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Analysis

Stated preferences for tropical wildlife conservation amongst distant beneficiaries: Charisma, endemism, scope and substitution effects

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ABSTRACT

Despite heightened awareness of the need to find additional resources for tropical biodiversity conservation, and recognition that the benefits to populations in developed countries may be significant, very few empirical studies have been conducted to estimate these values. In this article, we report the results of a choice experiment survey that investigated the preferences of UK residents for the conservation of threatened wildlife in the Eastern Arc Mountains in Tanzania, part of the Eastern Afromontane "biodiversity hotspot". We examine the sensitivity of values to species types, the number of species, the number of conservation sites and, more unusually, to potential substitutes/complements. Critically we find some evidence of coherency in preferences. Respondents are willing to pay significant, positive amounts to conserve charismatic and/or endemic species and are scope sensitive to the number of endemic species. In contrast, species which are neither endemic nor charismatic, and the number of conservation sites, do not contribute significantly to utility. Further, changing the overall scope of the 'good' is found to have a significant and differential impact on respondent's choices depending on the species type: as the availability of wildlife increases, we observe substitution effects for non-endemic charismatic species, and complementarity for endemic (non-charismatic) species.

1. Introduction

Tropical biodiversity continues to decline at unprecedented rates (Balmford et al., 2003; Butchart et al., 2010). Urgent action is required to tackle the direct and indirect drivers of loss and mainstream the economics of biodiversity (and ecosystem services) into development, decision-making (CBD, 2010a). This is expected to require the mobilisation of substantial resources (financial, human, and technical), and in particular, increased financial flows between developed and developing countries (CBD, 2010b).

Whilst the conservation of tropical wildlife may generate significant 'existence' value to populations in distant 'donor' countries like the United Kingdom, very little is known about the size of these values. In view of the current funding crisis this represents a significant gap in knowledge. Indeed such information may be of considerable value, for example, to stimulate much needed increases in financial (and technical) resource transfers, in market creation, raising public awareness and, in informing the necessary trade-offs between what can and cannot be conserved.

The only way to directly estimate these values is using Stated Preference methods which ask the public directly to express their preferences for such non-market goods. But, are stated preferences a sound basis for determining policy priorities for tropical wildlife, a remote and complex good? Two issues seem particularly salient. Firstly, what motivates willingness to pay (WTP) for the 'existence' value of wildlife conservation in remote locations? Historically, conservation organisations have used charismatic species as 'flagships' for raising funds and public awareness but is 'charisma' all the public care about, and what about other more scientifically/ecologically important characteristics, for example, endemism, the number of species, and the number of sites?

Secondly, but of critical importance, is whether the stated preferences of distant beneficiaries for tropical wildlife conservation are coherent and rationale in terms of economic theory. Obtaining valid and reliable estimates for such goods raises a number of methodological challenges to valuation practitioners and presents a more cognitively

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demanding task to respondents than is encountered under the elicitation of values for local, familiar and/or less complex goods. An initial concern is whether, when faced with previously unknown and complex goods, respondents are able to 'discover' theoretically consistent preferences (as per Plott, 1996) or instead use available heuristics to 'construct' responses which are susceptible to framing effects and thereby fail tests of procedural invariance (as per Slovic, 1995).

In seeking to distinguish between the former theoretically consistent preferences and those that are inadmissible within wider cost benefit analyses (CBA) a commonly employed consistency test is to examine the scope sensitivity of valuations (Arrow et al., 1993). Whilst we examine scope sensitivity, we argue that it is flawed and insufficient in that a finding of mere statistically significant differences in willingness-to-pay as scope changes does not imply that the degree of sensitivity is reasonable and sufficient. To address this failing we extend our survey design to allow tests for substitution (and/or complementarity) effects. Economic theory provides the clear expectation that WTP should decline as the availability of a substitute increases (and the converse in the presence of complements). Despite the fundamental nature of such a relation, substitution is rarely considered within stated preference (SP) methods and in particular in choice experiment analyses.

Correspondingly, in this paper we undertake an in-depth investigation of what drives WTP for non-use values of wildlife conservation in distant locations, and we assess the theoretical consistency of preferences by examining value sensitivity to: the number and type of species, the number of conservation sites, and the presence of potential substitutes (/complements). We approach the above issues using a split-sample choice experiment (CE) survey which elicits WTP for (i) conserving wildlife in the Eastern Arc Mountains of Tanzania, and (ii) a larger good, that includes conserving wildlife in the Eastern Arc and in the Cameroon Highlands. The above effects are investigated with respect to preferences for conserving endemic versus non-endemic species, and charismatic versus non-charismatic species.

2. Literature review

There are very few stated preference studies on the value of remote biodiversity; those that do exist indicate that respondents in developed countries are willing to pay significant positive amounts to conserve tropical wildlife. In most cases these studies have focused on charismatic species, for example, the Black Rhino or African elephant, or on specific biodiversity-rich ecosystems, such as, rainforests (Horton et al., 2003; Kramer and Mercer, 1997; Rolfe et al., 2000; Svedsater, 2000; Swanson and Kontoleon, 2003). For example, Horton et al. (2003) report that Italian and UK residents are willing to pay on average £30 per household per annum to conserve biodiversity in the Brazilian Amazon. Very little is known about the size of values for other remote wildlife, for example, uncharismatic but endemic species, species which are neither endemic nor charismatic, nor about how the public might prioritise between different types of species in a remote setting. Such information is expected to be of considerable value to the ongoing debate over how to prioritise the scant resources available for tropical conservation, and in creating appropriate value capture mechanisms.

