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Is Forest Landscape Restoration Socially Desirable? A Discrete Choice Experiment Applied to the Scandinavian Transboundary Fulufjället National Park Area

Running head: Is Forest Landscape Restoration Socially Desirable?

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Abstract

Using an economic valuation approach, we assessed people's stated preferences for policy aimed at enhancing a public good as restoration of functional networks of naturally dynamic boreal forest areas. This kind of landscape restoration can improve the functionality of land cover patches as green infrastructure, which is essential for biodiversity conservation and delivery of ecosystem services that managed forests are poor at providing. In contrast, so far designation of protected areas in Fennoscandia has focused on remnant patches of near-natural forests, and not on forest landscape restoration. We assessed citizens' preferences for forest landscape restoration in a transboundary border region primarily managed for sustained-yield wood production for the forest industry, and hosting the adjacent transboundary Fulufjället National Parks in Sweden and Norway. We conducted a discrete choice experiment by asking Swedish and Norwegian citizens to choose among two options for the Fulufjället area, viz. (1) extension of passive protection on one side or both sides of the border, by additional area protection and restoration of forest naturalness, and (2) a status quo option. The scenario assumed that extension of the protected forest area would imply a compulsory tax administered bilaterally by the two countries. In both countries 54-60% of citizens expressed willingness to pay for forest landscape restoration. Alternatives that contemplated bigger extension of the protected area on domestic segment of Fulufjället were assigned higher willingness-to-pay. Public awareness and support, combined with spatial planning, are necessary for forest landscape restoration to become efficient for biodiversity conservation.

Key words: stated preference valuation, passive protection, transboundary nature protected areas, naturally dynamics boreal forests, willingness-to-pay

Implications:

- A stated preference study indicated that passive area protection aiming at restoration of transboundary near-natural forest landscapes is a socially desirable land management in Scandinavia.
- Respondents in both Norway and Sweden stated on average positive willingness-to-pay for restoration of naturalness in human-transformed forests adjacent to Fulufjället National Park.
- A bigger extension of passively protected area on the domestic segment of the transboundary Fulufjället national parks was related to higher willingness-to-pay.
- Citizens' willingness-to-pay for extending the foreign part of the National Park was significantly lower than for extending the domestic part. .

Introduction

The term green infrastructure appeared to communicate the need to maintain natural capital by means of spatial planning (e.g., Thomas & Littlewood 2010; Čivić and Jones-Walters 2014). Natural capital highlights the key role of maintaining ecosystems that deliver the benefits desired by people (Daily 1997). Sufficient quality, size and functionality of land cover patches are three core features (Angelstam et al. 2011). According to the European Commission (2013a) green infrastructure is "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services". A key tool towards functional green infrastructure is to establish effectively and equitably managed, ecologically representative, and well connected systems of protected areas that meet evidence-based knowledge about how much area needs to be set aside for biodiversity conservation (Svancara et al. 2005; CBD 2010). In regions with a long history of transforming naturally dynamic forest landscapes to managed forests, protected areas and other kinds of set-asides need to be complemented by restoration (Halme et al. 2013).

Forest landscape restoration (FLR) is the process of regaining ecological functionality and enhancing human well-being across deforested or degraded forest landscapes (e.g., Mansourian & Vallauri 2005, Chazdon & Laestadius 2016). This implies viewing landscapes as coupled human nature systems, and applying transdisciplinary approaches that integrate academic disciplines and practices Naveh (2005), requiring diagnoses of both ecological and social systems (Angelstam et al. 2013), as well as subsequent proactive spatial planning and management (Elbakidze et al. 2015).

Re-wilding is another term used for landscape restoration through passive or active restoration of landscape properties (e.g. Gamborg et al. 2010). This concept gained impetus in Europe after the EU introduced measures for curbing agricultural production, for example by leaving farmland fallow for tree and grass growth (i.e. the “set aside” or non-intervention approach in EU policy). Similarly, given sufficient time, also intensively managed forest areas can be transformed back to some semi-natural and, eventually, a near- natural state (Rey Benayas et al. 2008, Peterken 1996). A considerable part of the remaining pristine nature areas in Europe is located in border areas between two or more countries. Examples of European transboundary National Park (NP) areas where landscape restoration towards naturalness takes place, are the Thayatal - Podyjí transboundary NP, shared by Austria and the Czech Republic, and in the Šumava - Bayerischer Wald transboundary NP, shared by the Czech Republic and Germany (Vasilijević & Pezold 2011).

To ensure that natural capital is maintained forest landscape restoration has to address both multiple spatial scales and engage a wide range of stakeholders. A key pre-requisite for governors’ and managers’ up-take of new knowledge is to map stakeholders and actors involved with GI planning and management of green infrastructure, including non-governmental organizations and civil associations, businesses, and government agencies and local government units. Given high rates of landscape change away from naturalness (Halme et al. 2013), it is crucial to provide both policy- and decision-makers involved with governance and management with analyses of people’s preferences.

In Europe’s boreal forest biome the extent and number of protected areas has increased considerably over the past century (Elbakidze et al. 2013). However, systematic analyses of the amount of different representative natural and semi-natural ecosystems, and comparison with evidence-based knowledge about how much area is enough to maintain functional habitat networks, show that there are severe gaps in boreal forest landscapes (e.g., Angelstam & Andersson 2001). With few and fragmented natural areas left, forest landscape restoration is thus necessary to help improving functionality of existing patches of different forest land cover types as green infrastructure (e.g., Angelstam et al. 2011a).

