Valuing Forest Recreation Activities

Final Phase 2 report

Report to the Forestry Commission

By

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1. Executive Summary

1.1. Research aims

Within Great Britain, there is around 2.74 million ha of forest and woodland, of which around 0.78 million ha is managed by the Forestry Commission. As part of its remit, the Forestry Commission endeavours to produce environmental, economic, and social benefits from its own forests and woods, as well as to promote these benefits in privately owned woodland. One key mechanism for this is through its aim to increase opportunities for public recreation within forests. Over the past few decades, the Forestry Commission has invested heavily in forest access and recreation. Furthermore, it has recognised that the recreation market is now becoming demonstrably more diverse and segmented. Through this research the Forestry Commission is now seeking to assess the value and economic impact of the different forms of forest recreation in Great Britain.

In particular, this research aims:

- To estimate the local economic (income and employment) impacts of forest recreation;
- To estimate changes in forest visitors' welfare associated with improvements to the recreational facilities provided in forests;
- To examine how the recreational values vary across different forest users and uses.

An assessment of the local economic impact of forest recreation was achieved using multiplier analysis. Three alternative economic valuation methodologies were also used in this research to examine the economic value of forest recreation. First, a travel cost count model was used to examine per-visit values for alternative groups of forest users. Next, contingent behaviour analysis and choice experiments were both used to estimate changes in visitors' welfare associated with improvements to recreational facilities in forests.

1.2. Forest recreation case study

Four forest-based recreation activities were investigated in this research:

- *Cycling*; defined as incorporating all types and abilities of cycling that occurs within forests ranging from short family rides, cross-country rides, single-track mountain biking, downhill, four-cross and dirt-jumps.
- *Horse-riding*; defined to include all types for riding that takes place in the forest from leisure riding to endurance riding.
- *Nature-watching*; defined to include all nature-watching activities from guided walks, viewing centres, to nature trails.
- *General forest visitor*; defined to represent a catch-all group of forest visitors including walkers / hikers, 'play', day trippers, as well as people who visit the forest for multi-activities.

The data for this research was collected using on-site, in-person interviews, administered over a five-month period between May and September 2005. Interviewing took place at seven forest located throughout Great Britain: Glentress, Dyfnant, Cwm Carn, Thetford, New Forest, Rothiemurchus, and Whinlatter. These forests were selected to cover a comprehensive range of forest recreation activities and abilities. A total of 1568 interviews were undertaken for this research.

1.3. Economic impact study

The economic impact of forest recreation was assessed using multiplier analysis. This methodology first requires data to be collected on the levels of visitor spend within the local economy of a forest. Analysis of this data provides estimates of mean local spend per visit,

which is then aggregated to total local spend for all visits to the forest. This total local spend is then multiplied by income and employment multipliers to assess the total local income and employment impacts associated with visits to the forest.

Based on this analysis, it was estimated that mean local spend on forest recreation was £26.22. However, there was considerable variation in the mean local spend between users groups and forests. Horse riders were found to spend significantly greater amounts (£118.02) than other users; however it should be noted that this high expenditure was largely driven by horse riders at the New Forest who spend significantly more than horse riders at the other sampled forests. Mean local expenditure of other user groups were as follows: general visitors = £32.05; nature watchers = £20.18; and cyclists = £13.43. There was also variation in the propensity of different user groups to spend locally, with horse riders spending the greatest proportion locally (86%) and cyclists spending the smallest proportion locally (57.7%).

The aggregate annual local expenditure, income and employment impacts associated with the seven forests investigated are reported in the Table 1 below. Forest recreation was found to attract significant expenditure in local economies ranging from around £0.18m in Dyfnant to £61.26m in New Forest. This injection of expenditure into the local economies generated between £0.30 million local income in Dyfnant and £17.11 million local income at Thetford. At the New Forest, it was estimated that around £100 million local income was generated from forest recreation. Although this figure is significantly higher than that found at the other forests, it is argued that most of this increase is driven by the significantly higher number of visitors going to the New Forest. In terms of job generation, it was found that visitor expenditure generated between 5 full-time equivalent (FTE) jobs at Dyfnant to 305 FTE jobs in Thetford. Again, the number of FTE jobs generated at the New Forest was significantly higher (1802 FTE jobs). Comparative analysis indicates that size of the economic impacts reported here are generally consistent with those found in other related studies.

Table 1: Local economic impacts generated that the case study forests.

Forest	Annual local expenditure (£m)	Annual local income generated (£m)	Annual number of FTE jobs created (FTE jobs)
Glentress	£2.02	£3.33	59.4
Dyfnant	£0.18	£0.30	5.3
Cwm Carn	£0.98	£1.62	29.0
Thetford	£10.37	£17.11	305.0
New Forest	£61.26	£101.09	1802.0
Rothiemurchus	£6.96	£11.49	204.8
Whinlatter	£4.79	£7.91	140.9

Finally, it is stressed that these expenditure, income and employment estimates relate to the total level of economic activity associated with trips to the forests. These estimated economic impacts are unlikely to constitute additional expenditure, income and employment to the GB economy as a whole; rather the expenditure, income and employment impacts will largely constitute displacement and substitution from other areas. Thus, the actual additionality impacts to local economies are likely to be only a proportion of the total impacts reported. It is also worth noting that if visits to the forests were to cease, it would be unlikely that all of the reported expenditures, income and employment would be lost; people would instead visit other places.

1.4. Travel cost 'count' model

Estimates of the economic value per visit for a range of forest recreation user groups were generated using a travel cost 'count' model. The count model is largely based on data collected on the number of trips made by an individual to the forest during the last 12 months and the cost of travel to that forest. In this research, user-group-specific count models were used to produce estimates of per-trip values for five user groups. This analysis identified that cyclists, horse riders, walkers and general visitors attained welfare benefits from visiting the forest equivalent to £15 per-trip, while nature watchers attained lower welfare benefits of £8 per-trip. The per-trip values estimated in our analysis are generally higher than those found in the existing literature. It is likely that part of the reason for our high values is related to recent increases in the costs of travel. In addition, there are a number of methodological issues (which are discussed in the report) that may have contributed towards the higher values.

1.5. Contingent behaviour model

A contingent behaviour model was utilised to estimate both changes in predicted number of visits and changes in visitors' welfare for improvements in forest recreation facilities. Data collected for this analysis included information on the number of trips an individual currently makes to a forest and then changes in the intended number of trips to that forest if the new facilities were provided. Two forest improvement scenarios were investigated for each of the four recreation user group studied. Thus, we hoped to estimate eight contingent behaviour models. Unfortunately, the key 'travel cost' parameter was not significant for the horse riders models, and therefore further analysis was not possible for these scenarios. Visits of more than 2 hours travel time one-way were excluded from the analysis, to focus on day visits rather than over night visits.

Table 2 below provides a summary of the key findings from the contingent behaviour analysis. It was predicted that the provision of new facilities would generate only relatively small increases in the number of trips to forests ranging from a 0.3% increase in trips associated with the provision of showers and changing rooms to an increase of 10.2% trips for the provision of family play areas. In terms of the welfare benefits, cyclists, on average, valued the construction of new trail obstacles such as jumps, drop-offs, and 'northshore' at £3.46 per cyclist per year. The provision of showers and changing room was valued at £0.66 per cyclist per year. Nature watchers respectively valued the creation of new hides and wildlife centres at £7.89 and £3.30 per year. General forest visitors were found to have high values the provision of new family play facility such as play areas and 'go ape' facilities: £8.75 per visitor per year. Art / sculpture trails were valued at £2.79 per visitor per year.

Table 2: Key findings from the contingent behaviour analysis

Improvement scenario	Predicted % change in trips over base	Economic benefits of improvements per visitor per year (£)
Cyclists: New optional trail obstacles built alongside existing bike trails.	+5	3.46
Cyclists: New shower and changing facilities provided at the forest.	+0.3	0.66
Nature Watchers: several new hides built in forest	+4.5	7.89
Nature Watchers – new wildlife centre built	+2	3.30
General Visitors: New art / sculpture trails.	+4.5	2.79
General Visitors: New family play areas provided at the forest.	+10.2	8.75

1.6. Choice experiments models

Choice experiments (CE) were used to value changes in visitor welfare for a range of improvements to recreational facilities in forests. Within the CE study, respondents were presented with a series of choice tasks in which they are asked to choose their preferred policy option from a list of three options; one of which was a 'stay-at-home' option. Each choice option is described in terms of attributes; in this case facilities provided at the hypothetical forests. This research adopted two types of choice task: a traditional choice-based choice task and a novel frequency-base choice task in which respondents were asked to allocate their next five trips between the two hypothetical forests and the 'stay-at-home' option. Four versions of the CE model were developed, one for each of the recreation user groups: cyclists, horse riders, nature watchers and general visitors. In each of the four recreation groups, the hypothetical forests were described according to eight attributes: four of which related to activity-specific facilities, three related to general facilities and the final one related to 'distance to forest'.

The key findings from the CE study was:

- Cyclists were willing to pay high values for the creation of downhill courses (£9.74), technical single-track trails (£8.40), cross-country trails (£5.81) and optional obstacles such as jumps and drop-offs (£7.56). Bike-wash facilities were also valued (£4.27). Generally, downhill riders had the highest values, followed by mountain bikers. Leisure cyclists did not have highly defined preferences.
- Surprisingly, horse riders did not appear to value the provision of horse-specific facilities such as dedicated horse-riding trails, optional obstacles (jumps and ditches), horse-friendly parking or horse corrals and tie-up points. It was thought that this was largely due to the large amount of effort involved in travelling with horses.
- Nature watchers were found to value the provision of wildlife hides (£6.83), wildlife-viewing centres (£5.56), 'off-the-beaten-track' nature trails (£6.48) and enhancements to the forest surrounds for viewing wildlife (£3.62). However, there was very little demand for easy access nature trails, or nature trails with information.
- General forest visitors valued the provision of technical single-track mountain bike trails (£4.59), wildlife hides (£1.56), art and sculpture trails (2.70). General visitors tended to have significant and negative values for the provision of horse-riding trails.

1.7. Policy implications

This research aimed to provide a unique insight into the value that different groups of forest users have for a range of enhancements to the forest recreation resource. Novel aspects of this research include the fact that this is one of the first studies to value forest recreation utilising a combined revealed-preference – stated-preference method: here we adopted a contingent behaviour model. Such a methodology is considered to be an improvement on either traditional revealed-preference or stated-preference methods since the combined approach draws on the relative merits of the two techniques. This study is also one of the first valuation studies to utilise an attribute-based valuation method to value the component attributes of forest recreation. Furthermore, in our analysis we analyse this data according to different groups of forest users, thus providing significant detail on the diversity of values for enhancements to forest recreation. Another novel aspect to this research is that we utilised a frequency-based choice task in the CE model. It is argued that this approach has advantages over the more traditional choice-based choice task for recreational-use applications since: (i) the choice task more closely reflects actual behaviour, and (ii) it would appear that survey respondents take more considered account of the travel-cost (price)attribute in a frequency-based task than in a choice-based task. Finally, this research has produced a wealth of information on the relative values of a range of improvements to the forest recreation resource by different user groups. It is considered that this information will be invaluable to the future management of forests in terms of enabling forest managers to target resources effectively between different forests and forest users.

The key policy implications stemming from our research are as follows. First, it was clear from the data that the more specialist users attain greater benefits from the provision of activity-specific facilities than non-specialist users. For example, mountain bikers had higher values for enhanced forests facilities than general cyclists and indeed general forest visitors. This evidence suggests that policies aimed to maximise economic benefits per visit from forest recreation would be best to target the provision of specialist recreation facilities. Further evidence in support of creating specialised facilities came from the fact that all groups of forest users opposed the creation of multi-purpose trails. In other words, forest visitors did not want to share trails with other user groups.

The results from this study also allowed us to make specific recommendations for the future management of forests for specific recreation activities. In terms of cycling, there was overwhelming support for further investments to create and enhance mountain-bike centres, and in particular to provide additional 'hard-core' facilities such as downhill courses and optional obstacles such as jumps and drop-offs on existing trails. Furthermore, there was general support for the provision of bike-wash facilities at forests where any form of cycling takes place. There was little evidence in support of the provision of horse-specific facilities within forests. Information gathered in debriefing interviews with horse riders indicated that the significant factor contributing to the lack of demand for horse-specific facilities stems from the difficulties associated with transporting horse to and from forests. Furthermore, evidence from other users groups indicate that any new riding facilities, if developed, should be developed away from areas used by the general public, who appear to be opposed to sharing the forest with horses. There was general support for increased investment in wildlife hides and viewing centres where appropriate. The increased provision of general forest facilitates such as car parks, toilets, etc did not appear to be important in people's choice of forests. However, it should be noted that the majority of visitors do use these facilities and therefore there provision is considered to be important to forest visitors.

Finally, it should be noted that the above improvements relate only to those improvements that generated the highest per-trip welfare gains. Recommendations for future investment should also take account of the number of potential users of these new facilities. This question was not fully addressed in this research. In addition, any future investment in facilities should also be assessed in terms of both the costs and benefits. This report provides information on the benefits, but information on the costs would be required in order to conclude whether investment would be recommended.

2. Introduction

Within Great Britain, there is around 2.74 million ha of forest and woodland, of which around 0.78 million ha is managed by the Forestry Commission. As part of its remit, the Forestry Commission endeavours to produce environmental, economic, and social benefits from its forests and woods, as well as promote to these benefits in private woodlands. One key mechanism for this is through its aim to increase opportunities for public recreation within forests. Over the past few decades, the Forestry Commission has invested heavily in forest recreation and access. The Commission is now seeking to assess the economic value and impact of the different forms of forest recreation in Great Britain. It is recognised that recreation is a major activity within forests and woodlands in Great Britain; however such recreation is largely unpriced. The few existing studies that have attempted to estimate the value (consumers' surplus) of forest recreation (e.g. Benson *et al.*, 1992, Scarpa, 2003) have tended to focus on generic recreation. However, the recreation market has become demonstrably more diverse and segmented. Understanding of the economic value and impact of forest recreation thus demands an understanding of the range of values and impacts associated with this diversity of recreation activities.

This research, commissioned by the Forestry Commission, aims to:

- *To estimate the value (consumers' surplus) of changes in the provision of key forest recreation facilities;*
- *To examine the range of these recreational values across different forest users and uses;*
- *To estimate the economic impact of forest recreation.*

The research was conducted over two phases. Phase 1 of the research involved a series of developmental and scoping studies. Full details of this developmental work can be found in the Phase 1 report (Christie et al., 2005), which is also available on the Forestry Commission website http://www.forestry.gov.uk/. The Phase 1 report concluded with a series of recommendations for empirical research to value improvements to forest recreation. In particular, the report recommended that a range of valuation methodologies, including travel cost count models, contingent behaviour models, random utility maximising travel cost model and economic impact analysis, should be utilised to capture these values. This 'Phase 2' report now presents the findings from these empirical studies.

The structure of this report is as follows. Following this introductory section, Section 3 provides an overview of the research method adopted. Readers should note that a theoretical discussion of the methods are not presented in the main report, but rather are discussed in an annex. The results from the empirical work are reported in Sections 4 to 8. Section 4 provides an overview of the survey results in terms of response rate and basic data on the activities undertaken by survey respondents. Section 5 reports the findings of the economic impact study, while Sections 6, 7 and 8 respectively report the findings of the travel cost count model, the contingent behaviour model and the choice experiments model. Section 9 of the report provides a discussion of the research findings, while Section 10 reports our recommendations from the research. Finally, copies of the survey instruments can also be found in the annex.

3. Methodology: an overview

The aim of this research is to estimate the economic impact and value (consumers' surplus) of different types of forest recreation activities. As already suggested, much of the developmental work for this research is reported in the Phase 1 report (Christie et al., 2005). In this section, we provide a brief overview of the various methodologies adopted in the empirical analysis. A technical discussion of the research methods can be found in the technical annex.

An assessment of the economic impact of forest recreation was achieved using multiplier analysis. This methodology first requires data to be collected on the levels of visitor spend within the local economy of a forest. Analysis of this data provides estimates of mean spend per visit, which is then aggregated to total spend for all visits to the forest. 'Multiplier coefficients' are then applied to this aggregate spend to assess the total local income and employment impacts associated with visits to the forest. A summary of the key findings from the economic impact analysis is reported in Section 5.

Three methodologies were used in this research to examine the economic value of forest recreation. First, a travel cost count model was used to examine per visit values for alternative groups of forest users. Details of this analysis are reported in Section 6. Next, contingent behaviour analysis and choice experiments (CE) analysis were both used to estimate changes in visitors' welfare associated with improvements to recreational facilities in forests. The results from this analysis are reported in Sections 7 and 8 respectively.

All of the data for this research was collected using on-site, in-person interviews, which is the recommended format for this type of study (Arrow et al., 1993). A copy of the survey questionnaire used in this research is reproduced in the annex to this report. A detailed discussion of the structure and content of the questionnaire is also provided in the annex to this report. Interviewing took place at seven forest recreation sites throughout Great Britain: Glentress, Dyfnant, Cwm Carn, Thetford, New Forest, Rothiemurchus, and Whinlatter. The main criterion for selecting these forests was that they, together, should cover the range of recreational activities to be examined in this research. Site selection was also influenced by the recommendations made by forest managers. Up to 24 days surveying was undertaken at each site over a five month period between May and September 2005. To capture all types of forest users, interviews were conducted both during week days and weekend days, as well as all daylight hours.

Four broad groups of forests users were targeted in this research: cyclists, horse riders, nature watchers and general forest visitors. The selection criteria used to identify these key user groups included:

- those activities which attract a significant number of users;
- those activities where the number of users are expanding most rapidly;
- those activities which have specific facility / infrastructure / management needs;
- those activities which are likely to generate the greatest economic value or impact;
- those activities which are important to the Forestry Commission's policy.

