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Preferences and Multiple Use Forest Management

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Abstract

This paper offers evidence relevant to the debate regarding the use of stated willingness-to-pay as a guide to public preferences about environmental management, and the possibility that individuals have distinct preferences according to whether a consumer or a citizen viewpoint is adopted. Multiple-use forest management requires some means of comparing market and non-market forest outputs. With this in mind, attempts are found in the economics literature to reveal public preferences for non-market forest outputs in terms of willingness to pay using contingent valuation studies. On the other hand, it has also been argued in the literature that estimated willingness to pay is not an appropriate or reliable way to capture public preferences. Visitors to a UK forest were surveyed and the forest managers were interviewed. In addition to willingness to pay for productive and recreational forest sites with varying non-market outputs, respondents reported on preferences for forest attributes from both a private/consumer and a social/citizen viewpoint. Our results tend to support the hypothesis that individuals express different preferences when adopting a consumer and a citizen viewpoint, and that the latter viewpoint gives more weight to attributes with less direct and obvious visual appeal. Despite this, visitors' willingness-to-pay estimates varied little whether consumer or citizen explanatory variables were used, and visitors' ranking of the sites on this basis differed from the ranking of forest managers. These results suggest that the consumer/citizen distinction is important, and that valuable information regarding public preferences is omitted if willingness-to-pay alone is used as a guide to decision-making.

Keywords: Willingness-to-pay, preferences, citizen, forest management

JEL Classification: Q12, Q13, Q18

1. Introduction

In recent years, there has been an increasing research emphasis on the non-market benefits of forests. This reflects increasing public demand for recreation opportunities and public interest in conservation, and, hence, greater pressure on forest management organizations to take action to protect environmental values on forest lands. In the economics literature it is taken as given that multiple use forest management should be guided by allocative efficiency criteria, and reflect consumer preferences as reflected in willingness to pay. Given that willingness to pay for non-timber forest outputs is not revealed in markets, this has stimulated interest in non-market valuations of those outputs. However, the reliability and appropriateness of non-market valuations, especially, but not only, those derived from contingent valuation studies, has been questioned. It has been argued that willingness to pay is not the proper way to incorporate the public's preferences into environmental management decision making.

This paper considers the role of preferences in forest management. In the next section, 2, we provide some background to a survey of visitors to a UK forest, the conduct of which is described in section 3. The results from this survey are presented in section 4. The views of those responsible for managing the forest were also ascertained with the results reported in section 5. These and the survey results raise questions about the role of preferences in multiple use forest management, which are discussed in concluding section 6.

2. Background

The data analysed in this paper were generated in a survey of visitors to Dalby Forest, in the North York Moors National Park in North Yorkshire, England. It is owned and managed by the Forestry Commission, a public sector organisation, which was established in 1919 and now owns and manages approximately 30% of the UK's forested land.

The original motivation for the establishment of the Forestry Commission was to ensure timber supplies, and until the 1970s, despite some public criticism of monocultural planting, that remained the dominant management concern. In the 1970s the Commission started to give attention to conservation and amenity issues, and to develop recreational facilities on its land. By the 1990s the Commission was fully, and formally, committed to multi-purpose forestry. The UK government, and therefore the Forestry Commission, is also formally and legally committed to sustainable forestry: see Forestry Commission (1998). Biodiversity conservation is now a major policy objective in UK public forestry as expressed through the 1994 UK Biodiversity Action Plan, the UK Forestry Standard, and the England Forestry Strategy (Forestry Authority 1998, Forestry Commission 1998). Forestry in Britain also follows published guidelines on wildlife conservation that managers of public and private forests have to comply with (Forestry Commission 1990).

In seeking to translate such general prescriptions into actual management strategies, which also meet the commercial requirement for timber production, the Forestry Commission has shown considerable interest in non-market valuation, and cost benefit analysis¹. Economists have encouraged this interest, and the Forestry Commission has financed a number of studies and reports on the monetary valuation of non-timber forest

outputs. In a 2000 report to the Forestry Commission, which reviewed previous UK work, the first recommendation stated that:

“As non-market benefits are the most important output of much of the forested area in Britain, it is clearly a high priority for policy makers to have a more comprehensive estimate of these benefits than currently exists. These estimates will inform future management decisions regarding the FC estate and, when used in conjunction with cost estimates, can help to resolve decisions such as whether or not to replant or restore areas of native woodland (Willis *et al.*, 2000).

Evans (1999) reports that the Forestry Commission undertook a cost benefit assessment of the national forest which valued recreation services at £38 million with the associated costs at £7 million per year.

Economists argue that environmental management generally should be guided by cost benefit analysis, and hence monetary valuation in terms of willingness to pay.² Opposition to this takes two forms. First, there are arguments that willingness to pay should not guide environmental management, that it is ethically the wrong way to do things. Second, there are arguments that it cannot guide environmental management because the methods for assessing willingness to pay for environmental public goods are not sufficiently accurate. The first of these arguments is advanced mainly by non-economists. The second, which is mainly focussed on the contingent valuation method, is advanced by economists, and others.³

With regard to the contingent valuation method, the two arguments are connected in that to the extent that survey respondents take the view that it is wrong to base environmental decisions on willingness to pay, they are likely to provide responses that do not accurately reveal their willingness to pay. The literature on this question is surveyed in Blamey and Common (1999).

Of particular relevance to the work reported in this paper is the consumer/citizen distinction introduced by Sagoff (1988): see also Sagoff (1994). The cost benefit/monetary valuation basis for environmental management requires that individuals relate to the environment as consumers, and that they have a single well-behaved utility function in which ordinary commodities and environmental attributes and services appear as arguments. Sagoff rejects this, arguing that individuals operate distinctly as consumers and as citizens, and that environmental questions fall within the citizen domain. He also argues that citizen preferences are less self-centred and more impartial than consumer preferences, reflecting assessments of what is desirable for society overall. A similar consumer/citizen distinction, with some variations, is also advanced in Margolis (1982), Kohn (1993) and Vадnjal and O ‘Connor (1994). Blamey *et al.* (1995) report results for data from a contingent valuation survey on forest preservation that they interpret as support for Sagoff’s position.