Apart from biodiversity conservation per se, a pertinent question concerning landscape restoration towards a functional green infrastructure is whether nature protection increases human well-being. Are individuals/households willing to sacrifice other land use alternatives (forestry, area for snowmobiles, hunting, etc.) for restoring managed forest areas' biodiversity and leaving some areas passively protected? Are they at the same time willing to pay the costs of such a decision (including lost profits implied by it)? Transboundary regions are particularly interesting as such regions are peripheral, and thus less intensively managed.

There is a professional interest in economics in assessing people's preferences towards public environmental goods, and there is a policy interest in learning about these preferences, with a particular interest in how people value the nature shared between nations. However, citizens' preference for landscape restoration by extension of protected areas may only to a limited extent be signaled by human behavior (Larson 1993). While protected areas are being visited by people, this may not reflect the non-use (passive use) values they attach to them (Krutilla 1967; Carson et al. 1999). Measuring non-use values is not straightforward, as economists cannot refer to people's actual choices. A widely used method for valuing public goods, particularly those that people value without the need of direct use (e.g., visits), is contingent valuation (Mitchel & Carson 1989). The method is survey-based. A sample of affected population faces a scenario for some possible change in a public good, e.g. a change in some land-use. Then they are asked if they accept a new policy according to which everyone has to pay some amount for the good, such as protecting natural forests, or to choose among policy options that may include different levels of area protection, or levels of enlargement of protected areas. The latter elicitation format is known as discrete choice experiments (DCE) (Carson & Czajkowski 2014). DCE have gained much popularity in recent years, as they allow respondents to trade-off more elements in a policy choice involving biodiversity conservation or other public goods (Carson 2012). The DCE respondents are presented with hypothetical policy scenarios and asked to choose the variant that they prefer most, given the associated cost to their household budget. Here we use the term “contingent valuation” in line with the nomenclature in stated preference research, as suggested by Carson and Louviere (2011); the term “contingent valuation” is independent of the preference elicitation method used, so it encompasses both open-ended questions and close-ended choice questions (including DCE).

Previous studies have applied DCE to landscape restoration in several different land cover types. Christie et al. (2006) valued restoration of natural grassland habitats in England, and Dallimer et al. (2015) applied DCE to natural grassland restoration in three European countries. Hoyos et al. (2012) applied DCE to the assessment of landscape restoration in a Natura 2000 site in the Basque country, Spain. Regarding forests, Meyerhoff et al. (2009) assessed a field-to-forest conversion program in Lower Saxony, Germany, and Liekens et al. (2012) valued forest restoration on former agriculture land in Belgium.

The aim of this study is to assess people’s preferences for landscape restoration of boreal forest areas primarily managed for timber production with the aim to improve the functionality of boreal forest green infrastructure. While economic considerations increasingly appear in the literature on biodiversity conservation and landscape restoration (e.g., Armsworth 2014, Schultz et al. 2012, Robbins & Daniels 2012, Weber & Stewart 2009, Crossman & Bryan 2006), Iftekhar et al. (2016) noted that “with few exceptions, ecological restoration studies that include economics focus solely on evaluating costs of restoration projects”. However, benefits may not be adequately signalled by market transactions because assessment often relies on community survey-based methods. In this study we fill the gap in terms of valuation of benefits of restoration of boreal forests.

As an example, we chose the transboundary Fulufjället area on the Scandinavian peninsula in northern Europe, shared by Sweden and Norway (Zachrisson 2009; Norwegian Environment Agency 2014). A large part of Fulufjället (in Swedish, "Fulufjellet" in Norwegian) is a National Park that includes a boreal forest and alpine heath continuum. Given gaps in current protected areas' ability to conserve species, habitats and natural processes there is a need for increasing the area of semi-natural forest habitats by passively protecting additional adjacent forest areas, and incorporating them into the National Park management regime. We therefore surveyed samples of the Swedish and Norwegian human populations, applying choice experiments. A total of 2531 individuals were asked to choose among two options for the Fulufjället area, viz. (1) extension of the National Park, on one side or both sides of the border, as specified in the choice experiment task, and (2) the status quo option. The scenario explained that National Park extension would imply costs for the respondents in the form of a compulsory tax administered bilaterally by the two countries for a five-year period. To our knowledge, this study represents the first stated preference study valuing forest landscape restoration for boreal biodiversity conservation and human well-being in a transboundary protected area.

Methods

Study region

Like in many other countries of Europe, the reminiscence of naturally dynamic forest areas along the border between Sweden and Norway can be explained by their remoteness to centers of economic development (Angelstam et al. 2004). This is linked to low human population density, combined with relatively limited physical accessibility from both sides of the border. Border areas between countries thus host valuable nature areas, sometimes protected, although often with no formal transboundary management. The area around Fulufjället is a good example. Most of these lands have not been used by humans intensively except for the forests at lower altitudes (forest do not grow at elevation of > 900 m above the sea level). Landscape restoration can take place either through active or passive regeneration of landscape properties (Crouzeilles et al. 2016). Some areas currently not yet used for forestry are adjacent to protected areas and would represent candidates for passive landscape restoration. Additionally, there is opportunity for active habitat restoration (e.g., Halme et al. 2013).