Below, a discussion of the key issues associated with each of these user groups is provided.

Cyclists

Cycling represents an interesting and unique case study for this research. Over the past ten years of so, the Forestry Commission has made significant investments in 'mountain bike centres' such as at Glentress, Coed-y-Brenin and Cwm Carn. These centres provide a range of specifically built technical single-track trails for mountain biking. These centres attract a high number of users, many of whom are prepared to travel long distances to access these centres (Forestry Commission, 2002a; 2002c). Thus, capturing the size of the economic value and impact of these mountain bike centres is likely to be of interest to the Forestry Commission. In addition, a number of forest recreation managers expressed some concern that the market for new mountain bike centres may be near saturation point. A valuation study that includes an assessment of the value of additional facilities would help to assess whether this is the case or not. Furthermore, there is also a move within the Forestry Commission to start providing more 'hard-core' facilities such as downhill, four-cross and dirt-jumps. Currently, little is known about the demand for such facilities and therefore information on this would be useful to aid future investment decisions. Limiting the examination of cycling to mountain biking alone however would be restrictive since forests also attract large numbers of casual / family riders. These riders are likely to have different needs to the mountain bikers and therefore it was considered that their needs should also be investigated. Cycling was therefore identified as a key recreation activity for this research. The working definition of cycling incorporated all types and abilities of cycling that occurs within forests ranging from short family rides, cross-country, single-track mountain biking, downhill, four-cross and jumps.

Horse riders

Horse-riding presents a second interesting case study for this research. Horse-riding currently takes place in 22% of the GB's main forest sites (Forestry Commission, 2004a), and accounts for around 2% of forest users (Tns Travel and Tourism, 2004b). Currently, horse-riding takes place on existing forest trails and bridleways; however the Forestry Commission generally does not provide specific facilities for horse riders. One prominent exception to this is at the forests of Dyfnant and Lake Vyrnwy. Here, the local riding group, in partnership with the Forestry Commission, have developed a suite of facilities aimed to meet the specific needs of horse riders. Facilities provided include corrals, horsebox friendly parking, dung heaps, mounting blocks, horse-friendly trail surfaces and optional challenges such as jumps. The facilities are now in much demand and serve to demonstrate the potential of providing horse-specific facilities. The facilities at Dyfnant have also won the British Horse Society's prestigious 'Access Award'. It was suggested in the stakeholder interviews (see Phase 1 report: Christie et al., 2005) that efforts to promote horse-riding in forests could follow the success of mountain biking. Furthermore, the Forestry Commission is showing increased interest in horse-riding with the appointment of a 'horse-riding liaisons officer' and the recent signing of a concordat on horse-riding. Horse-riding was also thought to have the potential to make significant contributions to local economies. The argument here is that horse-riding is a resource-intense sport and as such there is a significant opportunities for local businesses to benefit from the provision of horse-friendly facilities such as accommodation or temporary livery facilities. Like cycling, horse-riding comprise a number of specialist disciplines including short casual rides, jumping, endurance events and carriage driving. Thus again there would be opportunities to examine the different preferences for different groups of horse riders. Horse-riding was therefore identified as a second key activity for investigation. Our working definition of horse-riding included all types of riding that takes place in the forest and would investigate preferences for horse-specific facilities similar to those provided at Dyfnant and Lake Vyrnwy forest.

Nature watchers

Nature-watching was also considered to be an activity of interest for this research. Nature-watching currently takes place in 15% of the Forestry Commission's forests (Forestry Commission, 2004b); however, there are also opportunities within most forests to view nature. An interesting finding from forest visitor surveys is that whilst only a small proportion of visitors visit forests specifically to watch nature, many visitors reported that seeing nature enhanced their visit. Thus, if it is the aim of the Forestry Commission to improve visitor experience, then enhancing opportunities to see nature is likely to fulfil these objectives. The research therefore aimed to establish how the public might like to see opportunities to observe nature in forests enhanced. The nature-watching facilities investigated included formal facilities such as interpretation centres, wildlife hides, nature walks, as well as less formal provisions such as forest management that increases opportunities for wildlife and for viewing wildlife.

General forest visitors

Finally, it was recognised that limiting the study only to cover the three activities outlined above might be restrictive in that the views and values of other types of forest user would not be captured. Furthermore, it was considered that none of the other potential candidate user groups (such as walkers, 'Go Ape' high-wire course and children's play areas) stood out above the rest in terms of the selection criteria outlined above. For example, it was considered that there was already a plentiful supply of walking trails at forest sites (79% of the main Forestry Commission sites currently have walking trails; Forestry Commission, 2004b) and therefore it was perceived that there was little opportunity to enhance this resource. In terms of 'Go Ape' high-wire courses, it was suggested that since this was a franchised venture on the Forestry Commission's land, it was not really in the interest of the Forestry Commission to further explore the demand for such facilities. It was also evident from the developmental focus groups that a significant number of forest visitors went to the forest for multiple activities. It was therefore considered that it would be appropriate to group all of these other forest users into a single 'general forest visitor' category. Thus, our definition of this group was all forest users other than specialist cyclists, horse riders or nature watchers. There are several perceived advantages to adopting this group. First, it enabled exploration of a much wider range of user preferences for forest facilities (albeit at a less precise scale) than would be possible if we only focussed on single user groups. Second, in practical terms, it allowed us to sample all forest users during interviewing. If the sample selection was restricted to only specialist user groups, we would not pick up information on the needs of the other non-specialist groups of forest users.

4. Results: Overview

The key results from the empirical studies are reported in the next five sections of this report. In this section, we report the response rate to the main intercept survey and provide a summary of the type and level of recreational activity undertaken by survey respondents. Section 5 reports the results from the economic impact analysis. The results from the travel cost count model, contingent behaviour analysis and CE analysis are reported in Sections 6, 7 and 8 respectively.

4.1. Response to the survey

A total of 1568 on-site, personal interviews were undertaken during this research. Table 3 provides a breakdown of where the interviews were undertaken by forest and activity. Around 300 interviews were undertaken at Glentress, Thetford and Rothiemurchus, while around 250 were undertaken at Cwm Carn and the New Forest. Low numbers of visitors at Dyfnant forest meant that only 132 interviews were undertaken. Finally, Whinlatter forest was included towards the end of the survey period in an attempt to boost the numbers of nature watchers. Thus, only a small number of interviews were undertaken at Whinlatter.

Table 3: Summary of the number of interviews undertaken by forest and main activity.

Forest	Main recreation activity undertaken				All respondents
	Cycling	Horse-riding	Nature-watching	General forest recreation	
Glentress	221	6	27	47	**301**
Dyfnant	5	37	29	61	**132**
Cwm Carn	260	0	5	1	**266**
Thetford	70	2	24	205	**301**
New Forest	17	60	5	161	**243**
Rothiemurchus	8	0	30	267	**305**
Whinlatter	4	6	7	3	**20**
Total	**585**	**111**	**127**	**745**	**1568**

Table 3 also provides a summary of the main recreation activity undertaken during trips to the respective forests. General forest users account for just under half (47.5%) of the total sample, while cyclists accounted for 37.3% of the sample. Horse riders and nature watchers were less well represented, accounting for 7.1% and 8.1% respectively. These low numbers reflect the fact that there were often very few people in the forests undertaking these two activities. A detailed breakdown of the number of people undertaking the different activities in the different forests is also provided in Table 3. In Glentress and Cwm Carn, the majority of people interviewed were cyclists, reflecting the fact that both these forests were managed for mountain biking. There were also a significant number of cyclists interviewed at Thetford. The majority of horse riders were interviewed at Dyfnant and the New Forest. Nature watchers were found at all sites, but in low numbers. Finally, general forest users were found in large numbers at Thetford, the New Forest and Rothiemurchus.

4.2. Basic trip information

Details of the activities undertaken by survey respondents during trips to the forests were collected in Section B (Questions 6 to 15) of the survey: a copy of the questionnaire used is reproduced in the annex to this report. Summary statistics for these questions are presented below. It should be stressed, however, that the results from this study may not be fully representative of all users of the respective forests since the sampling strategy adopted targeted people undertaking the three main recreation activities of interest to this study, i.e. cyclists, horse riders, nature watchers.

4.2.1. Type of trip

Details of the type of trips undertaken by visitors to the sampled forests by activity are reported in Table 4. In terms of the average for 'All forests' surveyed, 15% of respondents were on a day trip lasting less than three hours in duration, 34% were on a day trip lasting more than three hours and 46% were on holiday away from home. There was, however, variation in the duration of trips depending on the activity undertaken and the forest visited. In terms of activities, cyclists were more likely to go on a long day trip (> 3 hours), while horse riders and general forest visitors were more likely to be on holiday. Also, visitors to the New Forest and Rothiemurchus tended to be on holiday away from home with very few visitors on short day trips, while those going to Cwm Carn were more likely to be on long (>3 hours) day trips. There was also great variation in the way people visit the different forests for a particular activities. For example, at Dyfnant 95% of horse-riding trips were day trips, while 85% of the horse-riding trips at the New Forest were made by people on holiday.

Table 4: Trip duration by activity and forest.

All Forests	Cycling	Horse-riding	Nature-watching	General forest visitors	All activities
Day trip (< 3 hrs)	17.0%	15.3%	16.7%	13.2%	**15.0%**
Day trip (> 3 hrs)	44.7%	29.7%	23.0%	28.4%	**34.1%**
Holiday away from home	34.2%	52.3%	49.2%	54.3%	**46.2%**
Other	4.0%	1.8%	11.1%	4.1%	**4.4%**
Total *n*	**582**	**111**	**126**	**736**	**1555**

4.2.2. Distance travelled to forest

A summary of the average distance travelled to the sampled forests for the four activities can be found in Table 5. The average distance travelled to all of the forests sampled was 45 miles. People on average tended to travel further to get to Cwm Carn (75 miles) and the New Forest (66 miles) than Whinlatter (12 miles). However, individual visitors travelled up to 500 miles to get to Glentress and 480 mile to Rothiemurchus. In terms of activities, people on average travelled further to go cycling (60 miles) and horse-riding (47 miles) than nature-watching (39 miles) and other forest activities (34 miles).

Table 5: Average (and maximum) distance travelled in miles to forest by activity.

	Cycling	Horse-riding	Nature-watching	Other	All activities
Glentress	50 (500)	2 (4)	51 (300)	19 (150)	44 (500)
Dyfnant	78 (110)	21 (65)	31 (60)	31 (90)	30 (110)
Cwm Carn	76 (300)	.	40 (60)	60 (60)	75 (300)
Thetford	30 (150)	11 (12)	22 (40)	30 (130)	29 (150)
New Forest	71 (256)	69 (300)	77 (100)	64 (335)	66 (335)
Rothiemurchus	11 (35)	.	47 (450)	24 (480)	26 (480)
Whinlatter	12 (12)	12 (12)	6 (7)	25 (30)	12 (30)
All Forests	60 (500)	47 (300)	39 (450)	34 (480)	45 (500)

Note: Figures in parenthesis relate to the maximum distance that a single person travelled to the forest.

4.2.3. Activities undertaken at forests

Table 6 provides a summary of the responses to Question 9a of the survey questionnaire by forest. The numbers in the table report the proportion of respondents to a particular forest that undertook a specified activity in that forest. The information reported in the table clearly demonstrates that different activities were undertaken in each of the seven forests. Some of the forests were clearly seen to attract specific user groups. For example, as expected both Glentress and Cwm Carn attract specialist mountain bikers; in Cwm Carn, mountain biking was virtually the only activity undertaken at that forest. Horse-riding was largely restricted to Dyfnant, New Forest and Whinlatter forests. Generally, nature-watching was popular in most forests other than Glentress and Cwm Carn. Watching nature at a viewing centre was popular at Dyfnant and Whinlatter, while nature trails were popular at Dyfnant, Thetford and Rothiemurchus. Rambling and hill-walking was only undertaken at Rothiemurchus. Thetford, New Forest and Dyfnant also appeared to attract more general forest users who went on short family / leisure walks or cycle rides, have a picnic and use children's play facilities.

Table 6: Proportion of visitors undertaking activities by forests

Activity	Glentress	Dyfnant	Cwm Carn	Thetford	New Forest	Rothiemurchus	Whinlatter
Cycling: family / leisure ride	5.6	10.6	5.6	21.3	21.8	5.9	20.0
Mountain biking: cross-country	50.2	n/a	55.3	14.0	4.9	4.3	10.0
Mountain biking: technical single track	70.8	n/a	77.1	11.6	1.2	0.3	n/a
Mountain biking: downhill course	22.3	n/a	36.5	3.7	n/a	n/a	n/a
Biking: dirt-jumping	4.7	n/a	10.2	5.6	n/a	n/a	n/a
Other cycling	n/a	0.8	1.5	0.7	n/a	0.7	n/a
Pony trekking	0.3	1.5	n/a	n/a	2.1	1.0	n/a
Horse-riding: family / leisure ride	1.7	24.2	n/a	0.7	24.3	0.3	35.0
Horse-riding: endurance	n/a	3.0	n/a	0.3	0.4	n/a	n/a
Carriage driving	n/a	1.5	n/a	n/a	0.4	n/a	n/a
Other horse-riding	n/a	0.8	n/a	n/a	0.4	n/a	n/a
Nature-watching: general	18.3	44.7	4.1	26.9	31.3	47.5	50.0
Nature-watching: at viewing centre	10.6	22.0	1.1	2.3	4.5	9.5	20.0
Nature trail	7.0	20.5	n/a	17.3	8.6	16.1	5.0
Guided nature walk	0.3	0.8	n/a	1.0	2.1	1.0	n/a
Other nature-watching	0.7	n/a	n/a	0.7	4.1	3.0	n/a
Dog walking	7.3	21.2	2.3	13.0	15.6	9.5	5.0
Running	2.3	3.0	1.5	1.7	1.2	0.7	n/a
Walking: short family / leisure walk	14.0	45.5	1.5	46.5	42.0	62.6	30.0
Rambling	2.7	11.4	2.3	6.0	4.9	15.4	n/a
Hill walking	3.7	3.8	3.4	1.3	1.2	10.8	n/a
Other walking	0.3	0.8	0.4	1.7	0.8	1.3	n/a
Picnic / BBQ	9.0	28.0	4.5	28.2	55.6	22.6	n/a
Art (e.g. sculpture trails)	0.7	10.6	1.1	1.7	1.2	0.3	n/a
Photography	3.7	20.5	3.4	6.3	10.3	17.7	5.0
Children's play	0.7	5.3	0.0	34.6	17.7	2.3	n/a
'Go Ape' high-wire adventure	0.3	2.3	0.4	17.3	1.6	n/a	n/a
Other activities (Specify)	0.7	2.3	n/a	0.7	23.5	10.2	n/a

Many visitors to the forest undertook multi-activities during their trip. Table 7 provides a summary of the average number of activities undertaken by each visitor to the seven forests surveyed. On average across all forests, visitors participated in a mean of 2.50 activities. Most activities were, on average, undertaken at Dyfnant (2.86 activities) and the New Forest (2.44 activities), while fewer activities were undertaken at Whinlatter (1.80 activities) and Cwm Carn (2.14 activities). These results largely coincide with the fact that at the more specialist forests, visitors tend to focus on a specific activity, whilst at a less specialist forest visitors participate in a wider range of activities.

Table 7: Multi-activity trips by forest

Number of activities undertaken	Glentress (%)	Dyfnant (%)	Cwm Carn (%)	Thetford (%)	New Forest (%)	Rothie-murchus (%)	Whinlatter (%)	All forests
0	0.0	0.0	1.1	0.0	0.4	0.3	0.0	0.3
1	26.2	23.5	28.2	24.3	23.9	33.1	55.0	27.3
2	35.5	28.0	44.0	26.6	23.5	27.5	20.0	31.0
3	23.3	14.4	18.8	21.9	23.5	18.7	15.0	20.5
4	8.6	18.2	3.4	16.6	15.2	9.8	10.0	11.4
5	4.0	9.8	1.9	6.6	9.9	5.6	0.0	5.8
6	1.3	3.0	1.9	3.0	1.6	3.0	0.0	2.2
7	0.7	1.5	0.4	0.3	0.8	1.6	0.0	0.8
8	0.0	1.5	0.0	0.7	1.2	0.0	0.0	0.4
9	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1
10	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Mean number of activities undertaken	**2.38**	**2.86**	**2.14**	**2.68**	**2.77**	**2.44**	**1.80**	**2.50**

Question 9b of the survey asked respondents to identify the main activity that they were undertaking during their visit to the forests. This information is reported in Table 8. Over all seven forests, the main activities undertaken were technical single-track mountain biking (20.0%), short family / leisure walk (19.5%), and cross-country mountain biking (10.5%). There was, again, much variation between forests in terms of the main activities undertaken. In Glentress and Cwm Carn around half of the visitors' main activity was technical single-track mountain biking, with a further 20% cross-country mountain biking. At Cwm Carn an additional 20% stated that downhill mountain biking was their main activity. Family / leisure cycling was an important main activity at Whinlatter (20.0%), Thetford (11.0%) and the New Forest (9.5%). Family / leisure horse-riding were the main activity for 30.0%, 22.7% and 22.6% of visitors to Whinlatter, Dyfnant and New Forest respectively. Nature-watching in general was considered the main activity for 15.0% of visitors to Whinlatter, and 10.6% of visitors to Dyfnant, 8.9% of visitors to Rothiemurchus and 7.0% of visitors to the New Forest. Walking was perhaps one of the most popular main activities undertaken in the forests. Fifty percent of visitors to Rothiemurchus, around 30% at Whinlatter and Dyfnant and 20% at Thetford stated that short family / leisure walks were their main reason for the visit to the forest. Rothiemurchus also attracted the more adventurous walker, with 10.2% stating that rambling was their main reason and 6.6% stating that hill walking was their main activity. Surprisingly, dog walking was only regarded as the main activity by less than 5% at all forests. Finally, 17.4% of visitors to Thetford stated that the 'Go ape' high-wire facilities were the main reason for the visit, with an additional 11.7% using the children's play area.