The present paper offers empirical support for Sagoff’s position, but also suggests that matters are less simple than a straightforward consumer/citizen dichotomy. In support, we find clear evidence of a consumer/citizen distinction in stated preferences regarding the importance of forest attributes. However, we find that this distinction is greater for some attributes than for others, suggesting that environmental goods vary in whether they are predominantly within the consumer domain or the citizen domain. We also find that

willingness-to-pay is relatively insensitive to whether it is estimated using consumer preferences or citizen preferences, so that in this study the typical consideration of consumer preferences would be a reasonable approximation to the result obtained by taking account of citizen preferences. We also compare the preferences of forest visitors with those of forest managers, finding that in some instances visitors' preferences are inconsistent with an understanding of forest ecology and hence do not easily translate into a forest management plan. This latter point is a reminder that good environmental decision making is not simply a matter of which set of preferences are used; it also requires an understanding of the reality of the system under consideration.

3. The Dalby Forest Survey

Dalby forest comprises five types of stand. In the following descriptions, biodiversity characteristics for the four 'conservation' stand classes are stated relative to those for the Sitka Spruce 'production' class of stand, which is dealt with first.

Sitka Spruce stands are timber production sites with the commercial crop closely spaced for maximum stocking and clearfelling at optimum economic rotation age of 48 years, with no dead wood retention. The stand age has a pronounced impact on flora and fauna due to very high stocking rates. Young crops have high numbers of rodents, which support kestrels and tawny owls, and provide good grazing for deer. Maturing crops produce cones, which support squirrels, small mammals and birds such as crossbills and siskins. Young crops support populations of plants, insects and reptiles but diversity diminishes after 7-10 years with decreasing below-canopy light levels. Substantial numbers of insects that feed in the tree canopy persist as the crop matures.

Douglas Fir sites are managed as for a commercial crop except that felling is delayed 30 years. The result is a fairly open canopy, with very tall trees to 30 metres. There is improved grazing for deer and small mammals and the older trees provide nesting sites for goshawks. Good ground flora cover provides food for robins, wrens and dunnocks. Mature trees benefit crossbills and siskins, birds that feed on cones. Ground flora late in the rotation provides moderate benefits for insects. There is reduced benefit for reptiles and amphibians due to the lower proportion of time in the establishment phase.

Mixed Forest sites, Larch and Scots pine, are managed as a commercial crop but with a very open canopy and a rotation age of 45 years. This gives improved grazing for deer and small mammals and a marginal improvement for bats. There is a small increase in some songbirds, and in reptiles, amphibians and fungi. The main benefit is greater diversity of insects, particularly moths and butterflies.

Shelterwood sites are mixed age stands of Scots pine. 70% of trees are felled at the commercial optimum, the remainder being left as seed trees for natural regeneration, with 10 % being felled at 60, and 20% at 80 years. This is the best class of site for ground flora, deer, small mammals (including bats), moths, butterflies, many insect species and reptiles. Mature trees favour seed eating birds, though less so than extended Douglas Fir. These sites are important for nightjar and tree pipit. There is a minor increase in fungi and little improvement for amphibians.

Windblown sites are Sitka Spruce managed as the commercial crop, except that a high proportion of deadwood is left to encourage wildlife, giving substantial changes in

light and the quantity of foliage, with some improvement in grazing for small mammals and bats. There is extra food for woodpeckers, and more nesting sites for redstarts and spotted flycatchers. There is a reduction in leaf/needle eating insects, but minor improvements for reptiles and amphibians. Fungi are the main beneficiaries, with an increase in both the density and diversity of species.

A survey of visitors to Dalby forest⁴ was undertaken for the Forestry Commission by staff and students of the Environment Department at the University of York.⁵

Each interviewee was told: “The Forestry Commission has a site of 250 acres (100 hectares or 100 football pitches, 2.9% of Dalby forest) which is about to be replanted and is deciding what type of new forest to have. There are two options, a Sitka spruce production unit and this x site” where x was one of the four 'conservation' types of stand described above. The interviews were conducted in car parks in full view of a forest site corresponding to the x that was put to the respondents. They were shown two showcards, one illustrating the Sitka spruce production unit and the other illustrating x. Respondents were also shown a map of the area in question and details for each option were read out by the interviewer.

Immediately after being presented with this information, respondents were asked: 'Which of these options do you prefer?' Those who preferred the Sitka Spruce option were then asked about the importance that they attached to various forest attributes, as described below. These respondents were not asked about willingness to pay. Respondents who preferred x were asked about willingness to pay, before going to the questions about the importance that they attached to various forest attributes.

The willingness to pay questioning took the following form. Respondents were told: “This x site costs the Forestry Commission money compared to a purely production forest. This could be paid for by the general public by increased taxes so it is important to find out how much, if anything you would be willing to pay to have 250 acres of this x site. Bear in mind however your total budget and how much you can afford to spend just on Dalby. Remember also that 250 acres is not a very big area and that paying too much on Dalby may mean that you cannot afford other worthwhile conservation schemes. For example there are other forests.”

Respondents were then asked: “Are you willing to pay something toward the extra cost in order to have 250 acres of x rather than the pure production unit described?” Those who answered this question in the affirmative were then asked: “If yes, are you willing to pay £y per year in increased taxes for 250 acres of this forest?” Those who said that they were not willing to pay anything were asked which of several statements best described why they were not willing to pay anything. For those who had stated a willingness to pay something, the offered values for y were £0.1, £0.5, £3, £10 and £20.

Thus, contingent valuation was used to determine a value for a marginal change in the supply of forest⁶. To seek to minimize respondents’ expression of preferences not truly reflecting their willingness to pay on account of ‘embedding’, respondents were reminded that this was only one of a variety of ways of conserving biodiversity or improving landscape views. To minimize hypothetical bias respondents were reminded also about their budget - what they could afford to spend just on this site and particularly what they were actually paying for - the size and features of the site. Respondents were told that the Forestry Commission was using this information in order to decide which forest types to use. They were told also that their answers might actually result in

increased income tax payments. Where a zero incremental willingness to pay was tendered, a reason was sought. Protest bids were thus identified and omitted from further analysis.

All of those interviewed, i.e. those who preferred Sitka Spruce to x and those who preferred x (irrespective of whether or not they were willing to pay anything) were next presented with the following list of forest landscape attributes: Number/species of conifer; Space and light between trees; Tree height and age; Dying trees and dead wood; Forest view and appearance; Mammals; Birds; Reptiles and amphibians; Flowers and other plants; Insects; Fungi. They were then asked: “would you indicate by circling the appropriate number how important each of these is to you personally” where the numbers and descriptors offered were: 1 = Very Important; 2 = Somewhat Important; 3 = Not Important; 4 = Not at all Important.

