Social & Environmental Benefits of Forestry
Phase 2 :

LANDSCAPE BENEFITS

Report to

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from

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1. Introduction

It is widely recognised that forestry plays an important role in landscape planning and design. Since the 1980s, UK forest policy has developed an increasingly multi-purpose focus based on securing a range of benefits in addition to timber production. These benefits are summarised in ERM (1998) and include non-market benefits such as the provision of landscapes for public enjoyment. Over the same period, a series of international agreements have established the importance of achieving sustainable forest management and have underpinned the multi-functional role of forests. Within this context, there is a need to understand public preferences for forest landscapes in designing policies that meet the needs of multi-purpose forestry.

Environmental economists have devoted substantial effort in the past decade or more to estimating economic values for non-market costs and benefits. In relation to forestry in the UK, such work has focused on recreational values (Willis and Garrod, 1991) and, to a lesser extent, amenity (e.g. Cobham Resource Consultants, 1991), biodiversity (e.g. Garrod and Willis, 1997) and landscape values (e.g. ENTEC, 1997). Further studies (e.g. Lee, 1990) provide evidence of attitudes towards and preferences for forest landscapes. The estimation of non-market values has been regarded by government departments as an important step in providing evidence of the public benefits of forests in a changing policy climate and in developing a firmer basis for decision-making on how to maximise economics benefits from the countryside.

Despite these considerable efforts no existing studies yield estimates that can be used to calculate the total aggregate landscape benefits of woodlands in Great Britain. The study attempts to fill this gap and aims to provide data from which robust estimates of aggregate forest landscape benefits can be derived. To achieve this, a questionnaire survey is used as the vehicle for a series of choice experiments designed to investigate how much people are willing to pay for visual or recreational access to the different forest landscapes depicted in a series of computer-generated images.

This report begins by describing the particular forest landscape benefits that will be estimated in this study. It goes on to outline the design and implementation of the choice experiments and reports the outcome of the associated questionnaire survey. A range of estimates of forest landscape benefits are presented and discussed in relation to the aggregation exercise that is described in the penultimate section. Finally, the results of the study are summarised and discussed.

2. Forest landscape benefits

Forests can provide benefits to a variety of user groups. Perhaps the most obvious beneficiaries are those individuals who enjoy recreational activities either in or adjacent to woodlands. These may be visitors to the area or local residents. In the case of the latter, benefits may also accrue from the aesthetic pleasure gained from regularly viewing the forest landscape. Commuters and other travelers may also benefit from the forest landscapes encountered on their journeys. Again, these benefits may arise from recreation or from enjoying views of the forest landscape. A range of other use and non-

use benefits associated with forests and woodland also exist and these are discussed in the other reports generated as part of this project (e.g. Hanley *et al.,* 2002, Powe and Willis, 2002).

This study concentrates on the amenity value of forests, that is the benefits that individuals gain from forest views. Specifically, it examines forest landscape benefits derived by individuals who enjoy forest views from home and by those who encounter forests during their regular journeys. This dual focus was determined following consultation with the project Steering Group and has certain consequences in terms of study design and these will be outlined subsequently. To ensure that amenity benefits are measured separately, recreational benefits are also investigated across these groups (see section 4). More complete estimates of the recreational benefits of forests are reported in Scarpa (2003).

Before any serious attempt can be made to estimate forest landscape benefits, a decision has to be reached concerning the particular forest landscapes for which benefits should be estimated.

Table 1. Factors used to determine conifer forest configuration

CONFIGURATION				
PLATEAU CONIFER	**SHAPE**	**SCALE**	**STRUCTURAL VARIETY**	**SPECIES VARIETY**
1	Basic	Large	Low	Low
2	More organic	Large	Low	Low
3	Basic	Smaller	Low	Low
4	Basic	Large	High	Low
5	Basic	Large	Low	High
6	More organic	Smaller	High	High
MOUNTAIN CONIFER	**SHAPE**	**SCALE**	**STRUCTURAL VARIETY**	**SPECIES VARIETY**
7	Basic	Large	Low	Low
8	More organic	Large	Low	Low
9	Basic	Smaller	Low	Low
10	Basic	Large	High	Low
11	Basic	Large	Low	High
12	More organic	Smaller	High	High
HILLY/ROLLING CONIFER	**SHAPE**	**SCALE**	**STRUCTURAL VARIETY**	**SPECIES VARIETY**
13	Basic	Large	Low	Low
14	More organic	Large	Low	Low
15	Basic	Smaller	Low	Low
16	Basic	Large	High	Low
17	Basic	Large	Low	High
18	More organic	Smaller	High	High

3. Choice of forest landscapes

Many different forest landscapes can be observed in the British Isles and it would not be practical to value each of these individually. Equally, it would be unrealistic to estimate the benefits of a few generic or 'ideal' landscapes and aggregate them across total forest area. Following discussions with the Steering Group, the strategy adopted was to attempt to estimate the values of a broad range of generic forest landscapes, which together would represent the large majority of forest landscapes found in Britain.

It can be argued that the amenity benefits of any landscape feature depend, to a certain extent, upon the landscape in which they are found. Thus, the landscape benefits associated with a particular woodland configuration may vary depending on the particular landscape context. The generic forest landscapes investigated in this study, therefore, are a combination of a given landscape context and an appropriate forest planting configuration. Four broad landscape contexts (mountain; plateau; hilly-rolling; and peri-urban) were selected by the Commission as being relevant to this study and, within each of these, a variety of planting configurations were chosen to reflect the types of woodland commonly found in similar landscapes across Britain.

Table 2. Factors used to determine broad-leaved forest configuration

MOUNTAIN BROADLEAVES	SHAPE	SCALE	STRUCTURAL VARIETY
19	Basic	Large	Low
20	More organic	Large	Low
21	Basic	Smaller	Low
22	Basic	Large	High
23	More organic	Smaller	High
HILLY/ROLLING BROADLEAVES	**SHAPE**	**SCALE**	**STRUCTURAL VARIETY**
24	Basic	Large	Low
25	More organic	Large	Low
26	Basic	Smaller	Low
27	Basic	Large	High
28	More organic	Smaller	High
URBAN FRINGE BROADLEAVES	**SHAPE**	**SCALE**	**STRUCTURAL VARIETY**
29	Basic	Large	Low
30	More organic	Large	Low
31	Basic	Smaller	Low
32	Basic	Large	High
33	More organic	Smaller	High

Forests were initially split into conifer and broad-leaved categories. The Commission then defined six configurations of conifer forest based on four factors: shape, scale, structural variety and species variety. For broad-leaved forests five configurations were used based on only the first three factors. In each case, *a priori* expectations based on previous experience of landscape design and its relationship with landscape benefits, suggested that the first configuration would have the lowest potential landscape value,

with the final configuration having the highest potential value. The other configurations were hypothesised to have a landscape value somewhere between the two extremes. The six conifer configurations were considered within each of three landscape contexts: plateau, mountain; and hilly/rolling (see Table 1). Similarly the broad-leaved configurations were considered within mountain; peri-urban, and hilly/rolling landscapes (see Table 2).

4. Methodology

Following the recommendations made in the pilot phase of the project (Willis *et al.,* 2000), this study adopted a choice experiment approach to investigate public willingness to pay (WTP) for visual access to the generic forest landscapes described in section 3. Choice experiments (CEs) are commonly used to determine individuals' preferences for the attributes of a good or service. This is achieved within a questionnaire framework where respondents are asked to make choices between various hypothetical alternatives offering different levels of the component attributes. If one of these attributes is price, then respondents' WTP for the other attributes can often be inferred.

CEs can be conducted in a variety of ways. A common approach is the use of a set of 'profiles' to describe the different levels of provision of the good or service being researched. Profiles are based on a set of attributes that may influence individuals' utility for the good, with attribute levels varying across profiles.

Most CEs involve some form of questionnaire survey where respondents are asked to study a set of profiles and then make choices based on their preferences for the various alternatives offered. The task that respondents are set may be to rank a given set of profiles, or to rate them, perhaps using some form of semantic difference scale. Alternatively, respondents may be asked to make choices based on pairwise comparisons of profiles, or to select their most preferred profile from a set of three or more. Often respondents are asked to perform these tasks a number of times; especially when smaller sets of profiles (e.g. three or four) are involved. The use of repeated choices across respondents can provide a wealth of information on relative preferences for the analyst.

