant at the 0.10 level.

economic development in rural areas (ECONDEV) or the local, national, or global advantages of wind power (WPADVAN), or the more worried they were about the decline of rural areas (DECLINE), the less likely they were to answer "no" to the question concerning interest.

4.2. Compensation claims for participation in LVT

Table 8 reports how forest owner's interest in participating in LVT ("no", "maybe", or "yes") affected the monetary compensation request for leaving a forest patch as a landscape shield. The results indicate that the greater was the interest in participating, the less forest owners claimed in compensation. The independent samples *t*-test (equal variances not assumed) for the pairwise comparison of the first two means ($t = 5.181$, $p = 0.000$) and the last two means ($t = 3.619$, $p = 0.000$), as well as the first and last means ($t = 7.499$, $p = 0.000$) showed that the mean WTAs significantly differed between the forest owners in different groups of interest.

In Table 9, with a grouped data model, we present the socio-economic variables that explain forest owners' possible WTA for participation in LVT, i.e., the smallest annual monetary compensation per hectare they would accept for providing a landscape shield. We found that an increase in the area of commercial cutting in the respondent's forest (CUTTING) or having an occupation in agriculture or forestry (AGRIFOR) increased the compensation claim. The WTA tended to decrease if the level of education of the respondent was higher (EDUC) or if the respondent's occupation was in environmental protection or related areas (ENVPRO).

Table 10 shows the combined model of socio-economic and attitudinal variables that explain forest owners' potential WTA. With respect to socio-economic variables, the larger the area of mature forest in the respondent's holding (MATURE), or the more often a respondent had voluntarily restricted cutting in her/his forest within the METSO program[3] (METSO), or the more often a respondent worked (WORKING), the larger the WTA was. In contrast, having an occupation in

[3] METSO is a voluntary-based program for preserving biodiversity in privately owned forests in Finland (Gustafsson, 2008; Mäntymaa et al., 2009).

Table 10
Grouped data regression model of socio-economic and attitudinal variables explaining forest owners' WTA compensation for leaving a forest patch as a landscape shield.

Independent variable	Coefficient	Std Error	z	p
Constant	**101.212	42.98412	2.35	0.0185
MATURE	**0.68576	0.34514	1.99	0.0469
METSO	**43.1374	19.98748	2.16	0.0309
WORKING	***28.8005	10.48053	2.75	0.0060
ENVPRO	**−57.8251	29.21791	−1.98	0.0478
PUBCOMP	*−9.32862	5.07027	−1.84	0.0658
COOPER	***−24.7315	5.51857	−4.48	0.0000
MISTRUST	***23.0640	6.76923	3.41	0.0007
ENTREP	***36.5290	5.77096	6.33	0.0000
Disturbance standard deviation	***154.518	3.71737	41.57	0.0000
Fit statistics				
Log likelihood function	−2424.469			
Inf. cr. AIC	4868.9			
AIC/N	4.806			
n	1013			

*** Significant at the 0.01 level.
** Significant at the 0.05 level.
* Significant at the 0.10 level.

environmental protection or other related areas (ENVPRO) tended to reduce the respondent's WTA.

Regarding attitudinal variables, the lower the trust in the system of land use planning (MISTRUST), or the more positive the attitude towards the freedom of entrepreneurship (ENTREP), the larger the claim was for possible compensation for participating in an LVT initiative. On the other hand, the more possible they perceived public compensation for the landscape externalities of wind power (PUBCOMP) to be, or the more interested they were in cooperation or LVT (COOPER), the smaller their WTA was.

Additionally, adding the attitudinal variables into the analysis slightly reduced the goodness of fit of the WTA model, as the value of the log likelihood function decreased from −2382.256 in the first model to −2424.469 in the second model and the AIC increased from 4776.5 to 4868.9. However, with respect to the number of observations, i.e., the AIC/n, the goodness of fit increased slightly with the figure decreasing from 4.849 to 4.806.

5. Discussion

We investigated the supply side of the LVT mechanism as an approach to preserve the provision of landscape values with forest management methods in areas around wind energy sites. Using a data set from an online survey and by means of models including either socio-economic regressors or socio-economic and attitudinal regressors, we analyzed both forest owners' interest in participating in LVT schemes and their willingness to accept compensation for making a contract within an LVT.