All were then asked: “Would you now think about the same attributes from the point of view of society as a whole, and keeping in mind the interests of future generations. Please indicate your assessment of the importance of the attributes from that perspective” and provided with the same attribute list, numbers and descriptors.

At each site around 100 respondents were interviewed i.e. around 20 individuals were asked about their WTP at each of the five prices at each of the five sites, totalling 502 individuals. To avoid bias, every other person was interviewed. Each interview lasted approximately 10 minutes and followed a set format. Interviewers were rotated around sites each day. The questionnaire was piloted over three days at Dalby forest and this aided the design of the survey. The full interview sample was taken at Dalby forest during the month of August 1995.

The site survey also included questions covering general information such as the purpose of the visit; holiday maker/day tripper status; length of stay; whether the visit was the main purpose of their day out; frequency of visits to Dalby; reasons for visiting; distance travelled; activities undertaken; willingness to pay for the preferred forest types and various household characteristics. This made it possible to relate bids to preserve the preferred option to the scores for forest characteristics described above, as well as to a range of household characteristics of relevance.

4. Survey Results

We look first at contingent valuation. Given the dichotomous choice format, the survey data are analysed using logistic regression⁷. As noted above, as well as asking about willingness to pay, the survey generated data on respondents', personal and social, ratings of attributes of forest landscapes, frequency of visitation, duration of visit, activities while visiting, and on socio-economic characteristics (sex, age, income etc). Additionally, dummy variables were created to indicate for each respondent which of the 'conservation' sites, x in the above account of the questionnaire, had been offered. Two logistic regressions were run, one using personal preferences across attributes, the other using social preferences. Initially, in both cases all of the other respondent data was included in the set of explanatory variables. In both cases, most of the explanatory variables had parameter estimates that were not statistically significant at 5%. The two regressions were re-run with just the significant explanatory variables included. The results then arising are given in Tables 1 and 2. Going from the full to the restricted regressions never involved a parameter estimate sign change, and generally had a small effect on the numerical value for the point estimate.⁸ The hypothesis that the omitted variables had no explanatory power failed to be rejected at conventional levels of significance with F-tests and likelihood ratio tests.

In Tables 1 and 2 the dependent variable is the log-odds ratio $\ln(P_i/(1 - P_i))$, where P_i is the probability of a 'yes' response to the willingness to pay question by the i^{th} respondent (i.e. the probability of willingness to pay). Use of the log-odds ratio as a dependent variable is equivalent in effect to modelling the probability of WTP as a logistic curve $P_i = 1/(1+\exp(-Z_i))$ where Z_i is the linear combination of explanatory variables in the estimated regression line. In a regression of this type, use of ordinary least squares estimators would be expected to introduce bias due to heteroscedasticity, thus the method of maximum likelihood was used to avoid this.⁹

Details of explanatory variables were given above with the survey description. Recall that Price in the willingness to pay question takes values of £0.1, £0.5, £3, £10 and £20 divided equally amongst respondents at each site and that Space and Light and also Birds are explanatory variables measuring stated preferences for forest site attributes on a four point scale from 1 = Very Important to 4 = Not at all Important. Mean values and other characteristics of these site attribute preference variables are shown in Figure 1 and discussed further below. The remaining four explanatory variables in Table 1 are not 'explanatory' variables in the usual sense but are a set of dummy variables allowing the intercept term to vary from site to site, thus capturing variations in willingness-to-pay (for respondents on the windblown site, this dummy = 1 and the other three are zero, and so on).

Table 1. Logistic Regression Results: Personal Preferences over Attributes (dependent variable (log-odds) willingness-to-pay)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Price	-0.103149	0.016191	-6.370910	0.0000
Space and Light	-0.444839	0.187806	-2.368601	0.0179
Birds	-1.035528	0.306192	-3.381961	0.0007
Windblown	2.938899	0.537408	5.468657	0.0000
Douglas Fir	3.194423	0.556511	5.740091	0.0000
Shelterwood	2.761571	0.524657	5.263571	0.0000
Mixed Forest	2.676165	0.500665	5.345222	0.0000
Mean dependent var	0.563536	S.D. dependent var		0.496633
S.E. of regression	0.457884	Akaike info criterion		1.235338
Sum squared resid	74.42837	Schwarz criterion		1.310591
Log likelihood	-216.5962	Hannan-Quinn criter.		1.265254
Avg. log likelihood	-0.598332			
Obs with Dep=0	158	Total obs		362
Obs with Dep=1	204			

The results shown in Table 1 are those that we get when preferences in the logistic regression are represented by the respondents' attribute scores given when they were asked about how important the attributes were to them 'personally'. Two attributes - space and light between the trees, and birds - significantly affect the probability of a 'yes' answer to the willingness to pay question, and both have the expected sign - recall that a lower number goes with a higher importance rating. The four conservation site dummies are all positive, as would be expected given that all of these respondents had said that they preferred a conservation stand to a production stand. 'Price' is the £ amount put to a respondent, and the estimated parameter value is negative as required for theoretical validity. Income does not appear in Table 1: in the initial regression it appeared with the incorrect sign and a z-statistic of 1.31.

Table 2. Logistic Regression Results: Social Preferences over Attributes (dependent variable (log-odds) willingness-to-pay)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Price	-0.095618	0.015801	-6.051452	0.0000
Space and Light	-0.469668	0.176380	-2.662817	0.0077
Windblown	1.756954	0.403439	4.354939	0.0000
Douglas Fir	1.870274	0.386920	4.833746	0.0000
Shelterwood	1.502032	0.369353	4.066656	0.0000
Mixed Forest	1.472651	0.350093	4.206462	0.0000
Mean dependent var	0.563536	S.D. dependent var		0.496633
S.E. of regression	0.465854	Akaike info criterion		1.266143
Sum squared resid	77.25907	Schwarz criterion		1.330646
Log likelihood	-223.1720	Hannan-Quinn criter.		1.291786
Avg. log likelihood	-0.616497			
Obs with Dep=0	158	Total obs		362
Obs with Dep=1	204			

The results shown in Table 2 are those that we get when preferences in the logistic regression are represented by the respondents' attribute scores given when they were asked about how important the attributes were 'from the point of view of society as a whole, and keeping in mind the interests of future generations'. One attribute - space and light between the trees - significantly affects the probability of a 'yes' answer to the willingness to pay question, and has the expected sign. The four conservation site dummies are all positive, and 'Price' has a negative parameter estimate. Income does not appear in Table 2: in the initial regression it appeared with the incorrect sign and a z-statistic of 1.18.