In environmental valuation studies, the profiles used in CEs define the key attributes of an environmental good or service in question, and as individual profiles offer varying levels of these attributes they provide different levels of utility to individuals. The random utility framework adopted by economists[1] to explain choice decisions suggests that when given the choice between several alternatives, consumers attempt to select the one that they like best (i.e. that offers them the most utility) subject to various constraints (e.g. income, information).

The choice of profiles utilised in this study was a key element in its design. As outlined in section 1, the main objective of the study is to estimate individuals' WTP for forest landscapes, so the profiles used had to encourage respondents to trade off different forest landscapes against the cost of consuming them either as views or through recreational access. The easiest way to describe a forest landscape to a respondent is through a

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[1] See Garrod et al. (2002) for a discussion.

picture. The profiles used in the CEs therefore comprised a combination of pictures and text. The computer-generated images of landscapes provided the visual element, while the text reported the availability, or otherwise, of recreational access and the magnitude of any difference in annual household costs between the location used in the profile and the cheapest alternative in the profile set (the baseline case). For the chosen survey areas the images used in the profiles were appropriate to the local landscape context. The design of forest landscape images is described in the next section.

Two versions of the questionnaire were designed, differing only in the focus of the choice experiment used within them (see Appendix 1). The choice experiments in version H focused on respondents' preferences for views from their homes, while those in version T examined preferences for views on regular journeys to and from home. This approach was adopted following the recommendations of the project Steering Group and has the advantage of investigating two separate sources of benefit rather than just one. One disadvantage of this, was the need to investigate WTP across two separate populations, thus splitting the sample which was already constrained by the project budget to be in the region of 400 households.

The split samples were necessary to avoid the potential confusion that could arise if choice profiles contained information about both the view that could be seen from home and the view that would be encountered on regular journeys to and from home. Such a task may be too complex for respondents and could lead to choice strategies that fail to take full account of preferences for forest landscapes seen in different circumstances.

Before undertaking the CEs, respondents were informed that the purpose of the survey was to find out how much people in Britain valued landscapes, and that to help this investigation a series of images depicting forest landscapes had been developed. Respondents were told that, if they lived in the countryside, these were the sorts of forest landscapes they might see from their homes or during regular journeys to and from home. They were also told that it might be possible to use these landscapes for walks or other sorts of recreation.

The valuation scenario used in both versions of the questionnaire (see Appendix 1) began by requesting respondents to imagine that they were about to move to the country. Respondents were then asked to consider a situation where, having examined all of the housing possibilities in their chosen area within their price range, they have arrived at a short list of their three favourites.. One of these is cheaper than the other two but does not have a forest view. The other two possibilities cost more but have forest views. There may also be recreational access to these views, which is not the case with the cheapest option. Including recreational opportunities as an attribute within the choice experiment was a response to the observation that unless such opportunities are made explicit, some respondents tend to assume them when making their choices and this could be reflected in their WTP. Having recreational access as a separate attribute emphasises that some choices will not offer recreational access to the landscape depicted on the choice cards. It also ensures that, in the data analysis, landscape benefits could be separated from any recreational benefits, thereby avoiding double counting.

Respondents were asked to imagine that they had examined all of the pros and cons of the three alternatives and that the only important differences between them were:

❑   the view;
❑   recreational access to the view;
❑   the annual cost of living there, e.g. council tax, the cost of travelling to work, and rent or mortgage.

In version H of the questionnaire, respondents were shown computer-generated images of the three views – one of which was from the house with the lowest price, with the other two from houses where it would cost more to live. For each of the four landscape contexts used in this study the same baseline profile was used to depict the cheapest alternative in the choice experiment: this consisted of an image of the contextual landscape without any woodland (see Appendix 2) coupled with text saying that no recreational access was available in this landscape. The baseline profile was presented to respondents along with two alternative profiles (see Figure 1). These again consisted of an image – this time the contextual landscape with a particular forest configuration set in it – plus text giving information on recreational access and the additional cost of having this view compared with the baseline profile.

Figure 1. Example of profile set used in choice experiment

BASELINE PROFILE	PROFILE 1	PROFILE 2
IMAGE OF CONTEXTUAL LANDSCAPE **WITHOUT** WOODLAND (see Appendix 2)	IMAGE OF CONTEXTUAL LANDSCAPE **WITH** WOODLAND (see Appendix 2)	IMAGE OF CONTEXTUAL LANDSCAPE **WITH** WOODLAND (see Appendix 2)
Recreational Access? **No**	**Recreational Access?** **Yes**	**Recreational Access?** **No**
Additional cost of having this view? **£0 – cheapest option**	**Additional cost of having this view?** **£150**	**Additional cost of having this view?** **£100**

The images and associated text in each profile set were based on an orthogonal experimental design based on the three attributes used in the profiles (i.e. 1. forest configurations – either five broad-leaved or six conifer; 2. recreational access – yes or no; and 3. additional costs, £50, £100, £150, £200, £250 or £300 per household per year).

Batsell and Louviere (1991) state that one should ideally design the attributes of all choice profiles to be orthogonal both within and between all alternatives. This means that each profile is independent of all other alternatives and that the levels of each attribute are evaluated independently of all the levels of other attributes thus avoiding the problem of multicolinearity. Orthogonality is also a minimum requirement for testing violation of independence of irrelevant alternatives (IIA) property of conditional logit (McFadden 1986). This property states that the ratio of the probabilities of choosing any two alternatives is independent of the presence or absence of a third alternative (McFadden, 1986).

In version T respondents were given the same images and information, except that in this case the views related to what the respondent would see on regular journeys to and from home. The monetary amounts used in the choice profiles in this version were: £20, £40, £60, £80 and £100.

Having been provided with this information about views, recreational access and cost, respondents were asked to select the alternative they liked best and the one they liked least. This exercise was completed four times by each respondent. Responses were then used to model the choice decisions and where possible to calculate the marginal benefits of the various landscape configurations.

5. Images of forest landscapes
In consultation with the Commission, consultants Cawdor Forestry were commissioned to generate images depicting each of the landscape configurations The nature of this project meant that any findings would be dependent upon the images used to depict the landscapes incorporated in the choice experiments. Initial research compared photo-montages of two generic landscapes with equivalent images generated by computer. These images were provided by the Commission. Following a variety of informal pilot exercises conducted with members of the public, it was found that, although respondents regarded the computer-generated images as more obviously artificial, they found them less contrived than the photo-montages and easier to treat as generic depictions of forest landscapes. A decision was then made to use computer-generated images in the choice experiments, while at the same time seeking to improve the quality and realism of the pictures used. The images were improved and the new versions were approved by the Commission and tested on members of the general public. A selection of these images along with corresponding images of the contextual landscapes without woodland are presented in Appendix 2.

Here, respondents were presented with three different images of forest landscape that they were told represented particular planting strategies. They were then asked to rank the images in order of preference. Following this exercise respondents were asked whether the nature or quality of the images affected their ability to complete the ranking exercise. Only one respondent out of 20 expressed dissatisfaction with the images, though two others expressed concerns that in some cases it was difficult to see any significant differences between some of the images they had been asked to rank. While these concerns were reasonable they should not unduly affect the outcome of the ranking

exercise where, if respondents are indifferent between forest landscapes, preferences could be based on the other attributes of the choices.

6. The sample survey

A survey of over 400 households was undertaken in August/September 2002 by the Research Factor, a professional market research company based in Sussex who have undertaken a number of choice experiment based questionnaire surveys. The sample was stratified to ensure that a demographically representative section of the population were surveyed in both urban and rural locations. Respondents were interviewed at home.

Six survey areas (see Table 4) were chosen in consultation with the Commission to reflect the different landscape contexts used in the forest landscape images. The chief criterion was that the populations living in these areas could feasibly encounter views similar to those used in the choice profiles.

The 'mountain' and 'hilly/rolling' landscape contexts were each covered by two survey areas in different parts of the country. In these cases the samples relating to the landscape contexts were split equally across the two survey areas. Separate samples of 72 individuals were used to cover the survey areas for the plateau and peri-urban landscape contexts.

