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Place attachment and preferences for wind energy – A value-based approach

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ABSTRACT

Research indicates that local energy projects may disrupt different dimensions of people's sense of place, such as place attachment, causing local resistance within a community. Place-based concepts have therefore been extensively studied in social energy science to explain resistance to energy projects. However, what has been less studied is the integration of place-based concepts within a value-based framework to explain resistance. We present a conceptual framework wherein place attachment enhances people's value (utility) of a natural area by generating a person-place relationship. The framework bridges the concepts of values and resistance against wind energy, predicting higher losses of values from a natural area transformed into a wind energy site when a stronger place attachment is present. To test the conceptual framework, we conduct a discrete choice experiment (DCE) to assess the role of place attachment in the valuation of impacts of a place-specific wind energy project. Consistent with the framework, we find that place attachment (i) enlarges people's stated compensation to accept wind energy and (ii) increases wind energy resistance by leading to a higher propensity to choose the no-wind farm status quo option systematically across choice scenarios. Our results suggest that wind energy resistance should be recognized as a rational response when people value environmental amenities adversely affected by potential energy sites.

1. Introduction

Energy generated from land-based wind energy plants is expected to play a crucial role in the decarbonization of the economy [1].[1] However, increasing land use associated with new wind energy projects puts pressure on a wide range of nonmaterial benefits people obtain from ecosystems that are not captured by market mechanisms, referred to as cultural ecosystem services (CES) [2,3]. CES changes include visual aesthetic landscape impacts, reduced recreational quality, and impacts on biodiversity. In land-use decisions at local scales, it is vital to define and understand the changes in CES values from wind energy development, as well as what factors shape preferences for CES [4,5]. More knowledge about how people value CES impacts from land-based wind energy projects is essential for making the right trade-offs between the positive aspects of wind energy and adverse effects on local CES.

For this purpose, stated preference (SP) methods, and especially the discrete choice experiment (DCE) method, have increasingly been used to explore people's preferences and their values for affected CES from wind energy [6–10] and forms of acceptance [11]. A reason for the rise of DCE is its advantage in uncovering marginal willingness to pay (WTP) or willingness to accept (WTA) compensation for specific environmental attributes through the choices people make across different attribute configurations within an economic framework.

However, even though SP methods can provide inputs into decision-making to implement more economically efficient policies, decision-makers still often experience stiff local resistance against new wind energy developments [12]. Consequently, policy implementation becomes challenging [13]. A better recognition of factors generating resistance, integrated with values of impacts on CES, can contribute to making more acceptable and efficient wind energy decisions.

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[1] Abbreviations: Cultural ecosystem services (CES), discrete choice experiment (DCE), place attachment (PA), stated preference (SP), willingness-to-accept (WTA), willingness-to-pay (WTP).

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Factors influencing local resistance have been widely studied in social energy science [14–18], including place-based concepts such as sense of place [19–26]. Sense of place is described as people's place meanings and attachment [27–30]. Place attachment (PA) is one of the dimensions of sense of place and is particularly relevant for land-based wind energy projects that involve dramatic visual impacts and the degradation of physical landscapes. Prior research shows that wind energy impacts disrupt people's PA, leading to resistance [20]. The resistance has commonly been referred to as the not-in-my-backyard (NIMBY) effect [20–22,31–33].

However, sense of place and its various dimensions have rarely been studied in the wind energy-related SP research [34], even though these dimensions underpin significant values for people [35–38] and can explain people's response to wind energy scenarios presented. Attachment to a place can be seen as a benefit per se, e.g., through satisfying identity preference [39]. As Hausmann et al. ([37],p. 117) stress: "*Sense of place provides physical and psychological benefits to people, and has neglected economic value*." Recognizing that sense of place generates values and utility in decision-making will ensure the provision of sense of place dimensions and provided benefits, such as PA, and promote environmental conservation [37]. Thus, more research is warranted on integrating sense of place and its dimensions in value-based approaches to appraise energy projects. We contribute to this scarce literature with an explicit focus on PA, as this is the most studied sense of place dimension [30].

Our contribution is two-fold: First, we provide a conceptual framework where PA is defined as a value-enhancing CES category. The conceptual framework further bridges PA benefits to other CES benefits and wind energy resistance. Resistance is also suggested to be driven by how people value environmental changes in a natural area. Arguably, higher losses of CES benefits are experienced with PA, contributing to increasing wind energy resistance. Second, from the conceptual framework, hypotheses are formulated and tested using an original DCE dataset on an actual site-specific proposed rural wind farm near a small village in the southeastern part of Norway. Few DCEs on wind energy are site-specific from proposed development plans, which enhances our contribution and general understanding of local people's preferences for wind energy. While previous SP studies have used proximity and user intensity variables to explain preferences for wind energy [40], this is the first study to incorporate PA and then use it to explain place-specific wind energy resistance and preferences.

The remainder of the paper is structured as follows: First, we present the conceptual framework and associated hypotheses. Second, we describe the empirical setting and DCE design. Third, the modeling approaches are defined before the results are presented. The paper ends with a discussion and conclusions with some implications for environmental policy and recommendations for future research.

2. Conceptual background

2.1. Introduction to key terms

Sense of place and PA are intertwined, with PA often used as an alternative term for sense of place [37]. However, sense of place should be considered a broader term that includes all dimensions of people's perception and interpretation of a place in an emotional, spiritual and cognitive way.

Sense of place is generally measured by both PA and place meanings [30]. However, PA is by far the most studied sense of place measure, defined as an individual's emotional bond to a place [29,41,42]. Correspondingly, this study focuses on PA as a sense of place measure because new wind energy sites can disrupt PA.

PA is often measured by two sub-dimensions [43], which we adopt in our study. These two dimensions are (1) functionality (place dependency) [44] and (2) personal identification and emotional bonding (place identity) [45]. Both dimensions describe people's attitudes, behavior, and response to local environmental issues [19,20,46].

Place dependency describes attachment to a place in terms of how suitable the place is for performing desired recreational activities [44,47]. Place dependency depends on the recreational functionality of a place relative to other places. Thus, an individual will compare different places to evaluate recreational functionality. If a place is highly functional for the performance of desired activities, the place provides more amenities necessary for conducting desired activities than other places [43]. The individual will then prefer and choose the place with high functionality and develop a particular bond with the place.

Place identity [45], the second dimension, describes an individual's attachment to a place in terms of personal identification, emotions, and feelings about the place. The place can be important for an individual's personal and social identification. The individual can have strong feelings and affection toward the place.

2.2. Conceptual framework

Community resistance is a major obstacle in achieving new wind energy projects and is widely studied in social energy science. Research has mainly focused on factors influencing attitudes toward proposed wind energy projects [48]. A simplified and common label for community resistance is the NIMBY effect. According to Dear [49], the NIMBY effect is defined as "protectionist attitudes of and oppositional tactics adopted by community groups facing an unwelcome development in their neighborhood." The NIMBY effect has been explored to explain resistance against several energy sources, including oil and natural gas development [50,51], wind energy [7], and nuclear reactors [52]. However, the more recent research argues that the NIMBY effect is an inappropriate explanation for resistance, neglecting complex motivations and perceptions [20,33].

Researchers have thus explored other concepts [53], including place-based approaches [12,20,54–56]. Rand and Hoen [33] review thirty years of research on public acceptance of wind energy in North America. They define PA as a critical predictor for wind energy acceptance, where stronger PA reduces acceptance. This finding is supported by a review of public perceptions of and responses to new energy technologies by Boudet [12], which finds that wind energy development can disrupt people's PA and threaten place identity. The development will then be perceived negatively, giving rise to resistance and place-protective behavior [12,20,57]. Jacquet and Stedman [58] review research on place-based concepts and oppositional behavior to large land use changes. Their review supports that land use changes often threaten place-based concepts, which can spur oppositional behavior.

A starting point for the interrelation between energy resistance and PA is Vorkinn and Riese [19], showing that PA explains more of the variance in attitudes toward a major hydropower development than socioeconomic variables. Devine-Wright & Howes [21] find that strong PA leads to negative attitudes toward an offshore wind energy site and oppositional behavior. Bidwell [24] finds a positive effect of PA on wind energy caution. Gonyo et al. [26] conclude that people with strong PA are more likely to oppose proposed wind energy projects, initiating place-protection action. Fleming et al. [59] find that a cluster of the study sample with strong PA is more likely to perceive an offshore wind energy site negatively.

What has received minimal attention in this literature is how people's value of wind energy impacts can be explained by PA and drive resistance. Fig. 1 provides a conceptual framework for integrating PA in a value-based approach to analyzing wind energy impacts, building on insights from Gee and Burkhard [35], Hausmann et al. [37], and Masterson et al. [30]. To define our conceptual framework, we bridge environmental economics research with social science research on acceptance of wind energy.