Comparing Tables 1 and 2, it makes very little difference to the estimated price sensitivity whether we use personal or social attribute ratings to represent preferences (this is further examined below). The level of explanation is also similar as between the two tables. The parameters attached to the four conservation site dummies are lower when social, rather than personal, preferences are used.

In contingent valuation applications using dichotomous choice, it is conventional to compute and report median willingness to pay, MWTP, which is the price at which the probabilities of answering ‘yes’ or ‘no’ to the would-you-be-willing-to-pay question are equal, i.e. at which the probability of willingness to pay, $P_i = 0.5$, making dependent variable $\ln(P_i/(1 - P_i)) = 0$ since the natural logarithm of 1 equals zero.. MWTP is thus the price at which the estimated regression equation equals zero. Here we are interested in MWTP in respect of each of the four conservation sites, which we can calculate using the four conservation site dummies. We can calculate, for each site, MWTP using either the parameter estimates of Table 1 or Table 2.

In the case of the Windblown class of site, for example, using the results for personal preferences, we solve $-0.103\text{Price} - 0.445\text{SandL} - 1.035\text{Birds} + 2.939 = 0$ for Price, using for SandL and for Birds the means of the personal attribute scores over the set of respondents who were asked the willingness to pay question in respect of x as Windblown (1.593 and 1.148, respectively). The solution for Price here is £10.12, which is the estimated MWTP for a marginal increase in this type of stand at Dalby Forest. Proceeding in the same way for the other stand classes and using social as well as personal preferences over attributes gives the MWTP results shown in Table 3. In calculating MTWP using social preferences, SandL is the mean of the attribute score when the social perspective is adopted.

Table 3. Estimates of Visitors’ Median Willingness to Pay

	Private MWTP	ranking	Social MWTP	ranking
Windblown	10.12	2	10.15	2
Douglas Fir	11.66	1	11.71	1
Shelterwood	7.86	4	8.02	4
Mixed Forest	8.61	3	8.64	3

There are three points of interest here. First, for a given preference set - personal or social - differences across site types are not very large. Second, for a given site type, it does not make a large difference to estimated MWTP whether we use the personal or social preference based parameter estimates. Third, using social rather than personal preferences does not affect the ranking of the site types.

Table 3 reports MWTP estimated using explanatory variables representing private preferences (Table 1), and again using variables representing social preferences (Table 2). It is natural to refer to the MWTP estimates thus arrived at as “private MWTP” and “social MWTP”, as we have done. Recall, however, as described above, that the WTP question itself was the same for all respondents of whom it was asked: “are you willing to pay £y per year in increased taxes for 250 acres of this forest?” Thus private MWTP and social MWTP in Table 3 do not represent distinct components of value in the sense proposed by Kohn (1993), such that these components can be summed to arrive at a total value. For example, private MWTP does not represent use value and social MWTP does not represent existence value. The approach here is instead intended to offer evidence on the relationship between private versus social preferences and elicited willingness-to-pay: in particular we find that MWTP estimates appear insensitive to which type of preferences are used. This is interesting because these two types of preferences do diverge, as shown below.

The information in Tables 1 to 3 can be expressed in terms of the probability of willingness-to-pay, $P_i = 1/(1+\exp(-Z_i))$. For example, for private willingness to pay, using mean values of variables Birds and Space and Light for the windblown site, P_i at each offered price of £0.1, £0.5, £3 and £10 and £20 is 0.737, 0.729, 0.675, 0.503 and

0.265. This illustrates the probability of willingness to pay falling as the offer price rises. Note that P_i of 0.503 at £10 corresponds well with MWTP (the price at which $P_i = 0.5$) of £10.12.

Table 4 shows P_i for a price of £10 for each site, calculated in a similar way to the MWTP figures. The small differences in private and social MWTP are reflected in correspondingly small differences in P_i at £10, with P_i higher for social than for private preferences in most cases. The apparently odd result for Douglas Fir whereby social MWTP is higher than private MWTP but the reverse is true for P_i at £10 is explained by the fact that the private and social P_i curves for this site intersect at £11 so that social P_i is greater than private P_i for prices above £11 and the reverse is true for prices below £11.

Table 4. Probability willingness to pay an offer price of £10

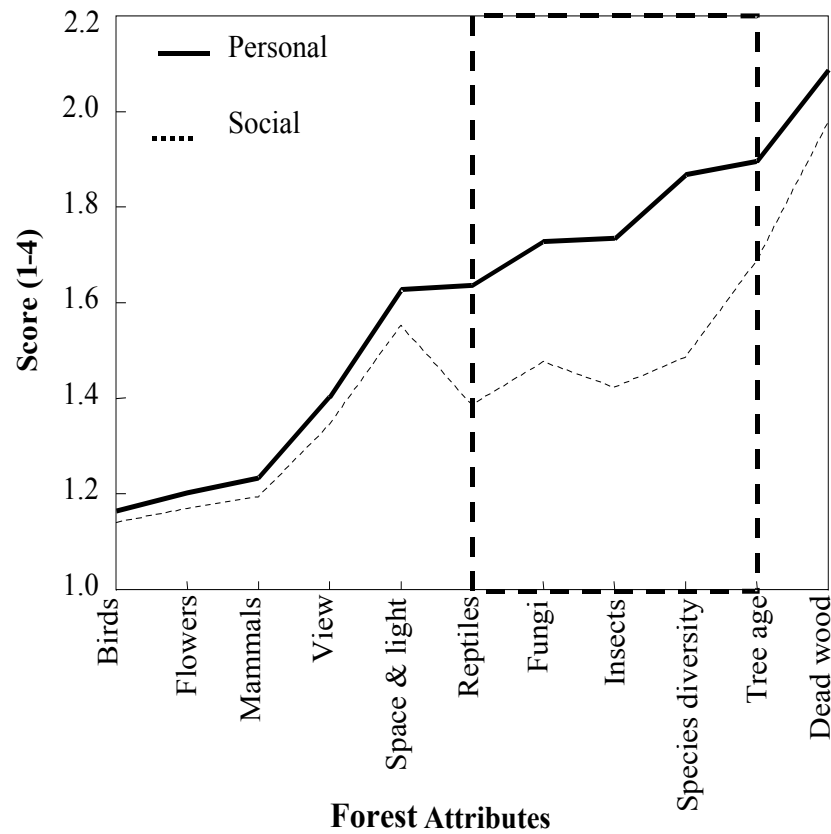
	P_i (private)	P_i (social)
Windblown	0.503	0.503
Douglas Fir	0.543	0.541
Shelterwood	0.445	0.453
Mixed Forest	0.464	0.467