We found that only 29.5% of the respondents were expressly interested in participating in LVT initiatives, which is quite a small percentage. However, if we add the respondents who indicated that they would possibly participate, we end up with 73.6% of the forest owners who responded to the survey. When considering launching and implementing a PES-type instrument, this is not a small share. In fact, given that LVT is a new mechanism and has not yet been implemented, the estimated rate of interest is surprisingly high. Additionally, this is true if compared to previous results regarding participation interest in forest-related PES (Mitani and Lindhjem, 2015; Markowski-Lindsay et al., 2011; Mäntymaa et al., 2018a). One reason for the high rate of interest might be that landowners in the area are accustomed to a similar policy mechanism for biodiversity preservation, i.e., the METSO program, which was first tested in the county of Satakunta from 2003 to 2007 (Juutinen et al., 2008; Mäntymaa et al., 2009). However, to turn the majority of the "maybe" responses into "yes" responses would require interaction, careful communication and deliberation on the features of the proposed instrument with the public (see e.g., Kurttila et al., 2019).

The identification of willing candidates, drawing their attention and successful recruitment are the key features of effective implementation of a PES mechanism. The results indicate that the larger was the area that the forest owners had recently cut, the smaller was the probability that they would be interested in participation. It may be reasonable to assume that a large cut area increases the income earned from forestry and consequently the importance of forestry as a livelihood (Karppinen et al., 2020). Thus, the socio-economic variable reflecting the respondents' dependence on forest management and forest income indicates a smaller tendency to become interested in participating in PES initiatives. Accordingly, the result indicates that owners earning a substantial share of their living from forestry and actively engaging in forest management are not the most likely segment to participate in LVT schemes. This may imply that LVT is perceived as a restriction on forest management rather than an alternative way to earn from the forest. This is in line with findings that the fear of tighter restrictions on forest management in the future tends to reduce the interest of forest owners in participating in voluntary protection measures (Karppinen et al., 2020; Lindhjem and Mitani, 2012; Mäntymaa et al., 2018a).

Regarding the dependency, we found additional results: the more often the respondents' occupation was in agriculture or forestry, the less likely they were to be interested in participation, and in contrast, the higher the educational level of owners was, the more likely they were to be interested. The latter makes sense if more highly educated people less often work in forest management or are less dependent on a forestry income. Previous studies (e.g., Meyer, 2015) have also shown that more educated forest owners tend to favor more nature conservation and may be more interested in landscape protection. An occupation in forestry also means that typical forest management practices are well known, but new types of forest management related to PES create uncertainty.

Our results revealed that male respondents were more often ready to join the LVT initiative than the rest of the owners. This contradicts the findings from previous literature that females usually had stronger environmental concerns and more positive preferences towards environmental protection than males (e.g., Xiao and McCright, 2015; Zelezny et al., 2000). Nevertheless, there are also research results indicating that males are more willing than females to join and demand less compensation from PES programs seeking to enhance the preservation of forest biodiversity (Lindhjem and Mitani, 2012; Mitani and Lindhjem, 2015). We also found that working respondents were more interested in joining LVT initiatives than others. It might be reasonable to consider that people working in a profession have more economic flexibility to try out new ideas than retirees and unemployed people with lower incomes. The interpretation of an additional result that having a positive attitude towards rural economic development increases the probability of being interested in LVT participation appears logical if the construction of wind turbines is regarded as part of the development.

In this study, the average annual compensation request was about €298 per hectare. This is a relatively large sum of money compared with the materialized mean compensation paid (€176/ha/year) in the Finnish program for forest biodiversity conservation (METSO), in which cutting is disallowed throughout the duration of an agreement, which is usually 10 years (Juutinen et al., 2008). The request is also higher than the annual operating profit of nonindustrial private forestry[4] in Satakunta

[4] The operating profit in non-industrial private forestry is the difference between the earnings from and costs of non-industrial private forestry. This comprises gross stumpage earnings (calculated on the basis of the volume of felled industrial wood and energy wood, as well as wood felled for own use and standing sales prices) and state subsidies for wood production. Expenditure includes investments in private silviculture and forest improvement, as well as administrative costs and other expenses. (Luke, 2020.)

and Varsinais-Suomi, which fluctuated between €133 and €201 per hectare in 2015–2018 (Official Statistics of Finland, 2019). However, as Nape et al. (2003) deduced, individuals in reality seem to accept less money in compensation than in a hypothetical situation. Hence, the paid sums in real LVT initiatives are expected to be slightly smaller than those elicited here.