Fulufjället is a mountain plateau area situated within the municipalities of Älvdalen in Dalarna County (Sweden) and Trysil in Hedmark County (Norway). The large core part is either bare rock or rock overgrown with lichens, and is surrounded by near-natural boreal forests on the mountain slopes and in adjacent valleys. There are remnants of old-growth coniferous forests, which host rare and endangered species, also including large mammal carnivores (PAN Parks 2009; Länsstyrelsen Dalarna 2011; Norwegian Environment Agency 2014). On the Swedish side, Fulufjället National Park was established in 2002 (Naturvårdsverket 2002). This provided an impetus for Norway to establish the adjacent Fulufjellet National Park on their side of the border in 2012 (DN 2012; Miljøverndepartementet 2012).

The two adjacent National Parks at the border between Norway and Sweden (see Fig. 1) have not yet been presented or promoted as a transboundary protected area. Instead, each country presents its own protected area (Länsstyrelsen Dalarna 2006; Norwegian Environment Agency 2014). The larger Swedish part, 385 km^2, has a well-established zoning system comprising four zones: (1) a wilderness zone (see category I of IUCN, in Dudley 2008); (2) a low-intensity activity zone; (3) a high-intensity activity zone (both zones 2 and 3 would probably fall into category II of IUCN); and (4) a development zone (category V of IUCN). The latter zone includes the major National Park entrance with car parking, cafeteria and a visitor center, and trails to Sweden's tallest waterfall (Länsstyrelsen Dalarna 2006). The National Park in Norway was established without zoning, and covers a considerably smaller area (86 km^2). As most Norwegian National Parks, it is not designated as a "visitor park" (Haukeland 2011), but aims at nature protection. The entrance to the National Park on the Norwegian side, a relatively small and simple gate structure at Storbekkåsen without other visitor facilities, was established in the years after the National Park designation. The connection with a larger Swedish protected area was important for the establishment of the National Park on the Norwegian side (Miljøverndepartementet 2012).

In general, the nature protection regime in Swedish and Norwegian National Parks is stricter than in National Parks on the European continent, allowing very limited infrastructure and normally banning motorized transport. Forests within both National Park areas are dominated by old-growth stands, and logging is banned other than for than safety and maintenance of trails (Naturvårdsverket 2002; Miljøverndepartementet 2012). The forest areas around the Fulufjället and Fulufjellet National Parks range from semi-natural forest (particularly in the areas with lowest wood productivity and/or low accessibility) to forests managed to provide raw material for the forest industry. A recent analysis of green infrastructure functionality stressed the need for improved forest protection and landscape restoration in this region (Angelstam and Andersson 2013).

Forestry was traditionally an important local industry on both sides of the border. On the Norwegian side, relatively large old-growth forest areas around Fulufjellet were cut as recently as around 1990, after Statskog SF, the Norwegian state-owned land and forestry enterprise, bought the forest area from a private Swedish owner (H. Ch. Gjerlaug 2013, Hedmark County Fylkesmannen, Hamar, personal communication). On the Swedish side, in spite of increase in protected areas and voluntary set-asides, nevertheless, habitat network functionality declined by 35-42% from 2002 to 2012 (Angelstam and Andersson 2013).

In both countries there was some local opposition to National Park creation (Wallsten 2003; **Blanco & Fedreheim 2011**), including representatives of forestry, reindeer husbandry and industrial tourism interests. However, in Sweden, local support has grown after the National Park was established (Zachrisson 2009; Wallsten 2012). Currently nature protection within this transboundary area implies challenges. For example, the existence of different management regulations at each side of the border affects, as well as the development of infrastructure for recreational activities such as appropriate transboundary trails.

Questionnaire development

After initial assessment of the Fulufjäll area for forest landscape restoration a questionnaire draft was developed in 2013-2014. The survey preparation phase included literature surveying and collection of information from National Park administrations (particularly for the Norwegian side, through the County Governor of Hedmark, as the National Park assignment was very recent) an interdisciplinary workshop was arranged, in late November 2013. The workshop gathered experts on the ecosystem of the area, on National Park management, and economic valuation of nature preservation and restoration in order to frame the valuation study into a wider interdisciplinary context. A draft of the questionnaire, in English (see final English version of the questionnaire in the Supporting Information section, Appendix S1), was developed in 2014. The questionnaire consisted of five parts, namely (1) introductory questions, (2) scenario, (3) DCE, (4) debriefing block of attitudinal questions, and (5) a block of questions on respondent's socioeconomic characteristics.

In early 2015 the adjusted questionnaire version in Swedish and Norwegian languages was tested in focus group sessions (Krueger & Casey 2015), one in Stockholm and one in Oslo, **both including seven participants**. The focus group participants indicated that the presentation of passive protection, i.e. gradual restoration of structures like standing and lying dead wood, multi-layered tree vegetation and of large and old trees in "production forest" adjacent to natural forest remnants, was somewhat demanding. The recommended solution was step-wise introduction of key concepts, and applying more illustrations and fewer words. The focus group participants also called for more clarifications of the choices among different options of extending the passive protection of forests.

