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JEL codes: Q51, D6, D91, Q20

Environmental attitudes and place identity as simultaneous determinants of preferences for environmental goods

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Abstract: Economic valuation is frequently employed to provide evidence of people's preferences for environmental goods. However, it is also often criticised for providing a simplified representation of preferences, with many factors that affect value formation not accounted for. This is the case of environmental attitudes and especially place identity perceptions, which have been largely overlooked in economic valuation, despite representing amongst the most important drivers of people's behaviour towards the environment, according to the environmental psychology and sociology literature. To address this gap, we designed and conducted a choice experiment where we explored the simultaneous role of environmental attitudes and place identity perceptions on willingness to pay (WTP), taking peatland restoration in Scotland as a case study. This study adds to the existing literature in that no valuation study to date has simultaneously integrated both aspects in preference modelling. Given that both factors are potentially strong drivers of preferences, focusing only on one or the other provides a partial picture of the determinants of WTP. Moreover, we do not just look at 'generic' environmental attitudes, but also at 'specific' environmental attitudes. Our results, estimated through a novel and econometrically robust approach based on the hybrid choice model, show that people with more positive environmental attitudes and those who feel attached to Scotland and think that peatlands are an important part of Scotland's identity and landscape tend to display higher WTP. These findings are important to provide a richer understanding of the determinants of preferences for environmental goods. Our results also open up new insights to the discipline in relation to the spatial heterogeneity of preferences: we have shown that people do not only relate with the space around them by focusing on the distance to the improvement site, as most frequently postulated in valuation studies. The idea that place can be understood as a space with emotional and cultural meanings also plays a critical role in shaping preferences. All these are critical elements to better inform policy-makers in the design of more socially acceptable and effective environmental policies.

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1. Introduction

The popularization of ecosystem services as the way to conceptualize the relationships betweens humans and nature over the past decade following the Millenium Ecosystem Assessment (2005), has reinvigorated the interst in environmental valuation (Martin-Ortega et al. 2015). Policy efforts are required to counter the degradation of ecosystems and the services they provide. However, policy action necessarily implies trade-offs between competing objectives. Although these trade-offs do not necessarily need to be expressed in monetary terms, budgetary limitations often require that the economic case for investments into environmental conservation and management are based on reliable monetary estimates of the value that society places on changes in ecosystem service provision (Costanza et al. 2017). Since many ecosystem services are not traded in markets and surrogate markets to infer their value are often absent, there is a continued need for applying non-market valuation methods and, in particular, stated preference techniques (Hanley and Czajkowski 2017).

Despite the long tradition of the economic valuation of the environment and ecosystem services, this approach is often critized for its simplified representation of human preferences, which often fails to account for the complex way in which some values are constructed (Costanza et al. 2017). The shaping of preferences can be affected by the dynamics and interactions taking place in a given social setting, as well as by the psychological processes occurring at individual level, influencing the way in which reality is perceived and valued. For this reason, there has been an ongoing, but still very limited, interest in identifying and investigating sources of preference heterogeneity, such as those that are related to incidental emotions (Boyce *et al.* 2017), personality traits (Czajkowski, Boyce and Hanley 2017), social norms and morals (Czajkowski, Hanley and Nyborg 2017), prior knowledge (e.g., Aanesen *et al.*, 2015), experience (e.g., Czajkowski, Hanley and LaRiviere 2014), information (e.g., LaRiviere *et al.* 2014; Czajkowski, Hanley and LaRiviere 2016; Czajkowski *et al.* 2016), risk and uncertainty perception (e.g., Hunter *et al.* 2012; Bartczak *et al.* 2017) and others. This paper contributes to this still scarce body of literature by focusing on the relationships between environmental attitudes and place identity beliefs and preferences for environmental improvements.

Although both environmental attitudes and identity beliefs are recognized in the environmental psychology and sociology literature to be among the most important factors explaining people's support for environmental conservation (Stets and Biga 2003; Fielding et al. 2008; Gatersleben et al. 2014), they have thus far received only limited attention in the environmental valuation literature. A positive environmental attitude - defined as the tendency to evaluate the environment with some degree of favour (Milfont and Duckitt 2010), based on the awareness that nature is suffering from excessive human-induced pressures and requires protection - is often found to increase the likelihood of pro-environmental behavior. Considering willingness-to-pay (WTP) as a behavioural intention, it can therefore be expected that stronger environmental attitudes lead to a higher WTP for the environment.[1] Similarly, identity beliefs and, in particular, place identity[2], understood as perceiving oneself or a public good to be attached to, and identified with, a given geographical and cultural context, have been found to correlate with the willingness to support environmental conservation (Lewicka 2011). Based on this, it is to expect that if people feel attached to a place, defined not only as a space with geographical and distance boundaries but also with emotional and cultural meanings, this influences preferences for environmental projects and policies.

Few valuation studies have explored the effect of environmental attitudes on WTP (Kotchen and Reiling 2000; Cooper et al. 2004; Aldrich et al. 2007; Bartczak 2015) and even fewer studies have considered the role of a person's identification with a place or with local culture in shaping environmental preferences (Hoyos et al. 2009; Andersen et al. 2012). As described in the following section, these studies have never simultaneously considered both aspects in the

[1] It is important to clarify that attitudes and preferences/WTP are not the same. The existence of an evaluative position towards something is a necessary but not sufficient condition for preferences, in that preferences can depend upon people's attitudes towards a given situation, but additionally they also reflect information about the trade-offs that people are willing to make (Meldrum 2015).

[2] We employ the term 'place identity' because it seems to be a well established concept in the environmental psychology literature. However, we also acknowledge that different terms are generally used to refer to the identification with a place (e.g., 'place identity', 'place attachment', 'sense of place', etc.) and there is no agreement on whether these terms define equivalent or different constructs (Lewicka 2011; Rollero and De Piccoli 2010).

modelling framework, despite this can be important to provide a richer picture of the determinants of preferences for environmental goods (Carrus et al. 2005; Prati et al. 2015). Furthermore, most studies assume that attitudes and identity beliefs can be directly measured. However, they are actually unobservable and can only be approximated through some indicators. Ignoring the associated measurement error can lead to biased results (Budziński and Czajkowski 2017).

Using a choice experiment on preferences for peatland restoration in Scotland as a case study, this paper aims to shed light on the role of both environmental attitudes and place identity beliefs as simultaneous determinants of WTP for ecosystems services. We do this by analysing the significance, magnitude and relative importance of the effect of both factors on WTP. To carry out our analysis we rely on a flexible but theoretically robust econometric approach (hybrid mixed logit (HMXL) model) (e.g., Hess and Beharry-Borg 2012; Czajkowski, Hanley and Nyborg 2017; Czajkowski *et al.* 2017), which addresses some important shortcomings of previous research in this area, for example with respect to measurement error. Our study contributes to providing a richer understanding of the determinants of preferences for environmental goods (Carrus et al. 2005; Prati et al. 2015). This is expected to be helpful for policy-makers, providing them with a more nuanced picture of the factors that can enhance or diminish support for environmental conservation, thus improving the information base for decision-makers to design more effective and socially acceptable conservation policies (Gatersleben et al. 2014).

2. Literature review

2.1. Role of environmental attitudes and place identity on pro-environmental behaviour

In environmental sociology, the attitudes that people have towards the environment have attracted much attention in the study of pro-environmental behaviour. According to the Theory of Reasoned Action (Ajzen and Fishbein 1980), attitudes drive people's intentions to engage in given behaviours, such that the likelihood for people to take action in favour of environmental conservation tends to be higher when people believe that natural resources are under excessive human pressures and require protection. This was found to be true especially when 'specific' rather than 'general' environmental attitudes are considered (Ajzen 1996; Carrus et al. 2005), with the former referring to people's views about a particular good or behaviour in a given context (e.g. specific measures to protect the environment) and the latter referring to individuals' beliefs about nature more broadly. Despite this, researchers have tended to focus more on 'general' rather than 'specific' attitudes, due to the fact that specific attitudes are situation-dependent, such that findings from different case studies are more difficult to compare when specific rather than general attitudes are considered (Kaiser et al. 1999). In line with this, since the 1970s, researchers have worked on the development of psychometric scales, the most well-known of which being the New Ecological Paradigm (NEP) (Dunlap et al. 2000), consisting of 15 statements that measure general environmental attitudes.

One of the major criticisms of the environmental attitude-behaviour model has been the lack of consideration of identity-related aspects (van der Werff et al. 2013) and, in particular, place identity, which is often recognized to be an important factor in explaining individuals' environmental behaviour (Hernàndez et al. 2010; Lewicka 2011). In some cases, stronger identification and attachment with a place has been found to increase willingness to engage in activities to protect the local environment (Bonaiuto et al. 2002). In other cases, stronger emotional bonds with a place have been found to be negatively associated with support for environmental protection, especially when conservation implies limiting local economic activities upon which respondents' livelihood strongly depends (Vorkinn and Riese 2001). Aware of the criticism to the environmental attitude-behaviour model, a small but increasing number of researchers have integrated identity-related aspects into the model framework. Within the behavioural science literature, Carrus et al. (2005) and Gatersleben et al. (2014) have shown that environmental attitudes and identity are positively related to people's support for environmental conservation and together help improving the understanding of pro-environmental behavior.