Table 4. Survey areas

Survey area and associated landscape context	Survey sites	Target sample size
Aberystwyth area (Plateau)	Aberystwyth, Machynlleth, Dolgellau, Trawsfynydd, villages along A487 Aberystwyth to Dolgellau	**72**
Chester area (hilly/rolling)	Chester, Northwich, Tarporley, Kelsall, Helsby, Kingsley, Crowton, Duddon, Cuddington	**64**
Loch Lomond area (Mountain)	Dumbarton, Alexandria, Helensburgh, Rhu, Garelochhead, Inverbeg, Luss	**64**
Exeter area (hilly/rolling)	Exeter, Okehampton, Postbridge, Moretonhampstead, Chagford, Drewsteignton, South Tawton	**64**
Harlow area (peri-urban)	Harlow, Epping, Chipping Ongar, Brickenden, Epping Green, Essendon, Nazeing, Wormley	**72**
Penrith and Keswick area (Mountain)	Penrith, Keswick, Cockermouth, villages along A66 Penrith to Cockermouth	**64**

7. Results

7.1. Sample characteristics

A total of 416 usable questionnaires were completed, comprising 211 version H and 205 version T. Responses were reported to be satisfactory with no particular problems encountered among respondents. As planned, households were sampled from a range of urban and rural locations with 25 per cent describing themselves as living in a town or city, 11 per cent as living in suburbs, 43 per cent were based on the edge of town or country, with the remaining 21 per cent describing themselves as country dwellers. This mix was necessary to permit the preferences of people with a range of experiences and aspirations about views to be investigated. Such coverage is necessary because the study aims to estimate landscape benefits for individuals who encounter forests either from their homes or on regular journeys. Also it is important to sample individuals who currently do or do not experience forest landscapes on a regular basis. This allows us to incorporate preferences for individuals with different current levels of consumption of a variety of forest types.

In order to motivate the aggregation process, the preferences of the sample should broadly reflect the preferences of those individuals who already come into regular contact with a woodland view, either from home or on their regular journeys to and from home. It was observed that 80 per cent of the sample aspired to live in a more rural location where experiencing a woodland view would be more likely. On this basis it is reasonable to assume that the preferences of our sample may not differ too greatly from those of the populations over which values will be aggregated (as many of these will indeed live in a rural or near-to-rural location).

7.2. Landscape preferences

Respondents were asked about the landscapes that they would prefer to live in, compared to the landscapes where they currently live (see Figure 2). The results are interesting, showing very high preferences for upland and coastal landscapes, in some of which woodland may not be a characteristic feature.
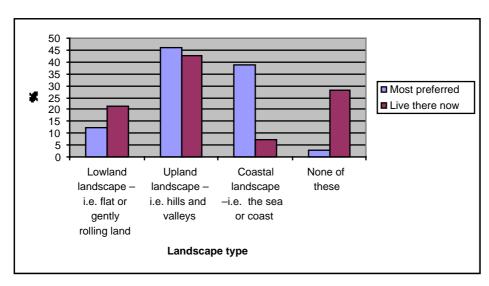
Figure 2. Respondents preferences for landscape types

When respondents were asked to rate a range of eight factors in order of their importance when choosing a place to live, nearly 30 per cent rated 'nice views' as one of the three most important, nearly 45 per cent felt that 'green or open spaces' ranked in the top three, while over 25 per cent felt the same about 'being near to walks and other recreational opportunities' ('being close to shops and other services', 'low levels of crime', and 'peace and quiet' were all rated as more important). This suggests that there are likely to be positive preferences for forest landscapes, provided that respondents find the resulting views aesthetically pleasing, or have positive preferences for any recreational opportunities offered by the forests.

Table 6. Respondents preferences for different forest characteristics

	Coniferous trees	Broad-leaved trees	Equal preference	Neither
Set 1	13.7%	54.6%	30.8%	1.0%
Set 2	Large forests 22.4%	Small woodlands 57.2%	Equal preference 19.2%	Neither 1.2%
Set 3	Trees of various heights 74.8%	Trees that are all similar heights 9.9%	Equal preference 14.7%	Neither 0.7%
Set 4	A mix of trees and open spaces 83.4%	Just trees 5.3%	Equal preference 10.8%	Neither 0.5%
Set 5	Regularly spaced trees 10.1%	Randomly spaced trees 77.4%	Equal preference 11.8%	Neither 0.7%
Set 6	Trees on hills 49.0%	Trees on flatter land 14.7%	Equal preference 35.6%	Neither 0.7%
Set 7	Near to towns 32.2%	Away from towns 38.5%	Equal preference 27.6%	Neither 1.7%

Respondents were also asked about their preferences for the types of forest that they would like to see in a view. The results of this investigation were quite revealing, suggesting that the sample had well defined ideas preferences about the characteristics of forests that they would like to see in a view. Preferences across the seven choices shown in Table 6, suggest that a 'typical' respondent prefers small woodlands comprising of

stands of randomly spaced broad-leaves of varying heights, interspersed with areas of open space. The majority of respondents also preferred to see woodlands on hills and away from towns. This result may, of course, reflect general landscape preferences rather than opinions about forests, and more than half of respondents had at least an equal preference for seeing forests on flatter land or near towns.

Of all the preferences investigated, the strongest were for plantings that mixed trees and open space and where spacing of trees was random rather than regular.   If these preferences were translated to the factors that determined the forest configurations used in the choice experiment, it might be expected that respondents would prefer shape to be 'more organic' rather than 'basic'; scale to be 'small' rather than 'large'; structural; variety to be 'high' rather than 'low'; and species variety to be high' rather than 'low'. If preferences for these attributes are separable and additive, then those configurations that offer all of the favoured factors (e.g. configurations 6, 12, 18, 28 and 33 in Tables 1 and 2) should attract the highest values. This result may not be observed if respondents either fail to see the preferred factors reflected in the images provided or if their preferences for combinations of factors do not reflect preferences for those factors when considered individually.

7.3. Recreational preferences
The number of visits made to forests and the countryside by respondents varied considerably. Just over 17 per cent of respondents made no recreational visits to the countryside in a typical year, while over thirty per cent visited between one and six times a year. Nearly a third of respondents made recreational visits on average at least once a fortnight. This figure dropped to 13 per cent when respondents were asked about tourism visit, that is non-regular visits of more than three hours in duration. More than 22 per cent of respondents made no such visits in a typical year.

Nearly 55 per cent of respondents made no recreational visits to conifer forests in a typical year, with 49 and 38 per cent making no visits to broad-leaved and mixed woodland respectively. The percentage of respondents making six or fewer visits to forests per year was 86 per cent for conifer forests, 83 per cent for broad-leaved woodlands and 78 per cent for mixed woodlands.

7.4. Results from the choice experiments
As previously described, the choice experiments used in this study required individuals to rank sets of three profiles from the most to the least preferred. Each profile in the choice set differed from the others in the levels of its component attributes, and the cost that the respondent would incur as a result of the choice. The attribute levels of each profile are used along with data on choices to estimate a discrete-choice, utility-maximising model for the sample data. The estimated parameters of this model are then used to estimate the trade-off which respondents make between disposable income and a change in the provision of the access to forest landscapes described in the choice sets. For any particular specification 12 separate models could be estimated, split evenly between the two different versions of the questionnaire.   For each version the six models corresponded to the six generic forest landscape types investigated by the study.

Analysis of choice experiments applies the probabilistic theory of choice (Ben-Akiva and Lerman, 1985), where the choices made by individuals from a non-continuous set of alternatives are modelled in order to reveal a measure of utility for the choice attributes (Louviere *et al.,* 2000). This technique has been extended to estimate the impacts on economic welfare from changing the provision of public goods in the US and Europe (e.g. Viscusi *et al.,* 1991; Opaluch *et al.,* 1993; Adamowicz *et al.,* 1994; Garrod *et al,* 2002), but various types of choice experiment have been used by psychologists and other user groups for more than 30 years. The technique has also successfully been used to assess the general public's preferences for different forest management standards (e.g. Garrod and Willis, 1996).

Since individuals were asked to choose their most-preferred profile from each set of profiles shown to them, a random utility model (e.g. McFadden, 1973) was used to investigate how the choices relate to attribute levels. Such models are based on the hypothesis that individuals make choices based on the attributes of the alternatives (an objective component) along with some degree of randomness (a random component). This random component is consistent with random individual preferences. It is also consistent with the realistic notion that the researcher only has a partial knowledge of the real structure of the respondent's preference, while the unknown component is assumed to behave stochastically.