Scenario and Experimental Design

The main idea of the survey scenario was the spatial expansion of the passive protection on the adjacent areas to the National Parks Fulufjället and Fulufjellet, in order to restore natural dynamic forest ecosystems remnant "islands" and improve functional and structural connectivity of intact forest habitats for species. On the Norwegian side a proposed extension of the protected forest area could comprise the Bergåa river valley, which would link the small Fregn Nature Reserve (4 km^2) to Fulufjellet National Park. On the Swedish side, the Fulan river valley, to the east of Fulufjället National Park, is also a forest area relatively intensively managed for forestry, while Lillådalen to the north-west of Fulufjället National Park is already designated a Nature Reserve (E. Zuñiga 2014, Fulufjället National Park, Mörkret, personal communication).

In the scenario presented to the samples of citizens, four possible sizes of protected area extension (attribute levels) were introduced, namely 0 km^2, 20 km^2, 40 km^2, 60 km^2, on both sides of the border. These attribute levels were visualized and verbalized in a manner facilitating correct scale perception by the respondents (for instance, 40 km^2 extension attribute was said to be equal in area to the square plot of land with the side of about 6.3 km, and so on). An additional textbox described how these levels of extension could be located in the three yellow-marked areas adjacent to the National Park related to the specific areas on the Fulufjället map (Fig. 1).

To simplify the respondents' choice experiment task, they were informed that as a result of passive protection introduction, near-natural forests would be restored in some two hundred years in any particular direction from the two adjacent National Parks. In the future the restored areas would thus have the same biodiversity conservation potential as existing protected areas in terms of providing natural forest habitat for rare and endangered species. Therefore, all possible areas of extension were assumed to be of uniform restoration value as future natural forest habitats. Hence, any square kilometre, contemplated for additional passive protection was presented as identical from the perspective of the program goals, regardless of its particular location.

In addition to protected area expansions, the DCE also included a cost attribute for enabling monetary valuation of the choices. Financial costs are involved in the National Park designation / expansion process, a considerable part being administrative work and consultations, but also remuneration of landowners for the future loss of income from forest harvesting because of the protection regime establishment. The existence of such costs and compensations are assumed either known or being perceived as comprehensible/realistic for survey respondents, thus representing a credible cost attribute ("payment vehicle"). A bilateral Swedish-Norwegian fund would administer tax payments from the citizens during a five-year period, and it would coordinate the extension of the protected area on both sides of the border.

Next, the respondents faced sixteen choice tasks, which always included the status quo option of no change (and no costs), together with either one, two or three alternatives describing the size of National Park extension (20, 40, or 60 km^2) on the Swedish side; the same attribute for the Norwegian side, and the annual tax cost to the respondent (see Fig. 2). Every respondent was asked to indicate for each choice task the best option from her point of view. Cost attributes of the choice tasks (or bids) were suggested for the pilot survey with respect to the factor of purchasing power parity (PPP) in order to maintain equality of the choice task conditions for citizens of the both countries involved. The bids have been denominated in national currency units in NOK and SEK respectively.

Survey administering and sample

The questionnaires were adapted to an Internet-consistent format (CAWI), and pilot-tested in September and October 2015 with a sample of 458 Swedes and 282 Norwegians with the help of existing Internet panels. As the questionnaire was found to work well in the pilot, it was carried over to the main survey without further changes, except that the design of the choice attribute levels was adjusted in order to improve statistical efficiency. As the main survey, carried out in November and December 2015, comprised 889 Swedes and 902 Norwegians, the sample used for subsequent analyses comprises in total 1347 Swedes and 1184 Norwegians. The CAWI survey was hosted by IQS Sp. z o.o. (http://www.grupaiqs.pl/en), a Polish Internet panel agency, which applied a quota sampling based on households' geographical distribution within the country, as well as the educational level. Table S1 provides descriptive statistics of the datasets from both countries.

Econometric analyses

The status quo alternative meaning no extension of the transboundary NPA, was the respondent's best choice in about 46% of the choice-tasks in the Swedish sample and in about 45% in the Norwegian sample. Moreover, 28% of the Norwegians and 24% of the Swedes consistently chose status quo in all the sixteen choice tasks. With the purpose of identification of protesters, i.e. respondents who for some reasons understate their true WTP and therefore bias the modelling results (Fonta et al. 2010), additional questions were asked about the motivation of systematically choosing status quo. After removal of protesters (those indicating that it is the government who must finance nature restoration programs, not them) the dataset (main surveys plus pilots) was reduced to 1000 Norwegian respondents and 1166 Swedish respondents; while status quo alternative in the protesters-free sample was picked as a respondents' best choice in about 35% and 38% of choice-tasks respectively.

The subsequent econometric analyses followed the random utility theory(McFadden, 1974), which assumes that the utility a person derives depends on observed characteristics and unobserved idiosyncrasies, represented by a stochastic component. As a result, individual i's utility resulting from choosing alternative j in choice set t can be expressed as:

$$V_{ijt} = a_i c_{ijt} + \boldsymbol{b}_i' \boldsymbol{X}_{ijt} + e_{ijt} , \qquad (1)$$

where the utility expression is assumed additively separable in the cost of the alternative, c_{ijt}, and other attributes, $\boldsymbol{X}_{ijt}$; a_i and $\boldsymbol{b}_i$ denote estimable parameters; and e_{ijt} is a stochastic component allowing for factors not observed by the econometrician to affect individuals' utility and choices. It should be emphasized that a_i and $\boldsymbol{b}_i$ are individual-specific, thus allowing for heterogeneous preferences amongst respondents and leading to a mixed logit model (MXL; Train 2003). Normalisation of the variance of the stochastic component of the utility function (e_{ijt}) leads to the following specification:

$$U_{ijt} = \sigma_i a_i c_{ijt} + \sigma_i \boldsymbol{b}_i{}' \boldsymbol{X}_{ijt} + \varepsilon_{ijt} \,. \tag{2}$$