With regard to the valuation of local (or domestic) wildlife, the literature indicates that respondents are sensitive to certain types of wildlife, in particular, respondents are willing to pay significantly more for 'charismatic' or 'flagship' species compared with uncharismatic ones (see Richardson and Loomis, 2009; White et al., 2001). This is consistent with the fund-raising approaches used by international conservation organisations which typically focus on megafauna (for example, the Giant panda or tiger in Asia, and elephant or rhino in Africa) — notably, the generated funds may also be used to conserve other species (see Tisdell, 2011). Moreover, there is also an ecological importance to such approaches because some charismatic species function as 'keystone' or 'umbrella' species, providing wider conservation benefits. However, this is case-specific, and a recent study reports that many threatened species, in particular, those which are uncharismatic or poorly known currently receive little or no conservation action (Clucas et al., 2008; Sitas et al., 2009). It has been suggested that 'flagship fatigue' could result in these less traditional (i.e. uncharismatic) species holding appeal to the public (see Clucas et al., 2008). Indeed, Ressurreição et al. (2011) and Veisten et al. (2004) find that local 'low profile' endangered species such as fish, algae, invertebrates, fungi, lichen and mosses may attract significant positive WTP. However, it remains to be seen whether this holds amongst distant beneficiaries too.

The situation is even less clear for endemics. Whereas a recent meta-analysis found that endemism did not significantly influence WTP (Martin-Lopez et al., 2008) – preferences mostly favoured anthropomorphic and anthropocentric characteristics instead of scientific factors – Meuser et al. (2009) find that endemism is the most important determinant of WTP. Given that their focus was on local socio-political endemics (rather than true endemics), the authors postulate whether it is endemism per se which is being valued or rather the value associated with a particular (proximate) place — they recommend that future work should examine whether residents in other jurisdictions value endemism over non-endemism.

We seek to add to this work by examining whether UK residents far removed from tropical endemic species value their protection over non-endemics; we also assess whether tropical species which are neither endemic nor charismatic generate significant positive WTP; and whether preferences are held for maintaining multiple conservation sites.

A corollary and critically important objective is to examine the theoretical consistency of such preferences. It has been argued that the public may be too unfamiliar with biodiversity and its various indicators to meaningfully interpret how changes in its provision might affect them (Spash and Hanley, 1995). Critics contend that in such instances respondents may construct their preferences in relation to the format of the elicitation setting or "clues" provided by the survey instrument or simply be random (Gregory et al., 1993; Vatn and Bromley, 1994). For example, Bateman et al. (2008) report evidence of asymmetric dominance effects in a choice experiment study of preferences for increasing plant and birdlife around a Norfolk lake — respondents choice behaviour and the resulting welfare estimates were significantly affected by the inclusion of a 'decoy' in the choice sets. As a result of such concerns, much of the empirical literature on biodiversity valuation has focused on testing the robustness of preferences by examining the impact of varying various aspects of the experimental design. The problem is that very few studies undertake rigorous tests of the theoretical consistency of values. Instead, many rely solely on the use of scope tests. This involves examining whether WTP significantly increases (decreases) with an increase (decrease) in the quantity or quality of the good being valued. However, there is mixed evidence of this in the empirical literature (see, for example, Boyle et al., 1994; Carson and Mitchell, 1995; Giruad et al., 1999; Horton et al., 2003; Loomis and White, 1996; Veisten et al., 2004; White et al., 1997). The CE technique may hold some advantages over the contingent valuation method (CVM) in that it internalises some of the smaller scope effects by presenting respondents with different levels of each attribute (see Hanley et al., 1998). Of concern is that if WTP is invariant to changes in scope that this may provide evidence that people are not valuing the intended good but instead the experience of contributing to a 'good cause' i.e. moral satisfaction/'warm glow' (Kahneman and Knetsch, 1992),[1] or providing

[1] Alternative explanations include poor study design (Carson and Mitchell, 1995), questionable probability of provision, or mental models of joint products (Schulze et al., 1998).

expressions of symbolic value or even simply random responses, rather than their true economic values.

Yet, there are a number of reasons why scope tests may not be a reliable indicator of the theoretical consistency of preferences (Banerjee and Murphy, 2005). A primary problem is that there are only weak expectations with regard to the degree of sensitivity (Fisher, 1996). Even more pressing is that whilst some respondents do adjust their WTP for more (or less) of a good, the problem remains that they still may not really comprehend what they are valuing just that they have been offered more of it and therefore strive to be internally consistent (see for example, Ariely et al., 2003). In addition, there are several situations in which scope insensitivity may be consistent with theoretical expectations (Bateman et al., 1997). For example, economic theory tells us that WTP for a good will decline as the availability of substitute goods increases (for example, Hoehn, 1991), and, empirical evidence tells us that WTP changes where it is presented later (rather than first) in a sequence of goods (see Randall and Hoehn, 1996). In addition, insensitivity to scope is also expected in the face of preference satiation. For example, Rollins and Lyke (1998) illustrate how the creation of successive protected areas generates positive but diminishing WTP so that sensitivity to scope depends upon where along the marginal demand curve the valuation was being conducted.[2] And, Loomis and White (1996) find that values for the conservation of threatened and endangered species increase at a decreasing rate with increasing population.

In short, sensitivity to scope cannot be regarded as a necessary and sufficient indicator of preference consistency (Banerjee and Murphy, 2005; Heberlein et al., 2005). There is a real need for better testing methods if the results of stated preference studies are to be reliably used in cost benefit analysis (CBA). In particular tests are required which can provide clear expectations with regard to theoretical consistency. One such area is substitution — this refers to the decreasing value of one good as more of another public good is made available (Carson et al., 1998). At the extreme, this means that WTP for one species could be the same as for all species if they are valued as pure substitutes (Hoehn and Randall, 1989). Kahneman and Knetsch (1992) caution that substitution (and satiation) may not apply to the values associated with endangered or unique species since their uniqueness is the crux of their value, however based on evidence reported in the CVM literature, it seems possible that even for relatively unique species we may observe substitution effects (see for example, Cummings et al., 1994; Hoehn and Loomis, 1993).