Table 8: Main activity undertaken by forest

Activity	Glentress (%)	Dyfnant (%)	Cwm Carn (%)	Thetford (%)	New Forest (%)	Rothiemurchus (%)	Whinlatter (%)	All forests (%)
Cycling: family / leisure ride	1.0	5.3	1.1	11.0	9.5	2.3	20.0	5.1
Mountain biking: cross-country	22.9	0.8	22.6	7.0	3.3	2.0		10.5
Mountain biking: technical single track	47.8		54.1	7.7	0.8			20.0
Mountain biking: downhill course	2.3		19.2	0.7	0.4			3.9
Biking: dirt-jumping				0.3				0.1
Other cycling						0.3		0.1
Pony trekking		0.8						0.1
Horse-riding: family / leisure ride	1.3	22.7		0.7	22.6		30.0	6.2
Horse-riding: endurance		3.0			0.4			0.3
Carriage driving		1.5						0.1
Nature-watching: general	4.7	10.6		3.7	7.0	8.9	15.0	5.5
Nature-watching: at viewing centre	5.0	0.8	1.5	0.3		2.3		1.8
Nature trail	0.3	5.3		2.7	0.4	1.0		1.3
Guided nature walk	0.7			0.3				0.2
Other nature-watching	0.7	0.8		0.7		1.3		0.6
Dog walking	2.7	3.0		4.0	3.3	3.3	5.0	2.7
Running	0.7	0.8		0.3				0.3
Walking: short family / leisure walk	6.3	28.0	0.4	20.7	10.3	51.1	30.0	19.5
Rambling	0.3	7.6		1.7	0.8	10.2		3.1
Hill walking	2.3					6.6		1.7
Other walking	0.3			0.3		1.0		0.3
Picnic / BBQ		4.5		5.0	14.8			3.6
Art (e.g. sculpture trails)		0.8		0.0				0.1
Photography				0.3	2.1	0.3		0.4
Children's play				11.7	7.8	1.0		3.6
'Go Ape' high-wire adventure				17.4	0.4			3.4
Orienteering				1.0				0.2
Other activities (Specify)	0.3	2.3			15.6	8.5		4.3

4.2.4. Frequency of participation in main activity

Survey respondents were asked to indicate how often on average they participated in the main activity that they were undertaking on the day of interview (Question 9c). Overall, 12.6% of respondents did their main activity on a daily basis, 34.4% one-to-three times a week, 25.3% one-to-three times a month, 17.9% one-to-three times a year and 7.6% less often. The activities that were most likely to be undertaken on a daily basis included dog walking, running, endurance horse-riding, carriage driving, and dirt-jumping. Between one-third and two-thirds of the respondents that went mountain biking (cross-country, technical single-track and downhill), horse-riding (all types), nature-watching (all types), walking (all types), and photography did their chosen activity one-to-three times a week. Activities that were generally undertaken less than a few times a year included nature trails, art, and 'go ape'.

4.2.5. Facilities used in the forests

Question 10 of the survey asked respondents to indicate the facilities that they had used or planned to use during their trip to the forest. A detailed breakdown of the proportion of

visitors using various facilities is reported in Table 9. A summary of the key facilities used at each of the seven forests is provided below.

Glentress

The majority of visitors to Glentress used the mountain bike trails at the forest (69.1% used dedicated single-track trails, and 15.9% used the downhill trails), while just under half (48.2%) of visitors used the multi-purpose trails. Approximately one-quarter of visitors used the bike-wash facilities and the shower / changing rooms. In terms of mountain bike trail obstacles, 29.6% of riders used the jumps / drop-offs and 20.9% used the northshore trails. The car parks, toilets and the forest café were heavily used by approximately three-quarters of the visitors, while the forest shop was used by 26.9% of visitors. One third of visitors used information provided along the trails and in leaflets, while 15.3% used information from the internet. Horse-riding facilities and wildlife facilities were generally not used at Glentress.

Dyfnant

At Dyfnant forest, there was good use of dedicated horse-riding trails (18.2%) and nature trails (15.2%), with multi-purpose trails attracting 32.6% of visitors. The horse-specific facilities at Dyfnant were also heavily used with 17.4% of visitors using the horse corrals / tie-up points and 24.2% using the horse friendly parking facilities. The wildlife-viewing facilities were also well used with 25.0% of visitors using the hides and 18.9% using the viewing centre. In terms of the more general facilities, the car parks, toilets and the forest café were all heavily used (68.0%, 61.4% and 46.2% respectively). Visitors gathered information on the forest from the information provided along the trails (32.6%), at the forest centre (23.5%) and provided in leaflets (29.5%).

Cwm Carn

Visitors to Cwm Carn made extensive use of the dedicated single-track bike trails (80.8%) and the dedicated downhill bike trails (25.9%). There was also good use of the bike-wash facilities (30.5%), showers / changing rooms (15.4%) and jumps / drop-offs (16.9%). The majority of visitors used the car parking facilities (76.7%), toilets (68.4%) and the forest café (68.8%). Information about the forest was gathered from information provided along trails (17.7%), in leaflets (12.4%) and from the internet (10.9%). There was virtually no use of any horse-riding or nature-watching facilities at Cwm Carn.

Thetford

Visitors to Thetford tended to use multi-purpose trails (38.9%), dedicated single-track bike trails (21.6%) and dedicated nature tails (14.3%). However, due to the lack of facilities, there was little or no use of cycling, horse-riding or wildlife-specific facilities. The car park (89.4%), toilets (89.0%), and the forest café (79.4%) were all used by most of the visitors, while the forest shop (48.8%), BBQ / picnic areas (32.6%), children's play area (37.5%) and baby-changing (7%) facilities were all heavily used. Information about the forest was generally gathered along trails (22.3%), at the forest centre (18.9%) and in leaflets (26.6%).

New Forest

Visitors to the New Forest generally only used multi-purpose trails (47.7%), with some use of dedicated bike trails (9.1%). There was little use of cycle or horse-riding specific facilities, while there was some use of wildlife-viewing centres (9.9%). The car parks (72.0%), toilets (61.3%) and picnic areas (46.9%) were all heavily used, while there was some use of children's play areas (16.5%) and the forest shop (10.3%). Information about the forest was collected along trails (30.5%), from leaflets (16.9%) and at the forest centre (13.2%).

Rothiemurchus

The majority of visitors to Rothiemurchus (75.4%) used multi-purpose trails. There was little or no use of cycling or horse-riding facilities. Ten percent of visitors used dedicated nature

trails, with a further 6.6% using wildlife hides and 8.5% using wildlife-viewing centres. General facilities such as car parks (81.3%), toilets (70.8%) and the forest shop (46.9%) were used by the majority of visitors. Information provided on the site was used by approximately a third of visitors: information along trails (37.0%), in leaflets (38.0%) and at forest centre (27.5%). In addition, a significant number of visitors to Rothiemurchus attained information from forest staff (16.4%).

Whinlatter

Two-thirds of visitors to Whinlatter used the multi-purpose trails. Visitors also frequently used the horse-riding facilities at Whinlatter, including 20% using dedicated horse-riding trails, 25% using corrals / tie-up points and 30% using horse friendly car parking. In addition, 40.0% of visitors used wildlife hides and 35.0% used wildlife-viewing centres. General facilities were used less in Whinlatter than in other forests with car park being used by 40.0% of visitors, toilets by 50% of visitors, and forest shop and café each receiving 45.0% of visitors. Visitors to Whinlatter also used information along trails (35%), at the forest centre (40.0%) and in leaflets (25.0%). It should however be noted that only a small number of visitors were interviewed at Whinlatter and therefore the results will not be fully representative of visitors to the forest.

Table 9: Facilities used during trip by forest.

Facilities used	***Glentress***	**Dyfnant**	**Cwm Carn**	**Thetford**	**New Forest**	**Rothie-murchus**	**Whinlatter**
	(%)	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**
TRAILS							
Multi-user trails (walkers, bikers and horses)	48.2	32.6	20.3	38.9	47.7	75.4	65.0
Dedicated single-track bike trails	69.1	1.5	80.8	21.6	9.1	1.3	0.0
Dedicated downhill / four cross bike trails	15.9	0.0	25.9	4.3	1.2	0.3	0.0

Dedicated horse-riding trails	0.3	18.2	0.0	0.7	4.9	0.3	20.0
Dedicated nature trails	3.3	15.2	0.4	14.3	4.5	10.2	0.0
CYCLING FACILITIES							
Bike-wash	24.9	0.0	30.5	1.0	2.1	0.0	0.0
Showers / changing rooms	26.2	0.0	15.4	0.3	1.6	1.3	0.0
Jumps / drop-offs	29.6	0.0	16.9	5.0	0.8	0.0	0.0
North shore (raised wooden cycle trails)	20.9	0.0	5.3	1.0	0.8	0.0	0.0
HORSE-RIDING FACILITIES							
Horse corrals / tie-up points	0.0	17.4	0.0	0.0	0.0	0.0	25.0
Horsebox friendly parking	0.3	24.2	0.0	0.7	0.4	0.0	30.0
NATURE-WATCHING FACILITIES							
Wildlife hides	1.3	25.0	0.0	3.7	3.3	6.6	40.0
Wildlife-viewing centre	10.3	18.9	2.3	3.3	9.9	8.5	35.0
GENERAL FACILITIES							
Car parking	76.4	68.9	76.7	89.4	72.0	81.3	40.0
Toilets	72.8	61.4	68.4	89.0	61.3	70.8	50.0
Baby-changing facilities	0.3	0.8	1.5	7.0	1.2	1.0	0.0
Forest shop	26.9	30.3	22.6	48.8	10.3	46.6	45.0
Forest café	68.1	46.2	68.8	79.4	7.0	14.1	45.0
BBQ / picnic area	7.6	25.0	5.6	32.6	46.9	16.1	10.0
Children's play equipment	0.3	9.8	0.0	37.5	16.5	0.7	0.0
INFORMATION							
Information provided along trails	33.9	32.6	17.7	22.3	30.5	37.0	35.0
Information provided at forest centre	19.3	23.5	9.8	18.9	13.2	27.5	40.0
Information provided in leaflets	33.6	29.5	12.4	26.6	16.9	38.0	25.0
Information provided on internet	15.3	2.3	10.9	3.3	6.6	2.0	0.0
Information provided by forest staff	9.6	9.8	6.0	8.6	8.6	16.4	5.0

4.2.6. Proportion of respondents on first visit to forest

Question 11 of the survey asked respondents to indicate whether this current trip was their first trip to the forest. Analysis of this question is reported in Table 10. One third (34.4%) of respondents indicated that the current trip was indeed their first trip to the forest. In terms of variation between forests, Rothiemurchus and Whinlatter attracted the highest proportion of first-time visitors (45.9% and 40.0% respectively), while Glentress (25.1%) and Cwm Carn (28.7%) attracted the least number of first-time visitors (and hence more repeat visitors). Analysis by main activity indicates that nature watchers (43.7%) and general visitors (40.0%) were more likely to be first-time visitors than horse riders (23.4%) and cyclists (27.3%).

Table 10: Proportion of respondents on first trip to forest by forest and activity

	Cycling	Horse riding	Nature watching	General forest visitors	All activities
Glentress	25.1	0.0	25.9	27.7	**25.1**
Dyfnant	40.0	27.0	51.7	34.4	**36.4**
Cwm Carn	29.0	-	0.0	100.0	**28.7**

Thetford	20.0	50.0	54.2	42.2	**38.0**
New Forest	52.9	21.7	0.0	34.2	**31.8**
Rothiemurchus	0.0	-	63.3	45.3	**45.9**
Whinlatter	100.0	33.3	14.3	33.3	**40.0**
All Forests	**27.3**	**23.4**	**43.7**	**40.0**	**34.4**

Survey respondents were also asked to include how many trips they had made to the forests in the last 12 months for their main recreation activity (Table 11). Overall, cyclists and horse riders made, on average, 15 trips per year to the forest that they were interviewed at. Walkers, nature watchers and people doing other activities respectively made, on average, 8, 6 and 11 trips per annum to the forests. There was, however, some divergence between the forests. For example, cyclists tended to visit Thetford (21 trips), Cwm Carn (18) and Glentress (15 trips) more regularly than the other forests. Horse riders at Dyfnant and Thetford respectively made, on average, 14 and 20 visits a year. Although it appears that horse riders at Glentress make very frequent use of the forest, it should be noted that this estimate was based on only a small number of dedicated, local riders. Nature watchers generally made fewer repeat visits, with Thetford receiving the most with an average of 11 visits a year. Walkers to Glentress made on average 39 trips per year, with Cwm Carn receiving 26 trips per year.

Table 11: Mean number of trips made to a particular forest in last 12 months by activity.

Forest	Cycling	Horse-riding	Nature-watching	Walking / rambling	Other activities
Glentress	15.76	58.38	7.60	28.84	39.43
Dyfnant	5.36	14.32	4.69	6.00	6.93
Cwm Carn	18.45	-	2.50	13.21	26.38
Thetford	21.66	20.00	11.33	5.30	7.07
New Forest	3.24	7.14	7.19	8.62	9.08
Rothiemurchus	5.00	2.00	2.75	4.44	3.71
Whinlatter	-	9.50	4.43	4.33	
All Forests	**15.93**	**15.09**	**6.61**	**8.77**	**11.08**

5. Economic impact of forest recreation

In making recreational visits to forests, people will spend money on items such as travel, accommodation, food and drink, admissions, and equipment. If this money is spent locally, the expenditure may contribute towards the generation of local income and jobs. Economic impact analysis is a methodology that can be used to assess the size of these impacts. Economic impact analysis involves two stages of analysis. First, data needs to be collected on the mean 'local' expenditure of visitors to forests. This data may be collected using survey questionnaires. The mean expenditure data is aggregated to estimate the total injection of money into the local economy. The second stage in the analysis is to estimate the extent to which this total injection of expenditure creates income and jobs within the local economy. This is usually achieved by multiplying the total local expenditure with income and employment multiplier coefficients. In this study, the income multipliers were calculated using the Local Multiplier 3 (LM3) methodology, while the employment multiplier was borrowed from existing, related studies. In this section we report the findings from the economic impact analysis.

5.1. Local expenditure by visitors to forests

In this study, forest visitors were asked (in Question 26 of the main survey questionnaire) '*How much do you expect to spend today relating to your trip to this forest?*' This represents

the *direct* spending of visitors. Table 12 reports the average daily spend of forest visitors to the seven forests for the four main recreation activities.

The average spend across all visitors and all forests was £37.08 per day. A more meaningful analysis can be achieved by splitting this figure between day visitors and holiday visitors. Thus, mean spend of day visitors and holiday visitors were £13.29 and £60.52 respectively. The higher spend figure for holiday visitors is explained by the fact that the holiday visitors' spend includes the costs of accommodation. There was also variation in spend between activities. Horse riders were found to have significantly higher spend than the other activities, with an average spend for all horse rider expenditure of £136.28 per day (£20.15 for riders on day visits and £221.85 for riders on holiday). However, it should be noted that the high spend by horse riders was very much concentrated on the New Forest where the average spend was £219.40 per day (£54.76 for day visitors and £242.45 for holiday visitors). It is interesting to note that around a quarter of the horse riders sampled at the New Forest spend more that £500 per individual per day. Much of this high spend was due to expenditure on high quality accommodation, transportation and housing of horses and / or renting horses. Horse riders at the other forests, however, tended to have a more moderate spend: £66.67 at Glentress and less than £20 at the other forests. Nature watchers and general forest users had similar daily spends of £28.07 and £32.05 respectively, while cyclists generally spent slightly less at £23.35 per day. There were also widespread variations in 'All visitors' spend between the forests, with the highest daily spend being found at the New Forest (estimated at £89.23, although much of this is attributed to the horse riders), around £30 at Rothiemurchus, Glentress, and Whinlatter, around £20 at Dyfnant and Cwm Carn and as little as £10 at Thetford.

Table 12: Mean spend (£) per individual by forest and activity.