The rate of change of probability of willingness to pay, P_i , with respect to the explanatory variables can also be derived from the information in Tables 1 and 2. In general for logistic models of this type the rate of change of probability with respect to an explanatory variable X is $dP_i/dX = \beta.P_i(1-P_i)$ where β is the estimated regression coefficient for X . Note that this rate of change varies with the level of probability from which the change is measured. The results shown in Table 1 imply that at MWTP with $P_i = 0.5$ the probability of private willingness to pay is decreasing at a rate of 0.026 per £1 and increasing at a rate of 0.111 per scale interval with respect to increasing preference for space and light and 0.259 per scale interval with respect to preference for birds. From Table 2 the corresponding rates of change for social willingness to pay are price: 0.024

and space and light: 0.117. These interpretations of Tables 1 and 2 re-tell the basic message that willingness to pay is sensitive to price but that the probability of willingness to pay also depends to a significant degree on respondents' preferences for site attributes. Estimated willingness to pay differs depending on whether private or social preferences variables are used, but by only a small amount.

We now turn to a direct examination of respondents' scoring of the importance of the various attributes of forest landscape. Figure 1 shows the mean scores over all 502 respondents. Recall that a lower numerical score indicates higher importance. Since all, both from personal and social perspectives, mean scores are less than the scale median of 2.5, all 11 attributes can be regarded as seen as having some importance to respondents. All 11 forest attributes have lower mean scores – are rated more important - from a social perspective than from a personal perspective. The other striking feature of Figure 1 is the divergence between social scores and personal scores for reptiles and amphibians, fungi, insects, species diversity and tree age. For these five attributes only, the difference between the means on the personal and social basis was, using the t test, significantly different from zero at 5% significance level.

Figure 1. Visitors' mean scores for forest attribute importance



Figures 2 through 6 bring out the same phenomenon in a slightly different way. Figure 2 shows for each attribute the number of respondents who gave personal and social perspective scores differing by 2 or more, and by 3. Figures 3 through 6 show, for each attribute, the percentage of respondents who, from personal and social perspectives, assigned each of the possible scores. The difference in responses according to perspective on the five attributes in the shaded region of Figure 1 is clear.

Figure 2. Differences in visitors' forest attribute importance scores

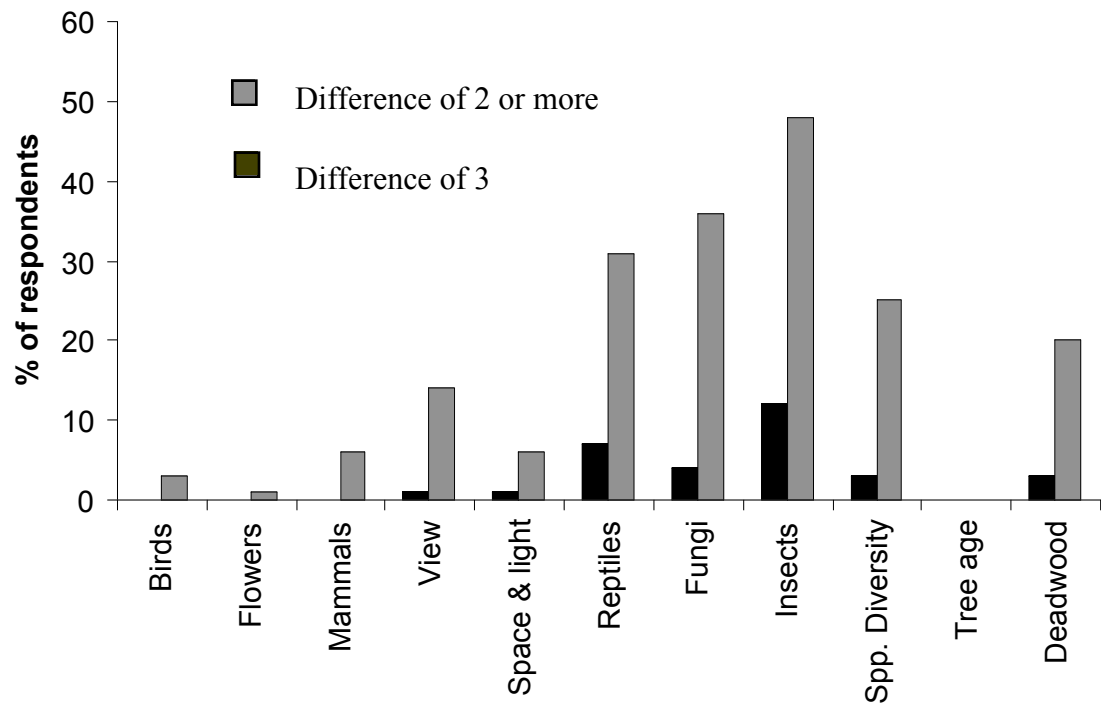


Figure 3. Percentages of respondents categorising an attribute as 'very important'