Note that due to the ordinal nature of utility, this specification still represents the same preferences as (1) does. The estimates $\sigma_i a_i$ and $\sigma_i \boldsymbol{b}_i$ do not have direct interpretation, but if interpreted in relation to each other, the scale coefficient σ_i cancels out. Given the interest in establishing estimates of WTP for the non-monetary attributes $\boldsymbol{X}_{ijt}$, it is convenient to introduce the following modification which is equivalent to using a money-metric utility function (aka estimating the parameters in the WTP space; Train and Weeks, 2005):

$$U_{ijt} = \sigma_i a_i \left(c_{ijt} + \frac{\boldsymbol{b}_i}{a_i}' \boldsymbol{X}_{ijt} \right) + \varepsilon_{ijt} = \lambda_i \left(c_{ijt} + \boldsymbol{\beta}_i' \boldsymbol{X}_{ijt} \right) + \varepsilon_{ijt} \,. \tag{3}$$

Note that under this specification the vector of parameters $\boldsymbol{\beta}_i$ is now scale-free and can be directly interpreted as a vector of implicit values for the attributes, $\boldsymbol{X}_{ijt}$. All the reported discrete choice models have been estimated in the WTP space.

The utility function specified in this study included six dummy-coded variables associated with the levels of spatial extension of the passive protection domestically and abroad, the continuous monetary cost variable, and an alternative-specific constant for the status quo. In the MXL model we accounted for the panel-structure of data, a normal distribution for the non-monetary random parameters, and log-normally distributed cost coefficient. The negative cost parameter was assumed log-normally distributed to impose the theory-driven restriction that marginal utility of money is positive. Finally, we note that all parameters were allowed to be freely correlated. The model was estimated using maximum simulated likelihood techniques, using 10,000 shuffled Sobol draws. The models were estimated in Matlab. The software used here (estimation package for DCE data) is available at https://github.com/czaj/DCE under CC BY 4.0 license. The dataset, additional results and estimation codes are available from http://czaj.org/research/supplementary-materials.

Results

Table 1 presents the estimation results using the two national sets (Norwegian and Swedish) using every respondent's sixteen choices between status quo option and various options involving National Park extensions (aka program alternatives). The MXL model was estimated in WTP-space, and therefore all model coefficients can readily be interpreted as marginal WTP for attribute levels. Whilst the respondents faced costs denominated in their own currency (2015-kroner, SEK or NOK), the modeling results are given in tens of EUR (2015) using PPP-weighted exchange rate for Swedish kroner (SEK) and Norwegian kroner (NOK), using the average exchange rates of 2014 and PPP adjustment based on the 2014 GDP per capita. Our model assumes that all parameters, except for the cost, are normally distributed and hence the estimate of mean and standard deviation are provided. Highly statistically significant standard deviations obtained for all the program attributes in both country-specific MXL models communicate that the data exhibits considerable heterogeneity of preferences. Table 1 presents the parameters of the underlying normal distribution, in tens of EUR.

All the estimated models parameters are consistent with a priori expectations. Parameters of the means for the status quo are negative and significant, indicating that on average respondents prefer implementing the extension to keeping the status quo, irrespective of the scale of the extension. The parameters of all extension-specific dummy variables are positive, highly significant, and they are increasing in the size of the extended National Park area. Therefore, both samples are, on average, willing to depart from the status quo and willing to pay positive amounts of money for the implementation of the contemplated landscape restoration programs, implying passive protection and restoration of the forests adjacent to the existing National Parks. Although respondents generally prefer extensions of the park on their side of the border, they also express positive WTP for extensions on the other side of the border – all the appropriate coefficients are positive and statistically significant.

Table S2 presents the estimated correlation coefficients of parameter estimates. We found that respondents who prefer some level of extension typically are also in favor of other scale of extensions, while disapprove the SQ. WTP for extensions within one's country are more strongly correlated with each other, than with extensions abroad, but they remain positive and relatively high. In other words, respondents who prefer extensions in their country, also have relatively higher WTP for extensions abroad, and more negative WTP associated with the SQ option. These results were consistent in both countries.

Assuming that the preferences, stated by surveyed samples of Norwegians and Swedes reflect the preferences of general population of respectively Norway and Sweden, aggregated annual WTP for forest landscape restoration of the Fulufjället area has been simulated for various forest restoration programs. Table 2 presents aggregated mean WTP (in millions of EUR) for various combinations of extensions in the two countries. Note that because the parameters are correlated, the aggregated WTP for a policy is not a simple sum of marginal WTP. We used Small and Rosen (1981) formula and simulation approach similar to Czajkowski, Hanley, and LaRiviere (2014) to calculate WTP for 15 possible extension programs. WTPs for the particular programs were multiplied by the voter turnout record from the recent national elections (held in the years 2013 and 2014 respectively), since the latter seem to be good proxies for the total adult population in between the national censuses in the countries under consideration. Appropriate numbers of adult individuals were 7,614,029 for Sweden and 3,655,788 for Norway (IDEA 2014). The aggregated annual WTPs range from EUR 100 to EUR 200 million in Norway, and from EUR 150 to EUR 270 million in Sweden. These are substantial amounts that could easily outweigh the costs of introducing extensions of passive protection, including the foregone benefits of land users in Fulufjället.

