Asymmetries of willingness to pay for Swedish semi-natural pastures

Lagerkvist, C.J., Hasund, K,P., Liljenstolpe, C.

Abstract

Within the EU, the agri-environmental goal of a varied agricultural landscape with policy objectives of ensured biodiversity and cultural heritage preservation is addressed by differentiated payments to farmers based upon the environmental quality of their pasture and meadowlands. These payments represent large annual budget costs within CAP. A relevant question in this respect is how social (i.e. citizen) valuation of environmental quality differs and hereby whether the implementation efficiency of payments varies due to environmental quality. A series of four choice experiments (n=1,284) was undertaken in a two-by-two design (location; quality class) to allow for a comparison both within as well as between oak pastures of basic and specific (high) values. Model estimation was performed by using a Bayesian multinomial logit model. The results showed that transferability of value estimates was supported between pastures of similar values classes (being either basic or specific), transferability between pastures of different quality classes appeared not valid. Our findings do not support the proposition from prospect theory. Instead, at the level of individual attributes, the results suggest that respondents' preferences are asymmetrical so that potential environmental quality improvements (gains) are more highly valued than quality reductions (losses), although the strength of this difference differed between attributes. Interestingly, welfare improvements in environmental qualities of pastures with basic values exceeded the welfare deterioration in pastures with specific values in absolute terms. The results from this study therefore suggest that improved environmental qualities in pastures with basic values should be preferred over further improvements of pastures with specific qualities.

Key words: choice experiment; asymmetries; willingness-to-pay; oak pastures, environmental services; landscape valuation; prospect theory

Introduction

Semi-natural pastures were historically important for the feed production and the appearance of these lands has evolved during a long period of time. Today, these pastures are highly valued by society for their recreational qualities, cultural heritage and high biodiversity, However, since the agricultural revolution in the 20th century, new technology and changing relative prices have made much of pastureland unprofitable or little profitable to maintain and use for the production of market commodities, The acreage and environmental qualities have consequently decreased significantly and would have done so even more if there was not the policy response of agri-environmental payments. A fundamental challenge is still how to size and design these payments to become socially efficient.

The environmental problem

The ecosystem services of Swedish semi-natural pastures have been declining significantly over the last decades, and risk to drastically decline even more. The threats to biodiversity are caused by decreasing area, decreasing number of pastures (reducing ecological connectivity by landscape fragmentation), and deteriorating habitat quality of remaining pastures (Losvik, 1999;Fahrig 2001, Mottet et al., 2006; Eriksson 2007). The area of semi-natural (never cultivated) meadow and pastureland has decreased by 70 % from the end of the 19th century (SS, SBA 2013). At present, there are 510 000 ha semi-natural pastures in Sweden (Palmgren 2010). Over the last 10 years, the environmental qualities have decreased significantly on 18 % of the area on pastures registered in the TUVA-database, that is, the environmentally most valuable pastureland (SBA 2013c).

Semi-natural oak pastures, at focus in this study, are denoted as Fennoscandian Wooded Pastures, habitat 9070, in the classification of The Habitats Directive. Their character is varied, with open parts and wooded parts dominated by oaks (*Quercus robur*). In general, they have an extremely high biodiversity; Old oak trees may harbor 1000 species, which is very high at these latitudes (Dahlberg *et al.* 2004). A prerequisite, however, is that the oaks are fairly "solitary" and sun exposed, implying that much of their role for biodiversity get lost if they become surrounded by high brushwood or disappear into forest. In addition, the grazing in oak pastures provides habitats for a great variety of ground level species, including grasses, herbs, mushrooms and insects. Much of the biodiversity get lost, however, if management and grazing intensity decrease. There was 42 000 ha pasture sites having 19 700 ha of oak wooded habitat in Sweden 2013 included in the TUVA-database (SBA 2013a). However, there are indications that the area is underestimated and that TUVA may cover only 25 – 30% of semi-natural pastures (Palmgren 2010).

For recreation and landscape scenery, wooded pastures are highly esteemed in large parts of the population. This affection is also expressed in popular songs, poetry and prose. The ancient Swedish "Allemansrätt", Right of Public Access, makes all pastureland open for the public. As parts of the historic land use structure, not the least in the manors of Southern Sweden, oak pastures are important in a cultural heritage perspective. Similar to biodiversity, these socio-cultural ecosystem services would be diminished by a decrease in the quantity or quality of oak pastures.

The economic problem

Most of the environmental services provided by oak pastures have a public good characteristic in the sense that the generated utility exhibits non-rivalry as well as non-excludability (Randal 1972, Samuelson 1954). A well-known consequence from such a market failure is the absence of a resource allocating pricing mechanism (Randall, 1972).

From transaction cost or game theoretical perspectives, the large number of heterogeneous producers and environmental consumers impedes efficient private solutions. Consequently, these services will be provided in socially sub-optimal quantities, unless they are by-products in sufficient joint production with market commodities, which was the case in previous centuries. The socially efficient price and quantity of oak pasture environmental services has instead to be estimated by other methods, where the value that society places on them is balanced against the marginal net costs of their provision after adjustments for possible incremental revenues from meat and other market commodities (Hasund 2013; Parris, 2004).

