Measuring the benefits of improvements to forest recreation facilities

Stephen Hynes[1], Nick Hanley[2] and Michael Christie[3]

ABSTRACT

This research utilises a contingent behaviour valuation technique to value a range of improvements to recreational facilities in woodlands in Great Britain. Four groups of forest users are targeted in this research: cyclists, horse riders, nature watchers and general forest visitors. It was found that heterogeneity of preferences existed within each of these groups. The results suggest that policies aimed at maximising consumers' surplus per visit from forest recreation would achieve their goal through 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. It is argued that small scale forestry would be ideally suited to cater for the separate specialised user groups. Small scale forestry could maximise its recreational potential and create a niche market for a specialised forestry product by concentrating on one single recreational activity per forest site.

Keywords: contingent behaviour, forest recreation

1. INTRODUCTION

An important question for forest managers, relating to the future investment in forest recreation, is what types of recreation facilities generate the greatest welfare gains to forest users. The majority of current research has either simply valued forest recreation in a generic sense (e.g. Bishop, 1992) or forest recreation as a single attribute of wider forest values (Hanley, 1989; Hanley and Ruffell, 1993; Willis and Benson, 1989; Willis et al., 1988). To date, few studies have actually examined the economic value of specific recreation activities that take place in the forest (e.g. walking, cycling etc.), nor does current research rigorously explore heterogeneity of consumers' surplus values between alternative user groups. This research therefore aims to fill this knowledge gap by specifically exploring the value of changes in consumers' surplus associated with a range of enhancements to the forest resource that will improve recreational facilities across different uses and users.

Existing studies that have valued forest recreation have tended to be based on either revealed preference (RP) methods (e.g. the travel cost method), stated preference (SP) methods (e.g. contingent valuation). The two approaches have very different merits. For example, RP approaches have the advantage that values are grounded on actual behaviour, but the approach is unable to value resource provision beyond current levels, whilst site choice models based on RP data often suffer from multi-colinearity in terms of site characteristics. SP approaches overcome these limitations, enabling valuations to go beyond existing levels of provision; however, they may be subject to a wide range of potential biases. Recent developments in valuation research has focused on combining these two data sources and therefore developing methodologies that potentially draw on the best elements of both approaches (Hanley et al., 2003b). An example of a combined RP-SP method is the contingent behaviour model, which is adopted in this research.

In this research, we are interested in identifying which types of improvements to the forest

[1] *Rural Economy Research Centre, Teagasc, Athenry, Co. Galway. Email: shynes@rerc.teagasc.ie*
[2] *University of Stirling, Scotland*
[3] *University of Wales Aberystwyth*

recreation resource may result in the greatest gains in welfare, and how these welfare gains are distributed across different uses and user groups. Existing research highlights that there are a wide range of activities currently taking place within forests (Forestry Commission, 2004). Following a series of focus group meetings with forest visitors and forest managers, four recreation activities were identified as being most suitable for further research: cycling, horse riding, nature watching and general forest visitors. The selection criteria used to identify these activities included: those activities that attract a significant number of users; those activities where the numbers of users is expanding most rapidly; those activities that have specific facility/infrastructure/management needs; and those activities that are important to future forest policy.

2. THE FOREST SURVEY

Data for this research was collected using on-site, in-person interviews between May and September 2005. Interviews were undertaken at seven forests throughout Great Britain: Glentress, Dyfnant, Cwm Carn, Thetford, New Forest, Rothiemurchus, and Whinlatter. These forests were selected to cover the range of recreational activities examined in the research. Interviews were conducted during both week days and weekend days, as well as during all daylight hours. The format of the survey questionnaire followed standard guidelines for the design of the valuation survey instruments (Bateman et al., 2002; Herriges and Kling, 1999). Survey respondents were provided with some background information on the study and then asked to outline how they use forests for recreation. Next, they were presented with information on how the forest where they were sampled might be improved for recreation. Respondents were then presented with a single contingent behaviour scenario (out of the 8 listed in Table 1) and asked to identify the extent to which their number of planned trips to the forest in the next 12 months would change if the stated improvements were made. Finally, socio-economic, demographic and attitudinal data was collected from the respondents.

3. METHODOLOGY

Contingent behaviour models, as used in this study, combine elements of travel cost and stated preference methods. Each person *i* in each data set yields two responses. The first is the number of trips (V_{ij}) she makes to a given forest *j* per year, as a function of travel costs to a forest (TC_{ij}, travel costs to other, substitute sites ($TC_{sub\ ij}$), income (Y_i), the gender, age and education level of the respondent (S_i, A_i, E_i), and a vector of dummy variables representing unobserved quality differences for each site in the sample ($D_1..D_6$). The second observation is how many extra trips (if any) she says she would make if a specified improvement in recreational facilities at the site occurs. Such models have been used before to predict changes in both consumers' surplus and visits from improvements in environmental quality such as reductions in coastal water pollution at bathing beaches (Hanley et al., 2003a).