This most-preferred alternative (MPA) approach does not utilise all of the information provided by the choice experiment, and the ranked data model developed by Beggs *et al.* (1981) can be adopted to utilise this additional information. Some controversy exists over which of these two approaches to use in the estimation of contingent ranking data (Foster and Mourato, 2002). As Foster and Mourato (2000) point out, while the conventional ranked-data model uses more information than the most-preferred-alternative model, it is also the more restrictive of the two, in that it assumes that the same underlying distribution governs both ranking decisions, rather than merely the first. If as, Hausman and Ruud (1987) and Ben-Akiva *et al.* (1991) have suggested, respondents only pay proper attention to selecting their most preferred options and do not think carefully enough about subsequent choices, then this assumption is invalid. In this case respondents were asked to select both their most and least preferred of the three alternatives simultaneously, thus identifying the middle-ranked option by default. This is in contrast with other studies (e.g. Ben-Akiva *et al.*, 1991) where the ranking exercise took place over a larger number of options where there are more possibilities for inconsistent responses.

Even if some bias is introduced to coefficient estimates, Hausman and Ruud (1987) maintain that this may not have an adverse impact on welfare measures if the various model coefficients are biased consistently (because welfare measures based on these models tend to be based on ratios of attribute coefficients). Work by Foster and Mourato (2000, 2002) gives partial support to these claims.

The main purpose of the estimated models is to provide data on the benefits of forest landscapes that can subsequently be used in an aggregation exercise. The aggregation exercise will seek to identify the number of households with regular access to views of a particular forest landscape configuration and then to derive aggregate benefits by multiplying this figure by estimated annual household WTP to gain visual access to that landscape, either as views from home, or during regular journeys to and from home.

Provided that the necessary coefficient values are statistically significant, the models will provide the WTP estimates required for the aggregation process. The most straightforward way in which to estimate the required WTP values is to model the choice decision using only the attributes levels from the choice profiles. More complex models incorporating the preferences and characteristics of the respondents can also be estimated, but here estimated WTP will not only depend on attribute levels (i.e. landscape configurations) but also on the characteristics of individuals. Use of such models would make any aggregation exercise problematic, as it may prove impractical to estimate the levels of these characteristics present in the populations over which WTP benefits must be aggregated. In this application such models are not feasible for the generic forest landscapes due to the relatively low sample sizes, which could result in any estimates of the relationship between WTP and respondent characteristics being unreliable. Larger data sets can be constructed by aggregating choice experiment data and these permit some investigation of the characteristics most linked with WTP. Even then, results may be unreliable due to hererogeneity in preferences across the different generic landscape types that choices are based on. Where such models have been estimated it seems that characteristics such as social class, geographic location and age are most likely to influence WTP, with for example older or retired people being willing to pay less than others and those in the highest socio-economic groups being willing to pay most.

Therefore the estimates reported in Tables 7, 8, 10 and 11 are based on attributes-only specifications of the model, rather than ones in which individual specific characteristics are also incorporated. Tables 7 and 8 report results for models based on version H of the questionnaire, while Tables 10 and 11 report results relating to version T. Columns 2 and 3 of the tables report the sign of the WTP estimates for the MPA and ranks models and state whether or not the coefficient values used to estimate it are statistically significant at a reasonable level. Columns 4 and 5 report the WTP estimate for those cases where the necessary coefficient estimates are statistically significant at the 10% level.

The Tables reveal that robust WTP estimates cannot be estimated for a number of configurations (e.g. those involving plateau conifer landscapes) due to a lack of statistically significant coefficient values. In other cases there is evidence that respondents experience a loss in welfare associated with certain forests in particular landscapes (e.g. broad-leaves in a mountain setting). Clear preferences for forested landscapes compared with the non-forested alternatives are only found for broad-leaved woodland in a peri-urban setting.

A greater volume of significant estimates were generated using the ranked data and these estimates were higher in magnitude than those generated by the models using information

only on the most preferred alternative. This result is expected due to the frequency of choices where the least preferred option was the non-forested landscape (zero additional cost). In these cases including data on the profile ranked second will boost estimated WTP by providing evidence of a positive WTP for a forested landscape compared with the non-forested alternative. The observation that the non-forested option tended to be either the first or last choice suggests that the inclusion of data on the second ranked profile is unlikely to have a large downward influence on WTP.

The lack of significant WTP values associated with certain landscape contexts is a cause for concern. The study design was such that relatively few respondents (i.e. 30-40) made choices using the same sets of choice profiles. Given that respondents undertook four choice experiments each this meant that WTP values were based on a maximum of 160 choices from 40 individuals. While this should be a large enough sample to generate robust estimates of WTP, low sample sizes increase the probability of sample-selection effects. That said, the incidence of significant results across the two different versions of the questionnaire is quite consistent with, for example, strongly significant positive coefficients estimated for views over peri-urban broad-leaved landscapes from both samples. The negative coefficients associated with views of broad-leaved woodlands in mountain areas are also observed in both samples. The results may therefore reflect indifference among the population regarding certain forested landscapes or dissonance in preferences across the population.

Table 7. Annual household WTP for views from home: conifer forests (£, per household per year)

CONFIGURATION	SIGN & SIGNIFICANCE		WTP ESTIMATE	
PLATEAU CONIFER	MPA MODEL	RANKS MODEL	MPA MODEL	RANKS MODEL
1	-ve (n/s)	-ve (n/s)	-	-
2	-ve (n/s)	-ve (n/s)	-	-
3	-ve (n/s)	-ve (n/s)	-	-
4	-ve (n/s)	-ve (n/s)	-	-
5	-ve (n/s)	-ve (n/s)	-	-
6	-ve (n/s)	-ve (n/s)	-	-
MOUNTAIN CONIFER	MPA MODEL	RANKS MODEL	MPA MODEL	RANKS MODEL
7	+ve (n/s)	+ve (*)	-	£111.60
8	+ve (n/s)	+ve (n/s)	-	-
9	-ve (n/s)	+ve (*)	-	£139.02
10	+ve (**)	+ve (*)	£99.94	£165.17
11	+ve (n/s)	+ve (**)	-	£115.57
12	-ve (n/s)	+ve (n/s)	-	-
HILLY/ROLLING CONIFER	MPA MODEL	RANKS MODEL	MPA MODEL	RANKS MODEL
13	+ve (n/s)	+ve (*)	-	£143.52
14	-ve (n/s)	-ve (n/s)	-	-
15	-ve (n/s)	+ve (**)	-	£123.53
16	-ve (n/s)	+ve (n/s)	-	-
17	-ve (**)	+ve (n/s)	-£310.39	-
18	-ve (n/s)	-ve (n/s)	-	-

*   Coefficients on cost and view significant at 5% level
**   Coefficients on cost and view significant at 10% level
n/s   Coefficients on cost and view not significant at 10% level

In both samples there were no systematic links between magnitude of WTP and incidence of the forest design factors shown in Table 6 to be those most favoured by respondents.

It is possible that the combination of different factors and their depiction in the images presented to respondents may have resulted in quite different visual impacts to those expected by respondents when considering verbal descriptions of those factors.