2.2. Non-market valuation literature

Within the stated preferences valuation literature, environmental attitudes[3] and especially place identity beliefs have only received scarce attention. Some stated preference studies, mainly using the contingent valuation method, have focused on the effect of general environmental attitudes on preferences, following the NOAA panel guidelines (Arrow et al. 1993). Among these studies, Kotchen and Reiling (2000) analysed the link between individuals' environmental attitudes – classified as weak, moderate or strong based on responses to the NEP statements – and preferences for the protection of endangered bird species. Cooper et al. (2004) explored the effect of environmental attitudes, measured through the NEP scale, on WTP for water quality improvements. Spash (2006) analysed the relationship between environmental attitudes, measured through the awareness of consequences scale (a less popular alternative to the NEP), and WTP for wetland restoration. Meyerhoff (2006), in his study on the effect of attitudes on WTP for riverbank restoration, distinguished between: i) general environmental attitudes, ii) specific attitudes towards riverbank restoration and iii) attitudes towards paying to preserve the environment. Ojea and Loureiro (2007) explored the effect of general environmental attitudes (measured through the awareness of consequences scale) on WTP for species preservation. Aldrich et al. (2007) studied how WTP for the protection of endangered species is affected by environmental attitudes classified as strong, moderate or weak, based on a cluster and latent class analysis of responses to NEP statements. More recently, López-Mosquera and Sánchez (2012) analysed the role of NEP on WTP for the preservation of a suburban park. Meldrum (2015) compared the role on WTP of general environmental attitudes and more specific attitudes towards invasive species in a study focusing on preferences for forest pest control measures. Halkos and Matsiori (2017) investigated the effect of NEP on preferences for marine biodiversity protection.

The literature on the role of general environmental attitudes on WTP using choice experiments (CE) is more scarce. Milon and Scrogin (2006) explored the role of responses to attitudinal questions (including the NEP scale and other statements measuring specific attitudes towards water scarcity) as determinants of latent class membership probability in a study of preferences for wetland restoration. Choi and Fielding (2013) analysed the relationship between WTP for endangered species and environmental attitudes (weak, moderate and strong), again using the NEP questions. Bartczak (2015) explored the effect of environmental attitudes, measured through a sub-group of the NEP statements, on people's preferences for forest management strategies. A similar example is Hoyos et al. (2015), who designed a CE to investigate the effect of environmental attitudes, measured through the awareness of consequences scale, on people's preferences for land-use policies. More recently, Agimass et al. (2017) studied the effect of environmental attitudes, measured through a reduced version of the NEP, on preferences for forest characteristics.

In some cases, SP researchers have focused on the role of specific rather than general environmental attitudes. For example, Pouta and Rekola (2001), using a contingent valuation study, analyse the influence of specific attitudes towards forest regeneration on WTP. Spash et al. (2009) explored the relationship between specific attitudes towards biodiversity restoration and WTP for catchment improvements.

The results of the above mentioned studies show that WTP generally increases with a more positive environmental attitude. Different conclusions were drawn in only few cases (i.e. Cooper et al. 2004; Milon and Scrogin 2006; López-Mosquera and Sánchez 2012; Halkos and Matsiori 2017), where environmental attitudes were not found to be strong determinants of WTP.

[3] In stated preference studies, it is common to collect information about people's beliefs and attitudes towards the topic of the survey through 'warm up' questions or as debriefing after the valuation exercise, even though this information is rarely incorporated in the econometric model to explain preferences (Morey et al. 2006). Often, to try to capture information about environmental attitudes, researchers ask questions about membership to environmental groups or about lifestyle choices (e.g. recycling habits), but it is questionable whether these actually reflect environmental attitudes or something else (Spash et al. 2009). Relatively few valuation studies have environmental attitudes as one of the main focuses of their work and these are the studies considered in this review.

Only few stated preferences studies so far have addressed identity-related aspects. Hoyos et al. (2009) used a CE to explore the link between respondents' WTP to protect natural resources and people's bonds with local culture, which was measured in terms of self-identification of the respondent with the culture in the Basque country (Spain). Also using a CE, Andersen et al. (2012) explored how WTP for water management in the Waikato Region (New Zealand) is driven by strong bonds with the Maori traditions and connection to nature. Dallimer et al. (2013) relied on a CE to explore WTP for biodiversity conservation in urban green spaces in the UK and additionally collected self-reported information about attachment to the place and personal identity. López-Mosquera and Sánchez (2013) analysed the role of place identity and bonds on respondents' WTP for conservation of suburban natural areas in Spain. Nielsen-Pincus et al. (2017) used a contingent valuation exercise to explore the role of place identity and attachment on WTP for watershed services in Oregon (USA). The studies show divergent results. In Hoyos et al. (2009), Dallimer et al. (2013) and Nielsen-Pincus et al. (2017), stronger place identity and attachment was found to increase WTP, while in Andersen et al. (2012) and López-Mosquera and Sánchez (2013)cultural identity and connectedness with nature were not always found to be correlated with preferences for the environmental attributes.

The existing evidence can be extended in several ways. Firstly, the above-mentioned studies have focused either on the effect of environmental attitudes or, to a lesser extent, on the effect of place identity on preferences. No valuation study to date has simultaneously integrated both aspects in preference modelling. Given that both factors are potentially strong drivers of preferences, focusing only on one or the other provides a partial picture of the determinants of WTP. Gathering information on the significance, magnitude and relative importance of both aspects can provide a more nuanced understanding. In addition, the reviewed studies have focused either on general or specific environmental attitudes, with only very few cases (Meyerhoff 2006; Milon and Scrogin 2006; Meldrum 2015) considering both and concluding that the incorporation of general and specific attitudes might be helpful. Secondly, the approach typically adopted by most of the reviewed studies relies on direct inclusion of responses to attitudinal questions as explanatory variables in the model. This approach does not account for the fact that the responses to attitudinal questions only approximate underlying latent variables (Kotchen and Reiling 2000; Cooper et al. 2004; Milon and Scrogin 2006; Hoyos et al. 2009; Andersen et al. 2012; Choi and Fielding 2013; Bartczak 2015). Even though some of the reviewed studies (e.g. Spash 2006; Meyerhoff 2006; Aldrich et al. 2007) have tried to overcome this problem by identifying latent constructs, typically by utilizing factor analysis, such a two-step approach is though not statistically efficient, as the identified factors are not necessarily the ones that provide the most explanatory power in the discrete choice component of the model (Pakalniete *et al.* 2017). All these limitations can be associated with a number of problems leading to inaccurate or biased results.

3. Methodology

The present study aims to address the limitations of earlier research by simultaneously exploring the role of environmental attitudes and place identity beliefs on WTP, while relying on an appropriate econometric framework: a hybrid choice model. For the purposes of our study, we look at stated preferences of people for peatland restoration policies in Scotland (UK), starting from respondents' choices of preferred hypothetical peatland restoration programmes presented in a non-market valuation survey (choice experiment). At the same time, we collected respondents' views about selected follow up questions aiming to gather information on individuals' environmental attitudes (general and specific) and place identity-related beliefs.

3.1. Case study

Peatlands cover approximately 20% of Scotland's land area (Bruneau and Johnson 2014). As a result of past human-induced conversion to more productive land uses, such as forestry or agriculture, these ecosystems have suffered a

severe process of degradation (Rotherham 2011). Today, more than two thirds of Scottish peatlands are thought to be damaged (Bain et al. 2011) and this condition compromises their capacity to deliver key ecosystem services, such as water regulation, carbon sequestration and healthy habitat provision for wildlife species. Given that, there is a growing interest among policy-makers in peatland restoration and consequently in the design of socially desirable policies, which requires information on the cost-benefit and acceptability of restoration efforts (Scottish Natural Heritage 2015).

The study of preferences for peatland restoration in Scotland offers a particularly interesting setting to analyse environmental attitudes and place identity for two main reasons. First, available evidence collected in the 2008 survey on Scottish people's environmental attitudes and behaviour (Scottish Government 2009) shows that people's attitude towards the environment and, at the same time, pro-environmental behaviors have been increasing over time. In the study, it is argued that attitudes and behaviours are linked, with the most environmentally engaged respondents being also the ones most likely to have made 'green' lifestyle changes.

Second, the Scottish population generally displays a heightened degree of place identity and, in particular, national identity (Simpson and Smith 2014), which, in the context of our study, is defined as the sense of attachment to Scotland, its traditions, land and people.[4] As part of this strong sense of identification with Scotland and its landscape, Scottish residents also tend to identify peatlands as iconic ecosystems in Scotland (Byg et al. 2015). Peatlands provide many people with a 'sense of place'. Characteristic peatland landscapes can provide local communities with a sense of inspiration and connectedness with their natural environment and with the culture and traditions of the place (Bain et al. 2011; Byg et al. 2017). Because of this, attachment and sense of place are often argued to be explicit benefits of peatlands in Scotland (Scottish Natural Heritage 2015).

3.2. Choice experiment design

The data utilised for this paper come from a CE survey, described in more detail in Glenk and Martin-Ortega (2018). In the CE, a sample of Scottish residents was asked to repeatedly choose their most preferred among a number of alternatives, each described by a different combination of environmental policy attributes. In particular, our CE required making choices between alternative (hypothetical) peatland restoration options by 2030. Each individual was presented with eight choice sets showing three alternatives each. Two alternatives, changing between choice situations, described the outcomes of hypothetical restoration programmes to bring Scottish peatlands' ecological condition to good status. The third alternative, constant across the choice situations, represented a business as usual (BAU) scenario, showing what would occur by 2030 if no additional action is taken.