Despite the relative ease with which information on substitutes may be incorporated into choice experiment design it is a much overlooked area in the literature. In one of the few exceptions, Rolfe et al. (2000) use labels to disguise the conservation site of interest amongst a pool of substitutes. Their work provides valuable information with regard to how preferences for a particular site are affected by varying the proportion of domestic and overseas sites and the type of ecosystem. In another example, Hailu et al. (2000) use a different choice experiment approach which enables respondents to select any combination of three ecosystem conservation programmes in Canada offered at specific prices — results indicated that two of the programmes, old growth forests and prairie grasslands, were valued as complements, whilst mountain stream ecosystems were not; and none was viewed as substitutes.

We contribute to this literature by extending the application of choice experiments to test the sensitivity of preferences for distant wildlife to substitutes (and complements), and more specifically, we add to it by assessing how preferences for different kinds of species may be affected, for example, endemics and charismatics.

3. Research design

The objective of this paper is to improve understanding of what drives WTP for the non-use values of tropical wildlife conservation amongst distant beneficiaries, and to assess the theoretical consistency of such preferences by testing the sensitivity of preferences to scope (quantitative and qualitative) and, critically, the availability of potential substitutes and complements.

Our case study concerns the preferences of UK residents towards conserving wildlife in the Eastern Arc Mountains, a chain of mountains covered in tropical forest and grasslands, which run the length of Tanzania. The Eastern Arc is considered to be globally important for biodiversity, forming part of the Eastern Afromontane hotspot (Burgess et al., 2004, 2006). As well as delivering vital ecosystem services to the local and national population, the forest areas provide critical habitat for a large number of endemic species, and many other rare and endangered wildlife. Many of these species are at risk of both local and global extinctions as the last vestiges of forest come under continued pressure for conversion; today less than 30% of the original forest remains (Burgess et al., 2007).

The conservation of such wildlife may generate significant existence value to populations in 'donor' countries like the United Kingdom. However, the elicitation of such values is particularly challenging. The good itself is highly complex and unlikely to be familiar to respondents, raising concerns that preferences may be shaped by the valuation process rather than in relation to the characteristics of the good (Spash and Hanley, 1995).[3] The scant literature on the preferences of distant beneficiaries for tropical biodiversity provides some evidence of such effects (see, for example, Horton et al., 2003; Spash and Hanley, 1995; Svedsater, 2000).

To test the theoretical consistency of preferences in the current context we pooled two sets of choice data elicited through a split sample design whereby wildlife in the Eastern Arc was presented on its own (small good); or as part of a more inclusive good (large good) which also included species conservation in a secondary site, the Cameroon Highlands[4] (this was further sub-divided to expand the range of species presented). In both cases, wildlife conservation was described in terms of the number of endemic ('unique') species and the number of non-endemic ('non-unique') species in each location; these were further characterised in terms of whether species were 'charismatic' or 'non-charismatic' — where charismatic was represented by relatively large and well known mega-fauna such as the lion or gorilla, and non-charismatic as birds, reptiles and amphibians. The cost attribute was the annual household donation required per annum. A key aspect of the design involved the use of symbols to convey to respondents the type (and number) of wildlife affected under the various options. This follows recent findings that numeric information may lack the 'evaluability' of visual representations of the same data and that the latter are more suitable for presenting biodiversity to respondents (Bateman et al., 2009; Christie et al., 2006). An example of the 'small' and 'large' good choice cards as shown to respondents is presented in Figs. 1 and 2. As illustrated, the small good presents

[2] Marginal WTP for the first protected area was significantly greater than for the tenth area; the authors conclude that at the far right of the WTP curve scope sensitivity can be difficult to detect and may require the use of large sample sizes (Rollins and Lyke, 1998).

[3] It is oft argued that familiarity and experience are essential in obtaining reliable and meaningful value estimates for environmental goods to the extent that individuals cannot be expected to hold stable and well-formed preferences for complex and unfamiliar goods (Gregory et al., 1993; Kahneman and Knetsch, 1992; Spash, 2007). Indeed, Boyle et al. (1993) find that ordering effects are more likely amongst respondents unfamiliar with the good.

[4] The Cameroon Highlands were selected due to their broad similarity with the Eastern Arc, being an African mountain range covered in patches of rainforest and grasslands which form part of a biodiversity hotspot, the Guinean Forests — enabling us to control for factors exogenous to our CE design, such as location and ecosystem type.