In the conceptual framework, PA is characterized by place dependency and identity. PA is generated through a *space-place* transition intermediated by *landscape* [35]. The space can be considered the

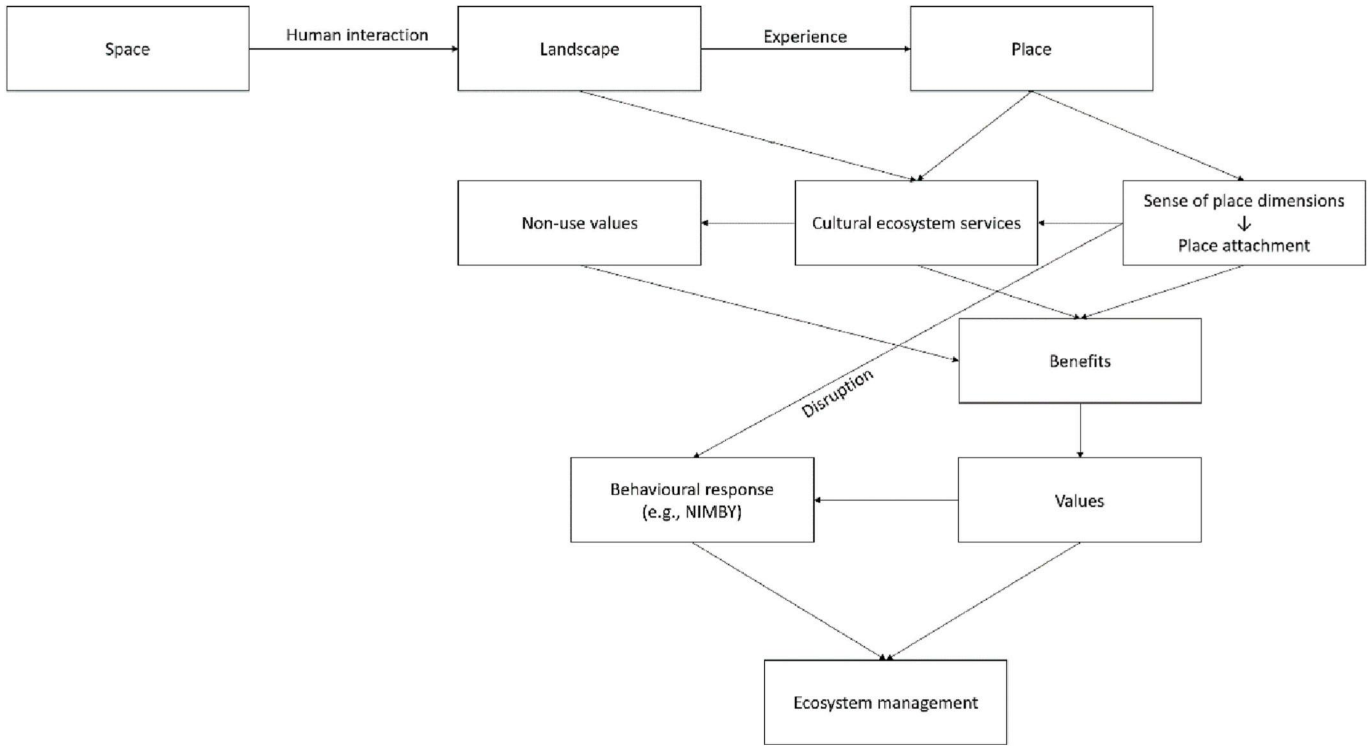

Fig. 1. Conceptual framework of PA in a value-based approach.

biophysical environment of an ecosystem, in other words, the physical aspects of a defined geographical area. Once the space is intertwined with humans, it initiates the transition from a space to a *landscape*. The landscape provides CES benefits, such as recreation and landscape aesthetics [4], which ultimately have nonmarket use values [60]. The provision of CES also generates non-use values.

For some, the transition, through psychological processes, lived experience, use, and social interactions [27], continues from the landscape to a *place*, generating a person-place relationship [12]. The place adds a new dimension to use values of CES, namely sense of place dimensions, expressed here as PA [27,35]. Through identity and dependency, PA generates a broader appreciation for this geographical area and its CES, which enhances its nonmarket values [34,37,61–63]. The conceptual framework suggests that the perceived nonmarket values from CES are greater with PA because the attachment enhances the benefit [37] and makes the place more valuable [61].

In what is perceived as a place, a new wind energy site will challenge people's PA [19,20,42,64–66]. Correspondingly, the implied landscape change is referred to as a place disruption, defined as a noticeable transformation of the place in physical and, thus, psychological terms. People with higher levels of attachment are more sensitive to place disruption, especially disruption of natural areas [19]. The place disruption will change the quality and the value of CES benefits, including people's PA through loss of identity and dependency [20,42,65,66], yielding a higher economic cost than a situation wherein loss of PA is not experienced, all else equal. From the conceptual framework, we can thus formulate our first hypothesis:

People with stronger PA have a higher willingness-to-accept (WTA) compensation for attributes associated with negative place-specific landscape impacts (**H1**).

This hypothesis will be explored through a mixed logit model (cf. Section 3.3).[2] Existing economic research supports this **H1**. Hoyos et al. [67] find that a stronger cultural identity in Basque culture increases WTP to protect natural resources. Accordingly, López-Mosquera and Sánchez [68] hypothesize and find that PA increases WTP for conservation. Likewise, Faccioli et al. [34] find that place identity increases people's WTP for peatland conservation, while Iversen and Dugstad [69] find that PA increases people's WTP to avoid environmental impacts from the development of recreational mountain cabins.

Further, from the conceptual framework, we argue that the psychological understanding of resistance intermediated by PA has disregarded a crucial element. The negative behavior from a place disruption is most likely generated by how people perceive CES values, including their PA. We argue that people who value CES more highly will be more likely to resist a place disruption because of significantly higher value losses. While resistance has traditionally been described as irrational, where opposing people lack understanding of the technology or the problem [22,51], the reaction could be perfectly rational once integrated with the concept of values.

We can thus formulate our second hypothesis related to wind energy resistance and PA from our conceptual framework.

PA significantly increases the propensity to systematically choose the status quo option describing "no construction of the proposed wind farm" in our DCE (**H2**).

In our DCE design, the resistance can be identified through respondents who systematically choose the status quo option, implying no

[2] We recognize that **H1** is contingent on people with PA perceiving the landscape changes from a wind farm as unfavorable. However, most existing research support this. Further, we do not evaluate the economic value of changes in PA per se because this is empirically challenging. Instead, as our framework suggests, we use PA as an explanatory variable to test whether it increases the economic valuation of changes in CES.

wind farm construction at zero reduction in municipal taxes (i.e., they *resist* the wind farm).

The reasoning for **H2** is as follows. From **H1**, people with PA are believed to value landscape more because of the transformation from the landscape to a place where PA is an enhancing benefit. The loss of value will then be higher among people with PA, making them more likely to oppose the alternative wind energy scenarios. **H2** will be explored within a structural equation modeling (SEM) framework (cf. Section 3). Notably, local people do not always perceive renewable energy projects to disrupt their PA. Devine-Wright [70] find that a tidal energy converter in Northern Ireland enhances PA.

Our conceptual framework's overall insight is that values and generated behavioral responses to a proposed management scheme should be incorporated into energy-related ecosystem management. Relatedly, this implies integrating PA into management efforts, as it has implications for why some oppose management proposals and practices [62].

3. Methods

3.1. The empirical setting

Our study area is the municipality of Aurskog-Høland, a rural area about 60 km east of Oslo, the capital of Norway. The proposed wind farm site is located in a forest area in the small village of Setskog with 750 residents. The area is used mainly by the local population of Setskog for recreational activities like hiking, skiing, fishing, and hunting. The construction zone covers about 3.2 km^2 and can accommodate about ten wind turbines. The site is close to Lake Setten, popular all season for recreational activities, not only among people in Setskog but also in the broader municipality with about 17,000 inhabitants. The people in the study area have limited experience with wind farm development. The closest existing wind farm, located in Ørje, is about 50 km away and was developed in 2018.

The residential homes closest to the planned wind farm are located at a distance, as the crow flies, of 1.5 km. The map in Fig. 2 shows parts of the municipality and the planned wind farm area. The wind farm will provide local economic benefits to the municipality. The benefits include value added and new jobs [71] from using local entrepreneurs in the construction phase. The wind farm also requires full-time employees, generating extra revenues for the municipality from tax payments. However, the wind farm will negatively impact local CES. The wind farm will be visible from many areas inside and outside of the municipality, causing visual intrusion and changes in landscape aesthetic [72]. Recreational services will also be negatively affected, and some local inhabitants might need to find new substitute sites for recreation. Visual intrusion might also negatively affect recreational services outside the planning area [73]. The wind farm requires new roads and upgraded powerlines, which entails additional impacts on recreational services and landscape aesthetic. The wind farm can also negatively affect property prices. In addition the wind farm and the new roads will harm natural habitats and biodiversity, including the Northern European wolf (*Canis lupus*) and the lynx (*Lynx lynx*).

3.2. Survey and discrete choice experiment design

We conducted a DCE internet survey of the inhabitants in the municipality of Aurskog-Høland to value the landscape impacts of the proposed wind energy project. A critical limitation of SP methods, in general, is hypothetical bias. The hypothetical nature of SP methods may influence the validity of elicited estimates, as hypothetical choices might not always align with real behavior. Thus, it is important to follow best practice guidelines [74]. The methods are further prone to other survey limitations, such as sampling selection bias [75].

The questionnaire first asked the respondents general questions that could indicate PA, such as how many years they had lived in the village of Setskog or the municipality of Aurskog-Høland. Respondents were then presented with information about the proposed wind farm consistent with the development plan that is available online (in Norwegian).[3] We used Fig. 2 to help respondents visualize the wind farm's potential size and show its location. We then asked how far away they live from the proposed area with alternatives, i.e., perceived proximity. The overall consequentiality of the survey instrument was strengthened by informing respondents that the results could affect decision-making related to the wind farm [74]. Furthermore, the DCE exhibited a high degree of realism as it was designed in line with the proposed plan for a wind farm, which has been discussed in public meetings with municipality residents before the survey.