Noteworthy in this context is that oak pastures are the highest valued among Swedish types of pastures, according to a choice experiment by Hasund *et al*. (2011) estimating the willingness-to-pay (WTP) of the population of adult residents in Sweden. The WTP for the quality attribute "absence of brushwood" in pastureland is as high as 114 SEK/y compared to if having 10 % brushwood area covering. Another environmental quality attribute, "Much grazed or mowed" grassland is valued to 265 SEK/y compared to "No grazing or mowing". Also relevant for policy design is the WTP of direct use values, that is, the value that people assign to pastures that they visit often relative pastures they never visit, which is 235 SEK/y/p (*ibid*.).

An underlying question is to what extent changes in the social value of alterations in the environmental qualities is different between pastureland with high and lower quality in the starting point. From an economic perspective the issue of interest here is to what extent the value function for pasture land can be expected to exhibit decreasing, constant, or even increasing marginal rates of change. In line with the theory of reference-dependent preferences (RDP) (Kahneman and Tversky, 1991), it should be expected that individuals' preferences are defined in terms of the value function for improved environmental qualities of pastureland such that the value function is increasing at a diminishing rate but steeper in the domain of losses (i.e., deterioration) compared to the domain of gains (i.e., improvements). Consequently, restoration payments should be directed to pastures with relatively lower environmental qualities in the starting point, *ceteris paribus*, as this in general would give higher welfare effects. Increasing marginal costs of improvements and management, which normally is the case, would further support this policy recommendation.

Furthermore, in addition to the assumption of a value function that is increasing at a diminishing rate, RDP postulate that individuals would interpret options in a decision problem in relation to an a reference point. In so doing, it is posited, due to loss aversion, that losses looms higher than gains. The tendency for people to avoid losses stronger than seeking to attain gains is reported to be the most extensively investigated economic phenomenon (Horowitz and McConnell, 2002). However, reference-dependence and loss aversion jointly imply that the values of gains and losses should differ for pastures of different environmental quality levels since they provide inherently different reference point towards which changes in qualities can be assessed in the preference formation of individuals.

The policy response

The major policy instrument to support Swedish semi-natural pastures and their biodiversity, recreational qualities and other public goods is the agri-environmental payments within the Swedish Rural Development Program of CAP, the agricultural policy. In a Swedish perspective, these payments to permanent meadow- and pastureland are fairly large, 795 MSEK in 2012, or about 20 % of the yearly budgetary means to Axis 2 (SS, SBA 2013). The agri-environmental payments to permanent pastureland are differentiated by two classes, with 1,000 SEK/ha/y to pastures with "Allmänna värden" and 2,500 SEK/ha/y to pastures with

"Särskilda värden", hereafter called pastures with "Basic" respective "Specific" (environmental) values. The differentiation is officially according to the cost of maintenance, but in reality after environmental quality. This is motivated by the stricter and more demanding management requirements for the contracts on environmentally more valuable pastures, those in the class "Specific values".

The contracted area of pastures with basic values was 203 000 ha and with specific values 147 000 ha in 2012 (SBA 2013b). The total area of permanent pastureland (never cultivated) has, however, decreased continuously over the program period starting 2007 (*ibid.*). This loss can mainly be addressed to pasture land with basic values (SS, SBA 2013). In a pronouncement by the Swedish Environmental Protection Agency, the loss of pastures with basic values is argued to constitute a serious threat to the overall level of biodiversity (Swedish Environmental Protection Agency, 2009). Regional case studies also suggest that pastures with basic values have the same potentials to develop a high biodiversity associated with trees as land with specific values (Eriksson, 2009; Lux, 2010).

Aim

In this paper, following the literature on preference formation in transportation research (e.g. Suzuki et al., 2001; Hess et al., 2008), we examine the presence of asymmetries in preferences for structural and functional qualities of pasture land. This is done by testing for reference effects and differential willingness to pay according to whether quality changes occur as improvements (gains) or as reductions (losses). Using the present quality level as the reference point, the approach in this study differ from the work by Hasund et al. (2011) where reference points were capturing elements in the landscape to which respondents were familiar so as to capture preference heterogeneity. A motive to put attention to the issue of asymmetrical preference structure is that possible asymmetry effects in valuation around the quality dimension ought to be considered for an efficient policy design where payments are directed to those pastures with the most efficient policy alternative. For instance, the official Swedish environmental goal of "A Varied Agricultural Landscape" with policy objectives of ensured biodiversity and cultural heritage preservation is addressed by differentiated payments to pastures with specific and basic values. A relevant question in this respect is how social (i.e. citizen) valuation of basic and specific values differs and hereby whether the implementation efficiency of payments varies between pastures with basic and specific values.

Methodology

Study design and data collection

The study is based on a 2 x 2 design to estimate the social value of oak pastures (basic values, specific values) and location (county: Östergötaland or Örebro). Oak pastures were chosen as survey object because they are distinct and environmentally significant habitats, and since these pastures are well-known out of their historical importance. The database TUVA of the national inventory of meadow and pasture land (SJV, 2010) was used to pairwise identify oak pastures being as similar as possible with respect to their environmental qualities. The TUVA database provides detailed information about the environmental qualities at each location. The choice was controlled for best possible match of size and accessibility in terms of distance to roads, population centres, etc. Table 1 presents descriptive data of each location. Data was collected from May to October 2010. The surveys were were mailed to a random sample of residents between 20 and 75 years of age within the municipality where the oak pastures are situated. Respondents were randomly drawn from the Swedish census registry. Two reminders were sent out within a 2-week period to those who had not replied.