Forest	Activity	Mean spend All visitors (£)	Mean spend Day visitors (£)	Mean spend Holiday visitors (£)
Glentress	Cycling	£ 31.82	£ 15.28	£ 47.32
	Horse-riding	£ 66.67	-	£ 133.33
	Nature-watching	£ 5.28	£ 5.59	-
	General visitors	£ 11.84	£ 8.28	£ 14.98
	All visitors	*£ 28.16*	£ 12.48	£ 45.76
Dyfnant	Cycling	£ 5.83	£ 5.00	£ 7.50
	Horse-riding	£ 16.44	£ 15.47	£ 30.00
	Nature-watching	£ 13.54	£ 4.17	£ 15.42
	General visitors	£ 27.65	£ 7.34	£ 36.97
	All visitors	*£ 20.67*	£ 11.70	£ 29.17
Cwm Carn	Cycling	£ 19.53	£ 14.42	£ 41.11
	Nature-watching	-	-	-
	General visitors	-	-	-
	All visitors	*£ 19.08*	£ 14.00	£ 41.11
Thetford	Cycling	£ 8.08	£ 7.77	£ 8.00
	Horse-riding	£ 10.00	£ 10.00	-

	Nature-watching	£ 4.61	£ 5.09	£ 3.33
	General visitors	£ 10.18	£ 10.06	£ 10.02
	All visitors	*£ 9.17*	£ 9.12	£ 8.63
New Forest	Cycling	£ 46.91	£ 13.88	£ 65.26
	Horse-riding	£ 219.40	£ 54.76	£ 242.45
	Nature-watching	£ 28.80	£ 21.33	£ 40.00
	General visitors	£ 43.59	£ 9.80	£ 70.79
	All visitors	*£ 89.23*	£ 14.10	£ 131.74
Rothiemurchus	Cycling	£ 9.38	£ 10.00	£ 9.17
	Nature-watching	£ 61.19	£ 5.00	£ 66.07
	General visitors	£ 35.84	£ 23.76	£ 37.59
	All visitors	*£ 37.42*	£ 22.29	£ 39.72
Whinlatter	Cycling	£ 16.67	-	£ 16.67
	Horse-riding	£ 16.60	£ 6.67	£ 31.50
	Nature-watching	£ 62.14	£ 11.67	£ 100.00
	General visitors	-	-	-
	All visitors	*£ 33.41*	£ 9.17	£ 57.00
All forests	Cycling	£ 23.35	£ 14.01	£ 42.01
	Horse-riding	£ 136.28	£ 20.15	£ 221.85
	Nature-watching	£ 28.07	£ 6.27	£ 46.69
	General visitors	£ 32.05	£ 12.23	£ 43.36
	All visitors	*£ 37.08*	£ 13.29	£ 60.52

The data reported in Table 12 relate to total spending by forest visitors. However, only that proportion of spending which is retained locally will go on to generate indirect and induced impacts in the local economy. Table 13 reports the proportion of total spend that was spent locally in each forest by each of the four recreational user groups and for all visitors, as well as a split between day visitors and holiday visitors. The definition of 'local' used in the study was largely based on Forestry Commission regions in which the forests were located – see annex for definitions of local areas used. Overall, the highest level of local spend was found at Whinlatter (95%), Dyfnant (87%) and Rothiemurchus (83%). Cwm Carn (54%) and Glentress (57%) had lower levels of local spend. Although there was some variation in the proportion of local spend between day visitors and holiday visitors, as well as between different recreation activities, no clear pattern emerges from the data relating to any specific group of forest visitors that has a greater propensity to spend locally. The data from Table 12 and Table 13 was then combined to estimate the mean *local* spend of the alternative user groups in the seven forests. This data is presented in Table 14.

Table 13: Proportion of expenditures spent locally.

Forest	Activity	% local spend (All visitors)	% local spend (Day visitors)	% local spend (Holiday visitors)
Glentress	Cycling	56.7	62.4	51.5
	Horse-riding	60.0	0.0	100.0
	Nature-watching	55.6	58.8	0.0
	General visitors	65.2	72.7	58.3
	All visitors	57.7	61.7	53.3
Dyfnant	Cycling	100.0	100.0	100.0
	Horse-riding	77.6	76.7	90.0
	Nature-watching	89.4	70.0	93.6
	General visitors	92.3	87.5	94.7
	All visitors	87.3	80.5	94.2
Cwm Carn	Cycling	53.7	50.5	66.4
	Nature-watching	80.0	80.0	-
	General visitors	-	-	-

	All visitors	54.0	51.0	66.4
Thetford	Cycling	77.8	85.0	57.3
	Horse-riding	100.0	100.0	-
	Nature-watching	54.5	62.5	33.3
	General visitors	73.4	71.4	81.3
	All visitors	72.9	73.9	69.3
New Forest	Cycling	73.7	64.5	77.8
	Horse-riding	84.1	80.0	84.7
	Nature-watching	85.0	75.0	100.0
	General visitors	67.3	51.4	79.5
	All visitors	75.4	63.8	81.6
Rothiemurchus	Cycling	62.5	100.0	50.0
	Nature-watching	67.8	15.0	72.0
	General visitors	85.9	87.5	85.6
	All visitors	83.5	84.2	83.3
Whinlatter	Cycling	100.0	-	100.0
	Horse-riding	86.0	100.0	65.0
	Nature-watching	100.0	100.0	100.0
	General visitors	100.0		
	All visitors	95.9	100.0	92.2
All forests	Cycling	57.5	56.6	59.2
	Horse-riding	86.6	89.0	85.0
	Nature-watching	71.9	65.0	77.8
	General visitors	78.8	69.0	83.9
	All visitors	70.7	63.6	77.2

Table 14: Mean direct spend (£) in local economy.

Forest	***Activity***	***£ local spend (All visitors)***	***£ local spend (Day visitors)***	***£ local spend (Holiday visitors)***
Glentress	Cycling	£18.04	£9.53	£24.37
	Horse-riding	£40.00	-	£133.33
	Nature-watching	£2.94	£3.29	-
	General visitors	£7.72	£6.02	£8.73
	All visitors	£16.25	£7.70	£24.39
Dyfnant	Cycling	£5.83	£5.00	£7.50
	Horse-riding	£12.76	£11.87	£27.00
	Nature-watching	£12.10	£2.92	£14.43
	General visitors	£25.52	£6.42	£35.01
	All visitors	£18.04	£9.42	£27.48
Cwm Carn	Cycling	£10.49	£7.28	£27.30
	Nature-watching	-	-	-
	General visitors	-	-	-
	All visitors	£10.30	£7.14	£27.30
Thetford	Cycling	£6.29	£6.60	£4.58

	Horse-riding	£10.00	£10.00	-
	Nature-watching	£2.51	£3.18	£1.11
	General visitors	£7.47	£7.18	£8.15
	All visitors	£6.68	£6.74	£5.98
New Forest	Cycling	£34.57	£8.95	£50.77
	Horse-riding	£184.52	£43.81	£205.36
	Nature-watching	£24.48	£16.00	£40.00
	General visitors	£29.34	£5.04	£56.28
	All visitors	£67.28	£9.00	£107.50
Rothiemurchus	Cycling	£5.86	£10.00	£4.59
	Nature-watching	£41.49	£0.75	£47.57
	General visitors	£30.79	£20.79	£32.18
	All visitors	£31.25	£18.77	£33.09
Whinlatter	Cycling	£16.67	-	£16.67
	Horse-riding	£14.28	£6.67	£20.48
	Nature-watching	£62.14	£11.67	£100.00
	General visitors	-	-	-
	All visitors	£32.04	£9.17	£52.55
All forests	Cycling	£13.43	£7.93	£24.87
	Horse-riding	£118.02	£17.93	£188.57
	Nature-watching	£20.18	£4.08	£36.32
	General visitors	£25.26	£8.44	£36.38
	All visitors	£26.22	£8.45	£46.72

Having identified mean *local* spend according to a range of different user groups (Table 14), the data was then aggregated to generate estimates of the aggregate direct local expenditure made in each forest over the course of a given year. This was be achieved by multiplying the mean local spend figures (Table 14) with estimates of the annual number of visits made to each forest in each category (Table 15). The aggregate direct local spending figures are shown in Table 16. A significant concern for this analysis was the lack of detailed official data on visitor numbers by types of activity and by day/holiday visitor categories at each of the case study forests. To overcome this issue, data from a range of relevant studies was used to produce estimates of visitor numbers for this analysis. Table 15 therefore provides our best estimate of the annual number of visitors to each forest, disaggregated by activity and type of visitor.

Table 15: Estimates of visitor numbers at forests by activities

Forest	***Activity***	***Estimated annual visitor numbers (All visitors)***	***Estimated annual visitor numbers (Holiday visitors)***	***Estimated annual visitor numbers (Day visitors)***
Glentress	Cycling	127,300	101,840	25,460
	Horse-riding	3,800	3,040	760
	Nature-watching	15,200	12,160	3,040
	General visitors	43,700	34,960	8,740
	All visitors	190,000	152,000	38,000
Dyfnant	Cycling	386	231	154
	Horse-riding	2,826	143	2,683
	Nature-watching	2,160	1,534	626
	General visitors	4,629	2,777	1,851
	All visitors	10,000	4,685	5,315
Cwm Carn	Cycling	92,857	78,000	14,857

	Nature-watching	1,786	1,500	286
	General visitors	357	300	57
	All visitors	95,000	79,800	15,200
Thetford	Cycling	319,500	28,755	290,745
	Horse-riding	6,000	540	5,460
	Nature-watching	63,000	5,670	57,330
	General visitors	1,111,500	100,035	1,011,465
	All visitors	1,500,000	135,000	1,365,000
New Forest	Cycling	500,500	50,050	70,070
	Horse-riding	71,500	7,150	10,010
	Nature-watching	214,500	21,450	30,030
	General visitors	6,363,500	636,350	890,890
	All visitors	7,150,000	715,000	1,001,000
Rothiemurchus	Cycling	35,000	7,700	27,300
	Nature-watching	50,000	11,000	39,000
	General visitors	165,000	36,300	128,700
	All visitors	250,000	55,000	195,000
Whinlatter	Cycling	31,181	23,386	7,795
	Horse-riding	10,393	7,795	2,598
	Nature-watching	89,386	67,040	22,346
	General visitors	76,914	57,685	19,228
	All visitors	207,876	155,907	51,969

As outlined above, the annual visitor number figures (Table 15) were multiplied by the mean spend figures (Table 14) to generate an estimate of the aggregate local spend (Table 16). We now discuss this data and underlying assumptions for each forest in turn.

- *Glentress*

Data from the Forestry Commission's (2002b) *Scottish Borders Visitor Survey* indicate that Glentress forest receives 190,000 visits annually. The same report also indicates that 20% of visits to the forest were holidaymakers and the remaining 80% were day visits. In terms of activities, the report also suggests that around 67% of the sample went cycling, around 2% horse-riding and around 8% nature-watching, leaving the remaining 23% of the sample to be classified as our general visitor category. Our estimate of annual number of visits to Glentress by activity and type of visitor is reported in Table 15. Combining this data with data on mean local spend (Table 14) suggests that the aggregated local spend associated with visits to Glentress is in the region of £2.02 million per annum (Table 16). Of this, the majority (£1.59 million) is associated with the spending of cyclists, with the remaining being split between general visitors (£0.28 million), horse riders (£0.10 million) and nature watchers (£0.04 million).

- *Dyfnant*

No official data was available on the total number of visits made to Dyfnant forest. An alternative approach was therefore adopted whereby the estimate of total visits to Dyfnant forest was based on an estimate of visits to a similar forest in the area, Hafren forest, which according to the Forestry Commission's (2005) *Wales 'all forest' survey* has an estimated 19,000 visits a year. The local forest manager, however, suggests that Hafren forest attracts about twice as many visits as Dyfnant forest. Therefore, it was assumed that the total number of visits to Dyfnant forest was in the region of 10,000 visits per annum. Information from our survey (Table 4) was then used to allocate these visits between the various activities and type of visitor. An estimate of the total local spend was again estimated by multiplying the annual number of visits with the mean local spend of the different user groups. It was thus estimated that the total local expenditure associated with visits to Dyfnant forest was in the region of

£0.18 million per annum (Table 16). The majority (£0.15 million) related to day visits. In terms of activities, most of the spend is associated with general forest visitors (£0.12 million), with horse-riding and nature-watching contributing £36,000 and £26,000 respectively.

- *Cwm Carn*

The *All Forests Monitoring survey* for Wales estimates that there were 95,000 visits to Cwm Carn in 2004 (Tns Travel and Tourism, 2004a). This data was then combined with data from the Forestry Commission's (2002a) *Cwm Carn Visitor Survey* which indicated that around 16% of all visits to the forest are holidaymakers, the remaining 84% being day visits. Since the majority of visits to Cwm Carn appear to be cyclists and also the fact that our data on mean local visitor spend (Table 14) almost entirely related to cyclists (there were too few respondents undertaking other activities to allow meaningful estimates of mean spend to be made) it was decided to base estimates of aggregate spend in Cwm Carn solely on the spend of cyclists. Thus, we assume that spending by cyclists is reasonably representative of all visitors to the forest. Based on the above data, it was estimated that the aggregate spend by visitors to Cwm Carn is £0.98 million per annum; of which £0.57 million comes from day visits and £0.41 million come from holiday visits (Table 16).

- *Thetford*

Information reported on the Forestry Commission website (http://www.forestry.gov.uk) suggests that there are 1.5 million visits annually to Thetford forest. Other data from a recent visitor satisfaction survey at Thetford suggest that 21.3% of visits to Thetford were cyclists, 0.4% horse riders, 4.2% nature watchers and the remaining 74.1% general visitors. Finally, it is reported that 9% of visits to the forest were holidaymakers while the remainder were day visits (Pers. Comm.: Giles Brockman). Based on this information, estimates of the number of visits by activity and type were made and are reported in Table 15. Combing this information with the mean spend data (Table 14) gives an all visitor spending figure of £10.37 million per annum (Table 16), the majority of which (£9.42 million) comes form day visits. In terms of the activities undertaken, spending by cyclists accounted for £2.05 million, while nature watchers and horse riders accounted for £0.88 million and £0.05 million respectively. However, by far the greatest injection of spending was made by general visitors who spend £8.08 million.

- *New Forest*

In the New Forest, there are an estimated 7.15 million visits (see http://www.thenewforest.co.uk). A recent study by the Forestry Commission (2004a) suggests that 76% of these are local visitors, 10% day visitors and 14% holiday visitors. Since local visitors are unlikely to contribute additional expenditures into the local economy these are excluded from the analysis. Therefore our base estimate of the number of visits to the New Forest was 715,000 day visits and 1,001,000 holiday visits. The most recent New Forest Visitor Survey provided further information on the split of activities. These figures suggested that cycling was the principal activity around 7% of all visitors, horse-riding the main activity of around 1% of visits and nature-watching the primary concern of 3% of visits. The remaining 89% of visits were classified as general visitors. Table 15 provides the breakdown of number of visits by type of visitor and activity. Multiplying this data on visits with mean local spend (Table 14) provided an estimate of the aggregate injection of spend into the New Forest local economy. Thus, the total aggregate spend in New Forest was estimated to be just over £61 million per annum (Table 16). The majority of this spend (£56.95 million) came from holiday visits. In terms of activities, the majority of spend came from general visitors: £53.35 million. Cyclists, nature watchers and horse riders contributed £4.00 million, £2.37 million and £1.54 million respectively.

- *Rothiemurchus*

It was estimated that there are around 250,000 visits made annually to Rothiemurchus estate (Pers. Comm.: Stuart Blackhall). Unfortunately, there are no official figures on the breakdown of the activities undertaken on the estate, or information on whether the visitors were on day trips or holiday trips. However, a recent visitor survey undertaken in the Highlands (George Street Research Ltd, 2003) provides this information for the Badenoch and Strathspey district in which Rothiemurchus is located. In this study, it was estimated that 78% of visits were holiday trips, with the remaining being day trips. In terms of activities, 14% of visits involved cycling and around 20% involved nature-watching. Table 15 again provides a breakdown of the annual number of visits between activities and type of visitor. Multiplying these figures with the estimated mean spend (Table 14) generated an estimated annual local spend associated with trips to Rothiemurchus of £6.96 million (Table 16). Again the majority of the spend came from holiday-based visits: £6.12 million. Cycling and nature-watching respectively accounted for £0.20 million and £1.86 million of the local spend, while general visitors accounted for £4.89 million.

- *Whinlatter*

For Whinlatter Forest an estimate of 209,436 visits per year was used (based on data collected for the 2004-05 financial year; Pers. Comm.: Adrian Jones). Of this figure 1,560 were school children. These were removed to leave 207,876 visits. This figure included an estimated 90,000 visits who had come specifically to view the ospreys, representing some 43% of all visits. A further 15% were estimated to be cyclists and an additional 5% horse riders. The remainder were classified as general visitors. No data are available on the split between day visits and holiday visits, but 25% holiday visits to 75% day visits was considered to be a fair estimate (Pers. Comm.: Adrian Jones). The split of annual trips between activity and type of visitor is again reported in Table 15. The estimated total spend in the Whinlatter local economy was £3.25 million per year. However, it should be noted that in our survey we did not sample general visitors at Whinlatter and therefore we do not have expenditure data on this group. Thus, we were unable to derive a figure for the aggregate spend from general visitors at Whinlatter. Thus, our above estimate of £3.25 million excluded general visitors. However, if we assume that the mean spend of general visitors to Whinlatter is similar to the average for all forest as reported in Table 14 (£12.23 for day visitors and £43.36 for holiday visitors), then it is estimated that the expenditure of general visitors to Whinlatter is in the region of £1.54 million. This brings the aggregate total local spend associated to Whinlatter forest to £4.79 million (Table 16). In terms of other activities, cycling, horse-riding and nature-watching respectively contributed £0.13 million, £0.11 million and £3.02 million to the local economy.

Table 16: Aggregate direct local spend by all visitors.

Forest	***Activity***	***All visitors (£ million)***	***Holiday visitors (£ million)***	***Day visitors (£ million)***
Glentress	Cycling	£1.59	£0.62	£0.97
	Horse-riding	£0.10	£0.10	£0
	Nature-watching	£0.04	£0	£0.04
	General visitors	£0.29	£0.08	£0.21
	All visitors	£2.02	£0.80	£1,22
Dyfnant	Cycling	£0.00	£0.00	£0.00
	Horse-riding	£0.04	£0.00	£0.07
	Nature-watching	£0.03	£0.00	£0.01
	General visitors	£0.12	£0.02	£0.06
	All visitors	£0.18	£0.03	£0.15

Cwm Carn	Cycling	£0.98	£0.41	£0.57
	Nature-watching	-	-	-
	General visitors	-	-	-
	All visitors	£0.98	£0.41	£0.57
Thetford	Cycling	£2.05	£0.13	£1.92
	Horse-riding	£0.05	£0	£0.05
	Nature-watching	£0.19	£0.01	£0.18
	General visitors	£8.08	£0.82	£7.26
	All visitors	£10.37	£0.95	£9.42
New Forest	Cycling	£4.01	£3.56	£0.45
	Horse-riding	£2.37	£2.056	£0.31
	Nature-watching	£1.54	£1.20	£0.34
	General visitors	£53.37	£50.14	£3.21
	All visitors	£61.26	£56.96	£4.31
Rothiemurchus	Cycling	£0.20	£0.13	£0.08
	Nature-watching	£1.86	£1.86	£0.01
	General visitors	£4.90	£4.14	£0.75
	All visitors	£6.96	£6.12	£0.84
Whinlatter	Cycling	£0.13	£0.13	£0
	Horse-riding	£0.11	£0.05	£0.05
	Nature-watching	£3.02	£2.23	£0.78
	General visitors[1]	£1.54	£0.83	£0.71
	All visitors	£4.79	£3.25	£1.54

Notes: 1 – these figures are based on the assumption that the mean spend of general visitors to Whinlatter are similar to the mean spend of visitors to the other forest sampled in this research.