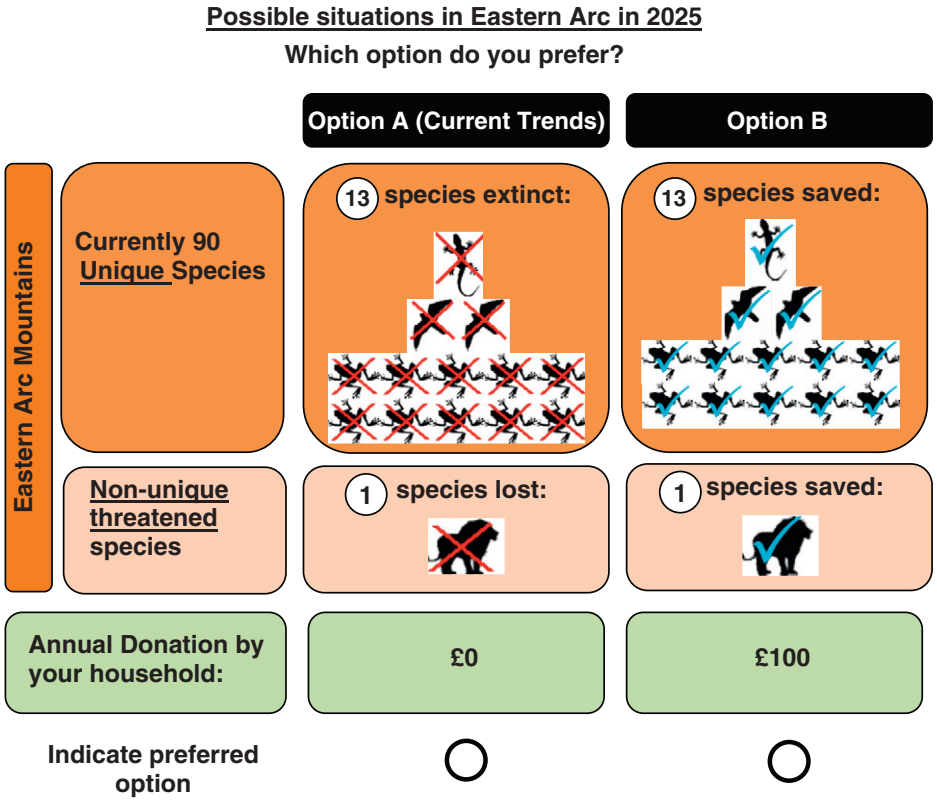

Fig. 1. Example choice card for the small good.

wildlife conservation options for Eastern Arc only, whereas the large good presents wildlife conservation options for two locations, the Eastern Arc and the Cameroon Highlands.

The species attribute levels for the Eastern Arc were based on expert knowledge of current biodiversity levels in the area and expectations under three different future scenarios (these were part of a wider project on Valuing the Eastern Arc[5]); the attribute levels for the Cameroon Highlands were set to meet the purposes of the experimental design whilst being broadly in keeping with the biogeography of the site.[6] The monetary levels selected for the annual household donation attribute were based on a review of the literature and thorough pre-testing.

To isolate the key determinants of WTP the responses to the two choice tasks were pooled and recoded to create the final attribute variables used in the model (see Table 1). (A detailed description of the attributes and levels presented to respondents in the two choice tasks is presented in Table A.1 in the Appendix). In terms of how respondents might understand and compare wildlife programmes in distant locations, four aspects seemed potentially salient: (i) the number of species conserved; (ii) endemism or 'uniqueness'; (iii) charisma; and (iv) the number of conservation sites. To this end the unique species attribute was disaggregated and recoded as a continuous variable representing the total number of 'unique and non-charismatic' species (UNC) and a dummy variable which isolated the value of one 'unique and charismatic' species (UC). A dummy variable was also created to test sensitivity to conserving wildlife in multiple sites (Twosites). Importantly, two interaction variables[7] were created to test the sensitivity of preferences to changes in the availability of substitutes and/or complements by interacting a dummy for the small good and the two species attribute variables (SMUNC and SMNUC).

This enabled the decomposition of preferences according to different species types and critically, to test the sensitivity of these preferences to the number of species, number of conservation sites and to changes in the availability of possible substitutes and complements.

3.1. Survey implementation

The contingent scenario informed respondents that wildlife in the Eastern Arc (and Cameroon Highlands) is under threat from habitat loss. The number and type of species, their conservation status, and the areas at risk, were conveyed using photos, texts and maps. Respondents were informed that WWF together with the domestic government(s) was considering ways to conserve the remaining species, which would require additional funding from members of the public in developed countries like the UK — the purpose of the research being to find out which schemes the public would be prepared to fund and which schemes they would not.

[5] See www.valuingthearc.org.

[6] We cannot claim current or future biodiversity levels in the Cameroon Highlands are accurately represented.

[7] The experimental design was a full factorial which allows estimation of all possible interaction effects and seemed the most appropriate design option given no clear a priori expectations of the nature of interactions (the latter being required for optimal designs). In both treatments, six implausible options were removed – these combined status quo levels with positive monetary payments – the remaining options were randomly allocated into blocks comprising six choice questions for the small good, and seven choice questions for the large good.