Table 8. Annual household WTP for views from home (broad-leaved woodlands) (£, per household per year)

CONFIGURATION	SIGN & SIGNIFICANCE		WTP ESTIMATE	
MOUNTAIN	**MPA**	**RANKS**	**MPA**	**RANKS**
BROAD-LEAVES	**MODEL**	**MODEL**	**MODEL**	**MODEL**
19	-ve (*)	-ve (n/s)	-£398.25	-
20	-ve (*)	-ve (n/s)	-£363.66	-
21	-ve (*)	-ve (n/s)	-£368.36	-
22	-ve (*)	-ve (**)	-£559.05	-£137.74
23	-ve (*)	-ve (n/s)	-£398.52	-
HILLY/ROLLING	**MPA**	**RANKS**	**MPA**	**RANKS**
BROAD-LEAVES	**MODEL**	**MODEL**	**MODEL**	**MODEL**
24	+ve (n/s)	+ve (*)	-	£162.27
25	-ve (n/s)	+ve (n/s)	-	-
26	+ve (n/s)	+ve (*)	-	£179.78
27	+ve (n/s)	+ve (*)	-	£216.91
28	-ve (n/s)	+ve (**)	-	£145.35
URBAN FRINGE	**MPA**	**RANKS**	**MPA**	**RANKS**
BROAD-LEAVES	**MODEL**	**MODEL**	**MODEL**	**MODEL**
29	+ve (*)	+ve (*)	£265.44	£505.29
30	+ve (*)	+ve (*)	£239.62	£455.49
31	+ve (*)	+ve (*)	£199.45	£378.76
32	+ve (*)	+ve (*)	£273.33	£490.13
33	+ve (n/s)	+ve (*)	-	£374.54

* Coefficients on cost and view significant at 5% level
** Coefficients on cost and view significant at 10% level
n/s Coefficients on cost and view not significant at 10% level

Table 9. Model coefficients for views from home of peri-urban broad-leaved landscapes

VARIABLES	MPA MODEL COEFFICIENTS (t-value)	RANK MODEL COEFFICIENTS (t-value)
Configuration 29	1.9215 (4.33)	2.8107 (8.03)
Configuration 30	1.7346 (4.01)	2.5337 (7.97)
Configuration 31	1.4438 (2.98)	2.1681 (5.87)
Configuration 32	1.9786 (4.03)	2.7264 (7.20)
Configuration 33	0.76421 (1.41)	2.0834 (5.33)
Recreational Access	1.2386 (3.99)	0.88696 (3.67)
Additional Cost	-0.0072389 (-4.20)	-0.0055626 (-4.22)
Log-likelihood	**-102.98**	**-148.94**
Pseudo R^2 [2]	**0.256**	**0.071**

Table 9 reports the coefficients of one of the models estimated in this study. Examination reveals strongly significant coefficient values, especially for the ranked data model. This model does not perform so well when considered using the pseudo R^2 measure of goodness of fit. For a non-linear model of this type, the level of explanatory power in the MPA model is noteworthy with pseudo-R^2 value of 0.256 In fact, Louviere *et al.* (2000) citing simulations carried out by Domencich and McFadden (1975) equivalence pseudo-R^2 values of between 0.2 and 0.4 to R^2 value of 0.7 to 0.9 obtained in OLS regression applications.

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[2] Pseudo-R^2 is a measure of goodness-of-fit, defined as $1-[L(\beta)/L(0)]$ where $L(\beta)$ is the maximised value of the log-likelihood function evaluated at the estimated parameters (βs), and $L(0)$ is the log-likelihood value when all coefficients are restricted to be zero or in the absence of covariates (Xs). It ranges from zero (for a model that is no better than chance, such that $L(\beta) = L(0)$) to 1 (for a 'perfect' model that provides a probability of one of each chosen alternative in every choice occasion faced by each sampled buyer, such that $L(\beta) = 0$).

Table 10. Annual household WTP for views on journeys to and from home: conifer forests (£, per household per year)

CONFIGURATION	SIGN & SIGNIFICANCE		WTP ESTIMATE	
PLATEAU CONIFER	**MPA MODEL**	**RANKS MODEL**	**MPA MODEL**	**RANKS MODEL**
1	-ve (n/s)	-ve (n/s)	-	-
2	-ve (n/s)	-ve (n/s)	-	-
3	-ve (n/s)	-ve (n/s)	-	-
4	-ve (n/s)	-ve (n/s)	-	-
5	-ve (n/s)	-ve (n/s)	-	-
6	-ve (n/s)	-ve (n/s)	-	-
MOUNTAIN CONIFER	**MPA MODEL**	**RANKS MODEL**	**MPA MODEL**	**RANKS MODEL**
7	-ve (n/s)	-ve (n/s)	-	-
8	-ve (n/s)	-ve (n/s)	-	-
9	-ve (n/s)	-ve (n/s)	-	-
10	-ve (n/s)	-ve (n/s)	-	-
11	-ve (n/s)	-ve (n/s)	-	-
12	-ve (n/s)	-ve (n/s)	-	-
HILLY/ROLLING CONIFER	**MPA MODEL**	**RANKS MODEL**	**MPA MODEL**	**RANKS MODEL**
13	-ve (n/s)	+ve (n/s)	-	-
14	-ve (n/s)	+ve (n/s)	-	-
15	-ve (n/s)	+ve (n/s)	-	-
16	-ve (*)	-ve (n/s)	-£88.64	-
17	+ve (n/s)	+ve (n/s)	-	-
18	-ve (n/s)	+ve (n/s)	-	-

*   Coefficients on cost and view significant at 5% level
**   Coefficients on cost and view significant at 10% level
n/s   Coefficients on cost and view not significant at 10% level

Table 11. Annual household WTP for views on journeys to and from home: broad-leaved woodlands (£, per household per year)

CONFIGURATION	SIGN & SIGNIFICANCE		WTP ESTIMATE	
MOUNTAIN BROAD-LEAVES	MPA MODEL	RANKS MODEL	MPA MODEL	RANKS MODEL
19	-ve (n/s)	-ve (*)	-	-£82.87
20	-ve (n/s)	-ve (n/s)	-	-
21	-ve (n/s)	-ve (n/s)	-	-
22	-ve (n/s)	-ve (**)	-	-£82.32
23	-ve (n/s)	-ve (*)	-	-£147.84
HILLY/ROLLING BROAD-LEAVES	MPA MODEL	RANKS MODEL	MPA MODEL	RANKS MODEL
24	+ve (n/s)	+ve (**)	-	£31.27
25	+ve (n/s)	+ve (*)	-	£45.60
26	+ve (n/s)	+ve (*)	-	£40.18
27	-ve (n/s)	+ve (n/s)	-	-
28	-ve (n/s)	+ve (**)	-	£32.62
URBAN FRINGE BROAD-LEAVES	MPA MODEL	RANKS MODEL	MPA MODEL	RANKS MODEL
29	+ve (*)	+ve (*)	£264.97	£329.37
30	+ve (*)	+ve (*)	£191.97	£284.41
31	+ve (*)	+ve (*)	£157.88	£246.67
32	+ve (*)	+ve (*)	£219.70	£268.78
33	+ve (n/s)	+ve (*)	-	£167.09

* Coefficients on cost and view significant at 5% level
** Coefficients on cost and view significant at 10% level
n/s Coefficients on cost and view not significant at 10% level

While the values estimated above are useful from a planning perspective at the individual forest level, this study requires some aggregate estimate of the landscape value of forests. The magnitude of the populations who have visual access to specific forest landscape configurations cannot be estimated at present. It is, however, possible to estimate the size of the relevant populations for certain of the broader generic landscape categories within which the individual configurations sit.

This suggests that for the purposes of aggregation WTP values are required for the six generic forest landscape categories listed in Tables 1 and 2. If the choice models are run with an alternative specification that ignores forest configuration and considers only whether or not woodland is present or absent in a given profile, then it is possible, in some cases, to generate a WTP estimate for views of generic forest landscapes (see Tables 12 and 13).

Table 12. WTP for generic forest landscapes: MPA model (£, per household per year)

Generic Forest Landscapes	From Home	While Travelling
Plateau conifer	Not significant	Not significant
Mountain conifer	Not significant	Not significant
Hilly/rolling conifer	Not significant	Not significant
Mountain broad-leaves	-£442.39	-£101.68
Hilly/rolling broad-leaves	Not significant	Not significant
Urban fringe broad-leaves	£268.79	£226.56

Table 13. WTP for generic forest landscapes: ranks model (£, per household per year)

Generic Forest Landscapes	From Home	While Travelling
Plateau conifer	Not significant	Not significant
Mountain conifer	£123.92	Not significant
Hilly/rolling conifer	Not significant	Not significant
Mountain broad-leaves	Not significant	-£48.29
Hilly/rolling broad-leaves	£132.71	£36.73
Urban fringe broad-leaves	£437.00	£246.23

The most important values in terms of magnitude of WTP and size of affected populations are for views of broad-leaved woodland in peri-urban areas. Annual household WTP based on the ranks model for views from home of this type of woodland is:£437: this falls to just over £246 for views while travelling to and from home (see Table 13). It must be emphasised that these values relate only to a relatively small sample of households from the south-east of England where mean incomes and house prices exceed those in many other areas. It is possible that the magnitude of WTP estimated here could exceed that which would be found in areas with lower net incomes.