Four groups of forest users were studied: cyclists; horse riders; nature watchers; and general forest visitors. In each group, people were asked how their behaviour, in terms of intended number of trips to the site where they were sampled, would change, if one of two improvements were undertaken by the Commission. These are described in Table 1. As may be seen, for each scenario, an improvement in recreational facilities is described. Two econometric considerations arise in this data. First, repeated observations across individuals imply a possibility of error correlation between responses. Second, the integer nature of the visits variable implies that one should make use of a count data model. To allow for possible over-dispersion of the data, we employ a negative binomial specification, which is a generalisation of the Poisson model. To take account of the panel nature of the data, we use a random effects specification, comparing this to a pooled model which ignores error correlation.

4. RESULTS

4.1. Descriptive Statistics

At total of 1,568 on-site, personal interviews were undertaken during this research, and provides a

TABLE 1: SCENARIOS USED IN CONTINGENT BEHAVIOUR EXERCISE

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. These facilities would be free to use and would include:
ª Horse box friendly parking facilities that had plenty of room to park and manoeuvre large vehicles with horse boxes,
ª 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/wheel chairs."

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:
ª An enclosed safe play area for toddlers,
ª Traditional and 'adventure' play facilities for older children, and
ª High wire 'Go Ape' facilities for teenagers (and the odd adult!).
All facilities would be built with material that blends in with the forest."

breakdown of where the interviews were undertaken by forest and by recreation activity. Table 2 also provides a summary of the main recreation activity undertaken during trips to the respective forests. General forest users accounted 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. 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

TABLE 2: SUMMARY OF THE NUMBER OF INTERVIEWS UNDERTAKEN BY FOREST AND MAIN ACTIVITY.

	Main recreation activity undertaken				
Forest	Cycling	Horse riding	Nature watching	General forest recreation	All respondents
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

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. Contingent Behaviour Model Results

Given the contingent behaviour scenarios described in Table 1, there are 8 models to estimate, two for each group of recreationalist. In each case, we are interested in (i) whether the travel cost parameter is significant (if not, then no welfare estimates can be made) (ii) whether the dummy variable for the change in site quality is significant (if not, no prediction of the change in visitor numbers can be made). As noted above, the econometric approach taken is to use a panel data estimator as it takes into account the correlation in the errors between each person's two choices – actual and intended behaviour. We use a random effects rather than a fixed effects specification, since this fits the nature of our data better. Finally, since the dependent variable is a "count" integer, we must test whether a Poisson or Negative Binomial panel estimator is appropriate. All models were estimated in Stata. To exclude overnight visitors, for whom the calculation of trip costs would be difficult, we restricted the sample to those visitors who had travelled no more than four hours in total to visit the forest where they were sampled.

We initially ran both Poisson and Negative Binomial versions of each of the 8 models. In all cases, tests on the over-dispersion parameter showed that the Negative Binomial was preferred over the Poisson. We also tested whether a panel specification was preferred to a pooled specification in each case and the Likelihood Ratio test statistics in all cases confirmed the need for a panel rather than pooled regression. Table 3 below thus gives the results for all 8 recreational cases, but just for the negative binomial random effects panel specification. Variables used were as mentioned in Section 3, namely travel costs, travel costs to the nearest substitute forest site, income, gender, age, education, site dummies for each of the forests sampled, minus one; and a Contingent Behaviour (CB) variable, which is a dummy representing whether the visits we are explaining are actual, with current facilities, or hypothetical, with improved facilities.

Looking at the number of observations in each group, we see that there are very few observations, relatively speaking, for both horse-riding groups, whilst the CB variable is insignificant in both cases. We thus constrain our attention to the cyclist, nature watchers and general forest visitor groups, since in all six cases, the CB variable is significant at the 95% level or better. A point of interest is the strong gender effect in both cycling groups – men make many more trips, both actual and intended, than women – whilst income effects within the samples seem weak. In all six models, travel costs are significant and correctly signed. This is also true of the contingent behaviour (CB) dummy variable, which is significant and positive,