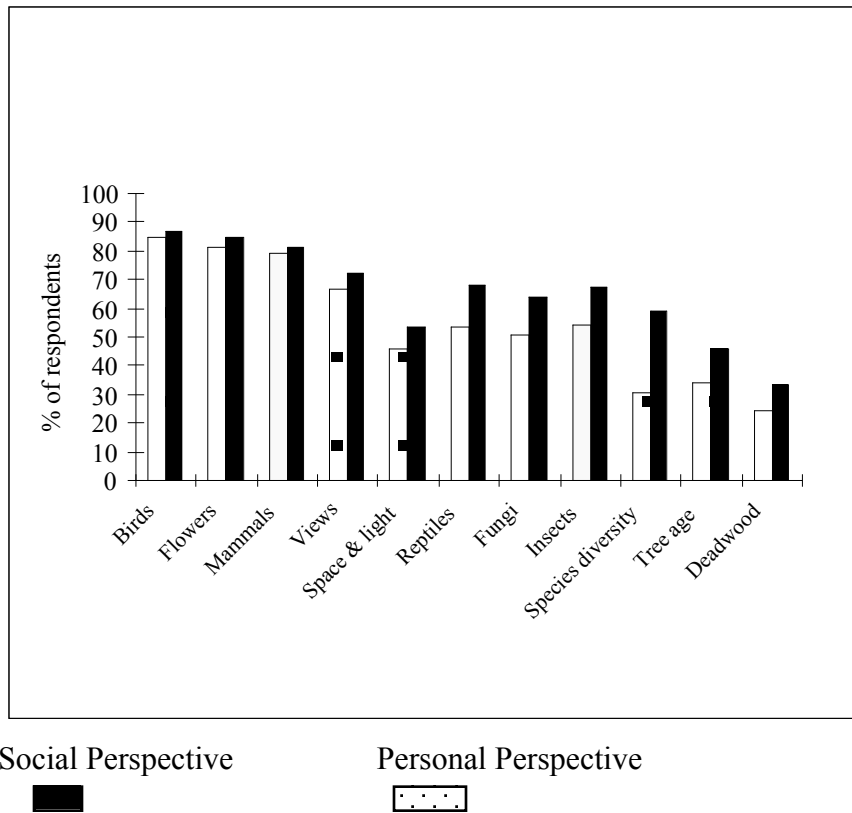


Figure 4. Percentages of respondents categorising an attribute as 'somewhat important'

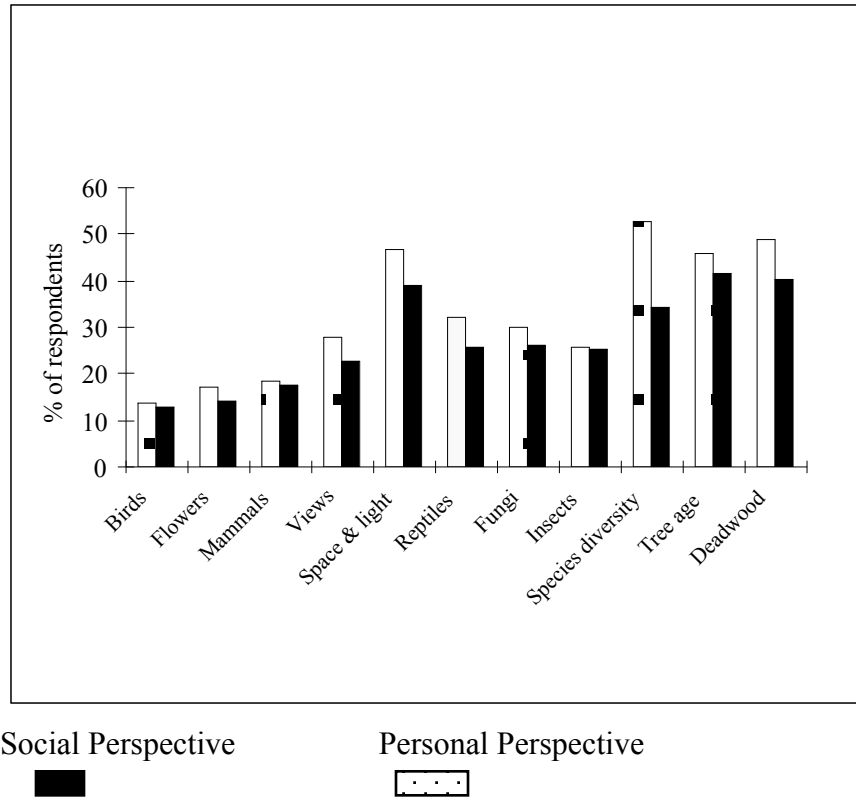


Figure 5. Percentages of respondents categorising an attribute as 'not important'