The values based on the MPA specification are shown in Table 12 and are somewhat lower than those from the ranks model. Tables 14 and 15 compare coefficient values and goodness of fit for both specifications for the two samples. Again, the MPA model is far superior in terms of the goodness-of-fit criterion, as indicated by the relatively high pseudo-R^2 value. Therefore the values from the MPA model (£268.79 per household per year for views from home; and £226.56 per year for views on regular journeys) were used in the aggregation exercise reported in section 8.

Table 14. Model coefficients for views from home of peri-urban broad-leaved landscapes

VARIABLES	MPA MODEL COEFFICIENTS (t-value)	RANK MODEL COEFFICIENTS (t-value)
Woodland view	2.2266 (5.48)	2.8712 (10.75)
Recreational Access	1.1154 (3.68)	0.86677 (3.58)
Additional Cost	-0.0082838 (-4.75)	-0.0065703 (-4.88)
Log-likelihood	**-99.285**	**-143.13**
Pseudo R^2	**0.283**	**0.033**

Table 15. Model coefficients for views on regular journeys of peri-urban broad-leaved landscapes

VARIABLES	MPA MODEL COEFFICIENTS (t-value)	RANK MODEL COEFFICIENTS (t-value)
Woodland view	1.7945 (3.0)	2.3248 (7.33)
Recreational Access	1.6498 (5.27)	0.4826 (6.09)
Additional Cost	-0.0079207 (-1.50)	-0.0094414 (-2.15)
Log-likelihood	**-95.224**	**-139.19**
Pseudo R^2	**0.343**	**0.040**

7.5. Investigating choices

Tables 16 and 17 report the reasons selected by respondents to explain their choices. The reasons given are consistent with observed choices in the vast majority of cases and only a small percentage may cast some doubt on the validity of responses and their use in the modeling exercises. One of the most interesting features is the high proportion of respondents where responses reflected preferences for recreational opportunities in the forest landscapes.

Table 16. Reasons that best explain choices (version H)

Reason	%
I didn't like any of the views so chose the cheapest option.	7.1
It's not worth paying extra for a view.	11.4
I wanted recreational opportunities as well as nice scenery.	27.6
It's worth paying more to get a good view.	14.3
I'd like to live in an area like that.	14.8
I just chose the least worst alternative.	2.9
I like that type of scenery best.	15.7
Other	6.2

Table 17. Reasons that best explain choices (version T)

Reason	%
I didn't like any of the scenery so chose the cheapest option.	1.9
It's not worth paying for something I'd only see when travelling.	16.0
I don't care about the view on journeys but I hope this would be the view from the house.	5.3
Attractive scenery makes a journey more pleasant	18.9
I like that type of scenery best.	21.4
I like the scenery but it's not worth paying for.	10.2
I like the idea of having forest recreational opportunities near by.	19.4
I just chose the least worst alternative.	2.4
Other	4.4

7.6. Estimates of recreational benefits

The design of the choice experiments permits estimation of WTP for recreational access to forest landscapes. WTP estimates were generated for the six broad forest landscape categories rather than for the individual configurations. This was partly based on analytical considerations, but more fundamentally reflected the expectation that respondents would not be able to make detailed distinctions between the recreational opportunities offered by particular planting configurations within a broad forest landscape category.

Tables 18 and 19 report estimates of the recreational benefits associated with each of the broad forest landscape categories for both versions of the questionnaire. Estimated recreational benefits are in general lower than landscape benefits, though in some cases

recreational benefits could be estimated when landscape benefits could not be. In the majority of cases, respondents who would see the forest landscape from home would have higher recreational benefits than those passing the forests on their regular journeys. This is explained by the fact that the former probably have more opportunities to take advantage of the recreational opportunities. The only exception is for recreational opportunities on the urban fringe where values are almost identical for both samples. This suggests that respondents felt that access to these recreational opportunities would be straightforward given that they would be located near to towns.

While these recreational benefit estimates are of interest, they cover only a subset of the population. More comprehensive estimates of forest recreation benefits are provided in Scarpa (2003). Even so, if used in the aggregation exercise along with the visual amenity benefits reported in section 7.4, these estimates would substantially increase the overall estimate of aggregate forest landscape benefits.

Table 18. Annual household WTP for recreational opportunities associated with generic forest landscapes seen from home

Generic landscape	MPA Model	Ranks Model
Plateau conifer	n/s	£105.87*
Mountain conifer	£141.36*	£173.21*
Hilly/rolling conifer	n/s	£73.75**
Mountain broad-leaves	£369.29**	£118.21*
Hilly/rolling broad-leaves	£155.75**	£117.26*
Urban fringe broad-leaves	£171.10*	£159.45*

  *   Coefficients on cost and view significant at 5% level
**   Coefficients on cost and view significant at 10% level
n/s   Coefficients on cost and view not significant at 10% level

Table 19. Recreational values associated with generic forest landscapes seen on journeys to and from home

Generic landscape	MPA Model	Ranks Model
Plateau conifer	n/s	n/s
Mountain coinifer	n/s	n/s
Hilly/rolling conifer	£91.39*	£49.91*
Mountain broad-leaves	n/s	n/s
Hilly/rolling broad-leaves	£61.09*	£39.33*
Urban fringe broad-leaves	£179.91**	£158.06*

  *   Coefficients on cost and view significant at 5% level
**   Coefficients on cost and view significant at 10% level
n/s   Coefficients on cost and view not significant at 10% level

8. Aggregation

The aggregate landscape value of woodland should be based upon the number of households with views of the different types of forest landscapes. However, estimating the number of residential properties in each of the broad landscape categories through a GIS system, such as ARCVIEW, using 'viewsheds' to determine which properties have

views of woodland and which do not, is a task well beyond the resources available to this project.

An alternative approach, to establishing the number of households over which aggregation should proceed, would have been to estimate the number of households with a certain distance, say 3km, of woodland in specific types of landscape. Unfortunately the Commission was unable to provide data on the number of households living within a certain distance of woodland landscape types in spatial areas of GB.

The method eventually adopted to aggregate WTP for views of broad-leaved woodland in peri-urban landscapes was based on the 1991 Census classification of wards. This classified wards into: (i) wholly rural; (ii) predominantly rural (1-25%); (iii) mixed rural (25-50%); (iv) mixed urban (50-75%); (v) predominantly urban (75+%); and (vi) wholly urban. GIS was used identify mixed-urban wards by regions in GB. The number of households in these wards was summed to provide an estimate of the number of urban fringe households. These household totals amounted to 795,912 in England (0.04216 of all households in England); and 52,220 in Wales (0.04663 of all households in Wales). The Scottish census did not classify wards into rural-urban types. Hence, the average proportion of mixed urban wards in England and Wales (0.04241) was used to estimate the number of households in mixed urban wards in Scotland (86,290) from the total number of Scottish households (2,035,134).

Table 20.   Aggregate value of woodland landscape.

Area	Number of urban fringe households with woodland view	Value of woodland view for houses (£, millions)	Number of households seeing woodland on journey	Value of woodland view on journeys per household (£, millions	Total value of views of urban fringe woodland (£, millions
England	183,324	1407.88	329,444	2132.54	3540.42
Scotland	19,875	152.63	60,506	391.66	544.29
Wales	12,028	92.37	17,733	114.79	207.16
GB	215,227	1652.88	407,683	2638.99	4291.87

Some 43 per cent of all households sampled in this study stated that they lived on the edge of town and country. Some 23 per cent of these reported that they had a view over woodland from their home. This figure, along with estimates of the number of households in urban fringe areas, was used to estimate the total number of households with woodland views in peri-urban areas across England, Wales and Scotland. Aggregate landscape amenity values were estimated by multiplying these regional totals by the conditional logit estimate of annual WTP (£269) for the 'with-without' woodland scenario, capitalised at a 3.5% discount rate into perpetuity (see Table 20). The capitalised value amounted to £7,680 per household.