Table 1. Details of study sites.

Name	Location	Type	Size (ha)	Distance from city centre (km)	Respondents	Response rate (%)
Göttorp	Östergötland	Specific values	20	20	1 200	28
Ökna	Örebro	Specific values	7.6	10	1 200	29
Ekäng	Östergötland	Basic values	6.8	3	1 200	30
Gällersta	Örebro	Basic values	14.8	10	1 200	20

The choice experiment

Experts in county administrative boards and at the Swedish Biodiversity Centre (CBM) were consulted prior to the survey to develop the attributes to be used within the study. Four attributes were identified and chosen to represent the most important factors for the environmental values of oak pastures in Sweden: biodiversity, brush wood, canopy cover and grazing status.

Each of the attributes analyzed in the choice experiment had three levels corresponding to varying qualities. Reference dependency implies that the value that somebody assigns an attribute is not based on its absolute level, but rather on its deviation from a reference level. Here, for each type of oak pasture (basic values, specific values), the baseline reference scenario 0) was set to represent the current quality level and from this level the quality could either be increased 2) or decreased 1). A common attribute level was set so that the highest level of the attribute in pastures with basic values 2) coincided with the lowest level of the attribute for pastures with specific values 1). This was done for three of the four attributes in order to capture the possible symmetries of preferences across pastures with basic and specific values. For the fourth attribute, 'canopy cover', all levels were identical between pastures with specific and basic values. Table 2 presents the attributes with sublevels and the common reference points between the types of pastures:

Table 2. Attributes and levels of oak pastures within the choice experiments.

Attribute	Basic values (Ekäng and Gällersta)	Specific values (Göttorp and Ökna)
Biodiversity	2) Somewhat developed* 0) Low level 1) Very low level	2) Extremely high level 0) Higher level 1) Somewhat developed*
Grazing status	2) To a small extent * 0) Sporadic grazing 1) No grazing	2) Whole area is grazed 0) Parts grazed 1) To a small extent*
Brush wood	2) Less cover (~50%)* 0) More cover (~75%) 1) Compact cover (>90%)	2) No brushwood 0) Little cover (~10%) 1) Less cover (~50%)*
Canopy cover*	2) High degree (>70%) 0) Intermediate (10-70%) 1) None/little (0-10%)	2) High degree (>70%) 0) Intermediate (10-70%) 1) None/little (0-10%)
Cost (annual tax surcharge)	0, 2, 5, 9, 11, 13, 15	0, 3, 6, 9, 12, 16, 20

Note: 0) baseline level, 1) decreased level, 2) increased level. * denote attribute levels set to be comparable across oak pastures with basic and specific values, respectively.

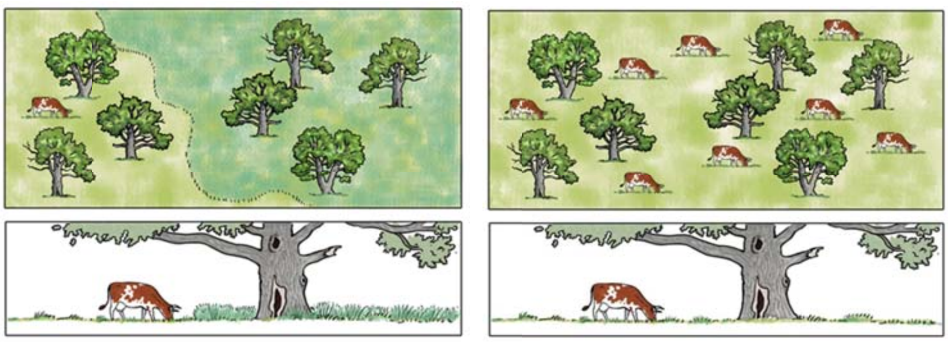
The combinations of attributes in choice sets were created using a fractional factorial design (Kuhfeld, 2001). Choice tasks were set up as unlabeled. Hence, each the heading of each alternative was generic (e.g. alternative 1, alternative 2, etc.) which meant that the only way to differentiate between them was through the attributes and their levels (Hensher et al., 2005). To establish a link to random utility theory and avoid the unfeasibility problem (Louviere et al., 2010), each choice task included one alternative denoted as today's status. This alternative was presented with a zero additional cost. The presence of this alternative functions as a status quo alternative. Each respondent evaluated six choice sets and within each set there was a three-way choice. An example of a choice task used for the DCE is given in Figure 1. The status quo alternative implied no change in utility level from the present quality today's form of the pasture and alternative two and three implied either improving or diminishing levels of utility to varying cost levels.