Furthermore, in the METSO program for biodiversity conservation, forest owners were paid to provide ES for society at large. In LVT, on the other hand, forest owners provide ES for particular, probably identified and known fellow citizens. In eliciting compensation claims, forest owners were asked to keep their own property in mind. It seems that they consider the community good more valuable than the public good. The public good and beneficiaries are dispersed in society, while the community good provided by the landscape shield is concrete, and it benefits real people and fellow citizens close to the forest property. A landscape shield has real value, as it undeniably improves the living conditions of the target people. For this reason, a higher value is indicated, paradoxically perhaps from a fellow community member point of view, in higher compensation claims than is the case for biodiversity and more abstract ES. This calls for further investigation into the moral aspects of property regimes in the face of emerging PES schemes.

Related to the cost-effective implementation of a PES mechanism, identifying and recruiting those forest owners who would claim low amounts of compensation for the production of environmental services is an essential issue. Just as it was found above that low dependence on forestry and forest-related income tended to increase interest in participation in LVT schemes, it also seemed to reduce the compensation claims. This is suggested by the negative coefficients of variables describing higher levels of education or having an occupation in environmental protection. On the other hand, while reducing interest, the variables suggesting a higher dependence, i.e., an increase in the area of commercial cutting or having an occupation in agriculture or forestry, were associated with higher compensation claims. In addition, as in previous studies by Lindhjem and Mitani (2012) and Mäntymaa et al. (2009), we found a positive dependence between the increase in the area of mature forests owned and WTA. This is a natural result, as the opportunity cost increases as trees in a protected stand grow. Moreover, the result is important for developing LVT, because forests in an ideal landscape shield should be high and dense and the principal in LVT should be ready to pay a reasonable price for an effective shield.

The analysis revealed a positive association between previous agreements on voluntary biodiversity preservation in METSO and the monetary amount of claims. A plausible explanation for this might be that based on the forest owners' experience of the previous program, PES is a trustworthy and profitable way to earn money from forests by postponing a decision to cut down a parcel of forest for a contract period. This result shows that the previous experience has not become an ethical motivation, because the payment claim would be lower if the internal motivation had increased. What may have happened here is that this kind of economic incentive structure reinforces a particular type of economic thinking and rationale and perhaps also external, compensation-driven motivation; this is a known general characteristic of any workable institutional arrangement (cf., Hiedanpää and Borgström, 2014; Hiedanpää and Bromley, 2012; Satz and Forejohn, 1994; North, 2005).

Related to the cost-effective implementation of the mechanism, a noteworthy and important result is that the more interested the respondents were in cooperation with an LVT initiative, the smaller the amount of compensation they would claim. Thus, the non-obligatory nature of LVT reduces the costs, as the more willing landowners engaged in the instrument will claim less compensation (Mäntymaa et al., 2018a). If the marketing of LVT schemes could find and recruit the most interested owners, it would also minimize the costs of landscape protection.

Several attitudinal variables associated significantly with compensation claims. An increasingly positive attitude towards the freedom of entrepreneurship, e.g., in forest management, tended to increase the compensation claims. This result is predictable, because the direct opportunity costs and financial losses increase with management restrictions. The result confirms previous findings that those owners who perceive preservation rules as too restrictive are less likely to participate (Mitani and Lindhjem, 2015; Mäntymaa et al., 2018a; Tyrväinen et al., 2020; Vedel et al., 2015b).

Regarding the perceptions of governance in landscape issues, we found that lower trust in the system of land use planning tended to increase the compensation claims. This is in line with the results of Broch and Vedel (2012) and Vedel et al. (2015a), who found that a control instrument developed to minimize the abuse of the system, i.e., the monitoring of landowners' behavior related to compliance with the mechanism, increased compensation level required by farmers. Landowners may be annoyed by monitoring and see it as an incursion into their private holding, considering monitoring as a signal of mistrust, for example (Vedel et al., 2015a). Low confidence in the LVT initiative as such may be a matter of risk, as distrust increases risks and risks may become costly.