Each peatland restoration programme was described by five attributes, summmarized in Table 1. Two attributes described the percentage shifts in ecological condition relative to the share of peatlands in each condition in a BAU scenario. We considered three ecological conditions: bad, intermediate and good. Given the lack of observed data on peatland extent and condition, we carried out a focus group with Scottish peatland experts, where 30% of peatlands were perceived to be in bad ecological condition (40% in the BAU case by 2030); 40% in intermediate (40% in the BAU case by 2030) and 30% in good ecological condition (20% in the BAU case by 2030). Up to 75% of the baseline condition in intermediate and bad condition could be shifted to good ecological condition. Improvements in peatland condition are associated with an increase in ecosystem service provision related to climate change mitigation (carbon storage),

[4] A strong sense of national identity in Scotland finds its roots in the Middle Age, when Scotland and England were divided but constantly in conflict due to England's ambition to rule over an independent Scotland, which has contributed to strengthen Scotland's sense of belonging and strive for autonomy. Based on the Census data (2011), 62.43% of all residents in Scotland today declare to have only a Scottish identity, with this figure constantly raising over the past two decades at the expense of British, English or any other UK identity. This sense of 'Scottishness' culminated with the Independence referendum taking place in 2014 to request devolution from the rest of the UK.

water quality improvement and greater biodiversity. Respondents were provided with a detailed explaination of how changes in ecosystem condition are associated with changes in ecosystem service provision.[5]

Two additional attributes correspond to two spatial criteria aimed at capturing people's preferences with respect to areas where restoration should be prioritized. The criteria emerged to be relevant in preparatory focus groups with the public (see Byg et al. 2017 and Martin-Ortega et al. 2017 for further details). The first criterion describes the degree of peatland concentration in an area and was described in terms of whether restoration would have taken place in areas where peatlands cover more or less than 30% of the land surface (high or low peat concentration). The second spatial criterion was related to the degree of remoteness or accessibility of a peatland and it was operationalized in terms of whether restoration would have taken place in remote and inaccessible areas (wild land areas) or in relatively accessible areas. Maps were created to illustrate the attribute to respondents. The cost attribute was framed as an annual tax paid towards a peatland trust that all residents in Scotland would pay to provide funding for the implementation of the peatland restoration policies.

The alternatives were created by combining different attribute levels by means of a D-efficient Bayesian experimental design optimised for an MNL model using prior estimates of parameters based on a pilot study (N=100). An example of a choice card is presented in Figure 1. The choice experiment was the result of an intensive preparatory work involving several rounds of focus groups and pre-testing with the public, in addition to consultations with peatland specialists (Martin-Ortega et al. 2017).

Figure 1. An example of a choice card

	Business as usual no additional restoration	Restoration Option A	Restoration Option A
Share in GOOD condition 	20%	40%	40%
Share in BAD condition 	40%	40%	20%
Focus in wild land areas	-	Yes	No
Focus in areas that are	-	High in peatlands	Low in peatlands
Cost per year	£0	£50	£75

Table 1. Attributes' description and their levels

[5] Despite the attributes being the percentage shifts in peatlands' conditions, in the choice cards we showed the share of peatlands resulting from each shift and, to simplify the exercise for respondents, we only displayed the share in good and bad condition, pointing out that the remaining percentage up to 100% would be in intermediate state.

Attributes' description	Levels
Improvement of share of peatlands from bad to good ecological condition[a]	0%, 25%, 50%, 75%
Improvement of share of peatlands from intermediate to good ecological condition[a]	0%, 25%, 50%, 75%
Peatland restoration in wild land areas	Yes, No
Peatland restoration in areas with high or low 'concentration' of peatlands	High, Low
Annual cost per household (£)[b]	T1: 10, 15, 30, 45, 90, 150 T2: 10, 25, 50, 75, 150, 250 T3: 10, 40, 80, 120, 240, 400

[a] Shifts are relative to the business as usual shares of peatlands for each ecological condition (bad: 40%; intermediate: 40%; good: 20%)

[b] In the survey, three cost vector treatments (T1, T2, T3) were considered and respondents were randomly assigned to one of them. Investigating differences between these treatment groups of almost equal size is not the focus of this study and will be reported elsewhere, so this study uses the pooled data i.e. includes all three treatments.

3.3. Environmental attitudes and place-identity

In the survey, environmental attitudes were captured in two ways. On the one hand, we focused on respondents' general environmental attitudes, by gathering people's views about each of the 15 statements constituting the revised NEP scale (Dunlap et al. 2000), reported in Table 2, which overall captures people's views about the environment and the role, as well as the influence, of humans on nature. On the other hand, information about specific environmental attitudes was gathered by collecting respondents' views about 13 statements focusing on people's views about the restoration of peatlands in Scotland (Table 3). Because specific environmental attitudes are context-dependent, there is no formal scale available and for the design of the statements we were inspired by discussions emerging from the preparatory focus group for the choice experiment survey.

In the survey, we also gathered information on place identity and, in particular, on national identity perceptions linked to the bonds and attachment with Scotland. While different scales have been developed in the literature to measure place identity constructs, no single scale is recognized to be more reliable and valid than others (Lewicka 2011). An alternative approach, and the one used here, is to develop ad hoc statements designed at a context-specific level. Four different questions (reported in Table 4) were therefore specifically designed to understand the degree to which individuals perceived peatlands as part of Scotland's identity and landscape and the extent to which they felt identified with and attached to Scotland, using as a basis the discussions of the preparatory focus groups for the present CE survey (Byg et al. 2015; Byg et al. 2017) and the available literature (Stets and Biga 2003; Scottish Natural Heritage 2015; Joint Nature Conservation Committee 2011; Waylen et al. 2016).

For all the above statements, we asked respondents to indicate their degree of agreement or disagreement on a 4-points Likert scale.

3.4. The sample

The survey was administered online via a professional market research company during February/March 2016 to a sample of 1,795 Scottish residents using a quota-based approach to sample from the online panel with age and gender as 'hard' quotas and a 'soft' quota for social grade. The sample was representative of the population of Scotland in terms of gender, age, and the rural/urban split (with 65% of the respondents living in the main cities, located close to small pockets of peat but far away from wild peatlands and areas with lots of peat). Respondents with higher educational attainment levels and higher employment-based social grade are slightly over-sampled. Socio-demographic

characteristics of the sample, collected through specific questions included in the survey, are reported in Appendix 1, together with information about the socio-demographic profile of the overall Scottish population.

3.5. Econometric approach

Our econometric approach relies on the use of hybrid choice models (Ben-Akiva *et al.* 2002; Hoyos et al. 2015; Czajkowski *et al.* 2017). This modeling approach has thus far largely been applied in the transportation literature (e.g., Vredin Johansson, Heldt and Johansson 2006; Hess, Hensher and Daly 2012; Daziano and Bolduc 2013) with a small but increasing number of applications in the environmental economic literature (Dekker et al. 2012; Hess and Beharry-Borg 2012; Hoyos et al. 2015; Agimass et al. 2017; Czajkowski, Hanley and Nyborg 2017; Pakalniete et al. 2017). The hybrid choice model is a structural model that incorporates choice and non-choice components.

Following the random utility framework (McFadden 1974), the choice component of the model assumes that individuals derive utility from observed characteristics of a good (here, features of a peatland restoration project) and unobserved idiosyncrasies. Respondents' preferences can be revealed by their choices in hypothetical situations. However, our model also allows to account for unobservable factors of interest (in our case, environmental attitudes and the perception of place identity). This is done by assuming that the *true* environmental attitudes and identity perceptions are unobserved (i.e. they are latent) and they can only be approximated (though imprecisely) using self-reported responses to attitudinal 'measurement' questions. Based on this, latent variables representing unobserved constructs such as environmental attitudes and place identity perceptions can be linked to measurement equations on the one hand, and to respondents' economic preferences, on the other. In addition, to better understand the socio-demographic profile of the respondents who displayed the identified latent traits, latent variables can be linked with respondents' socio-demographics.

The three sub-sections that follow will discuss in more detail the different components of the hybrid choice model, namely the discrete choice component, measurement equations and the structural component.

3.5.1. A discrete choice component

Formally, the utility that individual i derives from choosing variant j in choice task t can be expressed by

$$U_{ijt} = \sigma_i \alpha_i \left(c_{ijt} + \mathbf{X}_{ijt} \boldsymbol{\beta}_i \right) + \varepsilon_{ijt}, \qquad (1)$$

The expression in the right-hand side of (1) corresponds to the random utility theory (McFadden 1974) and it includes deterministic and non-deterministic components defining the individual's utility, the first resulting from observed characteristics of the project and the latter linked to unobserved idiosyncrasies. In particular, $\mathbf{X}$ represents the levels of non-monetary attributes associated with a project of peatland restoration; c_{ijt} denotes the level of the monetary attribute; the stochastic element ε captures factors unobserved by the econometrician that influence the individual's utility (choices) and σ normalizes the error term variance to $\pi^2/6$, which facilitates calculation of logit probabilities; $\boldsymbol{\beta}_i$ and α_i are individual-specific parameters to be estimated that express the individual's preferences towards the project's characteristics. Note that multiplying all attributes with the parameter of monetary attribute (α_i) allows for the vector of preference parameters $\boldsymbol{\beta}_i$ to be: (1) scale-free and (2) directly interpreted as a vector of implicit prices (marginal WTPs) for the non-monetary attributes $\boldsymbol{X}$. In addition to facilitating interpretation of the results, another advantage of this formulation is the possibility to specify a particular distribution of WTP in the population, rather than the distribution of the underlying utility parameters, thus avoiding implausible WTP values. Following common practice

we assume that the parameters of the non-monetary attributes are normally distributed and the parameter of the monetary attribute is log-normally distributed. The model allows for full correlation structure of the random parameters $\boldsymbol{\beta}_i$ and α_i by estimating all elements of the Cholesky decomposition of the variance-covariance matrix and thus corresponds to a hybrid mixed logit (HMXL) model with correlation.[6]

In particular one aspect of the utility specification in (1) needs to be emphasised. The parameters (α, β) are assumed to depend on the latent variables that capture unobservable environmental attitudes and place identity beliefs. We denote a vector of individual-specific latent variables by $\mathbf{LV}_i$ (in our case this vector consists of three elements: general environmental attitudes, specific environmental attitudes and place identity perceptions). Then, the relationship between the non-monetary preference parameters and the latent variables can be illustrated by

$$\boldsymbol{\beta}_i = \boldsymbol{\Lambda}' \mathbf{LV}_i + \boldsymbol{\beta}_i^*, \tag{2}$$

where $\boldsymbol{\Lambda}$ is a matrix of coefficients to be estimated and $\boldsymbol{\beta}_i^*$ has a multivariate normal distribution with a vector of means and a covariance matrix to be estimated. Similarly, the relationship between the parameter by the monetary attribute and the latent variables is of a form

$$\alpha_i = \exp\left(\boldsymbol{\tau}' \mathbf{LV}_i + \alpha_i^*\right), \tag{3}$$

where $\boldsymbol{\tau}$ is a vector of coefficients to be estimated and α_i^* is log-normally distributed with the parameters describing its mean and its standard deviation to be estimated.