This study estimates that an average household was willing to pay £226 per year for views of urban fringe broad-leaved woodland on journeys. Views of woodland in other landscape settings were either very small or statistically insignificant. The aggregate value of urban fringe broad-leaved woodland was estimated by calculating the proportion of population in predominantly rural wards plus mixed rural wards who commuted outside the district, from the 1991 Census. Applying this proportion to households provides an estimate of the number of households who commute outside the district. If we assume these households commute into an urban area, the number of households that commute can be multiplied by the probability that they encounter an urban fringe broad-leaved woodland on their journey. While no figures were available from the FC on the proportion of urban fringe tree cover in England and Wales, they estimate that 15.5% of the urban and urban fringe area in Scotland has tree cover. In the absence of more reliable data this figure was used to provide an approximation of the probability of encountering a woodland view on a journey. This figure should be updated as soon as more suitable estimates become available. Using these assumptions, the capitalised value, at 3.5%, of the average household's WTP for views of urban fringe broad-leaved woodland on journeys, is £6473. This capitalised value was multiplied by the number of commuting households who encounter this woodland. The results are reported in column 5 of Table 20.

The capitalised value of forest landscape of £7,680 per house is consistent with the results of previous hedonic price models that have estimated the contribution of trees to house prices. Local trees were estimated by Anderson and Cordell (1988) to add 4% to house prices, whilst Morales (1980) estimated they added 6%. Garrod and Willis (1992) estimated that 20% general tree cover added 7.1% to house prices, although higher percentages of tree cover could detract from property values. The Entec-Hanley (1997) study investigated landscape improvements in British forests using expressed preferences: choice experiment and contingent valuation. The CE assessed WTP per household per year for forest shape; felling method; species mix in autumn, and winter, and spring. This produced WTP values for (selective) felling: £12.89; (organic) shape: £13.90; and species: £11.36 (diverse mix of evergreen, broadleaf, and larch). WTP for the ideal forest landscape was inferred by summing these variables, and produced a value of £38.15 per household per year. The separate CV study indicated households would be willing to pay £29.16 per year to see enhancements in the appearance of British forests that resulted in the perception of an "ideal" forest emerging. Thus whilst both the Entec and Hanley (1997) study and the current study provide estimates of marginal values for changes in forested landscapes, the former cannot be used to derive aggregate benefits.

9. Conclusions

The objective of this study was to provide data from which robust estimates of aggregate forest landscape benefits could be derived. To achieve this, a questionnaire survey was used as the vehicle for a series of choice experiments designed to investigate how much people are willing to pay for visual or recreational access to the different configurations of forest landscape depicted in a series of computer-generated images.

Two versions of the choice experiment were designed that respectively aimed to estimate public WTP for views of forest landscapes from home and on regular journeys. A total of 33 forest landscapes were used in the choice profiles. These comprised six conifer forest configurations in each of three landscape contexts and five broad-leaved forest configurations, again shown in three landscape contexts.

Analysis of over 1600 responses to the choice experiments from more than 400 respondents, generated statistically significant coefficient values from which to estimate WTP values for a number of the forest landscapes. Values could be based either on models estimated from ranked choices or from the most preferred alternative. In either case, the resulting WTP estimates were of the same order of magnitude. Goodness of fit statistics suggested that the models based on the most preferred alternative should be preferred to those based on the ranked data models. The highest and most significant values were associated with broad-leaved woodland in peri-urban landscapes.

Due to difficulties in identifying populations with access to the forest landscapes investigated in this study. the aggregation exercise concentrated on those households with visual access to broad-leaved woodland in peri-urban landscapes. These landscapes attract the highest WTP values and impact on large proportions of the population of Great Britain. WTP for views from home over peri-urban broad-leaved forest landscapes was £269 per household per year, falling to £227 for views on regular journeys.

These values were capitalised and aggregated across the proportion of the population of Great Britain estimated to have regular visual access to these landscapes either from home or while travelling. The resulting aggregate capitalised value is over £4 billion, with an annual present value of £150 million. Such values are substantial and demonstrate the considerable contribution that forest landscapes make to the welfare of individuals with regular visual access. Adding estimated recreational value to these figures would increase them by around 60 per cent, while the contribution made by some other forest landscapes not included in the aggregation exercise would also be significant.

These values confirm the importance of landscape in contributing to the social and environmental benefits provided by forests and suggests that current policies of woodland expansion may generate additional benefits especially if more woodland is located close to urban populations. Such activities are consistent with the strategies underlying the various community woodland programmes in Great Britain and with much of the woodland planting supported by Lottery funds from the Millennium Commission and the Heritage Lottery Fund.

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APPENDIX 1

QUESTIONNAIRES

University of Newcastle upon Tyne	**UNIVERSITY OF NEWCASTLE UPON TYNE GENERAL PUBLIC SURVEY**

Hello, I'm (NAME). We've been commissioned to carry out a survey to find out more about the landscapes in which people would like to live. This information will be used to help inform decisions about the management of various landscapes across Great Britain. I'd be grateful if you would answer a few questions about the landscapes you'd like to live in. Any information that you provide will be kept strictly confidential. We do not require your name or address, only your opinions.

A. WHERE YOU LIVE

These first questions ask about where you live now and the sort of places that you might like to live.

A1. Which of the following (SHOW CARD A) best describes where you currently live?

	(Tick)
Town/city centre	
Suburbs	
On the edge of town and country	
Country	

A2. And if you had the choice, which of those four would you prefer to live in?

	(Tick)
Town/city centre	
Suburbs	
On the edge of town and country	
Country	

A3. This list (SHOW CARD B) gives a number of factors that people often consider when thinking about places where they would like to live. Can you choose the THREE that would be most important to you?

Being close to shops and other services
Having green open spaces nearby
Being near to walks and other recreational opportunities
Being close to the children's schools
Low levels of crime
Peace and quiet
Nice views
Being close to work

FIRST CHOICE		**SECOND CHOICE**		**THIRD CHOICE**	

A4a. Imagine that, for some reason (e.g. changing jobs, retirement) you were going to move to a new home in the countryside. Take a moment to think about what the 'ideal view' from your new home might be. (PAUSE) I'm now going to show you some cards (SHOW CARD C) that describe things that you might want to see in that view. Looking at the card (SHOW CARD) can you first select the type of LANDSCAPE you'd most like to see: (TICK BOX BELOW)

	4a (Tick)	4b (Tick)
Flat or gently rolling land – a lowland landscape		
Hills and valleys – an upland landscape		
The sea or coast – a coastal landscape		
None of these		

A4b. And which of these broadly describes the type of landscape you currently live in whether or not it is in the countryside. (TICK BOX ABOVE)

A5a. If you could choose, which of these features (SHOW CARD D) would you like to see in the landscape that provides your 'ideal view'? (This list is not intended to include everything just some of the things that you typically see in the countryside). (TICK BOX BELOW)

	A5a (Tick)	A5b (Tick)
Stone walls		
Broadleaved or mixed woodland		
Fields of crops		
Grazing animals		
Open moorland		
Large industrial buildings		
Hedgerows and hedgerow trees		
Large conifer forests		
Scattered farms or houses		
Quarries or mineral workings		
A small village or group of houses		
A river or stream		
A small lake or pond		
An historic building, church or chapel		

A5b. And which of these features, if any, can you currently see from your home? (TICK BOX ABOVE)

B. RECREATIONAL VISITS

We already know whether or not you live in the town or countryside, but now I'd like to ask you a few questions about any recreational visits that you make.

B1. In a typical year (SHOW CARD E) how often do you make recreational visits to the UK countryside (e.g. shopping trips, visits to friends or relatives)?

	(Tick Box)
None	
1 - 2	
3 - 4	
5 - 6	
7 - 12	
13 - 26	
27 - 52	
53 +	

B2. And on how many days (SHOW CARD E) do you make what are termed as 'tourism visits'? These are non-regular visits (including holiday days) lasting more than three hours.

	(Tick Box)
None	
1 - 2	
3 - 4	
5 - 6	
7 - 12	
13 - 26	
27 - 52	
53 +	

E

B3. In a typical year how many visits (SHOW CARD E) do you make to the following types of woodland? (please tick the appropriate cell in each column)

	a. Coniferous woodland	b. Broadleaved woodland	c. Mixed woodland (conifers & broadleaves)
None			
1 - 2			
3 - 4			
5 - 6			
7 - 12			
13 - 26			
27 - 52			
53 +			

C. FORESTS

Now I'm going to ask you some questions about woodlands and forests.