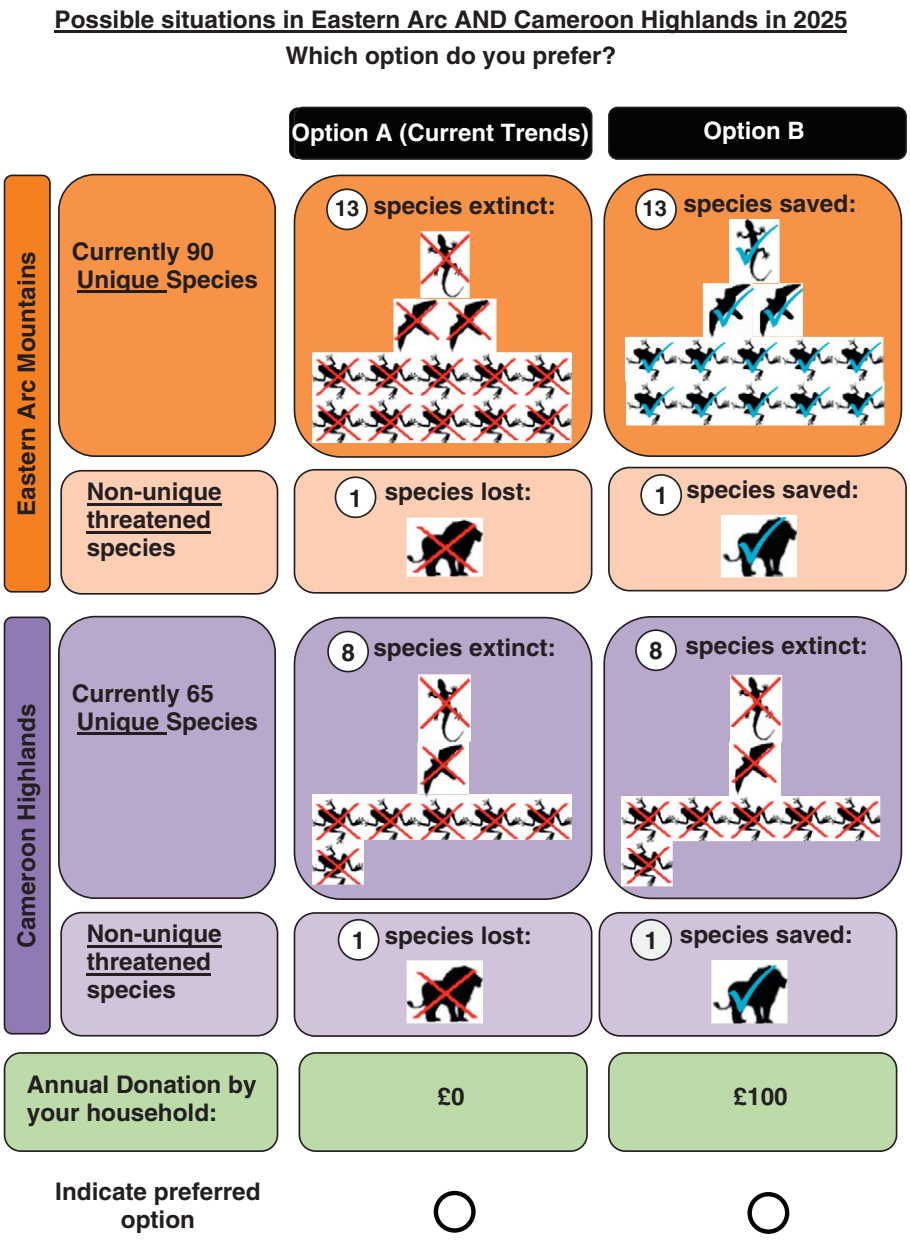

Fig. 2. Example choice card for the large good.

In the choice tasks respondents were presented with a series of binary choice questions describing the situation in 2025 if current trends were allowed to continue and the alternative situation if conservation measures were implemented, and asked to choose their most preferred option. To avoid any unintended internal sequencing effects the choice questions were presented in a random order and respondents were randomly allocated to a treatment and a choice block.

The survey was implemented using an online mode[8]; the design complied with guidance in the SP literature, and the survey was pilot-tested and administered using a professional survey company, Survey Sampling International. An email invitation containing a web-link to the survey instrument was sent to a pre-recruited panel of 42,264 online UK residents between January and May 2009 using a response-rate balanced approach designed to deliver a nationally representative sample. To control access to the survey, respondents were given a unique ID and password which enabled them to complete the survey only once. After 36 hours a reminder email was sent to those who had not responded.

In total, 6065 individuals started the survey, of these around 45% were screened out due to quota satiation, a further 20% dropped out and a further 35% completed the survey.[9] After adjustments to ensure

[8] The online mode is thought to offer several advantages over the traditionally preferred in-person approach, for example, it removes the potential for interviewer effects; respondents are able to complete the survey at their own pace; and it offers lower survey costs and faster turnaround. The main concerns with the mode relate to sample representativeness and data quality issues (Berrens et al., 2004), however, recent research indicates that online survey results can be statistically equivalent and no less reliable than in-person methods (see Lindhjem and Navrud, 2011).

[9] This is comparable with other internet-based stated preference surveys which typically have much lower response rates compared with other survey modes, for example, Marta-Pedroso et al. (2007) report response rates of 5.1% for internet and 84% for in-person.

Table 1
The attribute variables used in the final pooled model.

Attribute variable	Coding	Label
Unique and Charismatic species	Dummy variable where 1 = Gorilla species conserved; 0 = otherwise	UC
Unique and Non-Charismatic species	Continuous variable where the total number of unique and non-charismatic species conserved = 0, 7, 8, 12, 13, 19, 20 or 21.	UNC
Non-Unique and Charismatic species	Dummy variable where 1 = Lion species conserved; 0 = otherwise	NUC
Non-Unique and Non-Charismatic species	Dummy variable where 1 = Frog species conserved; 0 = otherwise	NUNC
Species conservation in two sites	Dummy variable where 1 = at least 1 species conserved in BOTH sites; 0 = species conserved in 1 site only or no species conserved	TWOSITES
Interactions with small good[a]	Small good x UNC	SMUNC
	Small good x NUC	SMNUC
Annual household donation	£0, £5, £20, £40, £60, £100, £200	COST

Notes: The final attribute variables used in the modelling were generated by pooling and recoding the data from the two choice tasks.
[a] Small good is a dummy variable coded 1 if species conservation is framed within the small good, 0 if framed within the large good.

representativeness, equivalence between treatments, and censoring for invalid and protest responses,[10] a final sample of 999 complete questionnaires was generated. No significant differences were detected between treatments for gender, age, household income and education. The sub-samples were found to be broadly representative of the UK population.[11]

4. Results and discussion

The pooled choice data was analysed using the random parameters probit[12] model with cost specified as fixed (i.e. non-random) and all other attributes specified as normally distributed random parameters. The utility function was specified as $U_{it} = V_{it} + \varepsilon_{it}$, where: $V_{it} = \beta_1 constant_{it} + \beta_2 UC_{it} + \beta_3 Ln(UNC+1)_{it} + \beta_4 NUC_{it} + \beta_5 NUNC_{it} + \beta_6 SMLn(UNC+1)_{it} + \beta_7 SMNUC_{it} + \beta_8 Twosites_{it}$, and V_{it} represents the measurable component of utility for individual i in group t (i.e. the vector of the response variable for choosing Option B or not); the βs are the estimated coefficients of the variables described in Table 2; and, ε_{it} represents the unobserved influences on a respondents' choice. The 'Unique and Non-charismatic' species attribute (UNC) was transformed by taking the natural logarithm of the number of species conserved[13] — this followed earlier model estimation which indicated improved model fit by specifying a non-linear relationship as opposed to a linear or stepped function.[14]

Table 2
The results of the random parameters probit model regression.