3.5.2. Measurement equations

We define separate latent variables to capture respondents' environmental attitudes (both general environmental attitudes and specific attitudes towards peatland restoration), as well as place identity perceptions. The mentioned beliefs are unobservable factors that may be related to respondents' preferences but cannot be measured in a direct and objective way as is the case for age or income. Instead, our survey included several indicator questions to assess these factors. Responses to the indicator questions could be expected to be determined by these factors. Measurement equations model the self-reported measures of the beliefs and attitudes as a function of the latent variables. Formally, this relationship can be expressed as

$$\mathbf{I}_i = \boldsymbol{\Gamma}' \mathbf{LV}_i + \boldsymbol{\eta}_i, \tag{4}$$

where $\mathbf{I}_i$ are indicator variables (each of the self-reported responses to the statements summarized in Table 2, 3 and 4 in the Results' section) which are linked through (4) to the corresponding LV that they contribute to measure; $\boldsymbol{\Gamma}$ is a matrix of coefficients; and $\boldsymbol{\eta}_i$ is a vector of error terms assumed to follow a multivariate normal distribution with zero means and an identity covariance matrix. To facilitate interpretation, the mean of each latent variable in $\mathbf{LV}_i$ is normalised to zero, and to assure identification, the variance of every latent variable is normalised to one (cf. Raveau, Yáñez and Ortúzar 2012). As a result, all latent variables have the same scale and, therefore, their relative importance (for instance, in measurement equations and in interactions with preference parameters) can easily be assessed.

[6] The software code for the model has been developed in Matlab and is available at github.com/czaj/DCE under Creative Commons BY 4.0 license. The code and data for estimating the models presented in this paper, as well as supplementary results are available from http://czaj.org/research/supplementary-materials.

In our survey, respondents' beliefs and attitudes were self-reported on four-point Likert scales. Therefore, we use ordered probit as the functional form in the measurement component of our HMXL. Note that the hybrid choice framework allows us to tailor the modelling approach to the character of each indicator variable, rather than treating them as arbitrarily classified dummies or continuous variables (Bahamonde-Birke and Ortúzar 2017).

3.5.3. Structural component

Latent variables can also directly depend on exogenous factors, such as socio-demographic variables, which are stacked in the vector $\mathbf{X}_i^{str}$. This relationship is described by the following structural equations:

$$\mathbf{LV}_i = \mathbf{X}_i^{str}\boldsymbol{\Psi} + \boldsymbol{\xi}_i, \quad (5)$$

with a matrix of coefficients $\boldsymbol{\Psi}$ and error terms $\boldsymbol{\xi}_i$ which are assumed to come from a multivariate normal distribution. Generally, linking socio-demographic variables with latent variables through structural equations is not necessary. In the absence of such structural equations, latent variables become similar to random parameters – they capture the correlation between individuals' preferences and measurement variables.

4. Results

4.1. Environmental attitudes and place-identity perceptions

Responses provided to the NEP scale (as reported in Table 2), generally show that participants tend to agree with most of the statements presented, despite in few occasions they displayed some degree of uncertainty in their level of agreement or disagreement (e.g. item 2 and 4) or provided less obvious responses (e.g. item 6). This suggests that they show a positive attitude towards the need to protect the environment from further human pressures, which overall indicates a pro-environmental worldview, consistently with the results of previous surveys to the Scottish population (Scottish Government 2009).

Table 2. NEP statements[a]

NEP statement	completely disagree	somewhat disagree	somewhat agree	completely agree
1. We are approaching the limit of the number of people the earth can support	4.80%	20.48%	46.88%	27.85%
2. Humans have the right to modify the natural environment to suit their needs (*reverse coded*)	5.13%	43.64%	38.95%	12.28%
3. When humans interfere with nature it often produces disastrous consequences	2.01%	11.38%	48.77%	37.83%
4. Human ingenuity will ensure that we do not make the earth uninhabitable (*reverse coded*)	7.76%	43.61%	39.48%	9.16%
5. Humans are severely abusing the environment	2.46%	10.38%	46.99%	40.18%
6. The earth has plenty of natural resources if we just learn how to develop them (*reverse coded*)	20.19%	55.88%	18.96%	4.96%
7. Plants and animals have as much right as humans to exist	1.23%	6.98%	42.07%	49.72%
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations (*reverse coded*)	4.52%	25.38%	48.41%	21.70%
9. Despite our special abilities humans are still subject to the laws of nature	0.45%	4.97%	53.10%	41.49%

10. The so-called "ecological crisis" facing humankind has been greatly exaggerated (*reverse coded*)	5.35%	25.54%	41.49%	27.61%
11. The earth is like a spaceship with very limited room and resources	3.18%	25.17%	48.88%	22.77%
12. Humans were meant to rule over the rest of nature (*reverse coded*)	4.74%	24.44%	41.91%	28.91%
13. The balance of nature is very delicate and easily upset	0.89%	10.28%	52.18%	36.65%
14. Humans will eventually learn enough about how nature works to be able to control it (*reverse coded*)	5.59%	39.66%	40.56%	14.19%
15. If things continue on their present course, we will soon experience a major ecological catastrophe	3.18%	20.70%	49.11%	27.01%

[a] To force respondents to pay attention when replying to the questions and avoid random responses, the NEP scale is constructed in such a way that, for half of the statements agreement implies a pro-environmental attitude, while for the other half it indicates an anti-environmental attitude. In this table (and the rest of the paper) we reverse coded these latter statements (item 2, 4, 6, 8, 10, 12, 14), such that agreement with these suggests a pro-environmental attitude.

Individuals also indicated a highly positive view towards the restoration of peatlands specifically (as displayed in Table 3). They perceive restoration as an important and justified investment to protect peatland ecosystems. Respondents appreciated peatland restoration because of non-use value reasons - mostly related to the perceived need to preserve these ecosystems for future generations - but also for reasons associated with the use benefits that peatlands in good condition can provide, including recreational opportunities linked to wildlife appreciation and the supply of good water quality.

Table 3. Specific attitudes towards peatland restoration

Statement	**completely disagree**	**somewhat disagree**	**somewhat agree**	**completely agree**
1. I want to have the possibility to enjoy the wildlife on restored peatlands	2.32%	10.81%	57.42%	29.44%
2. I support peatland restoration because it will give me better water quality	1.96%	15.83%	56.91%	25.31%
3. It is important to me that peatlands are handed over to future generations in good ecological condition	0.55%	5.81%	48.04%	45.60%
4. It gives me satisfaction to simply know that peatlands will be in a good condition	1.53%	9.17%	57.40%	31.91%
5. I want to see peatlands restored because it is an opportunity to do something about climate change	3.25%	11.15%	46.48%	39.13%
6. Future generations will benefit from peatlands being restored now	0.67%	4.08%	44.13%	51.12%
7. Peatland restoration is a waste of time and money	51.65%	40.07%	6.99%	1.29%
8. Land owners have an obligation to restore peatlands for the benefit of society	1.84%	11.96%	58.49%	27.71%
9. Peatland restoration will hurt the rural economy	25.96%	54.66%	17.14%	2.23%
10. Peatlands restoration will benefit me	6.48%	27.49%	50.28%	15.75%
11. I don't care about peatland restoration	44.27%	41.31%	12.02%	2.40%
12. Land owners should be compensated for restoring peatlands	6.04%	24.27%	57.66%	12.02%
13. Peatlands restoration will benefit others I care about	2.12%	15.75%	55.22%	26.91%

Regarding place identity perceptions, answers to these statements (summarized in Table 4) indicate, in line with expectations, that most of respondents feel a relatively high degree of attachment to Scotland and a strong sense that peatlands are an integral part of the Scottish identity and landscape.

Table 4. Place identity perceptions

Statements	completely disagree	somewhat disagree	somewhat agree	completely agree
I think peatlands are part of Scotland's identity	1.62%	8.64%	50.64%	39.10%
I have strong bonds with Scotland	2.01%	7.92%	32.74%	57.33%
I strongly identify with Scotland	2.46%	10.28%	30.56%	56.70%
I like to spend time enjoying the Scottish landscape of which peatlands are a very important part	2.34%	14.39%	44.62%	38.65%

4.2. Choice experiment results

To achieve the purposes of the present study, we start by estimating a HMXL model exploring the effect of general environmental attitudes and place identity latent variables on preferences. We begin by focusing on general rather than specific environmental attitudes, following the recommendations of the NOAA panel (Arrow et al 1993). Model results, obtained after protest bidders and missing values in the variables of interest had been removed[7], are shown in Table 5.