5.2. Economic impact of visitor spend in forests

Above, we have outlined the aggregated local spend associated with visits to our case study forests. The economic (income and employment) impacts of this spend were also investigated.

5.2.1. Local income impacts

The local income impacts generated from the expenditures of visitors to the forests were estimated using the Local Multiplier 3 (LM3) method. In LM3 analysis, businesses receiving income from forest visitors were asked to complete an LM3 questionnaire. In this questionnaire, businesses were asked to identify the proportion of business spend that is re-spent within the local economy and the proportion of which is spent outside the local economy. In addition to the expenditure survey, businesses were also asked to collect information from their employees on what proportion of the employees' income was spend locally. The aggregate levels of local income generated from visitor spend can thus be estimated by multiplying the aggregated visitor spend with the LM3 coefficient. The LM3 coefficient is a measure of the extent to which expenditures within a local economy generates income in that economy. In our analysis, we adopt two approaches to this. Further details of the LM3 method can be found in the technical annex to this report.

Marginal local income impacts

First, we derived estimates of the marginal income impacts generated from a day's visit to the various forests for different activities and types of visitors. These estimates are reported in Table 17. Thus, for example, the figures shown in Table 17 suggest that for each additional cyclist attracted to Glentress forest on a day visit we can expect up to an additional £15.72 to enter into the local economy in the form of direct, indirect and induced income. As might be expected, the figures shown in Table 17 suggest a substantially higher marginal increase in local incomes associated with holiday visits in comparison to day visits. It is important to note that due to the way in which these data have been calculated, this difference is entirely attributable to the difference in spend between visitors undertaking these two types of visit. Indeed, one might expect holiday visitors to spend more per day because they will have additional accommodation, food and drink and entertainment costs to cover in the course of their overnight stay away from home. The figures do, however, give some indication of the size of the differential, which clearly varies according to the nature of the activity being undertaken. Thus in the case of horse-riding, encouraging a visitor to stay overnight in the local area might be expected to add an extra £311.14 into the local economy compared to a £29.58 for day visitors. Encouraging overnight stay by an additional nature watcher, on the other hand, may be expected to add £59.93 to the local economy compared to £6.73 for a day visitor. Meanwhile, general visitors add £60.03 if they stay overnight. Cyclists, on the other hand, add the least to local incomes by staying overnight; the estimate income being £41.04. In general, the additional local income that might be expected to arise if a forest visitor can be persuaded to stay overnight in the area is £77.09 compared to £13.94 for day visitors.

Total income generated in local economy

By applying multiplier analysis to the figures shown in Table 16, it was also possible to estimate the total amount of local income generated from visitor spending. This data is shown in Table 18, below. The figures shown in Table 18 represent the total income – direct, indirect and induced – attributable to all forms of the recreation in each of the forests concerned. Generally, forest recreation was found to generate the greatest local income impacts at the New Forest: £101 million per annum. More moderate estimates of income generation were found at the other forests, with Thetford estimated to generate an additional £17.1 million per annum, Rothiemurchus (£11.4 million per annum), Whinlatter (£7.0 million per annum), Glentress (£3.3 million per annum), Cwm Carn (£1.6 million per annum) and Dyfnant (£0.30 million per annum). The estimates in Table 18 are our best estimates with current levels of data and generally do appear to be within the expected range.

Table 17: Marginal income (£) generated in local economy associated with a day's visit to the forests for different activities and types of visit.

Forest	***Activity***	***All visitors (£)***	***Day visitors (£)***	***Holiday visitors (£)***
Glentress	Cycling	£29.77	£15.72	£40.21
	Horse-riding	£66.00	-	£219.99
	Nature-watching	£4.85	£5.43	-
	General visitors	£12.74	£9.93	£14.40
	All visitors	£26.81	£12.71	£40.24
Dyfnant	Cycling	£9.62	£8.25	£12.38
	Horse-riding	£21.05	£19.59	£44.55
	Nature-watching	£19.97	£4.82	£23.81
	General visitors	£42.11	£10.59	£57.77
	All visitors	£29.77	£15.54	£45.34
Cwm Carn	Cycling	£17.31	£12.01	£45.05
	Nature-watching	-	-	-
	General visitors	-	-	-

	All visitors	£17.00	£11.78	£45.05
Thetford	Cycling	£10.38	£10.89	£7.56
	Horse-riding	£16.50	£16.50	-
	Nature-watching	£4.14	£5.25	£1.83
	General visitors	£12.33	£11.85	£13.45
	All visitors	£11.02	£11.12	£9.87
New Forest	Cycling	£57.04	£14.77	£83.77
	Horse-riding	£304.46	£72.29	£338.84
	Nature-watching	£40.39	£26.40	£66.00
	General visitors	£48.41	£8.32	£92.86
	All visitors	£111.01	£14.85	£177.38
Rothiemurchus	Cycling	£9.67	£16.50	£7.57
	Nature-watching	£68.46	£1.24	£78.49
	General visitors	£50.80	£34.30	£53.10
	All visitors	£51.56	£30.97	£54.60
Whinlatter	Cycling	£27.51	-	£27.51
	Horse-riding	£23.56	£11.01	£33.79
	Nature-watching	£102.53	£19.26	£165.00
	General visitors[1]	-	-	-
	All visitors	£52.87	£15.13	£86.71
All forests	Cycling	£22.16	£13.08	£41.04
	Horse-riding	£194.73	£29.58	£311.14
	Nature-watching	£33.30	£6.73	£59.93
	General visitors	£41.68	£13.93	£60.03
	All visitors	£43.26	£13.94	£77.09

Table 18: Aggregate total income (direct, indirect and induced) by all visitors.

Forest	***Activity***	***All visitors (£ million)***	***Day visitors (£)***	***Holiday visitors (£)***
Glentress	Cycling	£2.63	£1.02	£1.60
	Horse-riding	£0.17	£0.17	-
	Nature-watching	£0.07	-	£0.07
	General visitors	£0.47	£0.13	£0.35
	All visitors	£3.33	£1.32	£2.01
Dyfnant	Cycling	£0.00	£0.00	£0.00
	Horse-riding	£0.06	£0.00	£0.12
	Nature-watching	£0.04	£0.01	£0.01
	General visitors	£0.19	£0.03	£0.11
	All visitors	£0.30	£0.05	£0.24
Cwm Carn	Cycling	£1.62	£0.68	£0.94
	Nature-watching	-	-	-
	General visitors	-	-	-
	All visitors	£1.62	£0.68	£0.94

Thetford	Cycling	£3.38	£0.22	£3.17
	Horse-riding	£0.09	-	£0.09
	Nature-watching	£0.31	£0.01	£0.30
	General visitors	£13.33	£1.35	£11.98
	All visitors	£17.11	£1.57	£15.54
New Forest	Cycling	£6.61	£5.87	£0.74
	Horse-riding	£3.91	£3.39	£0.52
	Nature-watching	£2.55	£1.98	£0.57
	General visitors	£88.02	£82.73	£5.29
	All visitors	£101.09	£93.97	£7.11
Rothiemurchus	Cycling	£0.33	£0.21	£0.13
	Nature-watching	£3.07	£3.06	£0.01
	General visitors	£8.08	£6.83	£1.25
	All visitors	£11.49	£10.10	£1.39
Whinlatter	Cycling	£0.21	£0.21	-
	Horse-riding	£0.17	£0.09	£0.09
	Nature-watching	£4.98	£3.69	£1.29
	General visitors[1]	£2.54	£1.38	£1.16
	All visitors	£7.91	£5.37	£2.54

5.2.2. Local employment generated from visitor spend.

The data on visitor spend can also be used to estimate the contribution that forest recreation makes in terms of generating employment in the local economy. In this application, rather than creating new employment multiplier coefficients for each forest, we adopt the rather crude approach of 'borrowing' a coefficient from a study that has similar local circumstances. The Type II employment multiplier coefficient used in this exercise was taken from the Christie and Matthews' (2003) study which examined the impact of walking in England.

In this study, the multiplier coefficient used suggests that the injection of £34,000 spend in the local economy would generate one additional full-time equivalent (FTE) job. Based on this, it is estimated that forest recreation generates between 5 FTE jobs (Dyfnant) to 1802 FTE jobs (New Forest).

Table 19: Employment (FTEs) associated with forest recreation

Forest	*Estimated annual number of FTE created*
Glentress	59.4
Dyfnant	5.3
Cwm Carn	29.0
Thetford	305.0
New Forest	1802.0
Rothiemurchus	204.8
Whinlatter	140.9

6. Travel cost (count model) analysis

Estimates of consumers' surplus values per visit for a range of forest recreation user groups may be generated using a travel cost 'count' model. The count model is based on data collected on the number of trips made to the forest during the last 12 months. An index of the availability/travel cost of access to alternative sites (e.g. other forests) can also be included in such a model, along with an index of the comparative quality of these alternative sites. In this research, user-group-specific count models were used to produce estimates of per-trip consumers' surplus by alternative recreation user, e.g. cyclists, horse riders, etc. Further details of the theory and analysis of the count models can be found in the technical annex to this report. Estimates of the per-trip values for five alternative forest recreation activities were estimated using the inverse of the travel cost parameter from the respective count models. We restricted each model to those observations where participants had driven no more than two hours (one way) to access the forest, on the grounds that this was a good way of excluding from the analysis those staying overnight (since how to model overnight trips in a travel cost framework is unclear). These per-trip (consumers' surplus) values for five recreation user groups are report in Table 20.

Table 20: Point estimates of consumers' surplus per visit, £/trip.

User type	*Effective sample size*	*Consumers' surplus*

Cyclists	322	£14.97
Horse riders	81	£14.20
Nature Watchers	104	£7.90
Walkers	416	£14.51
Others	416	£14.99

As may be seen, the per-trip values for cyclists, horse riders, walkers and 'others' are all very close to each other in magnitude. Only the consumers' surplus for nature watchers is appreciably lower.

7. Contingent Behaviour Models

The objective of the contingent behaviour model was to estimate changes in the value associated with improvements to recreational facilities in forests. Four groups of forest users were studied in this analysis: cyclists, horse riders, nature watchers, and general forest visitors. In each group, respondents were asked how their behaviour, in terms of the intended number of trips to the forest where they were sampled, would change if facilities at the forest changed. The forest improvement scenarios used in the contingent behaviour analysis are presented in Table 21 below. Note that each respondent was only asked about one of these improvements.

Table 21: Description of forest enhancement scenarios used in the contingent behaviour analysis.

Cyclists A *– "suppose that next year a range of new optional trail obstacles were built along side the existing mountain bike trails at this forest. The types of challenges would include jumps, drop-offs, and sections of 'northshore' (raised wooden bike trails)."*
Cyclists B *– "suppose that new shower and changing facilities were built at this forest next year. These facilities would be free to use and would include showers, changing room, and secure lockers."*
Horse riders E *– "suppose that next year a range of new optional trail obstacles were built along side the existing horse trails at this forest. The types of challenges would include jumps and ditches. The severity of these challenges would range from easy to difficult. All challenges would be situated on a short loop off the main horse trail and therefore would not directly affect the difficulty of existing trails."*
Horse riders F *– "suppose that a new horse-friendly parking facility was built at this forest next year. This facility would be free to use and would include: horsebox friendly parking facilities that had plenty of room to park and manoeuvre large vehicles with horseboxes; safe horse corrals (pens) and tie-up points."*
Nature watchers I *– "suppose that next year several new wildlife-viewing hides were built at various locations within this forest. The hides would be built throughout the forest in areas where various types of wildlife are known to congregate. All of the hides are likely to be located at least 1 mile from a car park and several will be built in quiet remote areas of the forest over 5 miles from a car park. Although all hides would be accessible by trails, these trails generally would not be suitable for pushchairs / wheelchairs."*
Nature watchers J *– "suppose that next year a new wildlife-viewing centre was built at a central location within this forest. It is expected that you would be able to see a variety of birds and some large mammals from the centre. Active wildlife management (including the use of feeding stations) would be used to attract the wildlife to the centre. The viewing centre would be built near a main car park in the forest. The viewing centre would be accessible using a short 'all access' path suitable for pushchairs and wheelchairs".*
Forest visitors M *– "suppose that next year a new art / sculpture trail was built within this forest. The art / sculpture trail would be approximately 1 to 2 miles long. The art / sculpture exhibits would depict images of the forest / countryside and be built with materials that blend in with the forest. The actual trail would be suitable for people of all abilities."*
Forest Visitors N *– "suppose that next year a new family play facility was built at a central location within this forest. The play facilities would include play equipment for all ages including: an enclosed safe play area for toddlers; traditional and 'adventure' play facilities for older children; and high-wire 'Go Ape' facilities for teenagers (and the odd adult!). All facilities would be built with material that blends in with the forest."*

Thus, eight contingent behaviour models were estimated, using the same criterion for inclusion as in the travel cost count models (no more than 2 hours travel time one-way). Details of these models are provided in the technical annex to this report. Two steps are needed to estimate the recreation benefits from the improvement scenarios. First, the number of trips under current and hypothetical 'improved' conditions needs to be predicted to calculate the change in predicted trips (note that we compare predicted trips under current conditions with predicted trips under changed conditions – not actual trips). Second, the travel cost parameter estimated from the contingent behaviour models is used to value this increase in predicted trips in monetary terms. Table 22 gives the predicted trips for six contingent behaviour models under current and improved situations. Note that the contingent behaviour models for horse riders was insignificant and therefore further analysis was not possible of this group.

Table 22: Predicted visits per year under different conditions

	Predicted trips under current conditions	Predicted trips under improved conditions	% change in trips over base
Cyclists A	3.48	3.66	5.2%
Cyclists B	15.38	15.43	0.3%
Nature Watchers I	15.91	16.66	4.5%
Nature Watchers J	15.45	15.82	2.4%
General Visitors M	2.51	2.63	4.5%
General Visitors N	2.05	2.26	10.2%

Several features are apparent from this table. First, cyclists were predicted to make more trips under both conditions than general forest visitors, but about the same number of trips in version B as nature watchers. Second, the increase in predicted trips across all scenarios was small – between 0.3% and 10.2%. This accords with results reported in Hanley *et al.* (2003) which also used this methodology, and produced increases in trips of less than 10%. The biggest proportional change in visits is from investing in a family play facility, since this increases general purpose visits by 10.2%. The smallest increase is from investing in shower and changing facilities for cyclists.

Table 23, column 2, gives the estimates of consumers' surplus per visit from the contingent behaviour models – this can be thought of as a consumers' surplus estimate which takes into account the improvement in site condition. This point estimates was then multiplied by the change in the number of trips (the 'contingent behaviour' dummy variable) to provide an estimated of the annual value the change in predicted trips associated with the improvements to recreation facilities (last column in Table 23).

As may be seen, the biggest values are attached to providing new family play facilities (8.75) and installing new wildlife hides (£7.89). A benefit of £3.46/visitor/year is generated by constructing new mountain bike trails, and a rather similar benefit of £3.30 generated by constructing a new wildlife centre. Only a small value is associated with shower and changing facilities (£0.66).

Table 23: Value of different forest improvements

Improvement scenario	CS/trip £	Change in number	**Economic**

	(point estimate)	of predicted trips	**benefits of improvements per visitor per year (£)**
Cyclists A: New optional trail obstacles built alongside existing bike trails.	19.23	0.18	3.46
Cyclists B: New shower and changing facilities provided at the forest.	13.33	0.05	0.66
Nature Watchers I: several new hides built in forest	10.52	0.75	7.89
Nature Watchers J: new wildlife centre built	8.93	0.37	3.30
General Visitors M: New art / sculpture trails.	23.25	0.12	2.79
General Visitors N: New family play areas provided at the forest.	41.67	0.21	8.75

8. Choice experiments model

The aim of the choice experiments (CE) model was to estimate of the value of changes in consumers' surplus values associated with improvements to a range of forest recreation attributes.

The CE method relies on surveys to gather data. Within the survey, respondents are presented with a series of choice tasks in which they are asked to choose their preferred policy option from a list of (usually) three options; one of which normally includes the status quo or do-nothing option. Each choice option is described in terms of attributes; in this case facilities provided at the hypothetical forests and a travel distance attribute (which was used to present the 'price' attribute. An alternative, but rarely used option is to use frequency of use data in the choice experiment instead of the traditional choice-based choice data. In this application, we used both a choice-based and frequency-based choice task.

Four versions of the CE model were developed; one for each of the recreation user groups: cyclists, horse riders, nature watchers and general visitors. The forest recreation attributes and levels used in the CE model were based on information collected in the review of literature and the recreational-user and forest-manager interviews (as described in the Phase 1 report; (Christie et al., 2005). In each of the four recreation groups, seven attributes were specified (see Table 24 for summary of attributes). See Figure 1 for an example of a typical choice task.

Table 24: Summary of attributes used in the CE model.