Questions related to outdoor recreation in Setskog and the municipality in general, i.e., frequency and activities, were then asked, followed by statements related to the two dimensions of PA: place dependency and place identity; see Table 1. The statements for place dependency were adopted from Moore and Graefe [61], whereas the statements for place identity were adopted from Ramkissoon et al. [76]. PA was framed in connection to the proposed wind farm area. A seven-point Likert scale (from 1 = *totally disagree* to 7 = *totally agree*) was utilized to capture these dimensions, as recommended by Vorkinn and Riese [19].

The DCE attributes and levels (see Table 2) were chosen to describe salient landscape changes optimally based on (i) information provided in the development report made by the wind farm developer, (ii) insights from discussions in two local focus-group meetings held at two separate locations in the local area, (iii) review of the existing SP literature on wind energy externalities, and (iv) the SP-DCE recommendations and guidelines [74,77]. Jointly, the DCE attributes described landscape changes through the following wind energy characteristics: (1) the number of turbines, (2) the height of the turbines, and (3) the type of power lines. Combined, they represent the overall landscape change.

In line with Hevia-Koch and Ladenburg [6], we used realistic photos extracted from Shutterstock and the actual development plan to visualize the potential landscape impacts of the different attributes objectively. Neglecting to provide visualizations to the respondents may increase the uncertainty regarding the basis for their evaluations [78], leading to weaker conclusions and more uncertainty in inputs to policy decisions [6]. Research suggests that using immersive and realistic visualizations can increase choice certainty [78], which supports our decision to use visualizations in this survey. However, it is important to note that insufficient descriptions of potential landscape changes through visualizations could lead to additional uncertainty regarding respondents' evaluations and values. The visualizations we used in this survey were tested in focus group meetings, and deemed realistic and appropriate.

We defined and presented information about each attribute sequentially in the survey. The number of turbines has been used as an attribute in several wind energy DCEs [8,79]. In our case, the levels were set to be consistent with the development plan. We described the externalities associated with the installation of wind turbines and related infrastructure (paved roads), including the loss of natural areas for recreation from new turbines and paved roads and reduced biodiversity, including wolves, lynx, western capercaillie (*Tetrao urogallus*), and other local bird species. To help the respondents visualize the potential impacts, we showed a manipulated photo with and without wind turbines after providing the attribute descriptions; see Fig. A.1 in Appendix A. By using this approach, we aimed to capture respondents' values for changes in a bundle of CES resulting from the installation of new turbines. We chose this approach because the externalities correlate highly with more wind turbines. Thus, we cannot separate how people value

[3] https://webfileservice.nve.no/API/PublishedFiles/Download/201839912/2528787.

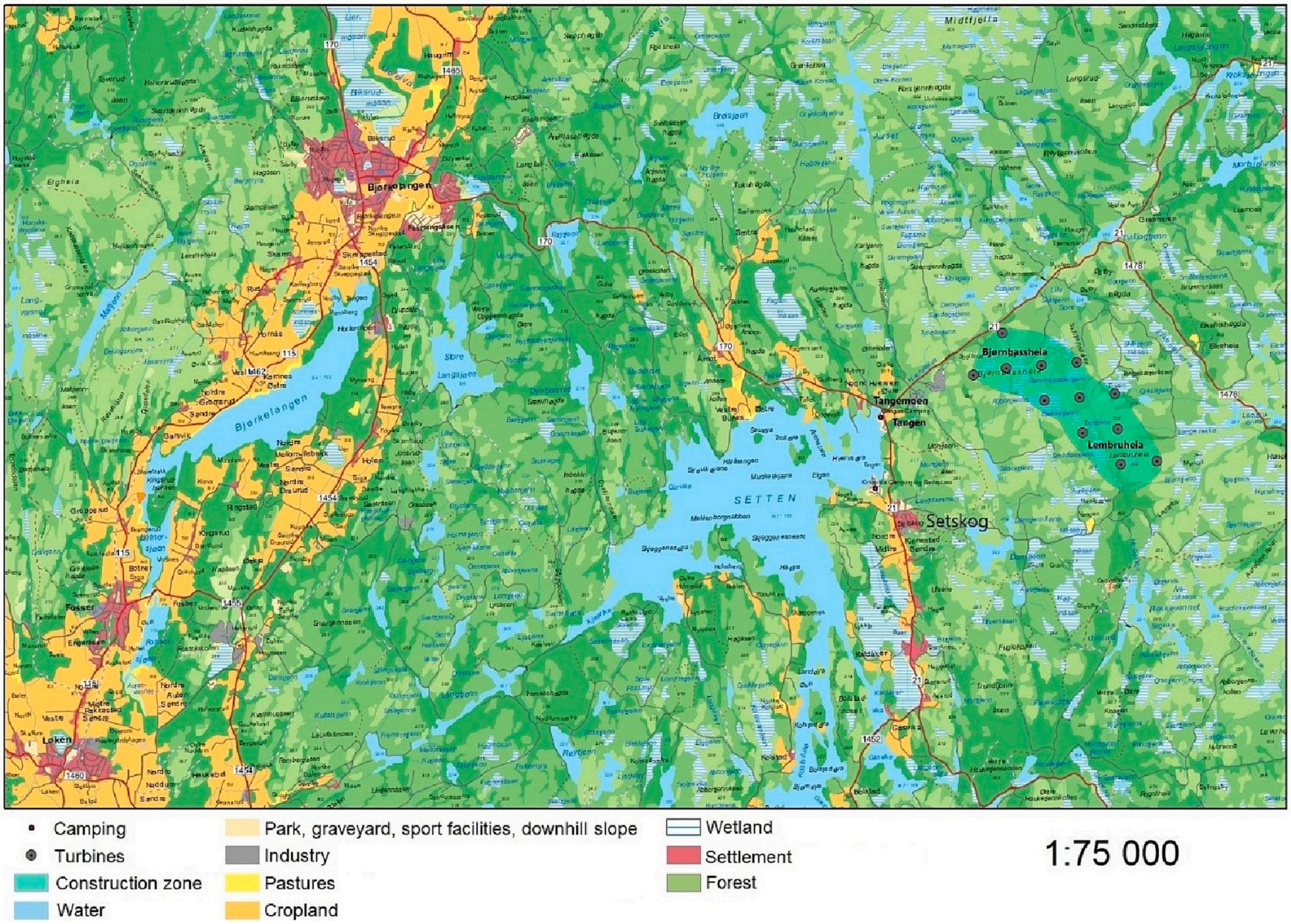

Fig. 2. Map of the study area.

Table 1
Attitudinal statements relating to different dimensions of PA.

Construct and scale items	
Place dependency	
pdep1	I enjoy outdoor recreational activities in Setskog more than in other areas in Aurskog-Høland municipality.
pdep2	I would not substitute Setskog for other areas in Aurskog-Høland municipality for the outdoor recreational activities I engage in there.
pdep3	For the outdoor recreational activities I enjoy most, I prefer the settings and facilities in Setskog.
pdep4	Engaging in outdoor recreational activities in Setskog is more important to me than engaging in these activities in other areas in the Aurskog-Høland municipality.
Place identity	
pid1	I identify strongly with Setskog.
pid2	I feel Setskog is part of me.
pid3	Staying in Setskog says a lot about who I am.
pid4	I am very attached to Setskog.
pid5	I feel a strong sense of belonging to Setskog.
pid6	Setskog means a lot to me.

Table 2
Attributes and levels.

Attribute	Levels
Turbines	0 (Status quo)
	2
	4
	6
	8
	10
	12
Turbine height	No construction (Status quo)
	150 m
	200 m
	250 m
Power line and environment	No construction (Status quo)
	Overhead lines in forests and residential areas
	Underground lines in forests and residential areas
	Overhead lines in forests, underground lines in residential areas
	Underground lines in forests, overhead lines in residential areas
Reduction in annual municipal taxes	No changes (Status quo)
	NOK 500 (USD 50)
	NOK 1000 (USD 100)
	NOK 2000 (USD 200)
	NOK 4000 (USD 400)

Note: USD 1 = NOK 9.5 PPP adjusted.

the impacts of, e.g., paved roads against new turbines, as they come as a bundled impact for this project and most other land-based wind energy projects in Norway [7].

Given the number of turbines, the height attribute represented visual changes from taller turbines. The development plan stated that the turbine height was not decided but could be between 150 and 250 m. The respondents were informed that taller turbines would be more visible from a distance. Height has also been used as an attribute in several DCE wind energy studies [9,10]. The respondents were shown two photos sequentially of the landscape with wind turbines seen from Lake Setten. In the first photo, the wind turbines were shorter, illustrating a height of 150 m. In the second photo, they were taller, showing a height of 250 m; see Fig. A.2 in Appendix A.[4] In other respects, the two images were identical. The initial photo was taken from the developer's license application and edited. We included the two photos to make it easier for the respondents to visualize the aesthetic impact of taller wind turbines seen from a relatively short distance. The respondents were also shown two viewshed maps illustrating turbine visibility inside and outside the municipality with 150 m and 250 m tall wind turbines.

According to the development plan, the wind farm would require upgrading an estimated 15 km of power lines (excluding underground cables between the turbines), transecting forested and residential areas. However, the upgraded power lines could either be constructed overhead or buried underground. It was uncertain whether the inhabitants associated underground cables with less landscape impact than overhead power lines. Few DCE studies of wind power externalities include the added visual impact of the power lines needed for wind power developments, so little is known about preferences for power lines in the respective context [80]. Contingent valuation studies in Norway indicate that people strongly prefer replacing overhead power lines with more expensive underground cables. Still, preferences vary with the type of landscape through which the power lines run, e.g., Navrud et al. [81]. We used visualizations to illustrate how the landscape would be with overhead power lines and underground power lines.