Table 5. Results of the HMXL model focusing on general environmental attitudes and place identity

The discrete choice component (WTP-space, in GBP)				
	Means	**Standard deviations**	**Interaction with LV_1 (positive general environmental attitudes)**	**Interaction with LV_2 (strong place identity)**
Status quo	-133.58***	82.91***	-20.78***	-3.32
	(5.28)	(5.01)	(2.58)	(2.86)
Bad to good (1% shift)	0.87***	1.48***	0.45***	0.18***
	(0.05)	(0.04)	(0.03)	(0.04)
Intermediate to good (1% shift)	0.59***	0.93***	0.30***	0.11***
	(0.031)	(0.03)	(0.03)	(0.03)
Restoration in wild land area	29.42***	38.82***	12.97***	3.56**
	(1.70)	(1.82)	(1.34)	(1.49)
Restoration in area with lots of peat	14.35***	39.55***	4.04***	2.04
	(1.77)	(1.86)	(1.39)	(1.40)
-Cost/100	1.25***	1.15***	-0.07*	0.04
	(0.05)	(0.06)	(0.04)	(0.04)
The measurement component[8]				
			LV_1 (positive general environmental attitudes)	**LV_2 (strong place identity)**
We are approaching the limit of the number of people the earth can support			0.6294***	
			(0.0372)	
Humans have the right to modify the natural environment to suit their needs (reverse coded)			0.5334***	
			(0.0346)	
When humans interfere with nature it often produces disastrous consequences			0.7421***	
			(0.0418)	

[7] From the initial dataset including N=1795 respondents, we excluded: N=58 individuals who always chose the status quo option and motivated their choices due to protest reasons, N=11 cases where missing data were detected in the choice experiment part of the survey and N=21 cases of missing information in the relevant attitudinal and identity variables. Some degree of overlap was found between those individuals for whom there is missing information on attitudinal and identity variables and those individuals protesting or for whom there are missing values in the choice experiment part. In addition, we also filtered out N=51 individuals who reported the same level of agreement or disagreement with all NEP statements. This is because such behaviour does not provide consistent information on respondents' environmental attitudes, but rather suggests some randomness in responses, given that positive environmental attitudes imply agreement with half of the NEP statements and disagreement with the other half.

[8] The estimated ordered logit threshold parameters are not reported here for brevity. We include full results in the supplementary materials available online. The possible responses were: 1=completely disagree, 2=somewhat disagree, 3=somewhat agree, 4=completely agree.

Human ingenuity will ensure that we do not make the earth uninhabitable (reverse coded)	0.4902*** (0.0338)	
Humans are severely abusing the environment	1.1063*** (0.0566)	
The earth has plenty of natural resources if we just learn how to develop them (reverse coded)	0.1293*** (0.0300)	
Plants and animals have as much right as humans to exist	0.7682*** (0.0451)	
The balance of nature is strong enough to cope with the impacts of modern industrial nations (reverse coded)	0.9014*** (0.0454)	
Despite our special abilities humans are still subject to the laws of nature	0.5311*** (0.0378)	
The so-called "ecological crisis" facing humankind has been greatly exaggerated (reverse coded)	0.9731*** (0.0472)	
The earth is like a spaceship with very limited room and resources	0.7022*** (0.0389)	
Humans were meant to rule over the rest of nature (reverse coded)	0.7104*** (0.0393)	
The balance of nature is very delicate and easily upset	0.9830*** (0.0509)	
Humans will eventually learn enough about how nature works to be able to control it (reverse coded)	0.3936*** (0.0322)	
If things continue on their present course, we will soon experience a major ecological catastrophe	1.2107*** (0.0586)	
I think peatlands are part of Scotland's identity		0.6650*** (0.0406)
I have strong bonds with Scotland		5.3769*** (1.1993)
I strongly identify with Scotland		3.8712*** (0.4702)
I like to spend time enjoying the Scottish landscape of which peatlands are a very important part		0.6635*** (0.0398)

Model diagnostics[9]	
LL at convergence	-40,160.53
LL at constant(s) only	-48,088.40
McFadden's pseudo-R^2	0.1649
Ben-Akiva-Lerman's pseudo-R^2	0.4934
AIC/*n*	6.0692
BIC/*n*	6.1342

Notes: ***, ** and * indicate 1%, 5% and 10% significance levels, respectively. All utility function parameters are modelled as random, correlated, normally distributed except for the cost parameter, which is assumed to follow a log-normal distribution (the estimates of the underlying normal distribution are provided). We use a negative of *Cost* attribute expressed in 100 GBP. Correlation parameters are reported in the supplementary materials available online.

To interpret the model results and to understand the link between the unobserved true (latent) attitudes of respondents towards the environment, as well as their place identity perceptions, and individuals' responses to the statements presented in Table 2 and 4, respectively, we focus on the measurement equation part of the model displayed in Table 5. We explained each NEP statement as a function of one latent variable (LV1), which therefore reflects respondents' general environmental attitudes. Similarly, we modelled each identity-related statement capturing respondents' identification with Scotland and perception of the role of peatlands in Scotland's identity and landscape, as a function of a separate latent variable (LV2), which we denominate 'place identity' perception. The decision to have one latent variable explaining all NEP statements and one latent variable explaining all identity-related statements was to facilitate

[9] Further information on the model diagnostics: *n* (number of observations) = 13,272; *r* (respondents) = 1,659; *k* (parameters) = 115.

the interpretation of results, but it was also supported by the outcomes of a factor analysis (Appendix 2) and high Chronbach's alpha coefficients, indicating high consistency between the items associated with each latent trait (0.83 for NEP statements and 0.79 for national identity statements). Results of the measurement equations indicate that individuals' responses to each NEP statement were significantly and positively related to the first latent variable (LV1). This way, a positive relationship between LV1 and agreement with the included NEP statements indicates that LV1 reflects positive environmental attitudes. Respondents' answers to identity-related statements indicate a significant and positive relationship with the second latent variable (LV2). LV2 thus reflects a high attachment of respondents to Scotland and a positive perception that peatlands are an important part of Scotland's identity and landscape.

The discrete choice component of the model, displayed in the upper part of Table 5, reports respondents' WTP (mean and standard deviation) for peatland restoration attributes, along with the interactions between these and each of the identified LVs.[10] This part of the model shows whether and how preferences of respondents displaying particular traits (latent variables) differ with respect to those of other respondents. Based on our results, on average, respondents have significant preferences for moving away from the BAU scenario and for carrying out peatland restoration projects in Scotland. They display a positive WTP for an improvement in peatlands' condition, with the WTP for a 1% shift in peatlands' condition from bad to good being higher than the WTP for a 1% shift from intermediate to good, indicating sensitivity to scope. Additionally, individuals display positive WTP for restoring peatlands in wild and relatively inaccessible areas and in areas with a relatively high share of peatlands in the land cover.

When looking at the interaction between preferences and LV1 and LV2, model results indicate that WTP is affected by environmental attitudes and respondents' place identity perceptions, both proving to be important drivers of preferences. The interaction between LV1 and the choice part of the model is significant and positive, suggesting that individuals displaying positive environmental attitudes experience higher disutility resulting from the BAU situation and have more positive preferences and WTP for all peatland restoration attributes. Similar conclusions can be drawn also for the effect of place identity perceptions, captured by LV2. Those respondents having high attachment and bonds with Scotland and those who think that peatlands are an important part of Scotland's identity and landscape are found to display significantly higher WTP and preferences for peatland restoration. Hence, both LVs prove to be important drivers of willingness to pay for peatland restoration. It is worth noting that based on the magnitude of the interaction coefficients, environmental attitudes seem to play a greater role on WTP compared to the effect of place identity perceptions.

To go a bit deeper into the analysis, we estimated an extra model (Table 6) by adding to the model estimated in Table 5 a third latent variable capturing specific environmental attitudes of respondents towards peatland restoration (based on the statements reported in Table 3). The decision to treat specific environmental attitudes as an independent latent variable with respect to general environmental attitudes was to facilitate the interpretation of results, but it was also justified by the outcomes of a factor analysis (Appendix 3). Results of this new model confirm the main message obtained from the model presented in Table 5. In addition, they show that: i) individuals' responses to each statement regarding attitudes towards peatland restoration are significantly and positively explained by LV3,[11] which therefore reflects positive attitudes towards peatland restoration, and ii) LV3 is a significant driver of preferences. From the interaction between LV3 and the choice components of the model we can see that individuals displaying positive attitudes towards peatland restoration are less likely to favour the BAU option and have more positive preferences for all peatland restoration attributes. Interestingly, we also found that the effect of LV3 on WTP is greater in magnitude

[10] Note that because means of the LVs are normalized to zero (with unit standard deviation), the main effects (means) can be readily interpreted as population means, without the necessity to take interactions into account, and this allows for an easy comparisons of the relative effects of different latent beliefs on preferences/WTP.

[11] The positive relationship is found for all statements except for those where agreement indicates low attitude towards restoration ("peatland restoration is a waste of time and money", "peatland restoration will hurt the rural economy", "I don't care about peatland restoration"), which are negatively explained by LV3.

than the effect of LV1, suggesting that 'specific' attitudes have an important effect over and above that of 'general' attitudes and both should be included in the analysis.