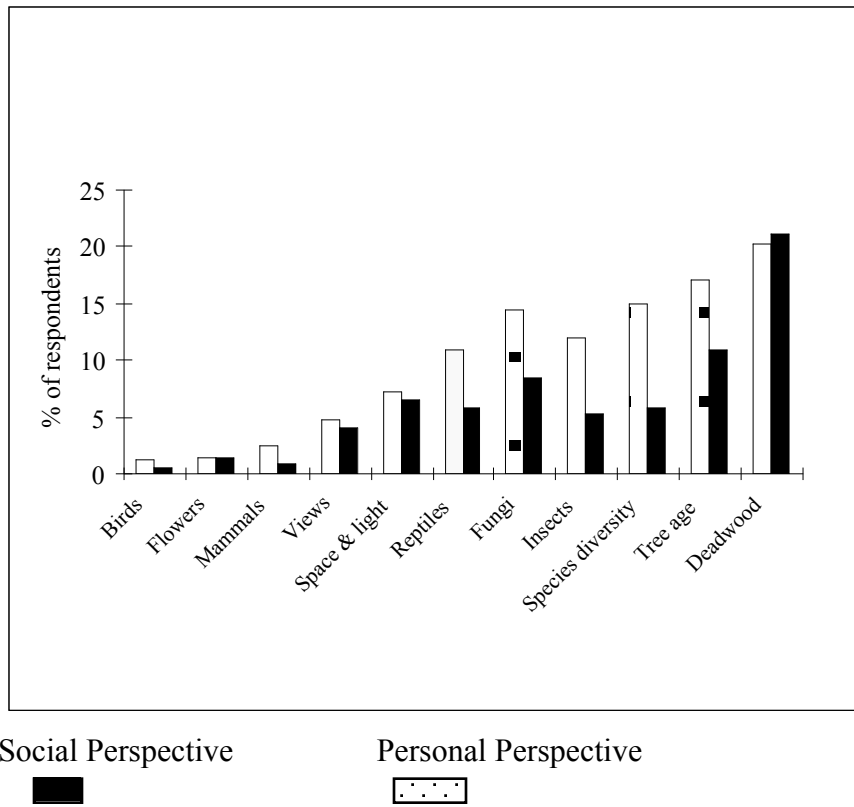
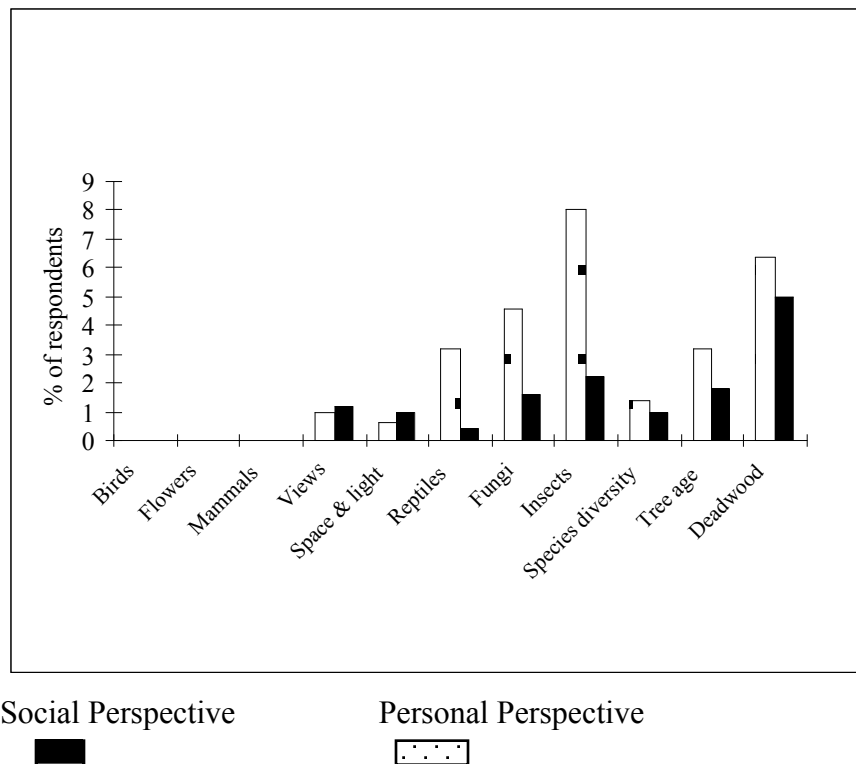


Figure 6. Percentages of respondents categorising an attribute as 'not at all important'



Respondents appear to feel that society's interests coincide with their own preferences for those attributes that they consider are most and least important. As regards reptiles and amphibians, fungi and insects it is also possible that what we call the 'snake effect' is operative. One of the authors has a strong aversion to snakes, and would rather not see any. On the other hand, he recognises that snakes play, possibly important, roles in ecosystem function, and would support measures to protect endangered species of snake, for example. Had he been a respondent to this survey, his scoring of attributes from personal and social perspectives would have reflected this with his score on the former basis much lower than on the latter. Personal indifference, as opposed to aversion, could produce the same effect. Reptiles and amphibians, fungi, insects, and tree age could well be the subject of personal indifference for visitors.

However, the results here do not support the view that respondents have a good grasp of the ecological interactions that occur amongst forest species or of the biological mechanisms that underlie food web ecology. Birds, flowers and mammals thrive only where ecological conditions are suitable. In the case of birds, for example, many of the species present prey on insects that require dead wood. From both the personal and social perspectives, respondents ranked birds first. Insects ranked sixth from the social perspective, and eighth from the personal. Deadwood ranked eleventh, lowest, from both perspectives. It is of interest therefore to compare respondents' preferences with those of forest managers with a knowledge of ecology.

5. Local Managers' Rankings

In terms of on-site management, Dalby Forest is run by 4 Forestry Commission employees. These forest managers include forest officers and area forest rangers who hold degrees in forestry and ecology. They are also actively involved in UK biodiversity action plans. The preferences of these forest managers with regard to the four 'conservation' stand classes present in Dalby forest and also with regard to the importance of listed forest attributes were sought, for comparison with the preferences of interviewed forest visitors. The managers' responses below were reported by one individual after consultation and discussion with his other three colleagues, and thus represent a managers' consensus view.

The managers were provided with the same information as visitors on the four 'conservation' types of stand described above. They were asked the following: "Please read the information provided regarding the 4 options, and then list the 4 options in order of your preference in terms of conservation value (list the most preferred option first)."

Table 4 shows the managers' ranking of the four 'conservation' types of stand along with visitors' ranking of these same stand types in terms of willingness-to-pay, reproduced from Table 3. The managers' ranking is different from both visitors' WTP rankings.

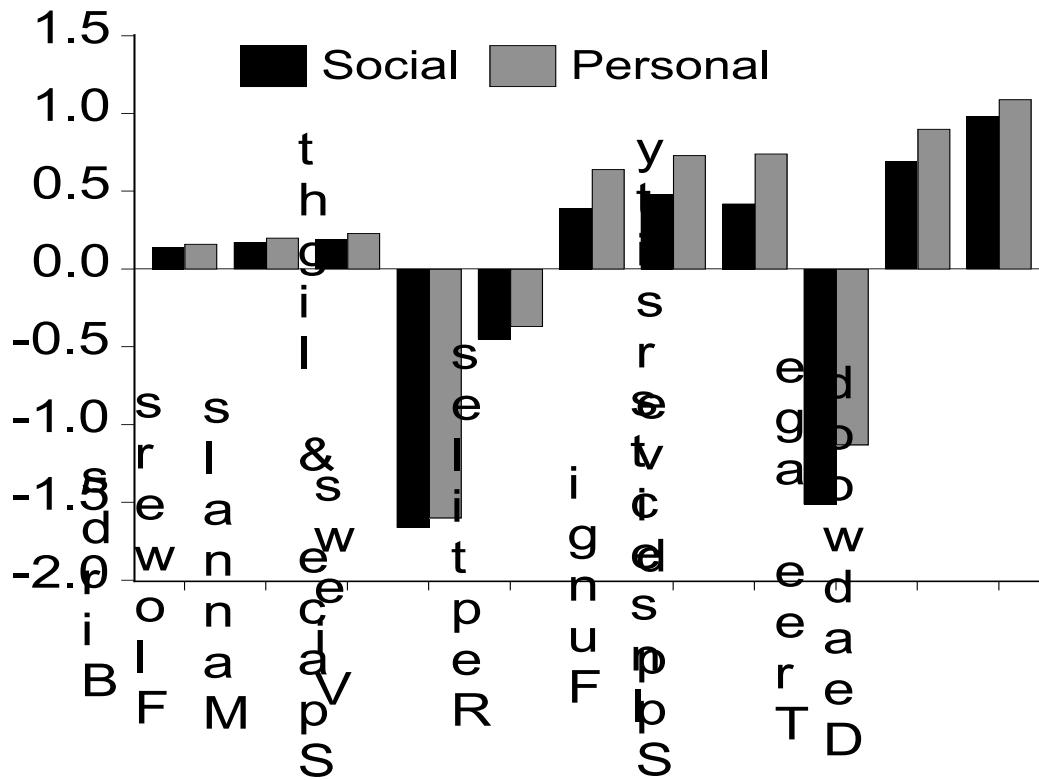
Table 5. Visitors and Managers Site Rankings