The monetary attribute was framed as a reduction in residents' annual municipal taxes. The respondents were told that the wind farm would generate increased revenues for the municipality, e.g., property tax revenues, but that some of the proceeds would be used to compensate for the negative environmental impacts. The monetary attribute is non-voluntary and realistic, as recommended by Johnston et al. [74]. We used a WTA compensation format to mitigate protest responses. Compensation for the negative impacts is likely to seem fairer and more realistic for the residents than a WTP to avoid format. Implicitly, we defined the property rights for an unchanged environment as belonging to the residents in the municipality. The choice of implied property rights is sensible as the municipality has arranged public meetings with the residents to discuss, vote, and express their opinion of the proposed wind farm.[5] Previous DCE studies on wind energy externalities have also used the WTA approach successfully [9]. The levels for the attribute represented a rebate of 5 to 30 % and were tested in the focus group meetings and deemed sufficient. To enhance consequentiality and incentive compatibility, we used municipal taxes as the payment vehicle in our study. Although rebates on the electricity bill or direct cash payments in the form of ownership could have also been used, we believed they would be perceived, to a greater extent, as a form of bribery by the developer. Moreover, we believed that the respondents had greater trust in the municipality (where they vote for elected politicians) than the developer, making municipal taxes more incentive compatible.

An example choice card is displayed in Fig. 3. The choice cards had three scenarios: two wind farm construction scenarios with specified reductions in annual municipal taxes and a status quo situation without the new wind farm. The status quo implied that the proposed wind farm area would remain unchanged. As this option would not result in increased revenues for the municipality, reductions in municipal taxes were set to zero. Each respondent answered six choice cards. Each choice card had a budget reminder. The exact framing of each choice scenario was (translated from Norwegian): "*Which alternative do you prefer? Choose your preferred alternative. If you choose "Today's situation: No construction", the municipality will not reduce its annual municipal taxes. In that case, the planning area will remain as it is today, and the wind farm will not be built. Remember that your choices can increase your disposable income, but then you will experience the impacts of the wind farm.*" We had four blocks and, thus, in total, 24 cards. A D-efficient design was programmed in Ngene [82], with priors indicating the expected directions of the utility coefficients [83]. Respondents also registered their socioeconomic characteristics at the end of the survey.

3.3. Modeling approach

To examine **H1**, we first used structural equation modeling (SEM) to estimate and predict the respondents' factor score of the latent construct of PA. The theoretical model estimated to predict individual-specific PA factor scores is displayed to the left in Fig. 4. SEM is a well-established multivariate statistical approach often used in psychological research that simultaneously integrates confirmatory factor analysis (CFA) and multiple linear regression analysis [84], where the CFA is used to verify an unobservable latent phenomenon from observable indicator variables. In other words, a model consists of a structural component (the multiple linear regression analysis) and a measurement component (the CFA). SEM is used to explain the relationships among various variables of a theoretically specified model and commonly uses maximum likelihood estimation [85].

Using SEM and the user-written package Lavaan in R [86], we defined PA as a second-order latent variable, determined by place identity and place dependency, to depend on some exogenous variables. Incorporated exogenous variables were i) socioeconomic characteristics (age, gender, education, income) [34], ii) an indicator of whether the respondents used the affected areas in Setskog for recreational purposes (more than ten days last year), iii) residential proximity to the wind farm [19], and iv) the number of years the respondents have lived in Setskog (since PA and its dimensions evolve and grow stronger over time [61]).

The factor score of PA was then predicted for each respondent to be incorporated into the estimated discrete choice model. We first estimated a baseline mixed logit model in WTA space [87], where the non-monetary attribute coefficients were assumed to follow a normal distribution, including the status quo option, as the people can have positive and negative preferences. The cost attribute was assumed to follow a positive log-normal distribution, constraining people to have the same sign of the preference parameter, as they should get a positive utility of more money (see Section B in the Appendix for a technical description). As the mixed logit model estimation relies on simulations, we used 4000 Sobol draws [88].

Second, we estimated a mixed logit model in WTA space with equivalent specifications and assumptions, but incorporated the predicted factor score of PA and interacted it with each attribute level. In our primary modeling approach, we used a two-step sequential approach rather than a simultaneous one. A simultaneous approach generally requires utilizing the hybrid choice modeling framework, which integrates a structural component, a measurement component, and a discrete choice component within the same estimation [89,90]. However, hybrid choice models have been criticized for their complexity and cost of estimation, see Mariel and Meyerhoff [91]. Since we have a relatively small sample and work with a complex second-order latent variable structure, the hybrid choice model framework would introduce additional and unnecessary complexity.

To examine **H2**, i.e., whether PA gives rise to resistance to the proposed wind farm, we extended the SEM model used to predict the latent score of PA described earlier in this section by including an additional

[4] We recognize that when turbines become taller, their blades also become longer. The development then becomes less dense. Thus, the visualizations for the height attribute might not truly reflect real world conditions. However, they still give an impression of changes in visual intrusion with taller turbines.

[5] Both "WTA to have" and "WTP to avoid" formats, all else equal, were tested when the survey launched with the purpose of comparing the designs. However, we immediately had to withdraw the WTP format survey because several people protested and complained. We did not receive any complaints against the WTA format survey design.

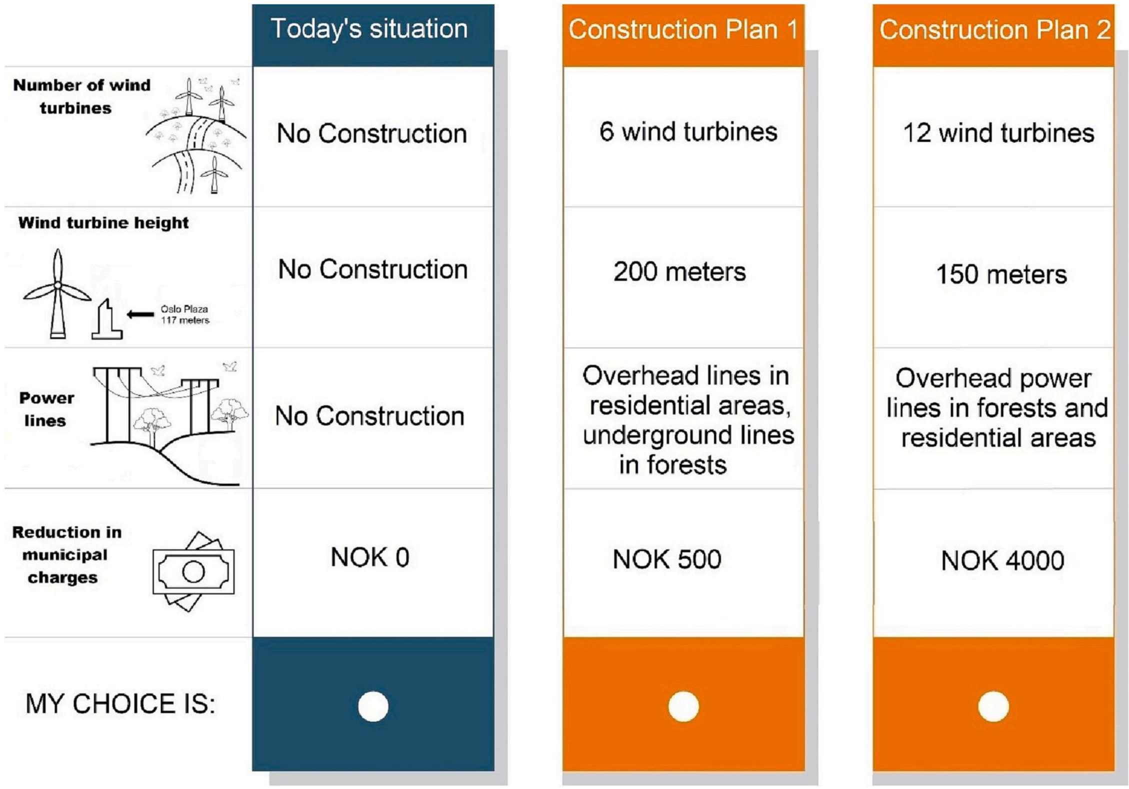

Fig. 3. Example of a choice card.

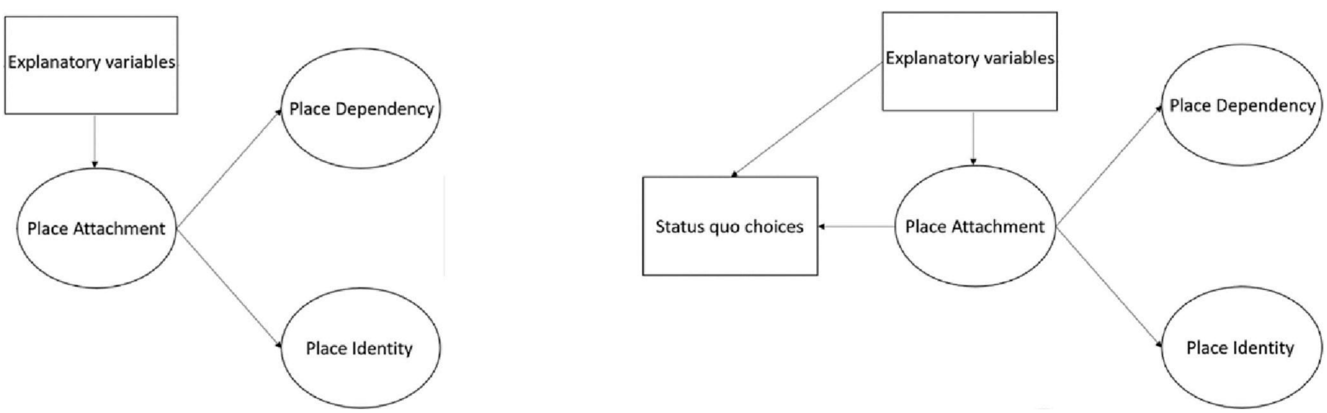

Fig. 4. Left: The theoretical model to predict the PA score will be included in the mixed logit model. Right: Theoretical model of PA on status quo choices.

structural model. This model is visually explained to the right in Fig. 4. The additional structural model defined a dummy coded variable equal to one if a respondent chose the status quo (no wind farm) option in every choice situation and zero otherwise to depend on PA and the same set of explanatory variables as previously described.