Table 6. Results of the HMXL with an additional latent variable capturing respondents' specific attitudes towards peatlands' restoration

The discrete choice component (WTP-space, in GBP)					
	Means	**Standard deviations**	**Interaction with LV_1 (positive general environmental attitudes)**	**Interaction with LV_2 (strong place identity)**	**Interaction with LV_3 (positive specific attitudes towards peatlands' restoration)**
Status quo	-138.72***	68.99***	-4.29*	0.13	-29.19***
	(4.98)	(4.41)	(2.45)	(2.32)	(3.14)
Bad to good (1% shift)	0.90***	1.36***	0.17***	0.10***	0.40***
	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)
Intermediate to good (1% shift)	0.60***	0.86***	0.11***	0.08***	0.25***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)
Restoration in wild land area	30.29***	36.88***	5.02***	2.08	11.29***
	(1.41)	(1.43)	(1.27)	(1.31)	(1.57)
Restoration in area with lots of peat	15.83***	40.98***	0.73	3.69***	5.04***
	(1.57)	(1.89)	(1.37)	(1.33)	(1.52)
-Cost/100	1.17***	1.04***	0.03	0.02	-0.14***
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)
The measurement component[12]					
			LV_1 (positive general environmental attitudes)	**LV_2 (strong place identity)**	**LV_3 (positive specific attitudes towards peatlands' restoration)**
We are approaching the limit of the number of people the earth can support			0.6429***		
			(0.0394)		
Humans have the right to modify the natural environment to suit their needs (reverse coded)			0.5714***		
			(0.0372)		
When humans interfere with nature it often produces disastrous consequences			0.7750***		
			(0.0453)		
Human ingenuity will ensure that we do not make the earth uninhabitable (reverse coded)			0.5124***		
			(0.0360)		
Humans are severely abusing the environment			1.0788***		
			(0.0582)		
The earth has plenty of natural resources if we just learn how to develop them (reverse coded)			0.1427***		
			(0.0316)		
Plants and animals have as much right as humans to exist			0.7870***		
			(0.0483)		
The balance of nature is strong enough to cope with the impacts of modern industrial nations (reverse coded)			0.8978***		
			(0.0475)		
Despite our special abilities humans are still subject to the laws of nature			0.5396***		
			(0.0398)		
The so-called "ecological crisis" facing humankind has been greatly exaggerated (reverse coded)			0.9085***		
			(0.0470)		

[12] The estimated ordered logit threshold parameters are not reported here for brevity. We include full results in the supplementary materials available online. The possible responses were: 1=completely disagree, 2=somewhat disagree, 3=somewhat agree, 4=completely agree.

The earth is like a spaceship with very limited room and resources	0.6935*** (0.0405)		
Humans were meant to rule over the rest of nature (reverse coded)	0.7553*** (0.0426)		
The balance of nature is very delicate and easily upset	0.9524*** (0.0525)		
Humans will eventually learn enough about how nature works to be able to control it (reverse coded)	0.4483*** (0.0349)		
If things continue on their present course, we will soon experience a major ecological catastrophe	1.1083*** (0.0568)		
I think peatlands are part of Scotland's identity		0.7128*** (0.0436)	
I have strong bonds with Scotland		8.6686*** (2.0730)	
I strongly identify with Scotland		3.4608*** (0.2075)	
I like to spend time enjoying the Scottish landscape of which peatlands are a very important part		0.6753*** (0.0414)	
I want to have the possibility to enjoy the wildlife on restored peatlands			0.8462*** (0.0443)
I support peatland restoration because it will give me better water quality			0.8266*** (0.0431)
It is important for me that peatlands are handed over to future generations in good ecological condition			1.5447*** (0.0793)
It gives me satisfaction to simply know that peatlands will be in a good condition			1.1185*** (0.0548)
I want to see peatlands restored because it is an opportunity to do something about climate change			1.0481*** (0.0503)
Future generations will benefit from peatlands being restored now			1.3940*** (0.0743)
Peatland restoration is a waste of time and money			-1.3832*** (0.0728)
Land owners have an obligation to restore peatlands for the benefit of society			0.5619*** (0.0368)
Peatland restoration will hurt the rural economy			-0.4508*** (0.0343)
Peatland restoration will benefit me			0.9606*** (0.0458)
I don't care about peatland restoration			-1.3117*** (0.0648)
Land owners should be compensated for restoring peatlands			0.1525*** (0.0307)
Peatland restoration will benefit others I care about			1.1668*** (0.0557)

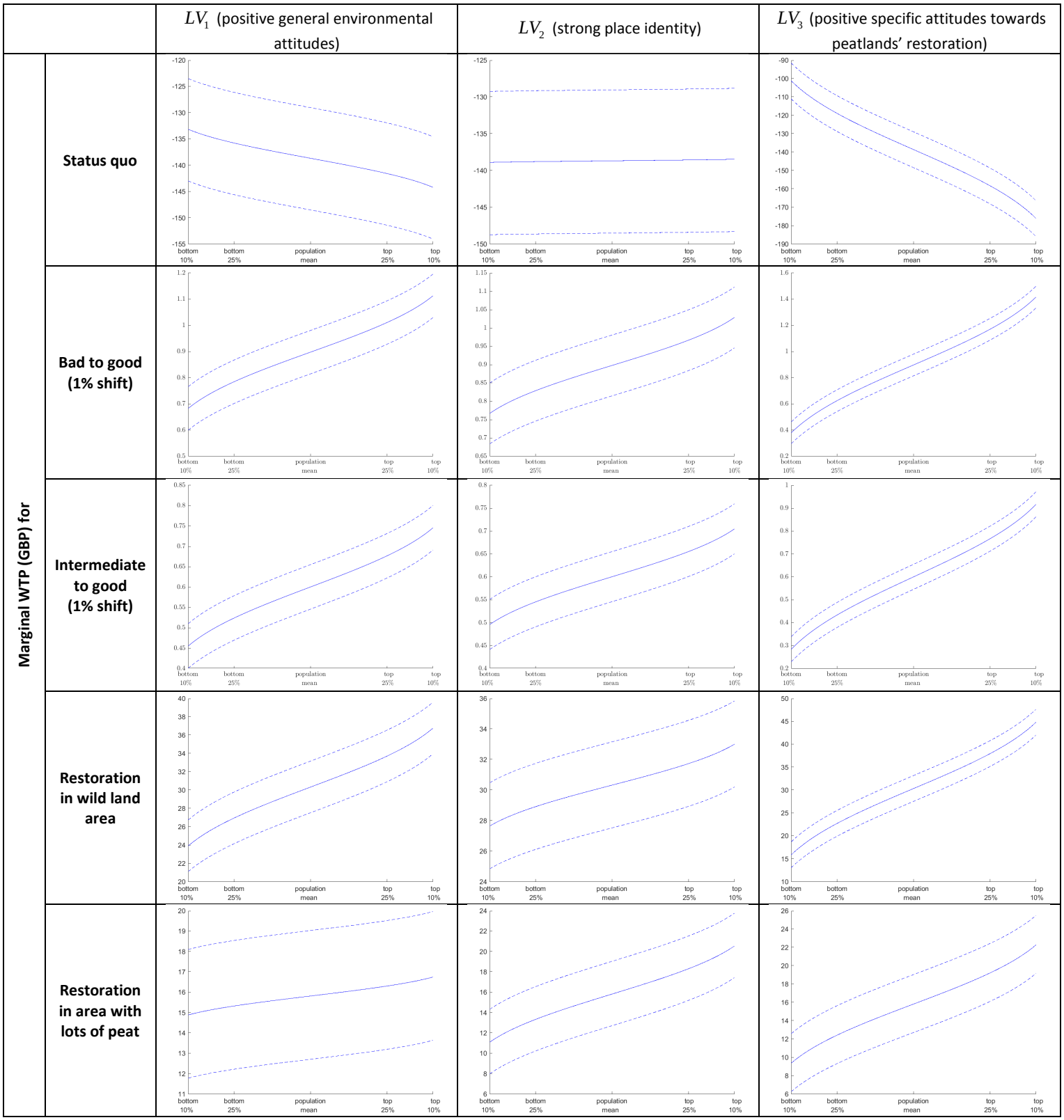
Model diagnostics[13]	
LL at convergence	-54,812.37
LL at constant(s) only	-64,461.70
McFadden's pseudo-R^2	0.1497
Ben-Akiva-Lerman's pseudo-R^2	0.4802
AIC/*n*	8.8401
BIC/*n*	8.9434

Figure 2 illustrates the results of the model reported in Table 6 by plotting the extent of WTP changes associated with the levels of latent variables in the population. Note that the LVs are assumed to follow normal distribution and hence it is possible to simulate WTP of respondents who are, for example, in the bottom 10% of the population in terms of

[13] Further information on the model diagnostics included: *n* (number of observations) = 12,440; *r* (respondents) = 1,555; *k* (parameters) = 173.

their latent general environmental attitudes. Large WTP changes and narrow confidence intervals indicate substantial effects of the latent variables.

Figure 2. Marginal WTP (GBP) of respondents with varying strength of the latent attitudes towards the general environment, place identity and specific attitudes towards peatland restoration



In Tables 5 and 6, we intendedly left the structural component of the model empty to be sure that the identified latent variables only relate to the corresponding indicators and there is no potential confounding effect driven by the inclusion

of socio-demographic variables. However, we also recognize that identifying the respondents who are more likely to display the identified latent traits is of interest. Hence, just to make an example, we re-estimated the model presented in Table 5 by additionally including the structural component and allowing each latent variable to be explained by a range of selected respondents' characteristics collected as part of our survey. Results, reported in Appendix 4, generally confirm the outcomes of the models without structural component and additionally show that indeed some socio-demographic groups tend to be more likely than others to display the latent traits associated with LV1 and LV2. Higher environmental attitudes are more often displayed, for example, by young people, females, less wealthy segments of society or members of environmental organizations, while stronger place identity perceptions are held by elderly people, females or those having visited wild peatlands in the past.