	Managers' ranking	Personal ranking	Social ranking
Windblown	3	2	2
Douglas Fir	4	1	1
Shelterwood	1	4	4
Mixed Forest	2	3	3

The forest managers were also presented with the same list of 11 forest attributes as visitors, and asked: "Please indicate by circling the appropriate number how important each of these forest attributes is in terms of conservation value." The numbers and descriptors offered were identical to those offered to interviewed site visitors, reported above. The forest managers scored eight of the eleven attributes as 1= very important. These eight "very important" attributes included all non-tree attributes, plus tree height and age and the presence of dying trees and dead wood. Of the remaining three forest attributes, space and light between trees was scored by managers as 2 = somewhat important, and both number/species of conifer and forest view and appearance scored 3 = not important.

Figure 7 shows a comparison of visitors' mean forest attribute importance scores (from both personal and citizen perspectives) and the scores of the forest managers. While these results are partly due to the discrete nature of the managers' choice in comparison with the average score across 502 visitors, there is an evident divergence between the preferences of visitors (both private and social) and forest managers.

Figure 7. Difference between visitors' and managers' forest attribute importance scores



There are three negative differences in Figure 7, indicating that the ‘average’ forest visitor regards these attributes as more important than do the forest managers. The most marked result is for forest view and appearance. This was the fourth most important attribute for visitors, with a mean score close to 1 = very important, whereas managers rate this as 3 = not important. There is a clear divergence here between the conservation objectives of multiple-use forest managers and the preferences of more recreation-minded visitors. Whereas managers appear to place emphasis on ecosystem functioning, visitors are understandably concerned with visual appearance. The number/species of conifer and space and light between trees is also considered more important by visitors than by managers. The results in Figure 7 remind us of a salient point about good environmental management. The preferences of users or of society as a whole, serve to help determine the desired management objectives. Any actual management regime must work with the reality of the functioning of the system, given current knowledge. If preferences (be they private or social) reflect an ignorance of reality, managers may find their task a difficult one.

6. Conclusion

In terms of median willingness to pay, the contingent valuation exercise generated what appear to be plausible results. Reported willingness to pay is price sensitive, but not income sensitive. It is interesting that it makes rather little difference to the results whether we use parameter estimates from regressions with social or personal preference, i.e. attribute score, variables. Only two of the preference variables are significant predictors of willingness to pay. Ranking conservation sites by median willingness to pay does not produce different rankings according to which preferences are used.

When we look directly at respondents' attribute scores, for five out of eleven attributes the scores on the personal and social bases are significantly different, with the attributes being rated as more important from a social than a personal perspective. The five attributes concerned are: reptiles and amphibians, fungi, insects, diversity of tree species, age of trees. The personal ratings reflect a preference for attributes that are obvious to visitors over those that are not, which preference is much less marked in the ratings based on social considerations.

These results lend some support to the hypothesis that individuals express different preferences when adopting a social, or citizen, viewpoint from those expressed when adopting a personal, or consumer, viewpoint. They are also consistent with the idea that in citizen mode individuals give more weight to attributes that have less direct and obvious visual appeal. However, this consumer/citizen difference was only apparent from direct examination of the attribute scores given in each mode. When looking at willingness to pay, it makes little difference which set of attribute scores are used as explanatory variables. This survey provides further evidence that the consumer/citizen distinction is important in regard to public preferences about environmental management, and that much valuable information on those preferences can be lost by confining inquiry about them to the determination of willingness to pay.

The managers of the forest rank conservation sites differently to the respondents' willingness to pay rankings. In regard to attributes, the managers score reptiles and amphibians, fungi and insects close to the respondents' socially based scores, and hence differently from respondents' personally based scores. Based on the results of this study, Forestry Commission management driven by respondents' personally based preferences would give more weight to recreation objectives than to conservation objectives. It is

very likely that this result generalises to forests other than Dalby. A question which then arises is: which preferences should count?

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Endnotes

¹ Readers unfamiliar with the application of cost-benefit analysis to environmental goods, or with techniques of environmental valuation such as the contingent valuation method used here, may wish to consult Freeman (1993) or Hanley and Spash (1993).

² Some economists argue that in some circumstances it is willingness to accept rather than willingness to pay that should be used. However, the issues raised by that argument are not directly relevant to the research reported here, and so we just refer to willingness to pay.

³ Most economists appear to take the view that for the recreational services provided by the environment, the travel cost method can provide accurate information on willingness to pay. For evidence to the contrary, see Common et al (1999).

⁴ A copy of the questionnaire is available on request from corresponding author.

⁵ At the time that the survey was conducted, the authors were members of the Environment Department.

⁶ A small, 'marginal' change in supply is necessary for the 'other things equal' assumption common to most economic analysis to hold. For example, despite a potentially misleading title: "What is the Value of Rangitoto Island?" (a small volcanic island around one third of the size of Dalby forest as a whole), Vадnjal and O'Connor ask respondents to consider the value of a marginal change in the island (a change in use of the shoreline and lower slopes) and not the value of the island itself.

⁷ For further information on logistic regression, see, for example, Gujarati (1995).

⁸ The full regression results are available on request from the corresponding author.

⁹ For further information on the limitations of ordinary least squares regression and the method of maximum likelihood estimation, see Patterson (2000) or Johnston and DiNardo (1997).