The no wind farm construction variable is binary. We thus use the weighted least square mean and variance adjusted (WLSMV) estimator in Lavaan. This approach implies that the binary structural model of status quo choices was estimated as a probit link function.

4. Results

Survey participants were recruited by telephone and through a web panel by the Norwegian survey sampling company NORSTAT to increase the sample size from a limited local population.[6] The participants recruited by telephone were subsequently sent an e-mail with a link to the online survey. A limitation of this approach is that it generally produces lower response participation and is prone to self-selection bias, where the most active community members could be more prone to

[6] Informed consent was handled by NORSTAT. The subjects were informed that participation was voluntary and non-binding, before being asked to state whether they would like to participate or not. The survey company is obliged to follow GDPR requirements. We communicated with the survey company throughout the process. We followed the national ethical guidelines for social sciences and humanities (NESH).

accept the survey invitation and be interested in the survey topic [75]. Our data collection took place in March 2020 and had a response rate of 34 %. The usable sample consisted of 308 respondents. Surveys of local environmental problems in small communities are expected to produce modest sample sizes like ours because the population sampled is small. However, as we have six observations per respondent, our total data consists of 1848 observations. Uncovering significant relationships and getting valid and reliable welfare estimates is more challenging with small datasets and affects external validity.

4.1. Socioeconomic characteristics

The socioeconomic characteristics of the survey participants versus census statistics for the local population are displayed in Table 3. As can be seen, our sample has a slightly larger share of males, higher income, and more individuals with at least three years of university education than the general population. For this reason, any direct utilization of the valuation results from our analysis in the benefit-cost analysis of the proposed wind farm should be done with caution. Our analysis primarily intends to illuminate the importance of the PA concept.

4.2. Modeling results

As explained in Section 5 and visualized to the left in Fig. 4, we used SEM to predict the respondents' score of PA, where PA was specified to depend on some explanatory variables. The results of this first-stage procedure are displayed in Table 4. The model fit satisfies the criteria listed by Hu and Bentler [92]. We can see that PA increases with the years the respondents have lived in Setskog and the proximity to the planning area (measured as the direct line in km from the residential zip code to the planning area). In addition, PA is stronger among respondents who use the area for recreation. This observation makes sense as PA grows stronger with experience and familiarity. The socioeconomic variables do not significantly explain variation in PA. We also used this first-stage analysis to evaluate the validity of the measurement models. In SEM, validity refers to how accurately the indicator variables measure what they are supposed to measure [93]. We assess and discuss the validity in Section C in the Appendix. The results support the validity of the measurement models. Thus, we are confidence using the items to define the latent constructs and incorporate the predicted factor score of PA in the mixed logit model.

Table 3
Socioeconomic characteristics of the sample and the population.

Variable name	Definition	Sample	Population
Male	Male, dummy	59 %	50 %
Higheduc	Dummy =1 if University education (3 years+)	45 %	20 %
Income	Annual gross median household income	USD 93750	USD 68125
Inc_mid	Dummy =1 if income is between USD 57900–94,700	36 %	–
Inc_high	Dummy =1 if income is >94,700	37 %	–
Age	Age of respondents	51	–
Years lived in Setskog	Years respondents have lived in Setskog	2.4	–
Recreation	Dummy =1 if respondents had engaged in recreation in the planning area 10 times or more last year	8 %	–
Distance	Distance (as the direct line) in km from home to the planning area	15 km	–

Note: In accordance with the OECD, the PPP adjusted exchange rate of USD 1 = NOK 9.5 was used to calculate the median household income in USD.

Table 4
SEM model to predict latent PA scores.

	PA
Structural component	
Age	−0.051 (0.053)
Years lived in Setskog	0.241*** (0.058)
Male	−0.024 (0.052)
University education (3 years+ completed)	−0.078 (0.052)
Recreation (10 days or more last year)	0.299*** (0.050)
Distance	−0.203*** (0.058)
Inc_mid	0.039 (0.064)
Inc_high	0.041 (0.064)

Measurement components	Indicator variable (mean)	Standardized factor loading
Place dependency		
	pdep1 (2.896)	0.849*** (0.018)
	pdep2 (3.039)	0.774*** (0.024)
	pdep3 (2.955)	0.905*** (0.012)
	pdep4 (2.487)	0.938*** (0.010)
Place identity		
	pid1 (2.438)	0.942*** (0.007)
	pid2 (2.315)	0.927*** (0.008)
	pid3 (2.341)	0.951*** (0.006)
	pid4 (2.744)	0.928*** (0.008)
	pid5 (2.484)	0.978*** (0.003)
	pid6 (2.445)	0.978*** (0.003)
PA		
	Place dependency	0.947*** (0.027)
	Place identity	0.892*** (0.027)

Validity statistics	Place dependency	Place identity	PA
Average standardized factor loading	0.867	0.951	0.932
Average variance extracted	0.755	0.904	0.873
Composite reliability	0.925	0.983	0.931
Observations	308	308	308

Notes: $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. Standard errors (SE) are given in brackets. Standardized coefficients are displayed. RMSEA = root mean square error of approximation = 0.079; CFI = comparative fit index = 0.959; TLI = Tucker-Lewis index = 0.951; SRMR = standardized root mean square residual = 0.023; Chi-squared test statistics (*p*-value) = 304.357 with 105 degrees of freedom (*p*-value = 0.000).

The two estimated mixed logit models are displayed in Table 5, which we now refer to as MMNL and PAMMNL, without and with PA, respectively. The models were estimated using the Apollo package in R [94].[7] Each attribute was specified to be categorical, except the number of turbines attribute. The attribute level associated with the most negligible landscape impact was kept as the baseline value for the categorical attributes. The models were estimated in WTA space so that the coefficients can be interpreted immediately in monetary terms.

The main effect coefficients in both models represent the average respondent estimates. The non-monetary attribute coefficients are significant and negative, whereas the coefficient for the status quo option is positive, sizeable, and significant (see Table 5). These results indicate that compensation is required to avoid reduced welfare associated with i) more turbines, ii) taller turbines, and iii) overhead power lines or combinations of overhead and underground power lines instead of using underground power lines solely. The sample has strong preferences for avoiding the proposed wind farm. The status quo option was chosen 60 % of the time, and 55 % of respondents chose the status quo option in each scenario, which could indicate potential status quo bias [95].

[7] Codes are available in Appendix A.

Table 5
Mixed logit models estimated in WTA space.

	MMNL	PAMMNL
Main effects		
Status quo	136.185*** (3.109)	128.554*** (3.248)
Turbines	−3.441*** (0.269)	−4.178*** (0.284)
Height 200 m	−6.082*** (2.570)	−8.964*** (2.331)
Height 250 m	−9.328*** (2.194)	−9.157*** (2.320)
Overhead lines	−43.540*** (2.727)	−43.956*** (3.342)
Overhead forest, underground residential areas	−36.454*** (2.931)	−34.872*** (2.997)
Underground forest, overhead residential areas	−24.224*** (2.506)	−21.813*** (2.602)
-Municipal taxes/100	−1.938*** (0.406)	−1.820*** (0.449)
Interaction effects		
Status quo × PA	–	223.143*** (3.582)
Turbines × PA	–	−0.936*** (0.041)
Height 200 m × PA	–	−5.549*** (0.484)
Height 250 m × PA	–	−9.368*** (0.496)
Overhead lines × PA	–	−6.431*** (0.518)
Overhead forest, underground residential areas x PA	–	−10.956*** (0.518)
Underground forest, overhead residential areas x PA	–	−10.016*** (0.467)
Municipal taxes x PA	–	0.019* (0.013)
Standard deviations of random parameters		
Status quo	563.964*** (11.564)	517.716*** (8.103)
Turbines	1.368*** (0.033)	0.935*** (0.032)
Height (200 m)	12.975*** (0.368)	13.866*** (0.427)
Height 250 m	2.377*** (0.217)	0.917*** (0.303)
Overhead lines	22.402*** (0.674)	22.701*** (0.353)
Overhead forest, underground residential areas	7.132*** (0.198)	4.627*** (0.294)
Underground forest, overhead residential areas	0.734*** (0.302)	3.420*** (0.291)
-Municipal taxes/100	2.087*** (0.317)	2.107*** (0.317)
Log-likelihood	−813.560	−792.390
Adjusted Rho-Square	0.578	0.584
AIC	1715.120	1688.780
BIC	1958.080	1975.920
Observations	1848	1848

Note: $*p < 0.1$, $**p < 0.05$, $***p < 0.001$. Standard errors (SE) are given in brackets. Coefficients are displayed in NOK, where NOK 9.5 is equal to USD 1, PPP- adjusted. The cost attribute is scaled by 100, so WTA values must be multiplied by 100 [34].