5. Discussion

Environmental attitudes and place identity beliefs are among the most important drivers of pro-environmental behaviour. Our study contributes to a scant body of literature that explicitly investigates the influence of these factors on preferences for environmental goods. Specifically, our study uses a robust methodological approach to relate attitudes, place identity beliefs and preferences and shows that general and specific environmental attitudes as well as beliefs about place identity are important determinants of preferences for environmental conservation. Overall, the analytical approach used in this case study on peatland restoration proves to be useful for improving our understanding of people's willingness to support, and pay for, environmental conservation (Carrus et al. 2005; Prati et al. 2015). Our results suggest that identity considerations should be integrated into the environmental attitude-behaviour model, which is the mainstream framework in environmental sociology, to provide more nuanced and realistic representations of preferences and behaviour with respect to the environment. In line with results from the Theory of Reasoned Action (Ajzen and Fishbein 1980), our findings also suggest that specific environmental attitudes should be taken into account to better understand people's support for nature conservation in addition to general environmental attitudes.

By shedding light on some key factors that affect respondents' support for conservation policies, our results have important implications for policy-making. They indicate that higher acceptance of policies to protect the environment is associated with positive environmental attitudes and a strong sense of place. Information and awareness raising campaigns accompanying policy development and implementation should be carefully designed because they are likely to impact policy support if they affect people's attitudes and beliefs. The efficiency of information provision could be enhanced by specifically targeting segments of the population that currently exhibit less positive environmental attitudes, or parts of the population which have a less developed sense of place. For example, our results show that only specific socio-demographic segments of Scottish society tend to hold less positive environmental attitudes and place identity beliefs. Positive attitudes towards the environment should then be especially fostered among e.g. elderly people, males, wealthy members of society and those who are not part of environmental organizations, while a greater sense of place should be especially encouraged within e.g. younger segments of society, males or those who haven't visited wild peatlands before. Our results did not show any correlation between where people live or how far away they live from peatlands and place identity perceptions. We will get back to this result later on in this section. The above findings suggests that different education, communication and awareness creation campaigns should be tailored depending on the socio-demographic group.

Compared to specific attitudes towards environmental projects and policies, general environmental attitude is likely to be a more stable construct. Yet, promoting a broad environmental friendly attitude amongst the public, not only towards a specific project but towards nature more generally, can contribute to a long-term transition towards pro-environmental behaviours, which in turn can increase public support for multiple environmental policies. Similarly, strengthening place identity beliefs is also advisable to increase public support and various possible means to do this could be considered such as communication campaigns fostering a sense of unity, social cohesion, traditions and common culture, or citizens' involvement and engagement in environmental policy and planning decisions that affect the place where individuals live or belong (Nielsen-Pincus et al. 2017). In this sense, the choice of the instrument should

be guided by a better understanding of the dimensions that people particularly appreciate in relation to place identity – whether the social versus physical bonds or rather the emotional versus functional bonds (i.e. instrumental to the achievement of a given tangible outcome). In any case, keeping or increasing place identity beliefs is particularly challenging in a globalized world that is increasingly fluid, mobile and individualistic. This is because fostering attachment and bonds with a place takes time and requires sharing and engaging with others in a community.

The above discussion points to an interesting avenue for future research in relation to preference stability and the transferability of values over time. Previous research on temporal preference stability in stated preference studies in the environmental context (Liebe et al. 2012; Schaafsma et al. 2014; Brouwer et al. 2017) finds mixed results with respect to test-retest reliability over the course of up to two years. These studies control only in a rudimentary fashion, if at all, for attitudes and beliefs as potential factors explaining preference shifts over time. Based on Brouwer and Spaninks (1999) attitudes can be important in benefit transfer exercises, it then remains to be tested whether and how environmental attitudes matter in relation to preference stability. The analytical approach used in our study could be applied to directly investigate this issue.

The results of this study point towards another interesting area for future research, which is linked to better understanding what spatial aspects are relevant in preference formation. Based on our findings, we shown that people do not only relate with the space around them by focusing on the distance from the respondent to the improvement site, as most frequently postulated in valuation studies (Holland and Johnston 2017). In fact, our respondents are willing to pay for the restoration of wild and less accessible peatlands, as well as areas with lots of peat, despite these are located very far away from them. The people in our sample put much more importance on the idea that place can be understood as a space with emotional and cultural meanings. Indeed, in our case study, place identity beliefs played an important role in shaping preferences for peatland restoration, even after controlling for the effect of the proximity of peatland areas to people's residence location. It would be interesting in future research to deepen existing knowledge about the role of different (objective and subjective) spatial dimensions and explore their relative importance in the modelling of preferences.

The research presented here could be further improved with future work. Despite our results seem to suggest independence between environmental attitudes and place identity beliefs in line with other studies in the environmental psychology literature (Carrus et al. 2005), the presence of possible interacting and mediating effects between the latent contructs could be further explored. More efforts could also be placed on better understanding the different dimensions underlying environmental attitudes and identity beliefs since, as indicated by our factor analysis, it seems that different sub-dimensions could be identified for the NEP scale. This would be consistent with investigations of environmental attitudes by, for example, Milfont and Duckitt (2010) in the environmental psychology domain, or Agimass et al. (2017) in a valuation context.

6. Concluding remarks

There is an increasing demand for monetary valuation of the environment to underpin efforts to counter the ongoing degradation of ecosystems and their capacity to support human well-being. However, for valuation to appropiately fullfil this knowledge demand, it needs to better represent and capture complex human preferences. This study aimed at contributing to this need through the simultaneous incorporation of two important factors influencing (pro-environmental) human behaviour – general and specific environmental attitudes and place identity beliefs – in the analysis of stated preference data obtained from a discrete choice experiment. More nuanced willingness to pay estimates, like the ones produced in this study, better serve the needs of environmental decision-makers when allocating limited public budgets and in terms of gathering of support for public environmental policies.

However, responding to this growing demand for better understanding the drivers of human preferences necessarily also introduces more challenges for economic valuation. It first requires to more routinely collect information on

respondents' views about different psychological and sociological dimensions to explore their role in valuation. Beyond environmental attitudes and place identity beliefs, other factors such as social norms, people's awareness, subjective perceptions or cognitive factors have only received scarce consideration by the valuation literature, despite being recognized as important drivers of values by environmental psychologists and sociologists. Working more collaboratively with environmental psychologists and sociologists will be increasingly important to develop more solid frameworks of analysis and to design improved, as well as tailored, scales for measuring latent constructs. At the same time, another challenge is that controlling for preference heterogeneity in a better way requires more and more advanced econometric tools, not necessarily readily available in commercial statistical packages or easy to use and intepret by most of practitioners.

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Appendix 1. Socio-demographic characteristics of the sample compared to the overall Scotland's population

Variable	Sample	Overall Population (Scotland)[a]
Gender distribution		
Female	50.3%	51%
Male	49.7%	49%
Age distribution (years old)		
18-24	6.8%	11.9%
25-44	36.2%	33.0%
45-64	34.7%	34.2%
≥ 65	22.3%	20.9%
Yearly household income		
GBP per year	£39,615	£38,337
Educational attainment (highest achieved Scotland census level)[b]		
Level 0	13.1%	26.8%
Level 1	20.8%	23.1%
Level 2	18.5%	14.3%
Level 3 and above	45.3%	36.0%
Prefer not to tell	2.4%	–
Social grade (employment-based)[c]		
Higher and intermediate	19.0%	19.0%
Supervisory, clerical, junior	43.2%	32.0%
Skilled manual	9.7%	22.0%
Semi-skilled, un-skilled	18.1%	28.0%
Prefer not to tell	8.3%	–
Average household size		
Persons per household	2.34	2.25
Urban/Rural population		
Urban	65.13%	69.9%
Rural	34.87%	30.1%

Note: [a] Scotland Census (2011) by National Records of Scotland (http://www.scotlandscensus.gov.uk/); [b] Population figures include the population of 16 years of age or older, while our survey includes respondents of 18 years of age or older. The under representation of the lowest age range and education level is partly explained by this different lower age bound. Level 0 corresponds to 'lower secondary school', Level 1 to 'upper secondary', Level 2 to 'College', Level 3 and above to 'University'; [c] Lower representation of lower levels of social grade might be explained by 'prefer not to tell' answers which are more likely to correspond to lower rather than higher social grades.

Appendix 2. Factor analysis over general environmental attitudes and place identity perception statements

Rotated Component Matrix[a]

	Component			
	1	2	3	4
We are approaching the limit of the number of people the earth can support	.260	.076	.081	**.721**
Humans have the right to modify the natural environment to suit their needs (reverse coded)	.163	**.654**	.007	-.023
When humans interfere with nature it often produces disastrous consequences	**.554**	.156	.036	.214
Human ingenuity will ensure that we do not make the earth uninhabitable (reverse coded)	-.027	**.677**	-.026	.193
Humans are severely abusing the environment	**.622**	.166	.062	.294
The earth has plenty of natural resources if we just learn how to develop them (reverse coded)	-.429	**.456**	-.040	.433
Plants and animals have as much right as humans to exist	**.693**	.121	.155	.005
The balance of nature is strong enough to cope with the impacts of modern industrial nations (reverse coded)	.235	**.695**	.024	.170
Despite our special abilities humans are still subject to the laws of nature	**.542**	.082	.171	.042
The so-called “ecological crisis” facing humankind has been greatly exaggerated (reverse coded)	.406	**.550**	.072	.119
The earth is like a spaceship with very limited room and resources	.290	.059	.070	**.761**
Humans were meant to rule over the rest of nature (reverse coded)	.340	**.622**	.058	-.083
The balance of nature is very delicate and easily upset	**.552**	.153	.192	.366
Humans will eventually learn enough about how nature works to be able to control it (reverse coded)	-.001	**.680**	-.002	.022
If things continue on their present course, we will soon experience a major ecological catastrophe	**.607**	.201	.068	.402
I think peatlands are part of Scotland’s identity	.399	-.006	**.552**	.131
I have strong bonds with Scotland	.031	.014	**.920**	.027
I strongly identify with Scotland	.012	.006	**.919**	.023
I like to spend time enjoying the Scottish landscape of which peatlands are a very important part	.299	.028	**.589**	.063