Finally, we found that the more often the respondents felt that public compensation for the landscape externalities of wind power was possible, the smaller the WTA was. This indicates that respondents' increasing support for the idea of public compensation, i.e. that municipalities could compensate for the disadvantages of wind power by developing non-environmental local services or by otherwise enhancing the quality of landscape, would reduce the compensation claimed. This may suggest that forest owners would be ready to substitute private monetary gains with social benefits, i.e., municipal services or other types of landscape quality. This is an interesting result, suggesting that private income (WTA) can be compensated for by municipality-supplied public goods.

6. Conclusions

The main findings of this study demonstrated that almost three-quarters of respondents were certainly or possibly interested in participating in LVT to minimize the harmful landscape effects of wind turbines. Related to the socio-economic characteristics of the landowners, a low dependence on forestry and forest-related income tended to increase interest in participation in LVT schemes, and vice versa. In addition, the compensation of the effects with municipal non-environmental services or other types of environmental benefits was inclined to increase the interest, whereas a positive attitude towards land or soil use or the freedom of entrepreneurship tended to decrease it.

This study revealed that the annual mean compensation for preserving one hectare as a landscape shield was about €300, tending to increase if the probability of interest in participating decreased, and vice versa. The modeling of compensation claims demonstrated a comparable message to participation interest: the socio-economic characteristics that indicate a high dependence on forestry and forest-related income tended to increase the compensation claim, and vice versa. With respect to attitudes, low trust in the land use planning system and a positive attitude towards entrepreneurial freedom inclined owners to increase their compensation claim, whereas the development of municipal non-environmental services and respondents' increasing interest in cooperation in landscape protection tended to decrease the claim.

Knowledge of the interest of landowners in participating in LVT schemes and their willingness to accept compensation for making a contract within LVT is essential for policy makers to consider when planning and applying a new PES mechanism. To create a well-functioning policy instrument, it is necessary to evaluate the characteristics of possible participants and the incentives that encourage forest owners to participate in LVT initiatives, or that discourage them. It is equally essential to evaluate the level of requests for monetary compensation and the factors influencing the claims. In particular, it is important to identify those landowners who are willing to accept a lower

level of compensation to effectively target and market LVT schemes. If the organizer of LVT knows the socio-economic characteristics and attitudes that increase or decrease the probability of participation with a reasonable level of compensation, this may enhance the process and improve the cost-effectiveness in the implementation of the mechanism.

From a policy relevance point of view, our outcomes can assist in the recognition of some of the most significant features of the possible supply side of LVT. These features are crucial for the successful planning and application of an upcoming payment instrument to minimize the disturbing effects of wind turbines. However, attitudinal variables that did not help in identifying the possible providers of landscape shields had a considerable role in explaining the participation and compensation claims. The importance of attitudes in determining the landowners' participation and compensation decisions highlights the significance of providing information to landowners. The attitudes and beliefs of those who are opposed to LVT need to be taken into account in planning counselling campaigns, as well as consulting and information services. These could provide evidence related to those beliefs that most strongly hinder participation.

There are, however, some limitations in the interpretations and applicability of the present results. First of all, because the harmful effects of wind turbines and compensation claims are highly localized, the general results of this study only have limited direct use in planning local solutions. Local circumstances constrain the possibilities of forest management to minimize the effects. Thus, an important challenge for LVT initiatives is to negotiate and make contracts with those owners who possess forest stands in crucial sites. If deals are not reached and if the owners wish to cut the stands, landscape shields will be lost. Consequently, these owners have a kind of monopoly at that site and can claim relatively high compensation for agreements. Thus, the results of this study can serve as background information for organizing LVT locally.

Second, the general regional scope of this study ignores the importance of the structure of a particular forest area and opportunity costs related to LVT. If a specific parcel that is crucial for a landscape shield is mature and ready for harvesting, the forest owner's opportunity costs of joining the program would be relatively large. As we are not, however, dealing with the total protection of large areas but the delaying of cutting of narrow belts of forests for a fixed period, the compensation need not be excessive. Alternatively, if forest owners have just clear-cut a parcel and planted new trees, they would probably agree to participation and not require much compensation, since the actual opportunity costs would be very low. In this case, however, the young stand would not act as an effective landscape shield for some time and would not be interesting for a manager of LVT. Shedding light on these aspects would require more detailed data than were generated in this study, and would be an interesting topic for further research. In the practical application of LVT in a local case, however, the structure of the forest and the opportunity cost of delaying a cut is essential information and should be taken into account when making a contract and defining the level of compensation.