Attribute	Coefficient	SE	t-stat	p
Fixed				
COST	−0.017	0.000	−59.79	***
Random (mean)				
Constant	0.138	0.052	2.626	***
UC	0.265	0.056	4.706	***
Ln(UNC + 1)	0.326	0.024	13.812	***
NUC	0.213	0.045	4.778	***
NUNC	−0.015	0.049	−0.296	
SMLn(UNC + 1)	−0.048	0.021	−2.310	**
SMNUC	0.184	0.055	3.378	***
TWOSITES	0.074	0.056	1.313	
Random (distribution)				
Constant	1.980	0.034	58.549	***
UC	0.065	0.056	1.157	
Ln(UNC + 1)	0.334	0.008	39.636	***
NUC	0.663	0.024	28.072	***
NUNC	0.055	0.047	1.175	
SMLn(UNC + 1)	0.185	0.011	16.252	***
SMNUC	0.169	0.033	5.117	***
TWOSITES	0.110	0.027	4.037	***
Observations	999			
Halton reps	500			
Parameters	17			
Log likelihood	−2947.48			
AICc	5929.58			

*** 1% sig level.
** 5% sig level.

Table 3
Mean marginal WTP (MWTP) per household per annum.

Species type	Mean MWTP
Unique and Charismatic (Gorilla)	£15.90
Unique and Non-Charismatic (Frog, Toad, Lizard, or Bird)	£9.77
Non-unique and Charismatic (Lion)	£12.78
Non-unique and Non-Charismatic (Frog)	−£0.87[a]
Premium for conserving in two sites	£4.44

[a] Coefficient is negative but not significantly different to zero.

The model outputs and marginal WTP estimates[15] are reported in Tables 2 and 3, respectively.

The regression results indicate that respondents significantly positively value the conservation of endemic and/or charismatic species in remote settings.

The significant positive values for endemics differ to the findings of Martin-Lopez et al. (2008), but are consistent with Meuser et al.

[10] Invalid responses were identified as those given by respondents that selected the 'do something' option in all choices for non-economic reasons, for example, 'I get a sense of satisfaction from contributing to good causes', 'I wouldn't really pay' or 'We have a moral duty'. Protest responses were identified as those given by respondents that selected the 'do nothing' (i.e. status quo) option in all choices for non-economic reasons, for example, 'The government should pay for this', 'I don't believe the money would really be spent on the programme' or 'The choices were too difficult'. In this way, a total of 33 respondents were excluded for invalid positive responses and a further 38 respondents were excluded for protest responses.

[11] In 2008 around 65% of UK households had internet access (ONS, 2008).

[12] Many models were tested as part of the preliminary analysis (e.g. logit with random effects, random parameters logit); the random parameters probit model provided the best fit to the data.

[13] To avoid the problem of taking the natural log of zero, the transformation was actually Ln(X + 1), where X is the number of 'Unique and Non-charismatic' species conserved.

[14] An earlier model specification using dummies for each level of 'Unique and Non-charismatic' species indicated that mean WTP tends to increase as the number of 'Unique and Non-charismatic' species increases. While mean coefficients were not significantly different between all levels, there was scope sensitivity at the extreme, for example, 7 species were worth significantly less than 13, 20 and 21 species (raw one-tailed test of confidence interval overlap at 5% sig level). The shape of the stepped function further suggested a log-linear relationship rather than a linear one — this was tested using the corrected Akaike Information Criterion (AICc) which, after Hess et al. (2008), is calculated by, $-2LL(\beta) + 2(Np/N - p - 1)$, where N is the number of observations and p is the estimated parameters – lower values indicating superior fit. Three models were estimated which varied according to whether the 'Unique and Non-charismatic' (and associated small good interaction variables) was specified using (i) dummies for each species level; (ii) a linear continuous variable; and (iii) log-linear continuous variable, giving AICc values of 5988. 7, 5950.1, and 5929.6, respectively — indicating that the log-linear specification is superior.

[15] Marginal WTP (MWTP) per annum was derived using the following formula: $MWTP = \beta_{attribute}/\beta_{cost}$, where $\beta_{attribute}$ is the coefficient on the attribute of interest, and β_{cost} is the coefficient on the monetary variable.

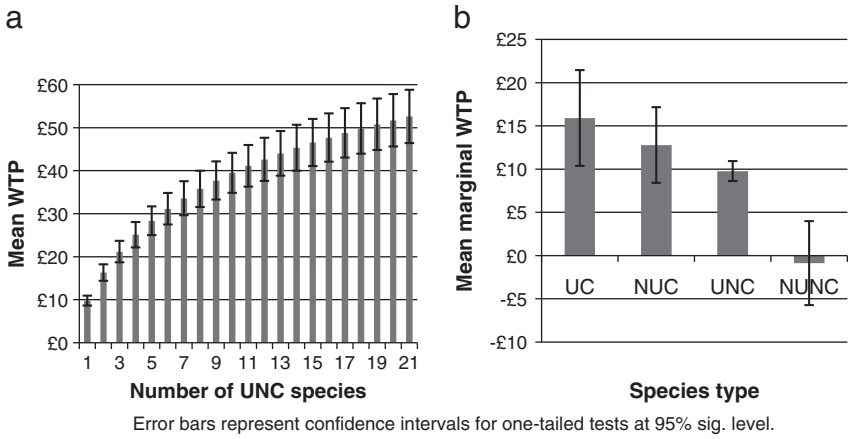

Fig. 3. (a) Predicted mean WTP for unique and non-charismatic (UNC) species; (b) Predicted mean marginal WTP by species type.

(2009) and indicate that true endemics are valued even by populations located far away.