Finally, in order to examine social desirability of transboundary co-operation compared to the unilateral natural forest restoration actions, aggregated annual WTP of Sweden and Norway (all for themselves) can be compared to the Total WTP (international cooperation). If the citizens of Norway only paid for the extension of the park in Norway, and the citizens of Sweden only paid for the extension of the park in Sweden, the aggregated WTP would be substantially lower than the aggregated WTP resulting from implementing a joint international program. This result illustrates the earlier finding that respondents in one country are also WTP for the extensions in the other country. Once this effect is taken into account, the estimated social welfare from extending the park is clearly higher. We acknowledge, however, that considering the uncertainty associated with these estimates, the differences are not statistically significant.

Discussion

The results obtained for Norway and Sweden were similar. About half of Norwegians and Swedes were willing to pay for the passive protection towards forest landscape restoration by allowing natural ageing of forest stands of additional areas adjacent to existing National Parks – including those previously transformed by humans. Additionally, over 60% of the respondents answered positively to the explicit question (asked before the choice experiment) about support for spatially extended protection of Fulufjället. Therefore, passive protection of transboundary forests aimed at forest landscape restoration is a socially desirable land management option by many citizens to improve green infrastructure functionality in Norway and Sweden. The estimated average WTP would most probably be sufficient to indemnify the loss of the current land use and financing the management of the extended bilateral National Park area.

In a similar survey of samples of Poles and Belarusians about passively protecting larger shares of the transboundary Białowieża Forest, the status quo option was picked as respondents' best choice in the majority of choice-tasks they faced (Valasiuk et al. 2017). In a study about public attitudes towards forest landscape restoration by re-wilding in Switzerland Bauer et al. (2009) estimated an approximately 50-50 division of wilderness proponents and wilderness opponents. In Scandinavia, opposition against the ideas of landscape restoration aimed at increased naturalness (cf Peterken 1996) has primarily been related to re-wilding by conservation of large predators (Ericsson & Heberlein 2003; Broberg & Brännlund 2008), or de-domestication by introducing large herbivores (Gamborg et al. 2010). Selecting areas for restoration of forest naturalness adjacent to an existing protected area may result in a positive feed-back loop. Liekens et al. (2012) found that "developing a nature area adjacent to an existing nature area increases WTP" (p. 556).

However, even if clearly necessary to meet biodiversity conservation policy targets (Angelstam and Andersson 2001), the landscape restoration approach is poorly represented in the toolkit for designing protected areas networks as functional green infrastructure in Scandinavia (Angelstam et al. 2011). The Swedish state forest company Sveaskog' Ekopark concept is an exception (European Commission 2013b). Instead, the establishment of existing protected areas has been a selection among areas that already had some high nature values (Angelstam et al., 2011b; Ministry of Climate and Environment, 2014). Combining mapping of high nature value forests (Angelstam and Bergman 2004) with spatial planning to improve habitat connectivity (e.g., Angelstam et al. 2011), passive protection can be enhanced by active restoration measures. These include restoration of dead wood both on the ground and in streams, introduction of fire as a natural disturbance, and removing drainage systems (e.g., Halme et al. 2013).

Landscape restoration may also aim at maintaining cultural landscapes, which are the result of human intervention in ecosystems (e.g., Garrido et al. 2017). However, this involves costly continuous management, otherwise cultural landscape will eventually transform to near-natural forest. Indeed, Jacobsen & Tømmervik (2016) showed the Swedes and Norwegians were opposed to forest restoration by natural overgrowing of traditional cultural landscapes.

An important aspect of the theoretical validity of the results is that WTP increased with increasing area of National Park extension (Carson & Mitchell 1993). Indeed, the program alternatives which contemplated bigger extensions of passively protected area on domestic segment of the transboundary Fulufjället were systematically assigned higher WTP. The bell-shaped preference structure manifested for the foreign segments by both national samples might point at satiation of appropriate preferences at some finite level of spatial protection. Moreover, bell-shaped preferences for preserving nature can actually be found in the literature, also for countable attributes (scales) similar to those we applied; for instance, Lutzenhiser and Netusil, (2001) found bell-shaped patterns for the valuation of urban parks and natural areas.

However, for neither national segment did WTP exhibit linearity: WTP per square kilometre with both Norwegian and Swedish respondents decreases in the additional area of passive protection, contemplated by the program. The decreasing value per unit when increasing the scope, or scale, of protection is well known from former valuation studies (Rollins & Lyke 1998; Veisten et al. 2004) and might be explained with the decreasing marginal utility derived by respondents from additional units of the good under consideration, which is consistent with economic theory.

A substantial part of both nationalities was willing to finance forest restoration and the National Park extension at the other side of the border. This resulted in positive and significant WTP for the spatially extended passive protection of the foreign part of Fulufjället thus setting the preferences mutually co-operative. However, the coefficients with the extension of the foreign part of the contiguous binational NPA were much lower than for the domestic one, and the tendency was the same for Norwegians and Swedes. Therefore, respondents seemed to derive (on average) higher utility from extension of a protection regime of an additional square kilometer of their domestic part than from the equal extension in the foreign part of the transboundary NPA. Also Dallimer et al. (2015) compared preference for nature restoration on domestic and foreign areas, finding that WTP was higher for the domestic program. However, their study did not involve transboundary nature areas. Difference in WTP for domestic and foreign parts of the transboundary area can be underpinned with some form of strategic or protest behavior of the respondents. However, accounting for the variety of potential reasons for such a behavior deserves a separate in-depth analysis.