C1. When thinking about the types of forest that you like to SEE IN A VIEW, can you say, in general, which of the following characteristics you prefer (SHOW CARDS F1 – F7)

(CIRCLE PREFERRED CHARACTERISTICS)

	1	2	3	4
a	**Coniferous trees (e.g. spruce, fir, pine)**	**Broadleaved trees (e.g. oak, beech, ash, birch)**	**Equal preference**	**Neither**
b	**Large forests**	**Small woodlands**	**Equal preference**	**Neither**
c	**Trees of various heights**	**Trees that are all similar heights**	**Equal preference**	**Neither**
d	**A mix of trees and open spaces**	**Just trees**	**Equal preference**	**Neither**
e	**Regularly spaced trees**	**Randomly spaced trees**	**Equal preference**	**Neither**
f	**Trees on hills**	**Trees on flatter land**	**Equal preference**	**Neither**
g	**Near to towns**	**Away from towns.**	**Equal preference**	**Neither**

We are interested in finding out how much people like you value different types of landscape. To help us a series of computer images of typical forest landscapes in Britain have been developed.

If you lived in the countryside these are the sorts of forest landscape that you might see <u>either</u> from your home <u>or</u> during regular journeys to and from home. It might also be possible to use these forests for walks or other sorts of recreation.

I am now going to ask you to imagine that you are about to move to the country. Suppose that you have looked at all the possible places to live within your price range and have decided on your three favourites –one of which is cheaper than the other two. You have examined all of the pros and cons and the only important differences seem to be:

❑ *The views that you'll get on your regular journeys to and from home (though __NOT__ the view from the house itself)*
❑ *The annual cost of living there, e.g. council tax, the cost of travelling to work, and rent or mortgage*

C2. *I'm now going to show you pictures of the three views – one of which you would see on REGULAR JOURNEYS TO AND FROM the house with the lowest price, and the others on regular journeys to and from two other houses where it would cost you a little more to live. I'll tell you whether or not members of the public are able to use any of the forests and other land shown in the pictures for recreation, the view that you'll have on regular journeys to and from cheapest house and how much extra a year living at each of the other two houses would cost you.*

(SHOW RESPONDENT THE THREE PICTURES SPECIFIED IN THE ROTATION ALONG WITH THE APPROPRIATE TEXT CARDS)

ROTATION			

Here are pictures of the views that you could see on your regular journeys to and from the three houses. Underneath each you can see whether or not there would be any recreational access and how much extra per year, compared to the cheapest house, it would cost to live at the house where those journeys would begin. Based on all of this information which of the three alternatives would you choose to live in?

10. So which of the three choices do you prefer? Which do you like least?
(RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		**MIDDLE**		**LEAST**	

ROTATION			

11. Here are three more views that you could see on your regular journeys. Can you tell me which choice you prefer this time and which you like the least?
(RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		**MIDDLE**		**LEAST**	

And again, three more views, with the same information about each as before.

ROTATION			

12. Which of these three choices would you prefer and which do you like least?
(RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		MIDDLE		LEAST	

And here are the final three views for you to consider.

ROTATION			

13. Which of these three choices would you prefer and which do you like least?
(RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		MIDDLE		LEAST	

C3. Which ONE of these reasons (SHOW CARD H) best explains the reasoning behind the choices you have just made? (CIRCLE ONE)	
a. I didn't like any of the scenery so chose the cheapest option.	1
b. It's not worth paying for something I'd only see when travelling.	2
c. I don't care about the view on journeys but I hope this would be the view from the house.	3
d. Attractive scenery makes a journey more pleasant	4
e. I like that type of scenery best.	5
f. I like the scenery but it's not worth paying for.	6
g. I like the idea of having forest recreational opportunities near by.	7
h. I just chose the least worst alternative.	8
i. Other (specify below)	9

D. PERSONAL QUESTIONS

The following questions help us to ensure that we have taken a representative sample of respondents in terms of age, occupation, interests, etc.

D1.	Have you or any members of your household belonged to any of the following groups **(SHOW CARD I)** in the last two years? (Circle the appropriate answers)						
a	Walking club	**1.Yes**	**2.No**	**f**	Woodland Trust	**1.Yes**	**2.No**
b	Cycling club	**1.Yes**	**2.No**	**g**	Local Wildlife Trust	**1.Yes**	**2.No**
c	English Heritage	**1.Yes**	**2.No**	**h**	Other Environmental group	**1.Yes**	**2.No**
d	National Trust	**1.Yes**	**2.No**	**i**	Other Wildlife group	**1.Yes**	**2.No**
e	RSPB	**1.Yes**	**2.No**				

D2. Into which of the groups on the card **(SHOW CARD J)** does your age fall?	

D3. What are the current occupation(s) of the chief income earner(s) in your household? (**write down the occupation in the left hand box, then write in the code for socio-economic class on in the right hand box: 1=A, 2=B, 3=C1, 4=C2, 5=D, 6=E)**	
Occupation 1	**SEC?**
Occupation 2	**SEC?**

D4. How many people in your household are:	
a. Under 16	
b. 16 and over	

D5. Looking at the card **(SHOW CARD K)** can you tell me which of these categories best describes the stage where you left or you have reached with regard to formal education?	

D6. Into which of the groups on the card **(SHOW CARD L)** does your total annual household income (before tax) fall?	

UNIVERSITY OF
NEWCASTLE UPON TYNE
GENERAL PUBLIC
SURVEY

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Country	

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Peace and quiet
Nice views
Being close to work

FIRST CHOICE		**SECOND CHOICE**		**THIRD CHOICE**	

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❏ *The view*

❑ *The annual cost of living there, e.g. council tax, the cost of travelling to work, and rent or mortgage*

C2. *I'm now going to show you pictures of the three views – one of which will be from the house with the lowest price, and the others from houses where it would cost you a little more to live. I'll tell you whether or not members of the public are able to use any of the forests and other land shown in the pictures for recreation, the view that comes with the cheapest house and how much extra a year living at each of the other two houses would cost you.*

(LAY OUT THE THREE PICTURES SPECIFIED IN THE ROTATION AND UNDER EACH PLACE THE APPROPRIATE TEXT CARDS)

ROTATION			

Here are pictures of the views that you could see from the three houses. Underneath each you can see whether or not there will be recreational access and how much extra per year, compared to the cheapest house, it would cost to live at the house with that view. Based on all of this information which of the three alternatives would you choose to live in?

1. **So which of the three choices do you prefer? Which do you like least?**
   (RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		**MIDDLE**		**LEAST**	

Here are three more views, again I'll tell you which of these three is the cheapest, how much more per year the others would cost and whether or not you'd be able to use these forests for recreation.

ROTATION			

2. **Can you tell me which choice you prefer this time and which you like the least?**
   (RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		**MIDDLE**		**LEAST**	

And again, three more views, with the same information about each as befor.

ROTATION			

3. Which of these three choices would you prefer and which do you like least?
(RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		**MIDDLE**		**LEAST**	

And here are the final three views for you to consider.

ROTATION			

4. Which of these three choices would you prefer and which do you like least?
(RECORD ALL THREE ALTERNATIVES IN RANK ORDER)

BEST		**MIDDLE**		**LEAST**	

C3.	Which ONE of these reasons (SHOW CARD G) best explains the reasoning behind the choices you have just made? (CIRCLE ONE)	
a.	I didn't like any of the views so chose the cheapest option.	1
b.	It's not worth paying extra for a view.	2
c.	I wanted recreational opportunities as well as nice scenery.	3
d.	It's worth paying more to get a good view.	4
e.	I'd like to live in an area like that.	5
f.	I just chose the least worst alternative.	6
g.	I like that type of scenery best.	7
h.	Other (specify below)	8

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The following questions help us to ensure that we have taken a representative sample of respondents in terms of age, occupation, interests, etc.

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Occupation 1	**SEC?**
Occupation 2	**SEC?**

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a. Under 16	
b. 16 and over	

D5. Looking at the card **(SHOW CARD K)** can you tell me which of these categories best describes the stage where you left or you have reached with regard to formal education?	

D6. Into which of the groups on the card **(SHOW CARD L)** does your total annual household income (before tax) fall?	

APPENDIX 2

EXAMPLES OF
FOREST LANDSCAPE IMAGES