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Appendix 3. Factor analysis over general and specific environmental attitudes' statements

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
We are approaching the limit of the number of people the earth can support	.107	.109	**.700**	.062	-.040
Humans have the right to modify the natural environment to suit their needs (reverse coded)	.077	**.620**	.072	.083	-.145
When humans interfere with nature it often produces disastrous consequences	.022	.225	.392	**.470**	.095
Human ingenuity will ensure that we do not make the earth uninhabitable (reverse coded)	-.091	**.644**	.196	-.046	-.064
Humans are severely abusing the environment	.167	.267	.415	**.435**	.170
The earth has plenty of natural resources if we just learn how to develop them (reverse coded)	-.067	.410	.251	**-.546**	-.235
Plants and animals have as much right as humans to exist	.282	.150	.231	**.589**	-.096
The balance of nature is strong enough to cope with the impacts of modern industrial nations (reverse coded)	.159	**.732**	.174	.020	.162
Despite our special abilities humans are still subject to the laws of nature	.164	.126	.147	**.597**	-.139
The so-called "ecological crisis" facing humankind has been greatly exaggerated (reverse coded)	.369	**.604**	.150	.075	.201
The earth is like a spaceship with very limited room and resources	.137	.088	**.751**	.064	-.143
Humans were meant to rule over the rest of nature (reverse coded)	.177	**.587**	.069	.255	-.097
The balance of nature is very delicate and easily upset	.268	.207	**.480**	.339	.034
Humans will eventually learn enough about how nature works to be able to control it (reverse coded)	-.075	**.665**	-.014	.119	-.124
If things continue on their present course, we will soon experience a major ecological catastrophe	.309	.252	**.541**	.253	.194
I want to have the possibility to enjoy the wildlife on restored peatlands	**.590**	-.057	.204	.106	-.049
I support peatland restoration because it will give me better water quality	**.616**	-.124	.220	.013	.039
It is important for me that peatlands are handed over to future generations in good ecological condition	**.718**	.128	.125	.161	.042
It gives me satisfaction to simply know that peatlands will be in a good condition	**.670**	-.009	.187	.112	.010
I want to see peatlands restored because it is an opportunity to do something about climate change	**.651**	.145	.254	.067	.186
Future generations will benefit from peatlands being restored now	**.660**	.126	.038	.251	-.007
Peatland restoration is a waste of time and money	**-.654**	-.297	.132	-.205	.141
Land owners have an obligation to restore peatlands for the benefit of society	**.385**	.047	.210	.215	-.376
Peatland restoration will hurt the rural economy	-.371	-.140	.173	-.165	**.454**

Peatland restoration will benefit me	**.685**	.005	.069	-.037	-.032
I don't care about peatland restoration	**-.691**	-.265	.100	-.124	.115
Land owners should be compensated for restoring peatlands	.183	-.081	-.060	.094	**.710**
Peatland restoration will benefit others I care about	**.718**	.021	.072	.064	.068

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Appendix 4. Results of the HMXL model with socio-demographic variables included in the structural component

The discrete choice component (WTP-space, in GBP)				
	Means	**Standard deviations**	**Interaction with LV_1 (positive general environmental attitudes)**	**Interaction with LV_2 (strong place identity)**
Status quo	-130.78***	89.83***	-13.62***	-10.78**
	(4.99)	(5.58)	(4.16)	(4.36)
Bad to good (1% shift)	0.81***	1.49***	0.52***	0.32***
	(0.05)	(0.05)	(0.05)	(0.06)
Intermediate to good (1 shift%)	0.56***	0.97***	0.34***	0.18***
	(0.03)	(0.04)	(0.04)	(0.04)
Restoration in wild land area	23.32***	39.22***	14.60***	7.28***
	(1.65)	(1.91)	(1.81)	(2.20)
Restoration in area with lots of peat	13.07***	37.75***	5.68***	4.94***
	(1.57)	(2.31)	(1.72)	(1.46)
-Cost/100	1.25***	1.09***	0.15***	0.06
	(0.04)	(0.05)	(0.04)	(0.04)

The measurement component[14]		
	LV_1 (positive general environmental attitudes)	**LV_2 (strong place identity)**
We are approaching the limit of the number of people the earth can support	0.6279***	
	(0.0419)	
Humans have the right to modify the natural environment to suit their needs (reverse coded)	0.5789***	
	(0.0400)	
When humans interfere with nature it often produces disastrous consequences	0.7700***	
	(0.0481)	
Human ingenuity will ensure that we do not make the earth uninhabitable (reverse coded)	0.5201***	
	(0.0388)	
Humans are severely abusing the environment	1.1286***	
	(0.0635)	
The earth has plenty of natural resources if we just learn how to develop them (reverse coded)	0.1219***	
	(0.0343)	
Plants and animals have as much right as humans to exist	0.7815***	
	(0.0510)	
The balance of nature is strong enough to cope with the impacts of modern industrial nations (reverse coded)	0.9230***	
	(0.0510)	
Despite our special abilities humans are still subject to the laws of nature	0.5505***	
	(0.0435)	
The so-called "ecological crisis" facing humankind has been greatly exaggerated (reverse coded)	0.9691***	
	(0.0518)	
The earth is like a spaceship with very limited room and resources	0.7092***	
	(0.0442)	
Humans were meant to rule over the rest of nature (reverse coded)	0.7923***	
	(0.0465)	
The balance of nature is very delicate and easily upset	0.9786***	
	(0.0564)	
Humans will eventually learn enough about how nature works to be able to control it (reverse coded)	0.4077***	
	(0.0369)	
If things continue on their present course, we will soon experience a major ecological catastrophe	1.2137***	
	(0.0638)	

[14] The estimated ordered logit threshold parameters are not reported here for brevity. We include full results in the supplementary materials available online. The possible responses were: 1=completely disagree, 2=somewhat disagree, 3=somewhat agree, 4=completely agree.

I think peatlands are part of Scotland's identity	0.798*** (0.0463)
I have strong bonds with Scotland	5.5750*** (0.6344)
I strongly identify with Scotland	4.6489*** (0.7435)
I like to spend time enjoying the Scottish landscape of which peatlands are a very important part	0.7345*** (0.0461)

Structural component[15]

	Dependent variable: LV_1 (positive general environmental attitudes)	**Dependent variable: LV_2 (strong place identity)**
Age	-0.1246*** (0.0264)	0.1588*** (0.0282)
Female	0.1188*** (0.0239)	0.1589*** (0.0256)
Secondary school beyond 16 (reference: secondary education up to 16)	-0.0019 (0.0331)	-0.0385 (0.0359)
College education (reference: secondary education up to 16)	-0.0049 (0.0308)	0. 1208*** (0.0310)
University education (reference: secondary education up to 16)	0.0251 (0.0348)	-0.0361 (0.0398)
Income above median (reference: income below median)	-0.1351*** (0.0230)	-0.0031 (0.0245)
Member of environmental organization	0.0661*** (0.0241)	-0.0013 (0.0223)
Children or grandchildren below 16	-0.0747*** (0.0243)	0.0625** (0.0299)
Household size (number of people)	-0.0274 (0.0262)	0.0288 (0.0263)
Lives in urban area (reference: lives in rural area)	-0.0210 (0.0233)	0.0259 (0.0249)
Some peat close to place of residence (reference: no peat)	-0.0236 (0.0292)	-0.0434 (0.0320)
Lot of peat close to place of residence (reference: no peat)	0.0402 (0.0294)	-0.0314 (0.0317)
Outdoor recreation - somewhat important (reference: not important)	0.0646 (0.0627)	0.0026 (0.0627)
Outdoor recreation – important (reference: not important)	0.1920*** (0.0601)	0.0889 (0.0596)
Outdoor recreation – very important (reference: not important)	0.3929*** (0.0658)	0.3398*** (0.0624)
Outdoor recreation – rarely (reference: never)	0.1629*** (0.0499)	0.1104** (0.0473)
Outdoor recreation – occasionally (reference: never)	0.0641 (0.0836)	0.0797 (0.0817)
Outdoor recreation – frequently (reference: never)	0.1163 (0.0958)	0.0863 (0.0913)
Outdoor recreation – very frequently (reference: never)	0.0331 (0.0951)	0.0783 (0.0919)
Previous visit to wild (peat) areas – once or twice (reference: never visited)	-0.0716*** (0.0260)	0.1093*** (0.0272)
Previous visit to wild (peat) areas – several times (reference: never visited)	0.0111 (0.0289)	0.2503*** (0.0303)
Previous visit to wild (peat) areas – live there (reference: never visited)	0.0064 (0.0278)	0.0973*** (0.0234)

[15] All explanatory variables in the structural componen are normalized for zero mean and unit standard deviation.

Model diagnostics[16]	
LL at convergence	-32,160.8
LL at constant(s) only	-38,701.9
McFadden's pseudo-R^2	0.1690
Ben-Akiva-Lerman's pseudo-R^2	0.4948
AIC/*n*	6.0388
BIC/*n*	6.1469

[16] Further information on the model diagnostics included: *n* (number of observations) = 10,704; *r* (respondents) = 1,338; *k* (parameters) = 159. The smaller sub-set of respondents considered for this model (with respect to previous ones) is due to the fact that socio-demographic information was not available for all individuals.