To ensure that representative forest and other land cover types are maintained through functional green infrastructure, restoration ecology has to address a wide range of stakeholders at multiple levels of governance. This includes ordinary citizens who are also stakeholders with their own preferences, even if they neither have business interests, nor derive use value as site visitors, and do not participate in NGO initiatives. Additionally, evidence-based ecological knowledge about biodiversity conservation targets (e.g. Müller and Bütler 2010), assessment of green infrastructure functionality by spatial analyses (e.g., Elbakidze et al. 2016), and approaches as well as opportunities to spatial planning (Angelstam et al. 2011, Blicharska et al. 2011, Elbakidze et al. 2015) are needed.

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Table 1. The MXL model results (WTP-space, EUR @ PPP)

	Norway		Sweden	
	Mean (st.err.)	**St. dev. (st.err.)**	**Mean (st.err.)**	**St. dev. (st.err.)**
SQ	-24.53*** (0.82)	54.45*** (2.81)	-16.76*** (0.36)	69.50*** (2.46)
NO +20 km^2	13.48*** (0.58)	19.95*** (0.98)	2.67*** (0.30)	16.05*** (1.09)
NO +40 km^2	20.26*** (0.59)	33.05*** (1.44)	3.39*** (0.43)	22.49*** (1.25)
NO +60 km^2	22.76*** (0.64)	45.18*** (1.73)	2.75*** (0.47)	28.79*** (1.20)
SE +20 km^2	4.47*** (0.48)	11.53*** (0.74)	12.41*** (0.46)	17.33*** (1.03)
SE +40 km^2	6.62*** (0.59)	15.33*** (0.82)	15.87*** (0.43)	30.81*** (1.32)
SE +60 km^2	5.91*** (0.71)	20.62*** (0.88)	16.40*** (0.54)	39.92*** (1.53)
COST	0.43*** (0.06)	1.49*** (0.06)	0.52*** (0.06)	1.71*** (0.06)
Model diagnostics				
LL at convergence	-9,562.45		-11,031.74	
LL at constant(s) only	-17,276.36		-20,010.45	
McFadden's pseudo-R^2	0.4465		0.4487	
Ben-Akiva-Lerman's pseudo-R^2	0.5883		0.5947	
AIC/*n*	1.2000		1.1866	
BIC/*n*	1.2211		1.2051	
n (observations)	16,011		18,668	
r (respondents)	1,001		1,167	
k (parameters)	44		44	

Table 2. Aggregated annual mean WTP for the extension of passive protection (million EUR @ PPP; 95% c.i. in parentheses)

	SE +0 km2	SE +20 km2	SE +40 km2	SE +60 km2
Norwegian WTP				
NO +0 km2	–	106.16*** (91.39;122.28)	113.97*** (97.54;130.82)	111.56*** (93.98;128.90)
NO +20 km2	138.96*** (122.21;157.36)	155.46*** (136.86;175.76)	163.06*** (143.20;184.10)	160.49*** (139.42;183.74)
NO +40 km2	163.63*** (144.27;184.34)	180.20*** (159.20;202.62)	187.74*** (164.88;212.08)	185.30*** (161.31;210.25)
NO +60 km2	172.98*** (150.76;197.00)	189.59*** (165.47;214.65)	196.94*** (171.81;222.95)	194.47*** (168.09;221.55)
Swedish WTP				
	SE +0 km2	**SE +20 km2**	**SE +40 km2**	**SE +60 km2**
NO +0 km2	–	222.34*** (182.91;263.85)	248.13*** (203.78;295.73)	252.54*** (203.46;303.51)
NO +20 km2	148.53*** (109.07;188.82)	243.22*** (195.34;291.73)	268.33*** (216.55;323.16)	272.54*** (215.75;331.08)
NO +40 km2	153.76*** (111.12;196.86)	248.41*** (197.10;301.11)	274.24*** (217.94;331.25)	278.55*** (216.69;340.10)
NO +60 km2	149.05*** (102.45;195.37)	243.36*** (189.44;299.51)	269.50*** (210.05;329.39)	273.63*** (210.55;338.52)
Total WTP (all for themselves)				
	SE +0 km2	**SE +20 km2**	**SE +40 km2**	**SE +60 km2**
NO +0 km2	–	222.34*** (182.91;263.85)	248.13*** (203.78;295.73)	252.54*** (203.46;303.51)
NO +20 km2	138.96*** (122.21;157.36)	361.30*** (344.55;379.70)	387.09*** (370.34;405.49)	391.49*** (374.75;409.90)
NO +40 km2	163.63*** (144.27;184.34)	385.97*** (366.61;406.67)	411.76*** (392.41;432.47)	416.17*** (396.81;436.87)
NO +60 km2	172.98*** (150.76;197.00)	395.32*** (373.09;419.33)	421.11*** (398.89;445.13)	425.52*** (403.29;449.53)
Total WTP (international cooperation)				
	SE +0 km2	**SE +20 km2**	**SE +40 km2**	**SE +60 km2**
NO +0 km2	–	328.49*** (274.30;386.13)	362.10*** (301.31;426.55)	364.10*** (297.44;432.42)
NO +20 km2	287.49*** (231.28;346.18)	398.68*** (332.20;467.49)	431.39*** (359.76;507.26)	433.03*** (355.17;514.82)
NO +40 km2	317.40*** (255.40;381.20)	428.61*** (356.30;503.73)	461.98*** (382.82;543.33)	463.85*** (3780;550.35)
NO +60 km2	322.03*** (253.20;392.37)	432.95*** (354.91;514.16)	466.44*** (381.85;552.34)	468.10*** (378.65;560.07)