Which of the following three pastures would you prefer?
Mark your choice, and please keep in mind the tax surcharge that is associated with your choice:

Attributes Oak pasture	**Situation today**	**Alternative 1**	**Alternative 2**
Biological diversity	Low biological diversity	Somewhat developed	Low biological diversity
Grazing status	Sporadic grazing	Sporadic grazing	Grazed only to a small extent
Brushwood	More 75% coverage	Less cover (~50%)	More75% coverage
Canopy cover	High cover (>70%)	Intermediate (10-70%)	None/little (0-10%)
Tax surcharge SEK/kg (total annual tax)	0 SEK (28 SEK)	+ 3 SEK (31 SEK)	+ 9 SEK (37 SEK)
Your choice (mark one alternative)			

Figure 1. Illustration of a choice set for oak pasture with basic values.

As landscape and environmental attributes and implications of these may be partly unknown to the respondents, each questionnaire was accompanied with an information pamphlet. Here, information about each level of the attributes was provided both in an objective tone and each sub-level was illustrated with illustrations prepared by an artist. The provision of accompanying graphical material is a natural, efficient way of encouraging respondents understanding of abstract attributes, because people's abstract thought and language are image-based (Damasio, 1994). Figure 2 show, as an example, illustrations of different degrees of the attribute 'Grazing status'.



Note: Left panel: sporadic grazing. Right panel: whole area is grazed.

Figure 2. Illustrations of different levels of grazing status.

Multinomial logit specification

The individual utility of a specific oak pasture could be represented by a relative utility function. The utility is typically assumed to either increase or decrease depending on how the individual assesses the different attribute sub-levels. The individual utility function for oak pastures is assumed to have the following linear specification where each individual *i* faces choices of *j* alternative forms of pastures:

$$U_{ij} = \boldsymbol{\beta}^{'}\mathbf{x}_{ij} + \boldsymbol{\varepsilon}_{ij} \tag{1}$$

The vector x_{ij} is constituted by the independent variables and β contain the attribute coefficients to be estimated. Since the vector β are assumed to be fixed across individuals. the specification does not allow for random taste variation. The error term ε_{ij} is assumed to be iid type I extreme value, which implicates that we can express the choice probability for individual *i* choosing alternative *j* of *J*+1 possible options as:

$$\text{Prob}(\text{Y}_i = j) = \frac{e^{\boldsymbol{\beta}'\mathbf{x}_{ij}}}{\sum_{j=1}^{J} e^{\boldsymbol{\beta}'\mathbf{x}_{ij}}} \tag{2}$$

It is implicitly assumed that the individual chooses the alternative that provides the highest level of utility. The log likelihood of the multinomial specification is derived by summing across probabilities and by defining a variable d_{ij} which varies between individuals and alternatives and takes the value 1 if the alternative is chosen and 0 if not:

$$\text{LogL} = \sum_{i=1}^{n}\sum_{j=0}^{J} d_{ij} \log \text{Prob}(\text{Y}_i = j) = \sum_{i=1}^{n}\sum_{j=0}^{J} d_{ij} \log \frac{e^{\boldsymbol{\beta}'\mathbf{x}_{ij}}}{\sum_{j=1}^{J} e^{\boldsymbol{\beta}'\mathbf{x}_{ij}}} \tag{3}$$

The basic idea of maximum likelihood estimation (classical approach) is to calculate the log likelihood function from the data sample and to find the estimates of β so as to maximize the likelihood function. Thus an important implication from the classical estimation approach is that the true β is assumed to be fixed, but the estimator $\hat{\boldsymbol{\beta}}$ is stochastic with calculated confidence intervals due to the sampling. The parameter β are also commonly represented by a mean value b and a covariance W or by its estimators $\hat{\mathbf{b}}$ and $\hat{\mathbf{W}}$.

The multinomial logit model is commonly used in empirical work because of its computable attractiveness as well as the well defined economic interpretation. However, the independence of the odds ratios between choices or independence of irrelevant alternatives (IIA) that follows from the independence of disturbances (iid), is a rather unattractive feature of the model. There is an extensive literature on how to improve modeling to overcome problems with IIA with alternative mixed specifications that allows for randomness in parameters (see for example Train, 2003). An alternative, suggested approach to the problem is by Bayesian estimation of the multinomial logit models is to modify the usual limiting IIA assumption, due to the inclusion of prior information of parameter values and hereby allowing for non-linear covariate effects (Washington et al., 2009). The Bayesian estimation is applied here instead of the classical maximum likelihood estimation.

A Bayesian estimation approach

The use of Bayesian approaches to analyze choice data for environmental and landscape attributes has received an increased interest (Scarpa et al., 2007; Leon-Gonzales and Scarpa, 2008; Moeltner and Rosenberger, 2013). Bayesian estimation adopts the log likelihood function as in the classical estimation. However, whiles the classical approach assumes a fixed parameter value that is estimated through a maximization of the log likelihood function, the Bayesian framework make use of the assumption of a true stochastic parameter value. The Bayesian approach involves a prior distribution p(b,W) that constitute a good guess of the means in b and the covariance matrix W.

This knowledge or assumption is combined with the calculated log likelihood function, by adopting Bayes rule on conditional and unconditional probabilities of parameter values. A posterior, conditional distribution of parameter values can hereby be obtained, which in practice constitutes the prior distribution updated by information given by the data in the sample. A sequence of draws is made from the posterior distribution using a random walk Metropolis sampling methodology. From this sampling procedure, point estimates of the mean values b and the credible intervals of parameters W can be assessed.