However, the observed status quo propensity could also be explained by the monetary compensation implied by the payment vehicle. Respondents who systematically chose the status quo were asked about their motivations. The main reason (indicated by 44 %) was that "*the cost of the alternative construction plans was too high compared to their benefit*," which suggests valid preferences for the status quo option. Indeed, only 20 % of the status quo respondents (<10 % of all respondents) could be identified as potential protesters by choosing the option "*I do not want to put a monetary value on the environment.*"

In the MMNL, WTA per turbine is NOK 344 per year. The difference between WTA for 200 and 250 m turbines is NOK 322, indicating increasing marginal disutility of taller turbines [96]. However, in Table A.1 in Appendix A, we test for differences in WTA between attribute levels within the two models and differences in WTA between models. Here, we observe that the difference in WTA between 200 m height and 250 m height is insignificant. Furthermore, the test results in Table A.1 indicate that overhead power lines are associated with a significantly higher WTA than the other alternatives, both in the MMNL and the PAMMNL.

The PAMMNL has a better fit as measured by adjusted Rho-square and AIC statistics, though it is punished with higher BIC because of more parameters. In the PAMMNL estimation, respondents with an average PA score demand NOK 418 in compensation per wind turbine installed. On the other hand, the WTA for 200 m and 250 m wind turbines, compared to 150, is NOK 896 and 937, respectively. As for the MMNL, the difference in WTA is insignificant (see Table A.1).

WTA of overhead power lines instead of underground power lines is around NOK 4396 among respondents with a mean score of PA. They prefer underground power lines rather than a combination of underground and overhead power lines. This finding points to the negative aesthetic impacts of using overhead power lines. As for the MMNL, overhead power lines are associated with a significantly higher WTA than the other combinations (see Table A.1).

Further, in the PAMMNL, we see significant interaction terms between all attributes and PA. The interaction coefficients suggest that people with stronger PA have an even higher WTA for i) more wind turbines, ii) taller wind turbines, and iii) overhead power lines or combinations of overhead and underground power lines, which is consistent with **H1**. Stronger PA also entails stronger preferences for reductions in municipal taxes, which means they have a higher marginal utility of money. The significant interaction term with the status quo variable indicates that people with stronger PA have stronger preferences for avoiding the proposed wind farm. This result supports **H2**, as it also indicates that people with stronger PA are more inclined to choose the status quo option and value the natural area higher.

The factor score of PA was normalized to have a mean of zero and a standard deviation of one. We can thus interpret the interaction effects in terms of how much WTA changes if PA changes by one standard deviation away from the mean. WTA per turbine then increases significantly with NOK 94. Thus, the WTA among people with 1 SD deviation above the mean is NOK 513. WTA for 200 m and 250 m tall turbines increases by NOK 550 and NOK 937 if PA increases by one standard deviation, respectively, indicating stronger scope sensitivity. WTA for overhead power lines increases by about NOK 643 with stronger PA. We further conducted a robustness check for whether PA affects WTA. First, we simulated and extract the conditional WTA estimates of the nonmarket attributes for each respondent from the MMNL model (without PA) in Table 5. Then, we ran a separate linear regression for each nonmarket attribute, where simulated WTA was the dependent variable. As explanatory variables in these regressions, we included the predicted score of PA from the model in Table 4 and the other explanatory variables used in this model. The results are displayed in Table A.2 in Section A in the Appendix. As can be seen, PA has a significant and sizeable effect in each regression, which further supports that PA increases WTA for the nonmarket attributes.[8] Higher age and recreational use of the planning area also increase WTA for most non-cost attributes. We also report the adjusted R-square with and without PA in the regression models to assess the improvement in model fit. Consistent with the results in Table 5, the adjusted R-square increases substantially with PA.

The SEM probit regression that shows how PA affects systematical status quo choices (**H2**) is displayed in Table 6 (i.e., the model to the right in Fig. 4). We display the standardized coefficients for interpretational convenience. The fit of the model (see Table 6) satisfies the

[8] We recognize the issues of using the conditional WTA estimates, in particular because we have relatively few choice situations.

Table 6
PA on systematical status quo choices.

	Status quo (standardized coef.)	PA (standardized coef.)
Structural components		
PA	0.387*** (0.074)	
Age	0.175** (0.070)	−0.028 (0.055)
Years lived in Setskog	−0.015 (0.075)	0.263*** (0.054)
Male	−0.039 (0.069)	−0.017 (0.054)
University education (3 years or more completed)	−0.055 (0.069)	−0.078 (0.055)
Recreation (10 days or more last year)	0.175* (0.091)	0.288*** (0.043)
Distance	0.139* (0.081)	-0.203*** (0.054)
Inc_mid	0.255*** (0.081)	0.033 (0.067)
Inc_high	0.191** (0.079)	0.041 (0.068)
Measurement components		
	Indicator variable	Standardized factor loading
Place dependency		
	pdep1	0.856*** (0.030)
	pdep2	0.751*** (0.040)
	pdep3	0.913*** (0.022)
	pdep4	0.956*** (0.018)
Place identity		
	pid1	0.958*** (0.013)
	pid2	0.949*** (0.018)
	pid3	0.947*** (0.016)
	pid4	0.936*** (0.018)
	pid5	0.961*** (0.012)
	pid6	0.959*** (0.013)
PA		
	Place dependency	0.982*** (0.044)
	Place identity	0.888*** (0.044)

Notes: $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. p-Values are given in brackets. RMSEA = root mean square error of approximation = 0.021; CFI = comparative fit index = 0.974; TLI = Tucker-Lewis index = 0.987; SRMR = standardized root mean square residual = 0.025; Scaled Chi-squared test statistics (p-value) = 129.712 with 114 degrees of freedom (p-value = 0.149).

criteria listed by Hu and Bentler [92] and Hair et al. [85]. The probit structural component shows that PA exerts a sizeable and significant influence on status quo propensity in each choice situation. The standardized coefficient is 0.39. Thus, if PA increases with one standard deviation, the likelihood of choosing this option in all choice scenarios increases by 0.39 standard deviations. We further find a strong and significant (at the 1 % level) correlation (0.29) between the binary variable for systematical status quo choices and the predicted PA score (from Table 4) as a robustness check. Higher age and income, recreational use, and longer distance increase the likelihood of systematically choosing the status quo option. We can also see that the explanatory variables in the structural model of PA are significant, as in Table 4. The results in Table 6 only assess how PA affects the likelihood of always choosing the status quo option, i.e., resistance, not protest responses per se. Moreover, as only 34 respondents were identified as protesters in the DCE, it is statistically difficult to assess whether PA is associated with protesting. However, we find a small and insignificant correlation (0.01) between a binary variable for protesting and the predicted PA score from Table 4.

5. Discussion and conclusion

The literature on public perceptions of renewable energy projects has focused chiefly on factors influencing attitudes toward proposed wind energy projects. Generally, socioeconomic impacts are important for wind energy resistance. If economic aspects (e.g., property prices, tourism) are perceived negatively, and the distribution of the costs and benefits are perceived as unfair, resistance will generally be large [33]. Benefits must stay local to ensure local acceptance of wind energy projects. Including socioeconomic impacts, place-based concepts are increasingly recognized as a factor shaping resistance. In the literature, as discussed in Section 2.2, there is a widespread agreement that PA tends to be disrupted by wind energy projects, spurring resistance [56,58]. However, a few studies, including Devine-Wright [70], find the opposite, to wit, that new renewable energy projects enhance PA.

There is increasing research using DCE to elicit people's acceptance of wind energy [7,11]. This value-based approach forces respondents to make tradeoffs between attributes of wind energy projects, enhancing knowledge of how people value wind energy features. However, the literature has largely neglected integrating place-based concepts within a value-based framework to explain wind energy resistance and preferences. In this paper, we presented a conceptual framework where PA was defined within the CES category, contributing to enhancing the use value of CES in transitioning from a landscape to a place. The conceptual framework further integrated the value of CES and PA to rationalize place-specific resistance, expanding the literature's understanding of why some people oppose proposed wind energy sites.

Our conceptual framework suggested that PA and nonmarket environmental values should be incorporated into the management and appraisal of renewable energy developments. Measuring people's PA to areas affected by proposed renewable energy projects and valuing the implied environmental impacts can result in more efficient environmental policy and management decisions. First, it is helpful to understand why conflicts and resistance emerge [64]. Second, the decision-makers are reminded of the involvement of the public in places, facilitating communication between policymakers, energy developers, and the community [12]. In turn, researchers and decision-makers better understand the distributional implications and equity considerations. Third, a fuller picture of the meaning of places (especially natural areas) is achieved, as traditional economic, emotional, symbolic, and spiritual values are emphasized. Fourth, recognizing that PA has a value in ecosystem management will ensure that people can experience all sense of place dimensions, which can promote environmental conservation [64].

From the conceptual framework, we derived hypotheses tested on collected DCE data of a proposed site-specific wind farm to value the implied landscape changes. We generally find negative preferences for wind energy attributes and strong resistance, which could be explained by distributional impacts [33]. However, by incorporating PA in a mixed logit model, we found that people with stronger PA require higher compensation in the form of reduced annual municipal taxes for more extensive wind energy scenarios. This finding is consistent with **H1**. People with higher levels of place dependency to Setskog engage in outdoor recreational activities in Setskog because the area provides more of the amenities necessary for their desired activities than other places. With a wind farm installed in Setskog's natural areas, the recreational functionality and the environmental amenities will be negatively affected. Thus, the inhabitants' place dependency and PA will be disrupted. Likewise, a new wind energy development might feel alien and weaken the local character [22], threatening the inhabitants' place identity and attachment. This finding implies a higher economic cost, increasing the WTA estimates.