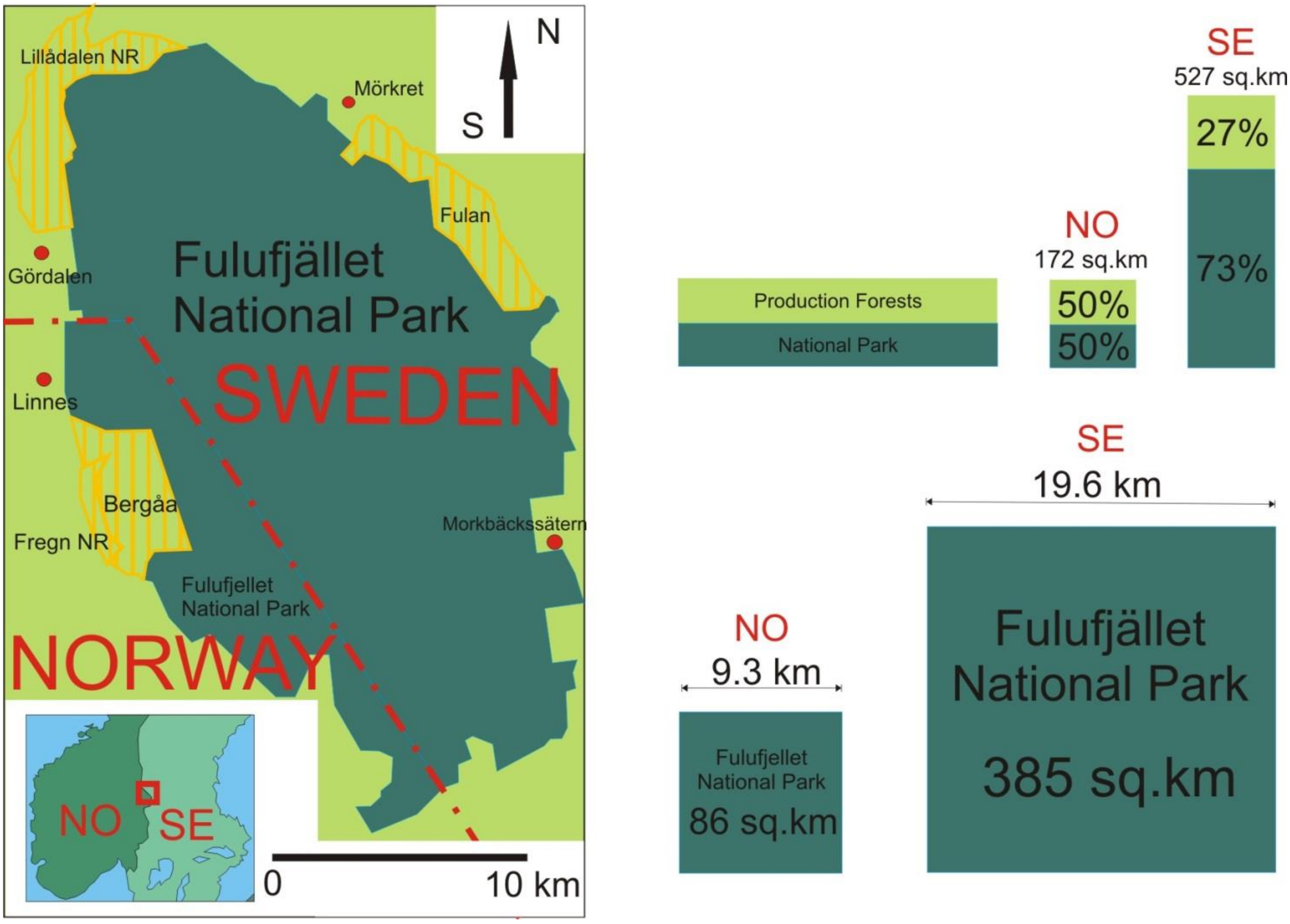

Figure 1. Fulufjället/Fulufjellet map. National border with dash dot line. Shaded areas indicate possible park extensions, as presented in the CE survey scenario

Choice-set	No Change	Option 1	Option 2	Option 3
Additional passively protected hectares in the Norwegian part of Fulufjellet/Fulufjället (overall area of passive protection in its Norwegian part)	+ 0 km^2 (50%)	+ 0 km^2 (50%)	+ 40 km^2 (73%)	+ 60 km^2 (85%)
Additional passively protected hectares in the Swedish part of Fulufjellet/Fulufjället (overall area of passive protection in its Swedish part)	+ 0 km^2 (73%)	+ 60 km^2 (84%)	+ 20 km^2 (77%)	+ 0 km^2 (73%)
Additional amount of income tax, which you would have to pay annually during five years	0 NOK	125 NOK	500 NOK	250 NOK
Your Choice	☐	☐	☐	☐

Figure 2. Choice card visualisation example