Asymptotically, the estimated Bayesian and classical parameters have been shown to be very close (Lindsey, 1996). Huber and Train (2001) examined the choice of electricity supplier in California and found that a correlation rate between estimated classical and Bayesian parameters in average reached 0.975. However, a small sample size may provide different results between the Bayesian and classical estimations, basically because the sensitivity of Bayesian estimation due to the need of a prior specification. If the number of observations is large enough though, the influence of the prior should become less important.

The choice between Bayesian and classical estimation is often referred to one between taste and implementation convenience (Huber and Train, 2001). However, according to Paap (2002), an advantage of the Bayesian approach could be addressed to the computational advantages. If the model to be analyzed contains unobserved or latent variables in a mixed or latent variable model setting, the Bayesian estimation could be much faster as one only has to consider the likelihood conditional on the unobserved variables.

Model estimation was performed in the Markov Chain Monte Carlo package (MCMCpack) in R (Martin et al., 2011). The Bayesian multinomial logit model (Bmnl) was simulated from the posterior distribution of a multinomial regression model, using a random walk Metropolis sampling with 100,000 iterations to run the sampler. The estimations used diffuse prior distributions. The Metropolis tuning parameter was set to 0.5 to make sure that the acceptance rate was satisfactory before using the posterior samples for inference.

Results: Unexpected asymmetries

Estimation results for each of the pasture sites with specific values are presented in Figure 3. For ease of interpretation, the mean (presented as bars) and the 95 % interval of the posterior distribution p(|x) are presented for each level of each attribute pairwisely for the two sites. An advantage of obtaining densities of a posterior distribution is that the shape of the density function may be examined. If the density is asymmetric, so will the 95% credible interval. The most important result captured in Figure 1 is the asymmetry between improvement qualities, and reduced qualities in comparison with each base level (Table 2), respectively. Only for the increase to 'extremely high' an unexpected negative result was obtained for the Ökna pasture site.

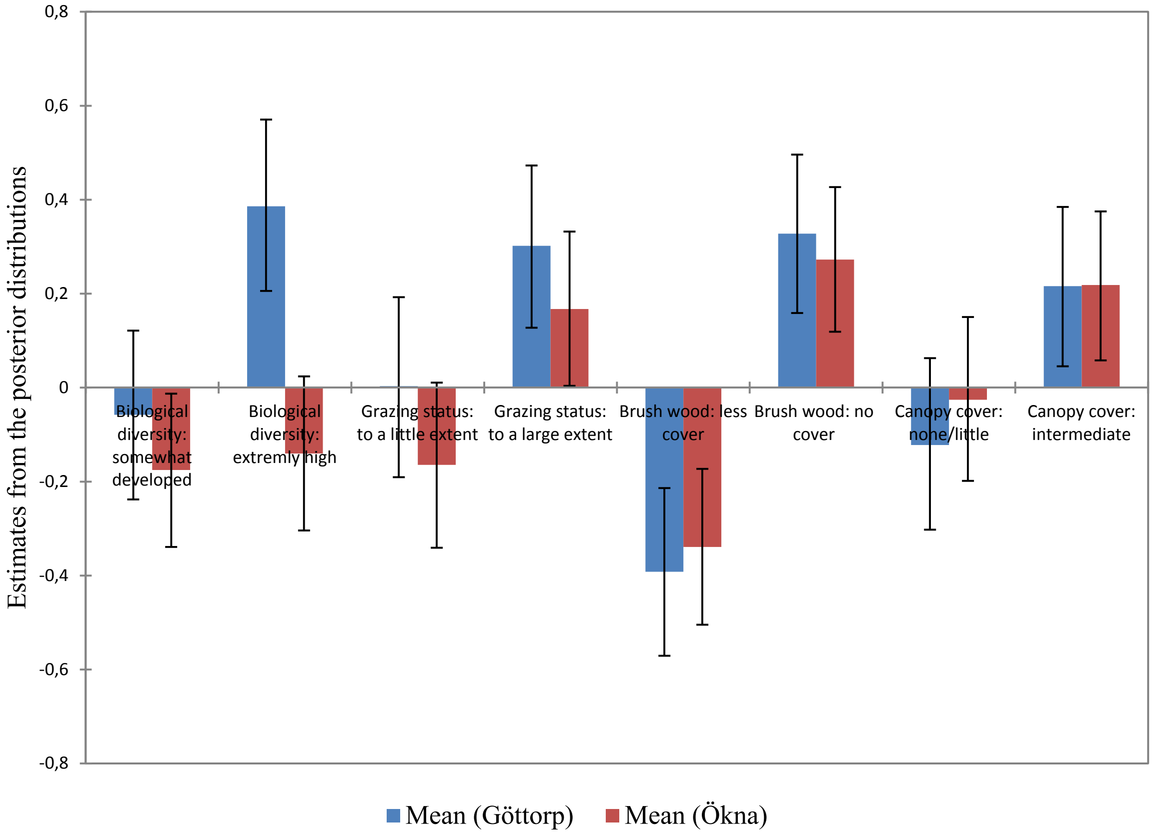


Figure 3. Mean and 95% intervals for posterior distributions for reductions and improvements of levels of biological diversity, grazing status, brushwood, and canopy cover for the two study locations with oak pastures having "special values".