CYCLING	HORSE-RIDING	NATURE-WATCHING	GENERAL FOREST USERS
Type of trails	Type of trails	Trails / routes	Walking trails
Optional trail obstacles	Optional obstacles	Hides	Mountain bike trails
Bike-wash facilities	Horsebox friendly parking	Wildlife-viewing centres	Horse-riding trails
Changing and Shower facilities	Horse corrals and tie-up point	Guided nature walk	Nature trails / wildlife hides
General facilities	General facilities	General facilities	General facilities
Information	Information	Information	Information
Surroundings	Surroundings	Surroundings	Surroundings
Distance	Distance	Distance	Distance

Analysis of respondent choices was undertaken using a conditional logit model. The parameters from these models can then be used to estimate implicit prices (economic values) for each level of provision of each of the forest recreation attributes. In what follows, we present these implicit prices. Further details of the theory and analysis of the choice experiment, along with the actual descriptions of the attributes and levels used in the choice tasks can be found in the technical annex to this report.

	Forest A	Forest B
Type of trail	Multi-use trails + dedicated way-marked, long-distance (+ 20 miles) cross-country bike trails.	Multi-use trails + dedicated technical single-track mountain bike trails.
Optional trail obstacles	No optional trail obstacles.	A range of optional trail obstacles provided including jumps, drop-offs, and north shore.
Bike-wash facilities	Bike-washing facilities available.	No bike-wash facilities.
Changing and shower facilities	Changing / shower facilities available.	No changing / shower facilities.
General facilities	Facilities included car parking, toilets, BBQ / picnic area, café and forest shop.	Facilities include car parking and toilets only.
Information	Only basic information on the forest, trails, and wildlife provided.	Detailed and up-to-date information on the forest, trails, and wildlife provided at forest centre, in leaflets, along trails and on website
Surrounding	Forest not managed to increase opportunities to view wildlife, points of interest and view points.	Forest enhanced to increase opportunities to view wildlife, features of interest and view points.
Distance	Forest located **300 miles** from your home.	Forest located **150 miles** from your home.

My preferred forest is:	**Forest A** ə	**Forest B** ə

I would allocate my next 5 trips (to be taken within the next year) to:	**Forest A** ə	**Forest B** ə	**Stay at home** ə

Figure 1: Example of a CE choice task

8.1. Results from the choice experiment

In this results section, we report the implicit prices for a series of CE models for each of the main recreation users groups: cyclists, horse riders, nature watchers and general forest users.

8.1.1. Cyclists

Table 25 reports the implicit prices for forest improvements estimated from data collected from cyclists, i.e. the sample included only those respondents who indicated that cycling was the main activity undertaken during the trip to the forest. Models 1 and 2 include all cyclists as defined above. Model 1 reports the model based on a traditional choice task, i.e. where respondents were asked to choose one option from a choice of Forest A and Forest B. Model 2 reports the model based on frequency data, i.e. respondents were asked how they would allocate their next five trips between Forest A, Forest B or stay at home.

Models 3, 4 and 5 disaggregate the data into different sub-groups of cyclists. Model 3 was restricted to include 'leisure cyclists' only, i.e. those who indicated that they were not riding on cross-country trails, technical single track, downhill or dirt-jumping. Model 4 includes 'mountain bikers', defined as those respondents who indicated that they were riding on either cross-country trails or on technical single track. Finally, Model 5 includes 'downhill riders', defined as those cyclists who indicated that they were downhill riding or dirt-jumping. It should be noted that there is a degree of overlap between the respondents categorised as 'mountain bikers' and 'downhill riders' in that some respondents indicated that they partook in both activities. Models 3, 4 and 5 are all based on frequency data. Attributes that were significant in the models are shown as bold font, while insignificant (and therefore unimportant) attributes are shown as normal text.

In Model 1 (the choice-based model of all cyclists) the highest implicit prices were found for 'dedicated single-track trail' (£19.48), 'obstacles' (£14.36), and 'dedicated downhill trails' (£13.34). Other significant attributes included 'dedicated cross-country trail' (£6.74), 'changing and shower facilities' (£4.16) and 'bike-wash facilities' (£3.29). All other attributes were insignificant in the model and therefore were considered as unimportant to cyclists choice of forest. A similar pattern of implicit prices was found for the all cyclists frequency-based model (Model 2). However, the main differences were that the implicit prices were generally lower in the frequency-based model than in the choice model. It is likely that this is a direct result of respondents taking more consideration of the distance attribute in the frequency-based model: a conclusion that was backed up during follow-up discussions in workshops. The other key differences in the implicit prices between these models are that the 'dedicated downhill' now has the highest implicit price (£9.74) and also that the 'bike-wash facilities' (£4.27) now has a higher implicit price than the 'changing and shower facilities' (£1.58). Finally, the 'multi-purpose trails' attribute has a high negative value (-£23.95). This indicates that cyclists did not like sharing trails with other users.

Model 3 relates to the implicit price for the 'leisure cyclists'. The estimated implicit prices were generally low for this model; it should however be noted that most of the attributes were insignificant. The only significant attribute was the 'bike-wash facilities' which generated an implicit price of £3.32. Thus, leisure cyclists were willing to pay for the provision of bike-wash facilities, but none of the other facilities. The 'mountain bikers' (Model 4) had highest implicit prices for 'dedicated single-track trails' (£10.07), 'dedicated downhill trails' (£8.93) and 'obstacles' (£7.39). Implicit prices for 'bike-wash facilities' was also significant at £4.04, while 'changing and shower facilities' were valued at £1.71. Of interest was the finding that the implicit price for 'multi-purpose trails' was -£25.90, providing a strong indication that mountain bikers did not want to use shared trails. Finally, the 'downhill riders' (Model 5) had very high implicit prices for the provision of 'dedicated downhill courses' (£23.34) and high values for 'obstacles' (£13.14). Bike-wash facilities were also valued (£3.05) by downhill riders, as was the provision of information in the forest (£3.41). Of interest was the findings that downhill riders had a negative value (-£4.71) for the enhanced surroundings attribute.

Table 25: Implicit prices for forest improvements - cyclists

	Model 1 All cyclists	Model 2 All cyclists	Model 3 Leisure cyclists	Model 4 Mountain bikers	Model 5 Downhill riders
Trails (Multi-purpose)	**-£39.56**	**-£23.95**	-£2.27	**-£25.90**	-£24.77
	(3.73)	**(1.48)**	(3.24)	**(1.63)**	(3.165)
Trails (Dedicated cross-country)	**£6.74**	**£5.81**	£1.19	**£6.89**	£1.26
	(2.83)	**(1.28)**	(3.07)	**(1.40)**	(2.76)
Tails (Dedicated single track)	**£19.48**	**£8.40**	£2.99	**£10.07**	£0.17
	(2.97)	**(1.30)**	(3.06)	**(1.42)**	(2.84)
Trails (Dedicated downhill)	**£13.34**	**£9.74**	-£1.91	**£8.93**	**£23.34**

	(3.12)	**(1.33)**	(3.20)	**(1.46)**	**(3.01)**
Obstacles (jumps and drop-offs)	**£14.39**	**£7.56**	£1.09	**£7.39**	**£13.14**
	(1.56)	**(0.66)**	(1.60)	**(0.71)**	**(1.50)**
Bike-wash facilities	**£3.29**	**£4.27**	**£3.32**	**£4.04**	**£3.05**
	(1.51)	**(0.66)**	**(1.63)**	**(0.72)**	**(1.40)**
Changing and shower facilities	**£4.16**	**£1.58**	-£0.04	**£1.71**	-£0.75
	(1.45)	**(0.64)**	(1.57)	**(0.70)**	(1.38)
Parking, toilets only	-£7.65	-£3.40	-£5.18	-£3.42	-£4.14
	(3.69)	(1.56)	(3.50)	(1.73)	(3.45)
Parking, toilets, picnic	£0.44	£0.79	£1.13	£1.29	£3.48
	(3.68)	(1.60)	(3.52)	(1.76)	(2.87)
Parking, toilets, picnic, café, shop	£3.61	£1.03	£0.36	£0.31	£2.87
	(3.54)	(1.54)	(3.30)	(1.72)	(3.41)
Parking, toilets, picnic, café, shop, play areas	£3.60	£1.58	£3.70	£1.81	-£2.22
	(3.65)	(1.59)	(3.50)	(1.76)	(3.51)
Detailed information	-£0.31	£0.18	£0.16	£0.40	**£3.41**
	(1.52)	(0.66)	(1.63)	(0.72)	**(1.43)**
Enhanced surroundings	£0.58	-£0.22	£1.42	-£0.60	**-£4.71**
	(1.53)	(0.66)	(1.63)	(0.72)	**(1.40)**

Notes: Standard errors in parenthesis
Implicit prices shown in bold were significant in the models; non-bold IP were not significant and therefore were considered as being unimportant to respondent choice

Thus, overall, within the cyclist user groups there appears to be a high demand for the provision of dedicated downhill courses and the provision of obstacles such as jumps and drop-offs along trails. All cyclists would like bike-wash facilities to be provided at forests, while downhill riders would like to see more information provided on facilities. There was also much resistance to the use of multi-purpose trails for cycling. Finally, cyclists appeared not to be concerned about the provision of more generally facilities within the forest.

8.1.2. Horse riders

Table 26 reports horse riders' implicit prices for improvements to forest facilities. As with the cyclists' models, Model 1 in Table 26 reports the findings from a choice-based choice task, while Model 2 reports the findings from a frequency-based choice task. Models 3 and 4 report two sub-groups of horse riders: Model 3 includes those horse riders that indicated that they were 'family / leisure riders', while Model 4 includes those horse riders that indicated they were participating in either endurance riding or carriage driving. In both Models 3 and 4, the frequency-based choice task was used in the analysis. Again, attributes that were significant are presented in bold text, while insignificant (and therefore unimportant) attributes are shown in normal text. In terms of horse-riding specific attributes, 'dedicated carriage-driving trails' were found to have positive values (c.a. £8) in both Model 2 (all riders) and Model 3 (family / leisure riders). 'Dedicated long-distance trails' was negatively valued (c.a. -£6) by these two groups. 'Horse corrals and tie-ups' was also negatively valued (-£4) by the endurance riders / carriage drivers. None of the other horse-specific attributes were significant in the model and therefore were not considered to be important in horse riders' choice of forest. The provision of 'detailed information' and 'enhanced surroundings' were highly valued (both £11) by the endurance riders / carriage drivers. There were mixed views with regard to which of the more general forest facilities were valued. Both the 'parking and toilets only' attribute and the 'parking, toilets, picnic, café and shop' attribute were negatively valued in Models 2 and 3, but positively valued in Model 4. Whilst the exact opposite was the case for the 'parking, toilets, picnic' attribute and the 'parking, toilets, picnic, café, shop and play areas' attribute. One possible explanation of this may be that Model 4 was only based on a small sample and therefore might not be truly representative. A point of interest to note from these results is that there was very little or no demand for horse-riding specific facilities such as the 'dedicated horse-riding trail', 'obstacles such as jumps and ditches', 'horse friendly parking'. It was

suggested in follow-up discussion with horse riders that the main reason for this was related to the difficulties and effort involved with travelling with horses.

Table 26: Implicit prices for forest improvements – horse riders

	Model 1 All horse riders (choice)	Model 2 All horse riders (frequency)	Model 3 Family / leisure riders (frequency)	Model 4 Endurance / carriage drivers (frequency)
Trails (Multi-purpose only)	-£2.97	-£5.37	-£5.67	£4.79
	(5.26)	(2.42)	(2.62)	(4.71)
Trails (Dedicated horse-riding)	£0.44	£2.33	£3.55	-32.23
	(5.33)	(2.38)	(2.57)	(5.46)
Trails (Dedicated carriage driving)	£7.92	**£8.88**	**£8.48**	-£5.32
	(5.03)	**(2.28)**	**(2.43)**	(5.80)
Trails (Dedicated long-distance trails)	-£5.39	**-£5.85**	**-£6.36**	£2.76
	(5.39)	**(2.45)**	**(2.65)**	(4.80)
Obstacles (Jumps and ditches)	£2.27	£1.25	£1.06	-£3.80
	(2.64)	(1.18)	(1.28)	(2.63)
Horse friendly parking	£0.89	-£0.17	£0.37	£3.29
	(2.74)	(1.23)	(1.33)	(2.74)
Horse corrals and tie-ups	-£0.37	£0.69	£1.20	**-£4.44**
	(2.75)	(1.24)	(1.33)	**(2.61)**
Parking, toilets only	-£13.17	**-£14.64**	**-£16.67**	**£14.48**
	(6.12)	**(2.80)**	**(3.04)**	**(5.68)**
Parking, toilets, picnic	**£16.78**	**£16.06**	**£19.52**	**-£16.07**
	(5.37)	**(2.27)**	**(2.69)**	**(6.04)**
Parking, toilets, picnic, café, shop	-£9.00	**-£8.25**	**-£11.95**	**£17.61**
	(5.89)	**(2.68)**	**(2.90)**	**(6.19)**
Parking, toilets, picnic, café, shop, play areas	£5.39	**£6.83**	**£9.10**	**-£16.03**
	(5.54)	**(2.52)**	**(2.73)**	**(5.61)**
Detailed information	£0.23	£1.05	-£0.77	**£11.70**
	(2.60)	(1.17)	(1.27)	**(2.62)**
Enhanced surroundings	£4.40	**£2.39**	£1.09	**£10.69**
	(2.71)	**(1.51)**	(1.30)	**(2.62)**

Notes: Standard errors in parenthesis
Implicit prices shown in bold were significant in the models; non-bold IP were not significant and therefore were considered as being unimportant to respondent choice

8.1.3. Nature watchers

The nature watchers' implicit prices for forest improvements are reported in Table 27. As with the other user groups, nature watchers were defined in terms of nature-watching being the main purpose of the trip to the forest during the day of interview. Models 1 and 2 were again based on all nature watchers, while Model 3 was restricted to only include those nature watchers who indicated that they were undertaking 'nature-watching – general' and Model 4 was restricted to include those nature watchers who stated that they were using a viewing centre, nature trail or guided walk. Throughout all four models, the highest implicit prices were found for the provision of wildlife hides (ranging from £11.53 in Model 1 to £5.60 in Model 4). Viewing centres attained positive values in three out of the four models (ranging from £5.56 to £7.14). Similar values were also found in Models 2 and 3 for 'off-the-beaten-track nature trails', while 'enhanced surrounding' attained a value of around £3. Facilities that were not significant in the models and therefore considered as unimportant included 'dedicated easy access nature trials', 'dedicated nature trails with information', 'guided nature walks', and all of the 'general facilities' attributes.

Table 27: Implicit prices for forest improvements – nature watchers

	Model 1 All nature watchers	Model 2 All nature watchers	Model 3 Nature watchers – general	Model 4 Nature watchers - centres &

	(Choice)	(Frequency)	(Frequency)	nature trails. (Frequency)
Trails (multi-purpose only)	-£10.62	-£10.25	-£8.02	-£9.95
	(6.47)	(3.21)	(3.41)	(4.08)
Trails (Dedicated easy access nature trails)	-£3.21	-£0.47	-£0.27	£0.53
	(6.12)	(3.13)	(3.26)	(3.90)
Trails (Dedicated nature trails with information)	£7.12	£4.24	£2.35	£3.19
	(6.10)	(3.17)	(3.30)	(3.99)
Trails ('Off-the-beaten-track nature trails)	£6.71	**£6.48**	**£5.94**	£6.23
	(6.01))	**(3.11)**	**(3.24)**	(3.86)
Wildlife hides	**£11.53**	**£6.83**	**£7.70**	**£5.60**
	(3.39)	**(1.67)**	**(1.75)**	**(2.10)**
Wildlife-viewing centres	**£7.14**	**£5.65**	**£6.63**	£9.89
	(3.29)	**(1.66)**	**(1.76)**	(2.10)
Guided nature walks	£0.28	£0.57	£0.94	£1.99
	(3.13)	(1.61)	(1.69)	(2.02)
Parking, toilets only	-£1.67	-£3.44	-£2.07	-£4.13
	(6.42)	(3.31)	(3.42)	(4.04)
Parking, toilets, picnic	£4.38	£4.75	£5.35	£5.19
	(6.67)	(3.43)	(3.53)	(4.41)
Parking, toilets, picnic, café, shop	-£0.49	£0.53	-£2.66	-£4.02
	(6.41)	(3.25)	(3.44)	(4.04)
Parking, toilets, picnic, café, shop, play areas	-£2.22	-£1.84	-£0.61	£2.96
	(6.82)	(3.49)	(3.59)	(4.43)
Detailed information	-£0.13	£1.66	£0.08	-£0.13
	(3.23)	(1.65)	(1.72)	(2.10)
Enhanced surroundings	£4.59	**£3.62**	**£3.57**	**£3.87**
	(3.32)	**(1.66)**	**(1.74)**	**(2.11)**

Notes: Standard errors in parenthesis
Implicit prices shown in bold were significant in the models; non-bold IP were not significant and therefore were considered as being unimportant to respondent choice

8.1.4. General forest users

The final group of forest users were general forest visitors. This group was defined as those visitors who did not have cycling, horse-riding or nature-watching as their main activity during the trip. Five CE models were generated for this group. As per the previous results, Models 1 and 2 were respectively based on the choice-based and frequency-based choice task for all general visitors. Model 3 (active general visitors) included those general visitors who indicated that, as part of their trip, they went cycling, horse-riding or nature-watching. Model 4 was based on visitors who indicated that they went on a walk during their visit to the forest. Finally, Model 5 was based on those visitors who did not cycle, horse ride, nature watch or walk during their trip to the forest. The implicit prices from the general forest visitor models are reported in Table 28. Over all the models, 'parking, toilets, picnic' had the highest implicit prices (ranging from £3.04 for the non-active visitors to £10.03 for walkers). 'Single-track mountain bike trails' (£3.79 to £6.26), 'Parking, toilets, picnic, café, shop, play areas' (£4.65 to £8.11), 'enhanced surroundings' (£2.03 to £8.12) and 'nature trails / wildlife hides' (£1.35 to £6.45) were also valued. The 'horse-riding trails' attribute was found to reduce utility in the walkers and non-active visitor models by £1.50; follow-up discussions indicate that this was largely due to the fact that some general forest visitors felt nervous about the presence of horses in the forest. General facilities that included a shop or café also appeared to reduce utility; although interestingly the additional presence of play areas was found to increase utility. Finally, it was generally found that the active visitors and walkers had higher values than that non-active visitors.