We further hypothesized that PA drives the decision to systematically choose the status quo option describing "no construction of the proposed wind farm" in our DCE. The results do indeed support **H2**. We find that PA shapes resistance. Implicitly, using a different methodological approach, our findings confirm what other studies have found. However, the results indicate that PA as a concept for shaping oppositional behavior should be nuanced. The so-called oppositional behavior and resistance could be explained by the fact that the attachment makes people value the impacted areas and their provided CES more. Hence, consistent with our conceptual framework, resistance channeled by PA could be seen as an understandable and rational reason for opposing the disruption of natural areas. In this case, the potential loss of values is too high to accept any new energy development.

While a large share of our sample systematically chose the status quo option, only a modest share was identified as protesters. As wind energy projects tend to disrupt people's PA, which spurs resistance and opposition, one might expect stronger PA to increase protest responses in DCEs. However, we could not find evidence of such an effect. Our results indicated that PA drived SQ choices from real preferences for use values, strengthening the argument that PA can be seen as an understandable and rational reason for opposing renewable energy projects. To mitigate SQ choices among people with strong PA, one must seemingly provide even higher compensations in the DCE scenarios because they also value their PA. However, more research is warranted on integrating PA in DCEs on actual proposed wind energy projects to evaluate the extent to which our conceptual framework and results are generalizable.

Relatedly, while we used a WTA format to enhance consequentiality, we still think our reasoning would hold for a WTP to avoid design, where respondents pay for less environmental impact with a status quo defined as a worst-case scenario. Given that the respondents in such a situation accept the implied property rights, PA is expected to reduce the likelihood of choosing the status quo option and increase WTP to avoid wind energy and PA impacts. Consistently, Faccioli et al. [34] find that place identity increases WTP for peatland conservation and reduces the likelihood of choosing the status quo option, defined as a worst-case scenario. However, for real, site-specific, and proposed local projects such as ours, the WTP to avoid format is more likely to be perceived as confounding due to the wrongful specification of implied property rights. Consequently, respondents are generally more likely to protest the presented scenarios and less likely to make reliable choices. How this is affected by PA requires more research.

A limitation of our study is that we have only evaluated the impact of PA in the experiment. Thus, we encourage future wind energy-related DCE research to integrate other place-based concepts with value-based approaches. Such explorations would contribute to evaluating whether our findings are generalizable to other settings, e.g., a comparison across cultures, and improve the literature's understanding of why some people resist place-specific energy projects. An interesting alternative place-based theory is *climax thinking*, referring to a state where individuals perceive their surrounding environments as ideal, which could influence wind energy resistance [23]. Future research could examine PA and climax thinking in a value-based framework. Future research could also look at the linkages between PA, substitute sites [97], and preferences for wind energy. Finally, future economic research could explore the added value of including latent psychological constructs to assess preference heterogeneity against standard economic variables.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary material

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References

[1] IEA, World Energy Outlook, OECD Publishing, Paris, 2021.
[2] A. Zerrahn, Wind power and externalities, Ecol. Econ. 141 (2017) 245–260.
[3] MEA, Ecosystems And Human Well-being: Synthesis, Island, Washington, DC, 2005.
[4] M. Riechers, J. Barkmann, T. Tscharntke, Perceptions of cultural ecosystem services from urban green, Ecosyst.Serv. 17 (2016) 33–39.
[5] B.S. Zaunbrecher, et al., The social and ecological footprint of renewable power generation plants. Balancing social requirements and ecological impacts in an integrated approach, Energy Res. Soc. Sci. 45 (2018) 91–106.
[6] P. Hevia-Koch, J. Ladenburg, Where should wind energy be located? A review of preferences and visualisation approaches for wind turbine locations, Energy Res. Soc. Sci. 53 (2019) 23–33.
[7] A. Dugstad, et al., Acceptance of wind power development and exposure–not-in-anybody's-backyard, Energy Policy 147 (2020), 111780.
[8] J. Meyerhoff, C. Ohl, V. Hartje, Landscape externalities from onshore wind power, Energy Policy 38 (1) (2010) 82–92.
[9] N. Brennan, T.M. Van Rensburg, Wind farm externalities and public preferences for community consultation in Ireland: a discrete choice experiments approach, Energy Policy 94 (2016) 355–365.
[10] A. Dimitropoulos, A. Kontoleon, Assessing the determinants of local acceptability of wind-farm investment: a choice experiment in the Greek Aegean Islands, Energy Policy 37 (5) (2009) 1842–1854.
[11] K. Linnerud, A. Dugstad, B.J. Rygg, Do people prefer offshore to onshore wind energy? The role of ownership and intended use, Renew. Sust. Energ. Rev. 168 (2022), 112732.
[12] H.S. Boudet, Public perceptions of and responses to new energy technologies, at. Energy 4 (6) (2019) 446–455.
[13] P. Enevoldsen, B.K. Sovacool, Examining the social acceptance of wind energy: practical guidelines for onshore wind project development in France, Renew. Sust. Energ. Rev. 53 (2016) 178–184.
[14] B.K. Sovacool, P.L. Ratan, Conceptualizing the acceptance of wind and solar electricity, Renew. Sust. Energ. Rev. 16 (7) (2012) 5268–5279.
[15] M. Wolsink, Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support, Renew. Energy 21 (1) (2000) 49–64.
[16] C.R. Warren, et al., 'Green on green': public perceptions of wind power in Scotland and Ireland, J. Environ. Plan. Manag. 48 (6) (2005) 853–875.
[17] D.L. Bessette, S.B. Mills, Farmers vs. lakers: agriculture, amenity, and community in predicting opposition to United States wind energy development, Energy Res. Soc. Sci. 72 (2021), 101873.
[18] S.B. Mills, D. Bessette, H. Smith, Exploring landowners' post-construction changes in perceptions of wind energy in Michigan, Land Use Policy 82 (2019) 754–762.
[19] M. Vorkinn, H. Riese, Environmental concern in a local context: the significance of place attachment, Environ. Behav. 33 (2) (2001) 249–263.
[20] P. Devine-Wright, Rethinking NIMBYism: the role of place attachment and place identity in explaining place-protective action, J. Community Appl. Soc. Psychol. 19 (6) (2009) 426–441.
[21] P. Devine-Wright, Y. Howes, Disruption to place attachment and the protection of restorative environments: a wind energy case study, J. Environ. Psychol. 30 (3) (2010) 271–280.
[22] P. Devine-Wright, Explaining "NIMBY" objections to a power line: the role of personal, place attachment and project-related factors, Environ. Behav. 45 (6) (2013) 761–781.
[23] E.N. Chappell, J.R. Parkins, K. Sherren, Climax thinking, place attachment, and utilitarian landscapes: implications for wind energy development, Landsc. Urban Plan. 199 (2020), 103802.
[24] D. Bidwell, The role of values in public beliefs and attitudes towards commercial wind energy, Energy Policy 58 (2013) 189–199.
[25] M.T. Brownlee, et al., Place attachment and marine recreationists' attitudes toward offshore wind energy development, J. Leis. Res. 47 (2) (2015) 263–284.
[26] S.B. Gonyo, et al., Resident perceptions of local offshore wind energy development: modeling efforts to improve participatory processes, Energy Policy 149 (2021), 112068.
[27] Y.-F. Tuan, Space And Place: The Perspective of Experience, U of Minnesota Press, 1977.
[28] S.M. Low, I. Altman, Place attachment, in: Place Attachment, Springer, 1992, pp. 1–12.
[29] R.C. Stedman, Is it really just a social construction?: the contribution of the physical environment to sense of place, Soc. Nat. Resour. 16 (8) (2003) 671–685.
[30] V.A. Masterson, et al., The contribution of sense of place to social-ecological systems research: a review and research agenda, Ecol. Soc. 22 (1) (2017).
[31] K. Sherren, et al., Does noticing energy infrastructure influence public support for energy development? Evidence from a national survey in Canada, Energy Res. Soc. Sci. 51 (2019) 176–186.
[32] M. Wolsink, Social acceptance revisited: gaps, questionable trends, and an auspicious perspective, Energy Res. Soc. Sci. 46 (2018) 287–295.
[33] J. Rand, B. Hoen, Thirty years of North American wind energy acceptance research: what have we learned? Energy Res. Soc. Sci. 29 (2017) 135–148.
[34] M. Faccioli, et al., Environmental attitudes and place identity as determinants of preferences for ecosystem services, Ecol. Econ. 174 (2020), 106600.