For most of these attribute levels (Figure 3), the signs of the estimated parameters are identical for the two sites with special values. It is only for the increased level of biological diversity that equality in parameter signs can be rejected. Any direct pooling of results from the two locations would be problematic as the estimated posterior parameters are confounded with the corresponding scale parameters (variance). However, the estimated means and posterior intervals are of comparable magnitude, which still satisfies the requirements favor that the requirements for transfer of benefits and disutilities taking the heterogeneity of preferences for these amenities into account.

For each attribute level, the associated willingness-to-pay (WTP) is presented in Table 3. As the WTP is obtained as the ratio between two attribute parameters (using the negative of the estimate for the cost parameter as the numeraire), the scale parameter will cancel out. This implies that WTP values can be compared across locations. Here, the WTP is either positive or negative. A positive WTP is to be interpreted as the amount of additional worth of annual taxes associated with an increase in the quality of a given attribute in relation to its base level. A negative WTP, on the other hand, reflects the annual tax discount corresponding to a reduction of the quality within each attribute from its base level. As can be seen in Table 3, the tax surcharges (WTP) for each location and for each attribute is consistent with the preliminary expectations in that gains (improvements in qualities) were largely positively valued while losses were assessed to have negative values (disutilities). However, the asymmetries between gains and losses contradict the findings from prospect theory (Kahneman, 1994) from which would state the opposite relationship of magnitudes, that is, higher absolute values of losses than of gains. Ratios of WTP between increased and decreased attribute qualities ranged from 95.4 (Grazing, Göttorp) to 0.78 (Brushwood, Ökna). These findings imply that people generally have stronger preferences to pasture quality attributes evaluated in the gains domain than for pasture quality attributes evaluated in the loss domain.

Next, considering the levels of WTPs in relation to the baseline of an annual tax burden of 98 SEK per person, the estimated mark-ups (WTP divided with current annual tax per person) were found not to be substantial. The highest WTP value (extremely high biodiversity) for the Göttorp location corresponds to a markup of around 8%. While these in in line with the diminishing sensitivity of the value function, this also suggests that the WTP values were less likely to have been related to a 'warm glow' effect (Andreoni, 1989) or to hypothetical bias (Christie, 2007).

Table 3. Posterior densities and attribute level willingness-to-pay (WTP) for the two locations with "specific values".

Attribute	**Variable**	**Mean of posterior density** (Göttorp)	**WTP**[a,b] (Göttorp)	**Mean of posterior density** (Ökna)	**WTP** [a,b] (Ökna)
	Intercept	-0.48		-0.31	
	Cost	-0.049		-0.057	
Biodiversity	Somewhat developed	-0.058	-1.2	-0.18	-3.2
	Extremely high	0.39	8.0	-0.14	-2.5
Grazing	To a small extent	0.0032	0.065	-0.16	-2.8
	Whole area	0.30	6.2	0.17	3.0
Brush wood	Less cover (~50%)	-0.39	-8.1	-0.34	-6.0
	None	0.33	6.8	0.27	4.7
Canopy cover	None/little	-0.12	-2.5	-0.022	-0.39
	High degree	0.22	4.5	0.22	3.9

[a] WTP is expressed in relation to the base level for each attribute (see Table 1), respectively.

[b] at the time of the study 1SEK≈0.104 Euro.

Estimation results for each of the sites with basic values are presented in Figure 4. For each of the attribute levels (Figure 4), the estimated means and posterior intervals are of comparable magnitude. The dispersion and the results are also consistent in that losses from each base level respectively are associated with disutility, while gains are associated with a positive utility change from the respective base levels, respectively. The most accentuated increase in utility is noted for improvement of biological diversity, while the most accentuated decrease in utility is noted for a more compact coverage of brush wood.

For each attribute level, the associated WTP is presented in Table 4. Despite the confounded scale factors, it can be observed that the WTP estimates for the Gällersta location are more dispersed (larger positive and mostly larger negative values) than for the Ekäng location. In comparison with the WTP values for the two locations with special values, it is here noted that the locations with basic values have in general a higher magnitude of valuation, both in positive and negative direction. However, the ratios of WTP between increased and decreased attribute qualities were less dispersed and ranged from 4.9 (Biodiversity, Gällersta) to 0.88 (Canopy cover, Gällersta).

In addition, the mark-ups for attribute levels are more pronounced for the two locations with basic values. Here, given a base line annual tax cost of around 20 SEK per year, the mark up for a somewhat more developed biological diversity is as high as 110%.