Table 28: Implicit prices for forest improvements – general forest users

	Model 1 All general Visitors	Model 2 All general Visitors	Model 3 Active general Visitors	Model 4 Walkers	Model 5 Non-active general visitors
	(Choice)	(Frequency)	(Frequency)	(Frequency)	(Frequency)

Trails (Multi-purpose)	-£1.27	-£2.68	£0.76	-£0.81	-£4.23
	(3.06)	(1.23)	(1.72)	(1.42)	(1.49)
Trails (Easy access)	-£1.94	£0.56	£0.97	-£0.14	£1.96
	(3.08)	(1.22)	(1.73)	(1.44)	(1.46)
Trails (Art / sculpture walks)	£4.50	**£2.90**	£2.58	£2.14	**£4.38**
	(3.06)	**(1.22)**	(1.72)	(1.41)	**(1.44)**
Trails (Long-distance walking)	-£1.29	-£0.77	**-£4.31**	-£1.19	-£2.11
	(3.17)	(1.25)	**(1.78)**	(1.46)	(1.51)
Single-track mountain bike trails	**£6.26**	**£4.59**	**£5.26**	**£3.79**	**£4.40**
	(1.61)	**(0.63)**	**(0.89)**	**(0.73)**	**(0.75)**
Horse-riding trails	£0.63	-£0.19	-£0.90	**-£1.52**	**-£1.47**
	(1.62)	(0.65)	(0.91)	**(0.76)**	**(0.78)**
Nature trails / wildlife hides	**£6.45**	**£1.56**	£0.81	**£1.36**	**£1.95**
	(1.63)	**(0.63)**	(0.89)	**(0.74)**	**(0.76)**
Parking, toilets only	**-£9.43**	**-£5.45**	**-£5.28**	**-£6.11**	**-£5.84**
	(3.35)	**(1.31)**	**(1.85)**	**(1.53)**	**(1.59)**
Parking, toilets, picnic	**£8.79**	**£6.95**	**£8.43**	**£10.03**	**£3.04**
	(3.31)	**(1.30)**	**(1.84)**	**(1.51)**	**(1.55)**
Parking, toilets, picnic, café, shop	**-£7.47**	**-£5.87**	**-£5.46**	**-£8.58**	-£2.55
	(3.37)	**(1.33)**	**(1.86)**	**(1.57)**	(1.58)
Parking, toilets, picnic, café, shop, play areas	**£8.11**	**£4.37**	£2.31	**£4.65**	**£5.35**
	(3.28)	**(1.30)**	(1.87)	**(1.52)**	**(1.53)**
Detailed information	-£0.14	-£0.11	**-£1.54**	-£0.99	£0.37
	(1.58)	(0.63)	**(0.89)**	(0.74)	(0.75)
Enhanced surroundings	**£8.12**	**£2.70**	**£3.37**	**£2.03**	**£2.47**
	(1.65)	**(0.64)**	**(0.90)**	**(0.74)**	**(0.76)**

Notes: Standard errors in parenthesis
Implicit prices shown in bold were significant in the models; non-bold IP were not significant and therefore were considered as being unimportant to respondent choice

9. Discussion

In this discussion, we provide a critique of the methodologies used in this research and also discuss the findings in the context of how the values attained in this research relate to other studies that have valued forest recreation. In Section 9.1 we provide a critique of the economic impact study, while the three economic valuation methods are discussed in Section 9.2.

9.1. Economic impact study

9.1.1. Discussion of economic impact methodology

Multiplier analysis was used in this research to estimate the size of the economic (income and employment) impacts generated by forest recreation. We now provide a critique of the method adopted.

First, it is noted that our survey sample (and hence estimates of mean trip expenditures) might not be truly representative of all users of the sampled forests. The reason for this is that, in certain forests, we targeted specific users groups as opposed to all forest visitors. This was particular in the case for those recreation activities with low users numbers, i.e. horse riders in Dyfnant and the New Forest, and nature watchers in Whinlatter. The method that we adopted to estimate aggregate spend however compensated for this by estimating a mean spend value for each group of forest users and the aggregating these spend figures with estimates of the total number of visits to the forests by activity. We are confident that this more sophisticated procedure removed any potential sources of sampling bias within our estimate of total spend in the forests.

A second issue of possible concern relates to our estimates of the annual number of visits to the case study forests. Generally, we based our estimates of the number of visits to forests on official Forestry Commission data. However, this data often did not provide information on the breakdown of visits by activity or type of visitor (i.e. day visitor or holiday visitor). To overcome this shortfall, we made assumptions on the proportion of visits in each category based on information from other, related visitor surveys. Clearly, some inaccuracies may have resulted from this procedure. Particular concerns were additionally identified at two of the forests. First, there were no data on annual number of visits made to Dyfnant forest. To overcome this, we 'borrowed' and adjusted data from the Wales 'All forest' study (Forestry Commission, 2005) on the estimated number of visits made to Hafren forest (which was considered to be similar to Dyfnant forest). Thus, our estimate of the annual number of visits to Dyfnant only represents our best guess of visitor numbers at this forest. The second forest of concern was the New Forest. Here, the official estimates suggest that there are 7.15 million visits per annum to the forest. This figure was over four times as many as was estimated at the next most-used forest, Thetford, and as such was considered to be on the high side. To address this concern, we removed 'local' users from our estimate of visits to the New Forest since these users were unlikely to inject much, if any, additional spend into the local economy.

Third, the LM3 method used to estimate of the income impacts from forest visitor spend only collated data from the first three rounds of spending. Thus, any further circulation of money within the local economy was not considered in our analysis. As such, the LM3 coefficient can be considered to provide a conservative estimate of the likely impacts. The extent to which the LM3 misses additional local spend from subsequent spending rounds can be measured in terms of the residual spend remaining in the local economy after taking account of leakages during the first three spending rounds. Thus, it was calculated that only 8.8% (i.e. initial injection * 1.00 * 0.45 * 0.20) of the original spend was retained within the local

economy after the three spending rounds. Thus, we are confident that our estimates of the local economic impacts captures most of the spend that was re-circulated within the local economy. A second issue relating to our application of the LM3 method is that, due to a poor response rate from the LM3 questionnaires, we only estimated a single LM3 coefficient to represent all of our sampled forests; as opposed to estimating separate LM3 coefficients for each forest individually. To test the implications of this, we analysed data from the two forests that had the highest response rate. This analysis indicated that the LM3 coefficients from these two forests were similar to that of the all forests LM3. Thus, it provides some validity to the approach adopted. However, it should be noted that, in reality, it is unlikely that the LM3 coefficients would be the same across all forests and therefore there is likely to be a small degree of error in our estimates of income impacts.

Finally, the expenditure, income and employment estimates generated in this research relate to the total level of economic activity associated with trips to the forests. It should be noted that the estimated economic impacts are unlikely to constitute additional expenditure, income and employment to the GB economy as a whole; rather the impacts will largely constitute displacement and substitution from other areas. Thus, the actual additionality impacts to local economies are likely to be only a proportion of the total impacts reported. It is also worth noting that if visits to the forests were to cease, it would be unlikely that all of the reported expenditures, income and employment would be lost; people would instead visit other places.

9.1.2. Validating the economic impact study

The findings from our economic impact analysis may be, to some extent, further validated using a sort of convergent validity tests; that is we compare the findings from our study with those from other related studies. In this exercise, we make comparisons for both our estimates of the mean spend per-trip and our estimates of the overall size of the economic impacts.

Mean spend per-trip

We turn first to examine mean spend per-trip. In our study, the mean spend of a day visitor was £8.45 per-trip; while mean spend of holiday visitors was £46.72 per-trip. A more detailed breakdown of this mean spend by forest, activity and type of trip can be found in Table 14.

A logical source of comparative data on forest visitor spend are the Forestry Commission's visitor surveys. Unfortunately, the majority of the surveys that have been undertaken at our case study forests (e.g. at Cwm Carn: Forestry Commission, 2002a) did not collect any visitor spend data. The Forestry Commission have undertaken other visitor surveys which have collected visitor spend data at relevant forests (e.g. the 'Scottish Borders visitor survey 2002 and the Wales Mountain Bike Survey 2002: Forestry Commission, 2002b; 2002c). However, most of these related studies only report visitor spend in terms of the proportion of visitors spending predetermined amounts on different items. Since it was difficult to translate these figures into estimates of mean spend, it was not possible to compare our findings directly with these studies. Furthermore, these studies generally did not address 'local' spend.

One of the few studies that can be used to help validate our results was the Wales 'All forests' survey 2004 (Forestry Commission, 2005). In this study, average spend by visitors to all forests in Wales was £13 per visit. In our study, the average spend at our two Welsh forests, Cwm Carn and Dyfnant, was £10.30 and £18.04 and therefore appear to be within the range of the 'All forests' report; note that the 'All forests' study does not specifically report the average spend of day and holiday visitors, and therefore a more precise comparison could not be made. Another useful source of comparative data is the Forestry Commission's 'Forests' Role in Tourism' report (Hill et al., 2003). In this study, Hill *et al.* disaggregated the spend data by country and type of visit: mean day-trip expenditures were £9.60, £5.24 and £10.33 respectively for trips in England, Scotland and Wales, while the equivalent mean tourist day-trip expenditures were £23.16, £14.97 and £8.15. Within our study, day-visit spend ranged

from £6.74 at Thetford to £18.77 at Rothiemurchus, whilst our holiday-visit spend ranged from £5.98 in Thetford to £107.50 at the New Forest. Overall, apart from the extreme case of the New Forest, our spend estimates appear to be comparable to found in the Hill study.

Finally, the GB leisure day-visits survey (Tns Travel and Tourism, 2004b) provides another useful source for comparison. In this report, the mean spend during a leisure day-trip was £13.70 for all leisure day-trips, £8.60 for trips to the countryside and £4.70 for trip to forests / woods. The equivalent mean spend during tourist day-trips was £27.70 for all tourist-day trips, £20.70 for tourist trips to the countryside and £17.30 for tourist trips to forests / woods. These figures appear to be lower than our figures, particular in terms of the DVS survey's spend figures for trips to forests / woods. Overall, it is concluded that our figures for mean spend per-trip tend to be higher than that found in other studies. Although the reason for this is unclear, it is considered that the focus of our research on specialised recreation activities within the forest may be part of the reason for higher spend figure.

Aggregate spend

Our estimates of the aggregate size of local economic impacts can also be validated by comparing our results with other related studies. To recall, our study suggested that forest recreation within a particular forest generated between £0.18 million and £61 million local spend; between £0.3 million and £101 million local income; and between 5 and 1802 FTE jobs depending on the forest studied. To put these figures into context, we compare these estimates with those from other studies.

The GB leisure day visitor survey 2002/03 (Tns Travel and Tourism, 2004b) estimates that total spend on trips to the countryside was £15,700 million (£10,900 million from leisure day-trips and £4,800 million from tourist day-trips), of which £1,700 million related to trips to forests (£1,200 million from leisure day-trips and £500 million from tourist day-trips). The Forestry Commission has also commissioned research that specifically examined the scale of tourist expenditure in forests. The 'Forests' Role in Tourism' project (Roberts et al., 2000), which surveyed 1900 forest day visitors at 44 forest sites located throughout Great Britain, estimated that the annual expenditures on tourism day visits to forests were around £2,268 million, of which £2,054 million is in England, £163 million in Scotland and £51 million in Wales. Our findings would appear to be appropriate in terms of these other studies.

We can also examine our results in terms of spend at individual forests. The Wales 'All forest' report (Forestry Commission, 2005) suggests that the annual spending of visitors to Welsh forests (who said that the presence of the forest was an important factor in their decision to visit the site) was £30 million per annum. In our study, the estimated annual spend at Welsh forests was £0.98 million in Cwm Carn and £0.18 million in Dyfnant. The RSPB have also examined the economic impact of a number of their reserves including Abernethy Forest reserve (Sheil et al., 2002) which is located next to Rothiemurchus estate. The RSPB reserve attracted 70,000 visits in 2000 and it was estimated that these visitors spent £1.4 million within the local economy. In our study, the estimated annual spend associated with trips to Rothiemurchus was £6.96 million. However, the number of visits to Rothiemurchus was around 3.5 times greater than Abernethy, and therefore the overall impacts are comparable. The RSPB report also suggests that the reserve generates 65 FTE jobs. Again, our estimate of 204 FTE jobs at Rothiemurchus is comparable. The New Forest District Council (n.d.) estimated that all tourist trips to the area generates in excess of £100 million income each year; the same income figures as our New Forest study suggesting that in comparative terms our figure is perhaps high. However, the same report indicates that tourists to the area generates 3000 FTE jobs, compared to our estimate of 1802 additional FTE jobs created. Thus, our estimate of jobs created would appear to be comparable with the Council's estimates.

Thus, based on the comparative analysis undertaken above, it would appear that the size of economic impacts reported in our research generally fit within current estimates of economic impacts associated with recreation trips to forests.

9.2. Discussion of economic valuation studies

Three alternative economic valuation methods were utilised in this research to assess the value of forest recreation: a count travel cost model, a contingent behaviour model and a choice experiments model. In this section, we discuss the validity of these models. Theoretical validity involves assessing the degree to which the findings of a study are consistent with theoretical expectations. Here the interest is focused on the determinants of a WTP amount. Typically this is achieved by regressing the dependent variable in the valuation models on a group of independent variables believed to be theoretical determinants of people's willingness to pay for the good being valued (Mitchell *et al.*, 1989). The size and sign of the estimated coefficients are then examined and judged to be consistent or otherwise with theory. A second type of validity test is convergent validity. Here the validity of a particular valuation study is assessed by comparing it with values attained in others related studies. A positive correspondence is interpreted as validating both measures, since neither can be presumed to be a superior measure. In this application, we compare our study findings with a range of estimates for the per visit value of forest recreation as summarised in Table 29 (which is reproduced from the Jones *et al.*, 2003report). The data reported in Table 29 includes 44 value estimates from contingent valuation (CV) studies, 9 individual travel cost studies (ITCols) that use ordinary least squares (OLS) estimators, 7 individual Travel Cost studies (TCml) that use maximum likelihood (ML) estimators, and 17 zonal TC (*ZTC*) estimates. In addition to the studies reported in (Jones et al., 2003), we also compare our results to a more recent study by Scarpa (2003) who estimated that the per-trip value of forest recreation was between £1.66 and £2.78.

Table 29: Summary of per person per visit woodland recreation value estimates.

Method	Whiteman & Sinclair	Hanley et al.	Bishop	Willis et al.	Bateman et al.	Everett	All
CV	3 0.78 (0.66-.093) [0.14]	6 1.30 (0.85-1.55) [0.27]	4 0.89 (0.46-1.46) [0.46]	28 0.71 (0.28-1.29) [0.27]	3 1.08 (0.47-1.55) [0.55]	0 - - -	44 0.84 (0.28-1.55) [0.36]
ITCols	0 - - -	0 - - -	0 - - -	6 1.46 (0.47-2.74) [0.84]	3 1.35 (1.07-1.58) [0.26]	0 - - -	9 1.42 (0.47-2.74) [0.68]
ITCml	0 - - -	0 - - -	0 - - -	6 0.57 (0.07-1.13) [0.47]	1 1.20 (1.20-1.20) [-]	0 - - -	7 0.66 (0.07-1.20) [0.49]
ZTC	0 - - -	1 2.14 (2.14-2.14) [-]	0 - - -	15 2.53 (1.58-3.91) [0.66]	0 - - -	1 1.30 (1.30-1.30) [-]	17 2.43 (1.30-3.91) [0.71]
All	3 0.78 (0.66-0.93) [0.14]	7 1.41 (0.85-2.14) [0.40]	4 0.89 (0.46-1.46) [0.46]	55 1.27 (0.07-3.91) [0.95]	7 1.21 (0.47-1.58) [0.38]	1 1.30 (1.30-1.30) [-]	77 1.24 (0.07-3.91) [0.83]

Notes: Cell contents are as follows: Number of estimates; Mean value (£/person/visit); (Range: minimum to maximum value); [StDev of values]. Source: (Jones et al., 2003)

9.2.1. Validity of the travel cost count model

Generally, our travel cost count models performed poorly. In particular, the truncated models mostly failed to converge. The reason for this poor performance is unclear. However, it is thought that the relatively low number of observations in the horse riders' and nature watchers' models may have contributed to the poor performance. Since we had difficulties attaining convergence in the truncated models, we based our analysis on the basic Poisson

model since this was the only model specification in which successfully convergence was reached for all of the forest recreation activities investigated. The basic Poisson model, however, does have a number of limitations. First, tests indicated that, in four out of the five cases, we had over-dispersal of the dependent variable (i.e. variation > mean). This over-dispersal can normally be taken into account using a negative binomial regression. However the level of significant of the travel cost parameter was lower in the negative binomial model than in the basic Poisson model and therefore we felt it would not be appropriate to use the negative binomial model. Second, since our data was collected on site, no zero values were recorded for the dependent variable. This would suggest that the use of a truncated model would be more appropriate than the basic models. However, as already stated the truncated models largely failed to convergence. Thus, in our analysis we reported the results from the basic Poisson model. Clearly there are econometric implications to this as outlined above.

The theoretical validity of the count models was assessed by assessing the size and sign of the independent coefficients in the model. The key parameter of interest was the travel cost parameter. In all cases where convergence was achieved, the travel cost parameter was significant and importantly had a negative sign. This adheres to *a priori* expectations in that the number of trips decline if travel cost increases. Other examples of expected behaviour include the travel-time parameter which was significant and negative and income parameter which was significant and positive. Thus there is evidence of theoretical validity in terms of the key parameters in the models.