Third, related to the plausibility and trustworthiness of the results, we cannot rule out the possibility of hypothetical bias, as the survey was based on a hypothetical situation. In non-market valuation, the bias may, however, be a more serious problem in cases focusing on non-use or existence values. Here, we assessed quite concrete use values that relate to market-based goods, i.e., future timber revenues or recreational and landscape values, which may not be so sensitive to the hypothetical nature of the valued good (Foster and Burrows, 2017).

Finally, in addition to the supply side, information related to the demand for the landscape shield is also essential. The public discussion and official complaints from residents indicate the landscape harm caused by wind turbines, which provides a reason to develop the idea of LVT schemes further. In addition to minimizing the costs of LVT, it is also necessary to maximize the net benefits of the mechanism. Knowledge of the demand is needed to ensure this. The question is whether residents are interested in participating in the PES mechanism. If they are, we should know the terms and conditions of their participation and, furthermore, their willingness to pay for minimizing the landscape effects of wind turbines. These questions are among the topics that should be analyzed in the future.

Author statement

The manuscript "Forest owners' interest in participation and their compensation claims in voluntary landscape value trading: The case of wind power parks in Finland" or a very similar manuscript has not been published, nor is under consideration by any other journal.

Declaration of Competing Interest

The authors of the manuscript "Forest owners' interest in participation and their compensation claims in voluntary landscape value trading: The case of wind power parks in Finland" have no conflict of interest.

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Appendix A. Appendix

Table A.1
Principal components based on perceptional statements on landscape changes (Oblimin rotation with Kaiser normalization. Loadings of 0.50 or above in boldface).

	Principal components		
	C1.1	C1.2	C1.3
Expansion of built-up areas.	**0.830**	0.005	−0.132
Construction of traffic routes.	**0.697**	−0.003	0.095
Expansion of commercial centers.	**0.679**	0.203	0.051
Business activities using the landscape, e.g., construction of buildings for the tourism business or private holiday living.	**0.594**	−0.169	0.131
Construction of new buildings in rural areas.	**0.507**	−0.433	0.048
Abandonment of villages or buildings in a poor state of repair.	−0.019	**0.845**	0.126
Decline of farming or abandonment of fields.	0.064	**0.790**	−0.164
Forest cuttings or intensive site preparations.	0.015	−0.002	**0.827**
Intensive agriculture.	−0.081	−0.132	**0.816**
Soil removal.	0.129	0.147	**0.721**
Eigenvalue (rotation sum)	30.235	10.493	10.274
Cumulative variance explained, %	32.350	47.275	60.015

Note: Interpretation of principal components:
C1.1 Economic development in rural areas.
C1.2 Decline of rural areas.
C1.3 Land or soil use in rural areas.

Table A.2
Principal components based on attitudinal statements related to the advantages and disadvantages of wind turbines (Oblimin rotation with Kaiser normalization. Loadings of 0.50 or above in boldface).

	Principal components	
	C2.1	C2.2
Wind turbines disturb birds and other animals.	**0.921**	0.106
Wind turbines cause disturbing noise.	**0.877**	0.034
Wind turbines may have harmful effects on people's health.	**0.871**	0.092
Wind turbines may destroy the image of a region.	**0.829**	−0.066
Wind turbines decrease the value of land.	**0.816**	−0.032
Wind turbines destroy the scenery.	**0.813**	−0.095
Wind turbines reduce possibilities to hunt.	**0.791**	−0.028
Wind turbines make farming and forestry substantially more difficult.	**0.755**	−0.076
Wind turbines reduce possibilities to take outdoor exercise.	**0.745**	−0.122
Wind turbines restrain climate change.	0.072	**0.911**
Wind turbines are an example of the technology of the future.	−0.016	**0.896**
Wind turbines are a good source of domestic energy.	−0.059	**0.869**
Wind turbines are essential for future energy production.	−0.076	**0.853**
Future generations will benefit from the development of wind energy.	−0.034	**0.849**
Wind energy is clean.	0.008	**0.824**
Wind turbines help people to be orientated in wild areas.	0.020	**0.547**
Wind turbines strengthen the uniqueness of a region.	−0.356	**0.403**
Eigenvalue (rotation sum)	10.209	1.585
Cumulative variance explained, %	60.05	69.38

Note: Interpretation of principal components:
C2.1 Local disadvantages of wind turbines.
C2.2 Advantages of wind power.