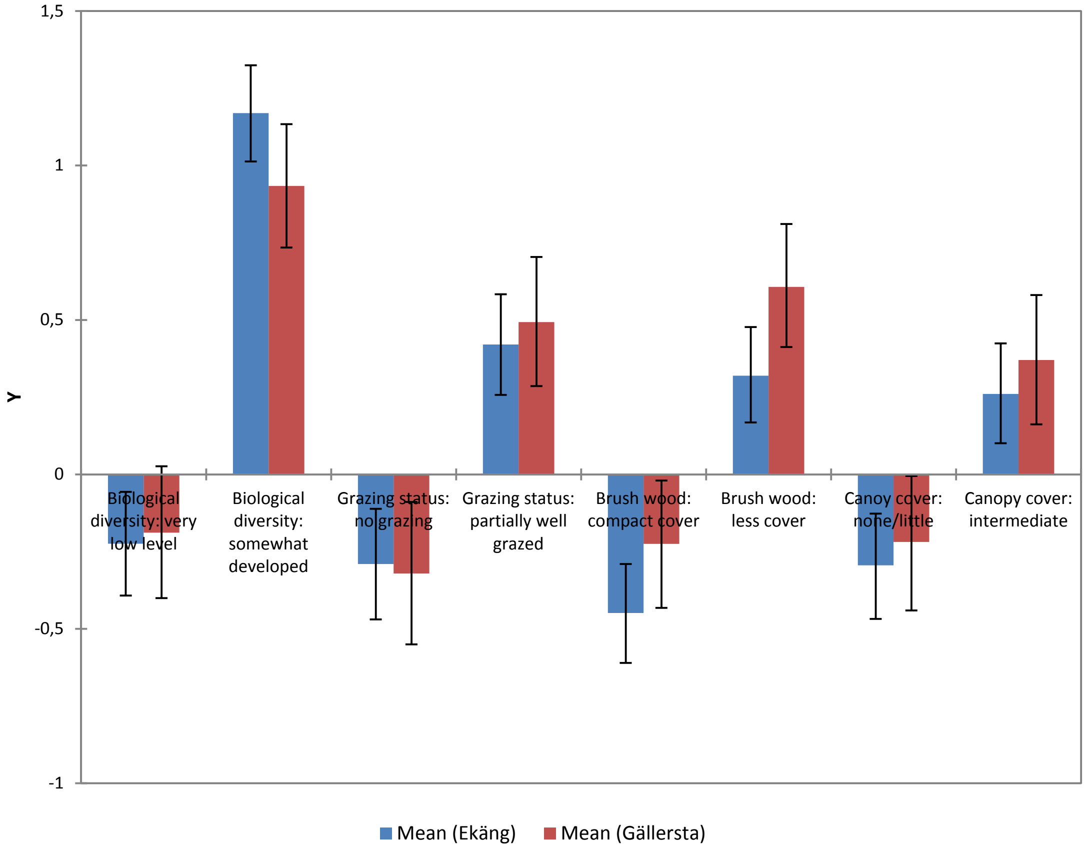


Figure 4. Mean and 95% intervals for posterior distributions for reductions and improvements of levels of biological diversity, grazing status, brushwood, and canopy cover for the two study locations with basic values.

Table 4. Posterior densities and attribute level willingness-to-pay (WTP) for the two locations with basic values.

Attribute	**Variable**	**Mean of posterior density** (Ekäng)	**WTP** [a,b] (Ekäng)	**Mean of posterior density** (Gällersta)	**WTP** [a,b] (Gällersta)
	Intercept	-0.73		-0.88	
	Cost	-0.056		-0.042	
Biodiversity	Very low	-0.22	-3.9	-0.19	-4.5
	Somewhat developed	1.17	21	0.93	22
Grazing	No grazing	-0.29	-5.2	-0.32	-7.6
	To a small extent	0.42	7.5	0.49	12
Brush wood	Compact cover	-0.45	-8.0	-0.22	-5
	Less cover	0.32	5.7	0.61	15
Canopy cover	None/little	-0.29	-5.2	-0.22	-5.2
	High degree	0.26	4.6	0.37	8.8

[a] WTP is expressed in relation to the base level for each attribute (see Table 1), respectively.
[b] at the time of the study 1SEK≈0.104 Euro.

Next, Figure 5 presents the estimated parameters for each of the attribute levels which were identical across the two types of locations (special and basic values, respectively). The choice experiment was set up so that the increased attributes levels for biodiversity, grazing status and brushwood for oak pastures with basic values corresponded to the reduced attribute levels for oak pastures with specific values. For the canopy cover attribute levels were identical between across types of locations. The results in Figure 5 show that an additional type of asymmetries can be identified when comparing preferences across types of pastures. The same level of an attribute generated either a negative estimate (when considered as a reduction for pastures with specific values) or a positive estimate (when considered as an increase from the base level for pastures with basic values). This implies that it would be improper to transfer WTP estimates across across pastures of different environmental values as such transfers are not neutral with respect to the reference points to which these changes are evaluated. However, for canopy cover such an asymmetry was not observed. This finding is important as it serves function to validate the comparison of preferences across types of pastures.

