Proceedings, 10th World Congress of Genetics Applied to Livestock Production

Determination of non-market values to inform conservation strategies for the threatened Alistana-Sanabresa cattle breed

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ABSTRACT: Livestock breed-related public good functions are often used to justify support for endangered breed conservation although little is known about such non-market values. This paper illustrates how stated preference techniques can be used to improve understanding of the relative importance of such values and to inform conservation strategies by the exploration total economic value of the Spanish Alistana-Sanabresa (AS) cattle breed. Overall, the findings reveal that the AS breed had significant non-market values associated with it, hence justifying public support. The value that respondents placed on each specific public function varied significantly. Functions related with indirect use cultural and existence values were much more highly valued than landscape maintenance values. Insofar as those breed conservation strategies with the highest potential to maximise societal welfare would be those that secure the breed-related functions that people value most, appropriate in situ conservation interventions may be identified accordingly.
Keywords: Choice modelling; TEV

Introduction

The increasing number of livestock breeds at risk is largely due to the expansion of intensive livestock production systems (FAO (2007)). Decisions about which breed to keep have been mainly based on maximizing livestock direct benefits (Mendelsohn (2003)). However, significant non-market values associated with livestock breeds have often been ignored in the economic analysis. Such values relate to the use of livestock breeds in supporting agroecosystem resilience, in maintaining evolutionary processes and global option values, as well as maintaining landscapes, socio-cultural traditions, local identities and traditional knowledge (Mendelsohn, (2003); Smale and Drucker (2007); Narloch et al. (2011)). Proper assessment of the full range of functions provided by livestock, as expressed in terms of their Total Economic Value (TEV, Bateman et al., (2002)), which includes use and non-use values, can be used to help determine which kinds of interventions and incentive mechanisms might be most appropriate for ensuring their long-term survival. The challenge in determining the TEV of a livestock breed arises from the private and public good values of animal genetic resources. Choice experiments (CE) allow the valuation of individual attributes of a given good or components of its TEV (Hanley et al. (1998)). Under such methods the stated values are expressed by the respondent's willingness to pay for hypothetical scenarios that describe the good in question. A number of economic studies using CE to examine farmers' values for livestock breed traits have been undertaken to date (e.g. Zander and Drucker (2008); Zander et al. (2013)).

This paper analyses the TEV of the threatened Alistana-Sanabresa (AS) Spanish cattle breed as a case study with which to illustrate the implications of its non-market public good values for conservation strategy planning. This paper consequently seeks to contribute further to the literature by: 1) analyzing the relative importance of the non-market components of the TEV of the AS breed; and 2) assessing the implications for AS conservation strategy in Spain. This study was realised in the context of the project 'Towards self-sustainable European regional cattle breeds' (EURECA; Hiemstra et al. (2010)).

Material and methods

The breed. By the mid-1990s, the AS breed was close to extinction (Yanes García (2000). A conservation program began in 1998, contributing to the recovery of the AS population, which now numbers over 3000 breeding females (Alistana-Sanabresa Breeders Association data, 2013). Nevertheless, it remains an endangered breed (Official Spanish Gazette, 15 February 2012). Some cultural elements generated through generations of coexistence with the AS breed still remain, like AS breed cattle markets and traditional stone stables. In addition, the breed meat has traditionally been considered a high quality product. However, no breed-specific label has been developed, leading some producers to argue that niche product market development could be a successful conservation strategy.

The choice experiment (CE) design. We created choice sets with three scenarios, one of which was always a status-quo (SQ) scenario and the other two represented the outcomes of hypothetical conservation programmes relative to the SQ. The scenarios were described through attributes (potential outcomes of the conservation program regarding AS values) that changed under each scenario. Cultural and landscape values of the AS breed were explicitly considered, as these two indirect use value attributes are often given as a justification for breed conservation interventions (FAO (2007)). The monetary attribute was a one-off contribution (ranging from €0 to €100) to a conservation programme. This monetary attribute allows willingness to pay (WTP)

estimates to be assigned to each of the attributes. Table 1 contains a description of the attributes of each scenario, their relationship to specific components of TEV and the number of attribute levels considered in the CE. Respondents were presented with several choice sets and were asked to select their preferred scenario in each of them, noting that they incurred no financial cost if selecting the SQ, while the other two scenarios would involve a once-off donation to an AS breed conservation programme. 203 households were interviewed, 102 in Zamora city and 101 in six villages the region of origin of AS breed.

Table 1. Attributes used to describe the choice scenarios, their levels considered in the choice experiment and their relationship to specific components of the total economic value (TEV) of the Alistana-Sanabresa cattle breed.