Table A.3
Principal components based on attitudinal statements related to compensation for the externalities of wind turbines (Oblimin rotation with Kaiser normalization. Loadings of 0.50 or above in boldface).

	Principal components	
	C3.1	C3.2
Wind turbines cause so few disadvantages that they do not need compensation.	**0.846**	0.168
It is wrong to grant licenses for wind power parks, as those suffering from the disadvantages are not compensated.	**−0.821**	−0.170
It is a good practice not to provide compensation for the disadvantages of wind power.	**0.818**	0.031
All sufferers from the disadvantages of wind turbines should be compensated.	**−0.776**	−0.015
Wind turbines should be allowed to be built more freely.	**0.757**	0.243
Wind turbines should be designed to fit the local conditions.	**−0.558**	0.267
Wind power should only be subsidized if the disadvantages are compensated for.	**−0.511**	0.364
Municipalities could compensate for the disadvantages of wind power by developing other local services.	0.037	**0.845**
The disadvantages of wind power could be compensated for by otherwise increasing the quality of the landscape.	0.164	**0.823**
Eigenvalue (rotation sum)	3.928	1.642
Cumulative variance explained, %	43.642	61.884

Note: Interpretation of principal components:
C3.1 Compensation for the landscape externalities of wind turbines.
C3.2 Public compensation for the landscape externalities of wind power.

Table A.4
Principal components based on attitudinal statements related to perceptions of the governance of landscape issues (Oblimin rotation with Kaiser normalization. Loadings of 0.50 or above in boldface).

	Principal components			
	C4.1	C4.2	C4.3	C4.4
Companies causing changes in the landscape should always compensate those suffering from the disadvantages.	**0.791**	0.008	0.001	0.129
The sufferers of landscape-related disadvantages should always be heard.	**0.768**	−0.161	0.031	0.133
Projects that change the landscape obtain permits for their realization too easily.	**0.750**	−0.058	−0.092	−0.025
Changes in the landscape often come as a surprise.	**0.685**	0.134	0.032	−0.231
At present, the rights of landowners are too restricted.	0.040	**0.863**	−0.041	0.080
Statutes related to the environment have restricted the possibilities for entrepreneurship too much.	−0.086	**0.806**	0.153	−0.024
Landowners should have the right to use their forests as they wish.	−0.001	**0.779**	−0.105	0.019
A change in the landscape could be compensated for with a protected area somewhere else.	0.062	−0.006	**0.901**	0.009
A change in the landscape could be compensated for with a new recreational service, e.g., an outdoor recreational route, somewhere else.	−0.052	−0.003	**0.880**	0.006

(*continued on next page*)

Table A.4 (*continued*)

	Principal components			
	C4.1	C4.2	C4.3	C4.4
I am aware of different projects changing the landscape.	−0.143	−0.013	0.044	**0.805**
If possible, I always participate in the preparation of regional plans in my neighborhood.	0.159	0.096	−0.030	**0.754**
Eigenvalue (rotation sum)	2.632	2.007	1.436	1.273
Cumulative variance explained, %	23.930	42.178	55.233	66.806

Note: Interpretation of principal components:
C4.1 Mistrust in land use planning.
C4.2 Freedom of entrepreneurship.
C4.3 Recreational-ecological compensation.
C4.4 Participation in local land use planning.

Table A.5
Principal components based on attitudinal statements related to interest in the LVT mechanism and forest management practices (Oblimin rotation with Kaiser normalization. Loadings of 0.50 or above in boldface).

	Principal components	
	C5.1	C5.2
I would be interested in providing a landscape shield if I received monetary compensation.	**0.902**	0.029
I am interested in discussing the provision of a landscape shield.	**0.894**	0.118
I am interested in discussing my forest management practices to reduce the harmful landscape effects of wind power.	**0.862**	0.176
I am willing to lease a part of my land to wind power companies for building wind turbines.	**0.786**	−0.225
I take into account the needs of my neighbors in my forest management.	0.084	**0.857**
I wish to hear the views of my neighbors when I plan my forest management.	0.177	**0.750**
I always take into account conditions related to the landscape in my forest management.	−0.149	**0.664**
Eigenvalue (rotation sum)	3.275	1.653
Cumulative variance explained, %	46.792	70.400

Note: Interpretation of principal components:
C5.1 Interest in cooperation and LVT.
C5.2 Takes landscape values into account in forest management.

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