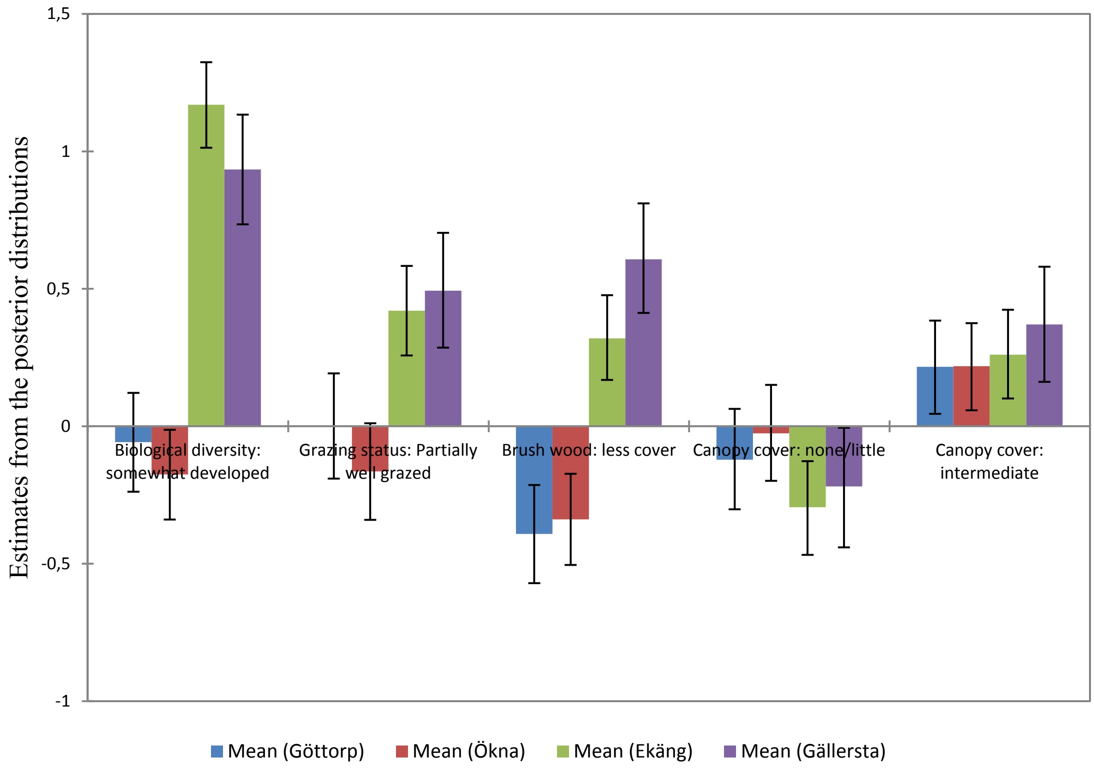


Figure 5. Asymmetries in mean and 95% interval from posterior distribution for identical attribute levels between oak pastures with specific (Göttorp and Ökna) and basic (Ekäng and Gällersta) values.

Conclusions and policy recommendations

This study investigates reference-dependent preferences for different starting point levels of appearance and functional qualities of oak pastures Our findings suggest potential social welfare improvements by adapting existing agri-environmental payments by introducing a differentiated improvement premium with higher payments to pastures originally having basic values. A series of four valuation studies was undertaken in a two-by-two design to allow for a comparison both within as well as between oak pastures of basic and specific (high) values. The analyses aimed at examining two types of asymmetrical responses to increases and decreases in the qualities of pasture attributes. First, in relation to each type of pasture (basic or specific values), it was investigated to what extent increases and decreases at the level of individual quality attributes were assessed asymmetrically. Secondly, for identical quality levels of attributes, it was investigated to what extent preferences are different between quality classes of pastures. The inclusion of reference-dependent preferences, which holds that evaluations of quality change options depend on the reference point taken, is a novel approach compared with that taken in previous studies assessing the social value of agri-environmental attributes.

The results suggest that members of the public in general assign positive values on increased biodiversity, higher intensity of grazing, absence of brush wood and an intermediate level of canopy cover. Moreover, the preferences seem to be consistent within environmental quality classes of pastures, which could indicate an absence of spatial auto correlation in preferences for oak pastures and that preferences for the type of oak pastures investigated are relatively stable across regions. However, the valuation between different types of pastures was not identical, so while the transferability of value estimates was supported between pastures of similar values classes (being either basic or specific), transferability between pastures of different quality classes appeared not valid.

In the four choice experiments reported here (two for pastures with basic values, and two for pastures with specific values), the results suggested that the preferences were asymmetrical for the included attributes. Interestingly, welfare improvements in environmental qualities of pastures with basic values exceeded the welfare deterioration in pastures with specific values in absolute terms. The results from this study therefore suggest that improved environmental qualities in pastures with basic values should be preferred over further improvements of pastures with specific qualities. Hence, assuming equal costs, a policy maker who face the option to either improve the qualities of a pasture with specific values or basic values better improve the latter alternative. However, this priority assumes an overall aim to increase the environmental quality, regardless whether the improvements occur in pastures with specific values or basic values. On the other hand, if the policy objective would be to have an overall increase in biodiversity to an extremely high level it could be more cost efficient to implement the policy in pastures with specific values as these are closer to have better potentials to the development of such qualities.

Our findings, however, do not support the proposition from prospect theory which state that losses are more highly avoided compared with the extent to which gains are sought. Instead, at the level of individual attributes, the results suggest that respondents' preferences are asymmetrical so that potential environmental quality improvements (gains) are more highly valued than quality reductions (losses), although the strength of this difference differed between attributes. This is an important finding, suggesting that when alternative levels of agri-environmental attributes are being evaluated, the relative intensity to which a change from a base level is assessed depends on whether the change represents a reduction or improvements. There is a need for further research on the role that such effects may have on the way that bundles of agri-environmental attributes are valued jointly and then to consider what this might imply for the development of policy measures.

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