The results suggest that international organisations are correct to use charismatic as flagships for raising funds and awareness, but that 'unique and non-charismatic' species may also be useful in this respect. Moreover, they indicate that public priorities overlap with existing biodiversity priority-setting approaches which highlight the importance of rare and endemic species (for example, 'biodiversity hotspots' (Myers, 1988) and tropical wilderness areas (Mittermeier et al., 1998); Alliance for Zero Extinction (www.zeroextinction.org)).

Contrary to preferences for local wildlife (see Ressurreição et al., 2011; Veisten et al., 2004), respondents do not significantly value the conservation of 'non-unique and non-charismatic' species such as birds, lizards, frogs and toads, when these are located far away.[16] This may raise concerns for policymakers since if taken literally, it could mean that species which are widespread and non-charismatic (i.e. species which are not 'big and furry') but may be important ecologically, may not make the grade in terms of cost benefit appraisal (White et al., 2001).

The log-transformed UNC variable is highly significant (t stat 13.812; 0.1% significance level) indicating that the conservation of 'Unique and Non-Charismatic' species exhibits positive but diminishing marginal WTP (see Fig. 3a). This is in accord with evidence elsewhere in the valuation literature that preferences for wildlife may generate diminishing marginal utility (see for example Rollins and Lyke, 1998). It indicates that whilst respondents may not react significantly to small changes in quantitative scope they do react to more obvious increases — for example, the value of conserving seven 'unique and non-charismatic' species is statistically equivalent to the value of eight species, but is significantly lower than the value of conserving thirteen (95% sig. level). This doesn't mean that scope sensitivity is initially zero and then becomes significant, but rather it suggests that the changes need to be more substantial to register in people's preferences. This sensitivity to quantitative changes in scope provides some preliminary evidence that preferences for distant tropical wildlife may be coherent. Importantly, it indicates that people are not solely reacting to charismatic or 'flagship' species, but that other more scientific and economic characteristics have a bearing on preferences.

Based on the size of the coefficients for marginal changes (moving from zero to one species conserved) reported in Table 3, the general order of preference for the different species types is (from highest to lowest): (1) 'Unique and Charismatic', (2) 'Non-unique and Charismatic'; (3) 'Unique and Non-charismatic'; and, (4) 'Non-unique and Non-charismatic' — notably, due to large standard errors we fail to observe statistically significant differences between all species types (see Fig. 3b),[17] but do observe sensitivity to some qualitative changes in scope (by this we mean differences in the type of species conserved). Pair-wise testing of the equivalence of mean coefficients (Wald test) for moving from zero to one species conserved indicates that, as expected, 'charismatics' and 'uniques' are consistently preferred over 'non-unique and non-charismatic' species. This is in accord with the valuation literature which has shown that people are typically WTP more for charismatic species (see for example, Loomis and White, 1996; Kontoleon and Swanson, 2003) and that they value the low substitutability of unique (endemic) species (see for example, Verissimo et al., 2009). We also find that 'unique and charismatic' (gorilla) species are close to being significantly preferred to 'unique and non-charismatic' species at the 5% significance level (p value = 0.082). However, there is no significant difference in mean marginal WTP for the 'unique and charismatic' (gorilla) and the 'non-unique and charismatic' (lion) species — that is 'charismatics' are valued the same whether they are unique or non-unique. And we find no significant difference in marginal WTP between 'non-unique and charismatic' (lion) and 'unique and non-charismatic' (frog, toad, lizard or bird) species.[18]

The coefficient on the 'twosites' variable is not significantly different from zero, indicating that no premium is placed on undertaking wildlife conservation in two sites as opposed to one site (or none).[19] This result seems very plausible and highly interesting.

[16] The coefficient on 'non-unique and non-charismatic' is negative although highly insignificant (t stat −0.296, p = 0.767).

[17] This is likely due to noise in pooling our data; we expect that with greater sample sizes sensitivity would become more apparent.

[18] Given values for 'unique and non-charismatic' display diminishing marginal utility, tests of sensitivity depend on the position along the curve: if we compare the marginal value at the point of moving from one to two species, we find the value is now significantly lower than for moving from zero to one NUC species: £12.78 and £6.51, respectively.

[19] This result is corroborated by preliminary model estimation in which the 'Non-unique and Charismatic' variable was specified as two separate dummies to capture 'lion conservation in 1 site' and 'lion conservation in 2 sites' — the results of Wald tests and raw one-tailed comparison of confidence intervals indicated no significant difference in mean coefficients between the two variables, meaning no premium for the additional site i.e. respondents are willing to pay the same for ensuring lion conservation in 1 site or 2 sites (results available from authors upon request).

Given that the two conservation sites are highly remote (in relation to the surveyed population), this may simply reflect the fact that we are dealing with predominantly non-use rather than use values (i.e. site visits are unlikely, thus as long as wildlife is conserved, the number of sites is not perceived to be important). Importantly, it means that the two conservation sites are perceived as substitutable such that the value of conserving in one site is the same as two sites — this is plausible given that the two sites are broadly similar, both being African mountain ranges covered with rainforests and grasslands. It does however suggest a limit on the public's understanding of wildlife conservation issues given the real-life importance of maintaining multiple sites, in particular, for wide-ranging, endangered species like the lion (i.e. the likelihood of overall species survival may be higher by undertaking conservation in multiple locations[20]), and the additional ecosystem services that may be provided.

Critically, the size of the coefficients on the interaction variables between the small good[21] and the 'unique and non-charismatic' (SMLnUNC), and the 'non-unique and charismatic' (SMNUC) species variables, indicates that changing the overall scope of the good, and thereby increasing the availability of potential substitutes and complements, has a significant impact on respondent's choices. Interestingly, the effect differs depending on the species type: the marginal value of 'non-unique and charismatic' (lion) species is significantly lower in the larger good ($p = 0.001$)[22] and the marginal value of 'unique and non-charismatic' species is significantly higher ($p = 0.021$).[23] Both outcomes seem highly plausible and consistent with economic theory. As the availability of wildlife increases, we observe substitution effects for the charismatic non-endemic species,[24] and complementarity for the endemic (non-charismatic) species. The latter is in line with Kahneman and Knetsch (1992), who suggest that endemic species should not be substitutable since their uniqueness is the crux of their value. Moreover, these results indicate considered rather than arbitrary choices, and provide stronger evidence of coherency in preferences.