[1]Attribute	TEV component	[2]Levels
Quality of the breed-related special food products (FOOD)	Direct use value	*Average,* Superior
Maintenance of local rural culture (CULTURE)	Indirect use value	*Declining*, Stable, Improving
Maintenance of the rural landscape (LANDSCAPE)	Indirect use value	*Declining*, Stable, Improving
Ability to re-establish the breed in the future if no live animals remain (FUTURE)	Option value	*Low***,** High
Certainty of the continued existence of live animals over the next 50 years (EXISTENCE)	Existence value	*10%*, 50%, 90%
One-off contribution (in €) to a conservation programme (DONATION)		*0,* 10, 25, 50, 100

[1]The variables names as used in the text are in brackets
[2]Status-quo levels indicated in italics

Model. The analysis of choice data is based on the random utility theory that assumes that respondents choose the scenario which yields the highest utility. Utility is a function of a vector of the attributes of the scenario (and socio-economic characteristics of respondents) and some random residual term. The probability of respondents choosing a scenario can then be expressed by a probabilistic model. The general model can be written as,

$$U_{njt} = \beta_n' x_{nj} + \varepsilon_{njt},$$

where U_{njt} is the utility perceived by the decision maker n of alternative j on occasion t, β_n is a vector of random parameters defining the weight of each covariable on the value of the utility, x_{nj} is a vector containing the known values for the level of covariables (attributes and monetary value) associated with alternative j, and, ε_{njt} is a random residual term. In our study, covariables included values for the attributes of the breed (Table 1), as well as socio-economic variables. The levels of the SQ alternative were used as the reference levels for the attribute levels. The WTP or welfare estimates of a marginal change in an attribute level were calculated as the (negative) ratio of the attribute coefficients to the monetary coefficient.

Results

The model chosen had a McFadden R^2 (McFadden, 1974) of 0.45. The coefficient for donation was negative and significant (-0.16), meaning that the higher the costs for respondents, the less likely that that alternative would be chosen. The attributes FOOD, CULTURE, EXISTENCE and the level "stable of LANDSCAPE, were found to be significant (attributes are defined in table 1). The coefficient of these attributes had positive signs meaning that respondents preferred improvements compared to the levels of the SQ. Respondents were found to be indifferent towards the attribute FUTURE and to the level "improving" of the LANDSCAPE attribute. Table 2 shows the welfare estimates of the significant attributes of the model. The TEV of the AS breed) was calculated as €83 per person, by summing the welfare estimates of the highest levels of the attributes. Over 91% of TEV of the AS breed was associated with indirect use and non-use values, with existence values and the maintenance of traditional culture being particularly important (representing just over 80% of TEV).

Table 2. Welfare estimates of the attributes of the components of the total economic value of the Alistana-Sanabresa cattle breed

[1]Attribute	Average welfare estimate	[2]Contribution to TEV
FOOD–Superior	€ 7	8.4%
CULTURE–Stable	€ 25	-
CULTURE–Improving	€ 31	37.3%
LANDSCAPE–Stable	€ 9	10.84%
EXISTENCE–50%	€ 34	-
EXISTENCE–90%	€ 36	43.4%

[1]The table includes the significant attributes of the model
[2]The total economic value (TEV) of the Alistana-Sanabresa breed was calculated by summing the welfare estimates of the highest levels of the attributes

Discussion

The AS breed was shown to have significant public good values associated with it. Although people placed a value on direct use aspects, they placed higher values on the indirect use cultural and landscape maintenance functions, as well as its existence value (Table 2). The *direct use value* of AS beef was not highly valued overall (€7). Since AS breed products do have a good reputation as a high quality traditional product, this

may suggest that improved differentiation and marketing of its products may be necessary. The *indirect use cultural value* of the AS was found to be between three to four times higher than the direct use value. Respondents were willing to pay more (31€) for improving cultural aspects associated with the breed than for merely maintaining them (€25), a fact that might reflect that the current status of AS cultural traditions is perceived as poor. The findings related to the *indirect use value related to landscape maintenance* contrast with the above. Although respondents would pay €9 for maintaining the landscape as it is, they are not willing to pay to improve it. This finding may indicate that the current landscape status might be considered to be satisfactory from the perspective of the respondents. The corollary to this is that if such environmental quality declines, it might be expected that the AS indirect value related to landscape maintenance would become more highly appreciated. The high *existence value,* the highest valued attribute of AS TEV, indicates the importance respondents place on the AS breed regardless of its use values.

Overall, the results indicate that respondents were willing to pay around three to four times as much for the existence and cultural values of the AS than for its landscape and direct use values, which is in line with the findings of Zander et al. (2013). In particular, the cultural value of the AS (37.3% of TEV) suggests that agritourism development, with funds being invested to help farmers to maintain/restore cultural aspects related to traditional farming practices and to attract tourists to farms, may well be worth exploring in greater detail as a potential component of a comprehensive AS conservation and use strategy. Furthermore, although our results have indicated that public WTP for niche products is likely to be limited, the identification of any such opportunities would nonetheless be of particular importance to those farmers using evolved management systems or those located outside of areas with culturally unique attributes. Given that farmers cannot be expected to, or be able to afford to maintain the AS at socially desirable levels, the development of incentive mechanisms to allow farmers to capture some of those public good values when they are significant (as has been shown in this study, where they comprise 91% of TEV) can be strongly justified.

Conclusions

This paper has shown how CEs can be used to explore the value that people place on the non-market attributes of local livestock breeds. The results of such stated preference techniques may be used to inform the design of conservation strategies. The case study analysis carried out in this paper reveals that the loss of this breed would imply the loss of significant public good values. The most valuable attributes of Alistana-Sanabresa cattle breed were shown to be related to securing cultural aspects and the long-term continued existence of the breed. Insofar as the intervention strategies with the highest potential to maximise societal welfare would be those that secure the breed-related functions that people value most, appropriate *in situ* conservation interventions and strategies may be identified accordingly.

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