In terms of convergent validity, our count models produced significantly higher consumers' surplus values per-trip (ranging from £7.90 for nature watchers to approximately £14.00 for cyclists, horse riders, walkers and general visitors) than those found in the majority of other forest recreation studies which range from £0.07 to £3.91 – see Table 29 above. Although it is unclear as to why our estimates are higher, we propose a number of possible explanations.

One potential issue of concern relates to how the travel-cost parameter was derived. In this application, the travel-cost parameter was estimated by multiplying the one-way travel distance by two (to attain the return journey mileage) and then multiply this distance by a standard per mile travel cost estimate of £0.15 per mile (based on the RAC's most recent estimate of the costs of travel). The first issue is that our figure of £0.15 per mile is somewhat arbitrary in that the use of another estimate of the costs of travel would significantly alter the absolute valuations from the count models; note that the relative values between the different user groups would however remain unchanged. Second, the actual per-mile costs of travel are likely to be different for the different users groups investigated in this research. For example, it is likely that the per-mile costs of travel are significantly higher for horse riders (who often tow large horseboxes) than for the other user groups. These relative differences in the costs of travel were not taken into account in the analysis. A third issue of concern is that in our analysis we assumed that the costs of travel to the forest would be two times the distance travelled to the forest. Although this assumption generally holds for day visitors, there are potential issues with regard to tourist visitors. To illustrate, take for example a tourist visitor who travels to the forest from his home address and visits that forest on his first day in the area, and then stays in the area visit other locations for several more days. It would be incorrect to assume that the costs of travel to the forest are two times the cost of travel from his home address. In our analysis, we attempted to mitigate this problem by excluding those visitors with more than a 2-hour travel time to the forest. However, it is likely that our estimates may still be somewhat inflated by the fact that for some tourists we have included two times the costs of travel from a home address. Another possible reason why our travel cost estimates are 'high' is that we assume that each respondent pays 100% of the cost of their travel to the site. However, it is likely that some visitors will share the costs of travel with other members of their party. If this is the case, then ideally one should divide the travel costs (TC) by mean group size. This would reduce the consumers' surplus estimates. Unfortunately, our survey did not collect data on who paid the cost of each trip (e.g. it would be different for

a family of four versus four friends). Thus, we were unable to perform this extra analysis. Finally, note that we have excluded time costs as an element of travel costs, since we have insufficient labour market data to correctly value leisure time for each individual. Travel time has instead been included as a separate variable in the count models. Finally, as already mentioned, some of the assumptions in the Poisson model were violated in our application and therefore this may affect our value estimates.

There are, however, a number of reasons why our values should perhaps be higher than those in the studies reported in Table 29. First, the majority of studies reported in Table 29 were undertaken in the 1980s and 1990s. Since then, there have been significant increases in the cost of fuel, which in turn would inflate value estimates. Second, our study largely focused on per-trip values of specialist recreational users of forests. The other studies tended to draw on a sample of general forest users or samples of the general population. The results from our and other research clearly indicate that specialist users such as mountain bikers tend to both travel further and more often to participate in their activity than general forest visitors. Thus, as indicated in Table 20, these specialist groups of forest recreationists tend to have higher per-trip values than general forest users. Finally, the 'count model' method that we used was different from the other studies listed in Table 29 and therefore it may be that the different approaches generate different values. Further comparative research would be required to assess whether this is in fact the case.

9.2.2. Validity of the contingent behaviour models

In the contingent behaviour model, we aim to assess: (i) changes in the number of predicted trips made to a forest following improvements to the recreation resource, and (ii) the value of these improvements. Eight models were generated: two improvement scenarios for each of the four recreation activities investigated. In all cases, tests indicated that there was over-dispersal of the dependent parameter and therefore the negative binomial model was used. In two of our models (the two horse-rider models), the key variable, contingent behaviour, was insignificant at the 95% level and therefore further analysis was not possible using these models. It was thought that this insignificance was due to a low sample size in these scenarios.

The theoretical validity of the six usable contingent behaviour models was considered to be upheld. First, the travel cost parameter was significant and as expected negative. Also, the contingent behaviour parameter 'Cont Beh' was significant and positive, indicating that the hypothetical improvements to recreational facilities, on average, increase the number of planned trips to the forest. Again, this accorded with *a priori* expectations.

Convergent validity tests of the contingent behaviour models were more difficult since no other study currently exist that address the recreation improvements examined here. However, it was possible to compare the findings from the contingent behaviour models with those from our CE models. This comparison is made in Table 30 below. Here, it is shown that there is some similarity between the two models, although the choice experiment model generally provides slightly higher value estimates.

As with the count model, the travel-cost parameter in the contingent behaviour model is based on two times that travel distance to the forest multiplied by an average travel cost of £0.15 per mile. It is likely that the issues discussed above for the count model are also likely to affect the contingent behaviour model. Thus, it is again possible that the travel costs for tourist visitors are over inflated in the contingent behaviour models.

Table 30: Comparison of the value of forest recreation improvements.

Improvement	Contingent Behaviour £ per visitor per year	Choice experiment Model 2:Frequency model £
Cycling – additional obstacles	£3.46	£7.56
Cycling – showers / changing facilities	£0.66	£1.58
Nature Watchers – new wildlife hides	£7.89	£6.83
Nature Watchers - new wildlife viewing centres	£3.30	£5.65
General visitor – art / sculpture trials	£2.79	£2.90
General visitors – play facilities	£8.75	£4.37

9.2.3. Validity of the choice experiments models

The CE models aimed to assess the consumers' surplus for various improvements to recreational facilities in forests. A range of models were generated for different sub-groups of cyclists, horse riders, nature watchers and general forest visitors. Also, both choice- and frequency-based models were generated.

Overall, the frequency-based models appear to outperform the choice-based models in that the frequency-based models tended to have more significant attributes. Further analysis of the data indicated that some respondents made inconsistent choices between the choice-based task and frequency-based task, i.e. a small number of respondents (28 in total) indicated in the choice-based task that they preferred Forest A, and then in the frequency-based task allocated most of their 5 trips to Forest B (or *vice versa*). The reason for the inconsistencies is unclear. However, intelligence gathered during debriefing sessions and from the valuation workshops suggested that some respondents might have considered the 'distance to the forest' attribute differently between the two choice protocols. It would appear that, in the choice task, respondents often choose their 'ideal' forest in terms of the recreation attributes of that forest with perhaps little consideration for the distance attribute. Alternatively in the frequency-based protocol, respondents appeared to take more consideration of the 'distance-to-the-forest' attribute and considered this in terms of their normal recreation behaviour; e.g. they might only travel long distances on an *ad hoc* basis, but use local forests on a more regular basis. Further analysis of the data revealed that in over half of the 28 cases of inconsistency, the distance travel to the forest was greater than 150 miles (the higher of the travel distances used in the experimental design). Also, in 24 out of the 28 cases of inconsistency the distance to the forest initially chosen in the choice task was greater than the second forest which then received more trips allocated to it. This evidence supports the claim that respondents took more account of the distance travelled in the frequency-based task than in the 'standard' choice-based task. Since the distance travelled reflects the monetary component of the CE model, the level to which it is considered in the choice tasks is of great importance. This evidence thus appears to indicate that a frequency-based approach is likely to provide more accurate valuations than a standard choice task.

The reliability of CE models may be measured in terms of the goodness of fit of a model. In the CE models, the pseudo-Rho^2 values were generally below the recommended values of between 0.2 and 0.4 (Bennett *et al.*, 2001). However, it should be noted that lower pseudo-Rho^2 values are often found in valuation studies. It was thought that to some extent the poor fit of the model may be related to the small sample sizes, particularly for the horse-riding and nature-watching models, and the disaggregated models.

In terms of convergent validity, we have already shown that some of the results from the CE models are consistent with our contingent behaviour models. There was, however, great

variability in the values generated for recreation improvements both between different user groups and also within the different sub-groups of users, and therefore it is difficult to compare our findings meaningfully with those from other existing studies. However, in general terms, the consumers' surplus values from our study appear to be higher than from those studies outlined in Table 29. However, we again highlight the fact that, to some extent, this was expected since our study dealt with specialist user groups. Furthermore, the CE model assesses values for improvements to the forest resource, while most of the existing studies value a particular forest. Thus again we are not comparing like with like.

10. Recommendations

The results from the valuation studies indicated that different groups of forest users value different types of facilities in the forest. Overall, cyclists (and in particular mountain bikers and downhill riders) had the highest values for improvements to forest recreation facilities, while non-specialists users had lower values. A summary of the key findings from the different user groups is provided below.

10.1. Cyclists

Cyclists were generally found to value highly opportunities for cycling in the forest. Consumers' surplus values per-trip, as estimated using the count model, was £14.97. This value was similar to most other users groups other than nature watchers which had lower values.

The CE model investigated cyclists' preferences for different types of cycling facilities in the forest. The key findings from this exercise were:

- Cyclists were generally opposed to cycling on multi-purpose trails.
- All types of cyclists valued the provision of bike-wash facilities in forests (£4.27).
- In the leisure cyclists model, none of the attributes investigated (other than the provision of bike-wash facilities) were significant. This suggests that this group of cyclists appear not to have strong preferences for any particular type of forest facilities.
- Mountain bikers highly valued to provision of cross-country trails (£6.89), technical single-track trails (£10.07), downhill courses (£8.43) and obstacles such as jumps and drop-offs (£7.39).
- Downhill riders were generally willing to pay more than any other group of forest users and had high values for the provision of downhill courses (£23.34) and obstacles (£13.14), as well as the provision of detailed information on the forest (£3.41).
- Cyclists generally did not consider that the provision of general forest facilities such as car parking, etc., to be important to their decision to go to a forest. However, it should be noted that the cyclists do use these facilities when at the forest.

The contingent behaviour models for cyclists indicated that the provision of optional trail obstacles (such as jumps, drop-offs, and 'northshore' trails) would increase the number of trips to forests by 5%, and that such provision would, on average, be valued at £3.46 per cyclists per annum. The provision of showers and changing facilities in the forest would result in a 0.3% increase in trips to the forests, and be valued at £0.66 per cyclist per annum.

Thus there appears to be a demand for the provision of cycling-specific facilities in forests and in particular downhill courses, technical single track, optional obstacles and bike-wash facilities. The average daily spend by cyclists is generally low (£23.35) compared to the other activities investigated. Furthermore, cyclists appear to be less likely to spend locally. As a result, the development of cycling opportunities is unlikely to generate high levels of economic impact on a per-trip basis.

10.2. Horse riders

Horse riders were found to spend significantly higher amounts of money on riding trips (£136.28) than any of the other activities investigated. Furthermore, much of this spend was within the local economy. Thus, horse-riding has the potential to generate significant local economic benefits per visit. However, it should be noted that much of this was skewed by the extremely high levels of expenditures at the New Forest. The spending patterns at other forests were more equivalent with other user groups.

The count travel cost models also indicated that horse riders had high per-trip consumers' surplus values (£14.20). However, evidence from the CE models suggests that horse riders generally did not value improvements to specific horse-riding facilities in forest. In particular,

- Horse riders generally did not appear to value the provision of dedicated horse-riding trails in forests; although, they did have positive values for carriage-driving trails (£8.00).
- There was no apparent demand for the provision of horse-specific facilities such as obstacles (jumps and ditches), horse friendly parking or horse corrals and tie-ups.
- There was a mixed message with regard to how horse riders valued general forest facilities. Family and leisure riders generally valued picnic sites and play areas, while the more adventurous riders valued cafes and shops.

The findings from the horse riders are somewhat confusing in that horse riders appear to gain high levels of utility from riding in forests, but generally do not value the provision of horse-specific facilities within the forest. The results from follow-up workshops discussions provide some insight into these apparently conflicting findings. It would appear that horse riders require significant amounts of time, effort and money to travel with their horses. As a result of this, horse riders are less willing (or able) to travel long distances to ride their horses. In the workshop discussions, riders indicated that they tended to have local rides which they go to often, and that the proposition to travel to a new location would require serious consideration. In particular, they suggested that a key consideration was the time and effort required to get to a site. Only once they were happy with the amount of travelling effort, did they consider the attributes of the forest. This, and the fact that horse riders do not appear to value specific horse-riding facilities in forests, would suggest that it would not be in the interest of the Forestry Commission to develop 'horse-riding' centres based on the model that has been used for mountain bike centres in that it is unlikely that horse riders would travel to these sites. This, however, does not rule out the opportunity to develop local riding facilities in forests such as that in Dyfnant forest. Such facilities would need to be developed in collaboration with local riders. It is, however, unlikely that the provision of local riding facilities would generate the high local economic impacts that could potentially be made from horse-riding.

10.3. Nature watchers

Although nature watchers had moderate levels of spend (£28.07) associated with trips to the forest, they did have a relatively high propensity to spend locally. However, the low numbers of nature watchers mean that nature watchers are unlikely to generate significant local economic benefits.

Per-trip consumers' surplus value for nature-watching (£7.90) was almost half of that found for the other activities. In terms of facilities, nature watchers were found to value the provision of wildlife hides (£6.83), wildlife-viewing centres (£5.56), 'off-the-beaten-track' nature trails (£6.48) and enhancements to the forest surrounds for viewing wildlife (£3.62). However, there was little or no demand for easy access nature trails, or nature trails with information. Finally, the provision of general forest facilities was not considered important to nature watchers.

The contingent behaviour model showed gains from investments in wildlife viewing ranging from £7.89 - £3.30 /visitor/year.

10.4. General forest visitors

General forest visitors made moderate levels of spend (£32.05) and were likely to spend most of it in the local economy. Considering that the majority of visitors to most non-specialised forest were general visitors, then this group has the potential to provide significant local economic impacts.

Per-trip consumers' surplus values were £14.51 for walkers and £14.99 for other general forest visitors. These values were similar to those found for the other activities apart from nature-watching; which was lower. However, the findings from the CE models indicated that the implicit prices for improvements to forest facilities were generally low for this group. Facilities which general visitors valued included the provision of technical single-track mountain bike trails (£4.59), wildlife hides (£1.56), art / sculpture trails (2.70). General visitors tended to have significant and negative values for the provision of horse-riding trails. The provision of picnic sites and play areas seemed to enhance the forest experience, while the provision of shops and cafés appeared to reduce it.

In the contingent behaviour models, it was found that the provision of new art / sculpture trails would increase the number of trips to forests by 4.5%, while the provision of family play areas would increase trips by 10.2%. The values of these improvements were respectively estimated to be £2.79 and £8.75 per visitor per annum.

Policy implications

We now highlight some of the key policy implications stemming from our research. First, it is clear from the data that the more specialist users attain greater consumers' surplus from the provision of activity-specific facilities than non-specialist users. For example, mountain bikers had higher consumers' surplus values than general cyclists and indeed general forest visitors. This evidence suggests that policies aimed to maximise consumers' surplus per visit from forest recreation would be best to target the provision of specialist recreation facilities. Further evidence in support of creating specialised facilities came from the fact that all groups of forest users opposed the creation of multi-purpose trails. In other words, they did not want to share trails of other user groups.

The results from this study also allow us to make specific recommendations for the future management of forests for specific recreation activities. In terms of cycling, the was overwhelming support for further investments to create and enhance mountain bike centres, and in particular to provide additional 'hard-core' facilities such as downhill courses and optional obstacles such as jumps and drop-offs on existing and new trails. Furthermore, there was general support for the provision of bike-wash facilities at forests where any form of cycling takes place. There was little evidence in support of the provision of horse-specific facilities within forests. Information gathered in debriefing interviews indicates that the main reason for this lack of demand stems from the relative difficulties associated with transporting horse to and from forests. Furthermore, evidence from other user groups indicate that any new riding facilities, if developed, should be created away from areas used by the general public, who appear to be opposed to sharing the forest with horses. There was general support for increased investment in wildlife hides and viewing centres where appropriate. The increased provision of general forest facilitates such as car parks, toilets, etc, did not appear to be important in people's choice of forests, however, it should be noted that the majority of visitors do use these facilities and therefore there provision is considered to be important to forest visitors.

Finally, it should be noted that the above recommendations relate only to those improvements that generated the highest per-trip welfare gains. Recommendations for future investment should also take account of the number of potential users of these new facilities. This question was not fully addressed in this research. In addition, any future investment in facilities should

also be assessed in terms of both the costs and benefits. This report provides information on the benefits, but information on the costs would be required in order to conclude whether investment would be recommended.

10.5. Concluding comments

This research aimed to provide a unique insight into the value that different groups of forest users have for a range of enhancements to the forest recreation resource. Novel aspects of this research include the fact that this is one of the first studies to value forest recreation utilising a combined revealed-preference – stated-preference method: here we adopted the contingent behaviour model. Such a methodology is considered to be an improvement on either traditional revealed-preference or stated-preference methods since the combined approach draws on the relative merits of the two techniques. Also, this study is also one of the first valuation studies to utilise an attribute-based valuation method to value the component attributes of forest recreation. Furthermore, in our analysis we analyse this data according to different groups of forest users, thus providing significant detail on the heterogeneity of values for enhancements to forest recreation. Another novel aspect to this research is that we utilised a frequency-based choice task in the CE model. It is argued that this approach has advantages over the more traditional choice-based choice task for recreational-use applications since: (i) the choice task more closely reflects actual behaviour, and (ii) it would appear that survey respondents take more considered account of the travel cost attribute in a frequency-based task than in a choice based task. Finally, this research has produced a wealth of information on the relative values of a range of improvements to the forest recreation resource by different user groups. It is considered that this information will be invaluable to the future management of forests in terms of enabling forest managers to target resources to different forests and forest users in the best way.

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