[35] K. Gee, B. Burkhard, Cultural ecosystem services in the context of offshore wind farming: a case study from the west coast of Schleswig-Holstein, Ecol. Complex. 7 (3) (2010) 349–358.
[36] T.C. Daniel, et al., Contributions of cultural services to the ecosystem services agenda, Proc. Natl. Acad. Sci. 109 (23) (2012) 8812–8819.
[37] A. Hausmann, et al., The ecosystem service of sense of place: benefits for human well-being and biodiversity conservation, Environ. Conserv. 43 (2) (2016) 117–127.
[38] F. Ryfield, et al., Conceptualizing 'sense of place'in cultural ecosystem services: a framework for interdisciplinary research, Ecosyst.Serv. 36 (2019), 100907.
[39] G.A. Akerlof, R.E. Kranton, Economics and identity, Q. J. Econ. 115 (3) (2000) 715–753.
[40] J. Ladenburg, M. Skotte, Heterogeneity in willingness to pay for the location of offshore wind power development: an application of the willingness to pay space model, Energy 241 (2022), 122900.
[41] E. Relph, Place And Placelessness, Vol. 67, Pion London, 1976.
[42] B.B. Brown, D.D. Perkins, Disruptions in place attachment, in: Place Attachment, Springer, 1992, pp. 279–304.
[43] J.J. Vaske, K.C. Kobrin, Place attachment and environmentally responsible behavior, J. Environ. Educ. 32 (4) (2001) 16–21.
[44] D. Stokols, People in places: a transactional view of settings, in: Cognition, Social Behavior, And the Environment, 1981, pp. 441–488.
[45] H.M. Proshansky, The city and self-identity, Environ. Behav. 10 (2) (1978) 147–169.
[46] R.C. Stedman, Toward a social psychology of place: predicting behavior from place-based cognitions, attitude, and identity, Environ. Behav. 34 (5) (2002) 561–581.
[47] D.R. Williams, J.W. Roggenbuck, Measuring place attachment: some preliminary results, in: NRPA Symposium on Leisure Research, San Antonio, TX, 1989.
[48] L.S. Giordono, et al., Opposition "overblown"? Community response to wind energy siting in the Western United States, Energy Res. Soc. Sci. 43 (2018) 119–131.
[49] M. Dear, Understanding and overcoming the NIMBY syndrome, J. Am. Plan. Assoc. 58 (3) (1992) 288–300.
[50] C. Zanocco, et al., NIMBY, YIMBY, or something else? Geographies of public perceptions of shale gas development in the Marcellus Shale, Environ. Res. Lett. 15 (7) (2020), 074039.
[51] H. Boudet, et al., "Fracking" controversy and communication: using national survey data to understand public perceptions of hydraulic fracturing, Energy Policy 65 (2014) 57–67.
[52] A. Uji, A. Prakash, J. Song, Does the "NIMBY syndrome" undermine public support for nuclear power in Japan? Energy Policy 148 (2021), 111944.
[53] H. Boudet, Getting closer, Nat. Energy 6 (10) (2021) 945–946.
[54] R.C. Sayan, Exploring place-based approaches and energy justice: ecology, social movements, and hydropower in Turkey, Energy Res. Soc. Sci. 57 (2019), 101234.
[55] P. Devine-Wright, Decarbonisation of industrial clusters: a place-based research agenda, Energy Res. Soc. Sci. 91 (2022), 102725.
[56] S. Batel, Research on the social acceptance of renewable energy technologies: past, present and future, Energy Res. Soc. Sci. 68 (2020), 101544.
[57] T. Smythe, et al., Beyond the beach: tradeoffs in tourism and recreation at the first offshore wind farm in the United States, Energy Res. Soc. Sci. 70 (2020), 101726.
[58] J.B. Jacquet, R.C. Stedman, The risk of social-psychological disruption as an impact of energy development and environmental change, J. Environ. Plan. Manag. 57 (9) (2014) 1285–1304.
[59] C.S. Fleming, et al., Engaged minority or quiet majority? Social intentions and actions related to offshore wind energy development in the United States, Energy Res. Soc. Sci. 84 (2022), 102440.
[60] R.S. De Groot, et al., Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making, Ecol. Complex. 7 (3) (2010) 260–272.
[61] R.L. Moore, A.R. Graefe, Attachments to recreation settings: the case of rail-trail users, Leis. Sci. 16 (1) (1994) 17–31.
[62] B.W. Eisenhauer, R.S. Krannich, D.J. Blahna, Attachments to special places on public lands: an analysis of activities, reason for attachments, and community connections, Soc. Nat. Resour. 13 (5) (2000) 421–441.
[63] G. Hailu, P.C. Boxall, B.L. McFarlane, The influence of place attachment on recreation demand, J. Econ. Psychol. 26 (4) (2005) 581–598.
[64] D.R. Williams, et al., Beyond the commodity metaphor: examining emotional and symbolic attachment to place, Leis. Sci. 14 (1) (1992) 29–46.
[65] N. Cass, G. Walker, Emotion and rationality: the characterisation and evaluation of opposition to renewable energy projects, Emot. Space Soc. 2 (1) (2009) 62–69.
[66] D. Clarke, C. Murphy, I. Lorenzoni, Place attachment, disruption and transformative adaptation, J. Environ. Psychol. 55 (2018) 81–89.
[67] D. Hoyos, P. Mariel, J. Fernández-Macho, The influence of cultural identity on the WTP to protect natural resources: some empirical evidence, Ecol. Econ. 68 (8–9) (2009) 2372–2381.
[68] N. López-Mosquera, M. Sánchez, Direct and indirect effects of received benefits and place attachment in willingness to pay and loyalty in suburban natural areas, J. Environ. Psychol. 34 (2013) 27–35.
[69] E.K. Iversen, A. Dugstad, Spatial dimensions in stated preference: the role of place attachment, in: Valuing Ecosystem Services to Inform Land Use Policies in Norway - Methodological Issues And Applications of Stated Preference Methods, Norwegian University of Life Sciences, Ås, 2023.
[70] P. Devine-Wright, Place attachment and public acceptance of renewable energy: a tidal energy case study, J. Environ. Psychol. 31 (4) (2011) 336–343.
[71] H. Lindhjem, et al., Medvind for landbasert vindkraft? Eller stille før (ny) storm? Vi har tatt tempen på folks preferanser for videre utbygging, Samfunnsøkonomene 5 (2022) 48–61.
[72] M. Mattmann, I. Logar, R. Brouwer, Wind power externalities: a meta-analysis, Ecol. Econ. 127 (2016) 23–36.
[73] G. Kipperberg, et al., The impact of wind turbines on local recreation: evidence from two travel cost method–contingent behavior studies, J. Outdoor Recreat. Tour. 25 (2019) 66–75.
[74] R.J. Johnston, et al., Contemporary guidance for stated preference studies, J. Assoc. Environ. Resour. Econ. 4 (2) (2017) 319–405.
[75] P. Mariel, et al., Environmental Valuation With Discrete Choice Experiment: Guidance on Design, Implementation And Data Analysis, Springer, 2021.
[76] H. Ramkissoon, L.D.G. Smith, B. Weiler, Testing the dimensionality of place attachment and its relationships with place satisfaction and pro-environmental behaviours: a structural equation modelling approach, Tour. Manag. 36 (2013) 552–566.
[77] D. Hoyos, The state of the art of environmental valuation with discrete choice experiments, Ecol. Econ. 69 (8) (2010) 1595–1603.
[78] I. Mokas, et al., Can immersive virtual reality increase respondents' certainty in discrete choice experiments? A comparison with traditional presentation formats, J. Environ. Econ. Manag. 109 (2021), 102509.
[79] J.H. García, et al., Willingness to accept local wind energy development: does the compensation mechanism matter? Energy Policy 99 (2016) 165–173.
[80] K. Grimsrud, et al., Efficient spatial distribution of wind power plants given environmental externalities due to turbines and grids, Energy Econ. 102 (2021), 105487.
[81] S. Navrud, et al., Valuing the social benefits of avoiding landscape degradation from overhead power transmission lines: do underground cables pass the benefit–cost test? Landsc. Res. 33 (3) (2008) 281–296.
[82] ChoiceMetrics, Ngene 1.2 user manual & reference guide, Available from, http://www.choice-metrics.com/NgeneManual120.pdf, 2018.
[83] R. Scarpa, J.M. Rose, Design efficiency for non-market valuation with choice modelling: how to measure it, what to report and why, Aust. J. Agric. Resour. Econ. 52 (3) (2008) 253–282.
[84] J.C. Anderson, D.W. Gerbing, Structural equation modeling in practice: a review and recommended two-step approach, Psychol. Bull. 103 (3) (1988) 411.
[85] J. Hair, , W.B., R. Anderson, Multivariate Data Analysis, Eight edition, EMEA: Cengage Leaning, 2019.
[86] Y. Rossel, Lavaan: na R package for structural equation modeling, J.Stat.Sofw. 48 (2) (2012) 1–36.
[87] K. Train, M. Weeks, Discrete choice models in preference space and willingness-to-pay space, in: Applications of Simulation Methods in Environmental And Resource Economics, Springer, 2005, pp. 1–16.
[88] M. Czajkowski, W. Budziński, Simulation error in maximum likelihood estimation of discrete choice models, J.Choice Model. 31 (2019) 73–85.
[89] M. Ben-Akiva, et al., Process and context in choice models, Mark. Lett. 23 (2) (2012) 439–456.
[90] M. Ben-Akiva, et al., Hybrid choice models: progress and challenges, Mark. Lett. 13 (3) (2002) 163–175.
[91] P. Mariel, J. Meyerhoff, Hybrid discrete choice models: gained insights versus increasing effort, Sci. Total Environ. 568 (2016) 433–443.
[92] L.t. Hu, P.M. Bentler, Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives, Struct. Equ. Model. 6 (1) (1999) 1–55.
[93] R.P. Bagozzi, Y. Yi, Specification, evaluation, and interpretation of structural equation models, J. Acad. Mark. Sci. 40 (1) (2012) 8–34.
[94] S. Hess, D. Palma, Apollo: a flexible, powerful and customisable freeware package for choice model estimation and application, J.Choice Model. 32 (2019), 100170.
[95] J. Meyerhoff, U. Liebe, Status quo effect in choice experiments: empirical evidence on attitudes and choice task complexity, Land Econ. 85 (3) (2009) 515–528.
[96] A. Dugstad, et al., Scope elasticity of willingness to pay in discrete choice experiments, Environ. Resour. Econ. 80 (1) (2021) 21–57.
[97] I. Logar, R. Brouwer, Substitution effects and spatial preference heterogeneity in single-and multiple-site choice experiments, Land Econ. 94 (2) (2018) 302–322.