5. Conclusions

In this paper we report the results of an in-depth investigation of the preferences of UK residents for conserving tropical wildlife.

Whilst some argue that the general public cannot be expected to judge accurately complex and unfamiliar goods such as tropical biodiversity and come up with sensible decisions (Sagoff, 1988), we find evidence here to suggest that responses are not arbitrary and broadly conform with economic theory.

Marginal WTP is sensitive to the number of species (quantitative scope) and to certain species types (qualitative scope changes), and to changes in the available wildlife. Interestingly, we find that the latter has a differential impact depending on the species type, and, crucially, that the differences seem logical: endemics are subject to complementarity and non-endemic charismatics to substitution effects.

In terms of what people are really valuing, we find that preferences are mainly driven by charisma (big, furry and familiar species); and endemism; and the number of species conserved. In contrast, species which are neither endemic nor charismatic, and the number of conservation sites do not significantly contribute to utility.

In relation to the earlier question of whether stated preferences for remote wildlife are a sound basis for policy-making, of concern is that public prioritisation of 'charismatic' wildlife (as evidenced here) could result in policies that conserve 'furry' animals at the expense of other less charismatic and non-endemic yet ecologically/biologically important species (see also Martin-Lopez et al., 2008). There is already evidence to suggest that a disproportionate amount of conservation funding goes to relatively few species (Dawson and Shogren, 2001; Metrick and Weitzman, 1996; Richardson and Loomis, 2009), thus relying on public preferences could compound the problem that species which are poorly known and uncharismatic may be ignored by conservation action (Sitas et al., 2009). Of course, in some instances, little known and widespread animals might be vital for the conservation of bigger charismatic animals and their value can be considered embedded in a Lion's or gorilla's WTP in which case such values may be a good proxy for a wildlife project.

The lack of a premium for conserving multiple sites may also raise concerns and highlights the importance of incorporating ecosystem service values to ensure that site conservation issues are not overlooked. Moreover, future research into public preferences for wildlife conservation should examine sensitivity in situations where the sites are more dissimilar since it seems plausible that in the context of more diverse ecosystems habitats or biomes that preferences could be sensitive to the conservation of multiple sites — this is an area for future research.

Given these outcomes, we concur with Hanley et al. (2003) that the use of such estimates in cost–benefit type appraisals should be conducted in conjunction with expert opinion, so that policy can be designed to secure maximum benefits for society, and, crucially for nature. While we feel that this experiment provides important evidence regarding the coherence of preferences, this does not necessarily mean that those preferences align with ecological requirements for sustainability. Any policy seeking to provide sustainable solutions would have to ensure that the implementation of preference based decisions are constrained within the bounds of the latter requirements (Common and Perrings, 1992).

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[20] Of course, the counter-argument also holds that by spreading resources too thinly, the chance of survival may be lowered — such preference would be exhibited by a significant and negatively signed coefficient on twosites.

[21] The small good dummy variable was coded 1 if choices related to the small good, and 0 if choices related to the large good. The small good comprised twelve or thirteen 'Unique and Non-charismatic species' and one 'Non-unique and Charismatic' (lion) in one location only. In contrast the large good comprised up to twenty one 'Unique and Non-charismatic' species, and depending on the treatment either two 'Non-unique and charismatic' (lion) species, or one 'Unique and Charismatic' (gorilla) species, one 'Non-unique and Charismatic' (lion) species and one 'Non-unique and Non-charismatic' species, spread across two locations.

[22] The coefficient on SMNUC is significant and positively signed, indicating that the value increases significantly when framed as part of the small good.

[23] In addition, the results of Wald test indicate that in the small good, 'Non-unique and Charismatic' species are worth significantly more than 'Unique and Non-charismatic' species (t stat 6.025, $p = 0.000$), whereas in the large good they are statistically equivalent.

[24] For example, in the large good, the presence of a 'Unique and Charismatic' gorilla species may serve to reduce the value of the 'Non-unique and Charismatic' lion species.

Appendix Table A.1. Attributes and levels used in the choice experiments

Attribute	Levels		
	Small good	Large good	
Eastern Arc	1 lizard, 2 birds and	1 lizard, 2 birds and	
Unique species	10 frogs/toads extinct	10 frogs/toads extinct	
	1 lizard, 2 birds and	1 lizard, 2 birds and	
	9 frogs/toads saved	9 frogs/toads saved	
	1 lizard, 2 birds and	1 lizard, 2 birds and	
	10 frogs/toads saved	10 frogs/toads saved	
Eastern Arc	Lion lost	Lion lost	
Non-unique species	Lion saved	Lion saved	
Cameroon Highlands	n/a	**1 lizard**, 1 bird and	**1 gorilla**, 1 bird and
Unique species		6 frogs/toads extinct	6 frogs/toads extinct
	n/a	**1 lizard**, 1 bird and	1 bird and
		5 frogs/toads saved	**6 frogs/toads** saved
	n/a	**1 lizard**, 1 bird and	1 **gorilla**, 1 bird and
		6 frogs/toads saved	6 frogs/toads saved
Cameroon Highlands	n/a	**Lion** lost	**Frog** lost
Non-unique species	n/a	**Lion** saved	**Frog** saved
Annual HsH donation	£0, £5, £20, £40, £60, £100, £200		

Notes: The small good refers to wildlife conservation in the Eastern Arc only, whereas the large good refers to wildlife conservation in the Eastern Arc and the Cameroon Highlands. Bold highlights differences in wildlife between the sub-divisions of the large good.

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