TABLE 3: NEGATIVE BINOMIAL RANDOM EFFECTS PANEL MODELS

	Cycling A	Cycling B	Horse Riders E	Horse Riders F	Nature Watchers I	Nature Watchers J	Forest Visitors M	Forest Visitors N
Travel Cost	-0.052	-0.075	0.084	-0.092	-0.095	-0.112	-0.043	-0.024
	(4.97)**	(7.10)**	(2.58)**	(3.10)**	(3.74)**	(2.51)*	(3.80)**	(2.32)*
Travel Cost to	0	-0.038	0.126	-0.011	0	0.023	-0.007	-0.009
nearest sub. site	-0.57	(5.87)**	-0.44	-0.13	-0.03	-1.9	(2.11)*	(2.21)*
Income	0.109	0.219	0.227	0.632	-0.244	0.314	-0.111	-0.032
	-0.93	-1.67	-0.57	(2.43)*	-0.85	-1.61	-1.13	-0.32
Female	-0.667	-0.705	0.624	0.74	0.158	0.106	0.048	-0.047
	(2.71)**	(2.90)**	-1.09	-1.87	-0.74	-0.27	-0.35	-0.37
Dyfnant Forest	-0.788	-0.969	-1.425	-1.805	-0.526	-1.833	-0.533	-0.237
	-0.85	-0.62	-1.2	(2.50)*	-1.5	(4.15)**	-1.43	-0.69
Cwmcam Forest	0.153	0.136			-0.184	-0.799		
	-0.72	-0.57			-0.35	-0.97		
Thetford Forest	0.614	-0.008	-5.008	-0.861	-0.514	-1.89	-0.997	-0.339
	-1.91	-0.03	(2.66)**	-0.64	-1.77	(3.48)**	(2.96)**	-1.2
New Forest	-0.777	-1.537	-3.845	-2.453	0.733	-0.847	-0.178	0.144
	-1.61	(2.23)*	(3.07)**	(3.35)**	-0.7	-0.64	-0.5	-0.47
Rothiemurcus Forest	-1.785	-2.652			-1.535	-2.898	-1.32	-0.618
	(2.80)**	(2.47)*			(3.51)**	(5.73)**	(3.93)**	(2.26)*
Whinlatter Forest	-1.666	-3.136	-1.944	-0.985	-0.553	-2.248		
	-1.68	(2.98)**	-1.09	-0.79	-1.26	(3.76)**		
Age	-0.075	0.192	-0.388	0.292	-0.072	0.003	0.014	0.119
	-0.74	-1.71	-1.77	(2.09)*	-0.57	-0.02	-0.25	(2.33)*
Income Squared	-0.01	-0.018	-0.013	-0.037	0.015	-0.022	0.008	0.003
	-1.17	(2.03)*	-0.42	(2.04)*	-0.79	-1.55	-1.21	-0.47
Qualification below A Levels	0.296	-0.841	0.435	2.078	0.062	-0.314	0.014	-0.285
	-0.79	(2.13)*	-0.61	(3.37)**	-0.14	-0.54	-0.07	-1.4
A Levels or Equivalent	0.524	0.085	-1.043	1.326	0.69	0.182	-0.139	-0.421
	-1.4	-0.2	-1.12	(2.16)*	(2.35)*	-0.4	-0.66	(1.99)*
Degree Holder	0.063	-0.391	-1.863	0.534	0.163	0.028	0.392	-0.257
	-0.19	-0.98	(2.54)*	-0.86	-0.47	-0.06	(2.03)*	-1.39
CB	0.183	0.052	0.12	0.121	0.751	0.363	0.167	0.209
	(5.16)**	(2.31)*	-1.47	-1.85	(5.39)**	(3.07)**	(3.19)**	(3.47)**
Constant	3.984	15.784	19.804	14.53	17.854	17.003	3.723	2.354
	(6.10)**	-0.05	-0.05	-0.02	-0.02	-0.03	(6.04)**	(4.36)**
Observations	436	406	58	94	90	82	558	549
Number of Respondents	218	203	29	47	45	41	281	278
Wald Chi 2(16)	111.78	149.37	64.3	84.22	87.36	83.31	73.38	48.79
Log Likelihood	-1244	-1175	-132	-222	-155	-145	-1151	-1095
Likelihood Ratio versus								
Pooled Model	593.11	645.58	61.93	111.23	10.69	60.97	661.70	557.58

* significant at 5% * * significant at 1%

indicating that hypothetical improvements in recreational facilities have the effect of increasing planned trips on average. The Wald statistic reported in Table 3 shows a high level of significance for each of the models.

To estimate the recreation benefits from these improvements, two steps are needed. First, we predict trips under current and hypothetical conditions, in order to calculate the change in predicted trips. Second, we use the travel cost parameter estimate from the panel models to value this increase in trips in monetary terms. Table 4 summarizes these two stages, giving the change in predicted trips in column 2 and the change in consumers' surplus per visitor per year in column 3. Confidence intervals for this welfare measure are also shown. As may be seen, the largest proportional changes in trips come from investing in new family play areas for "general visitors"; and investing in new trail obstacles for cyclists. The largest increase in consumers' surplus per annum would accrue to general visitors for new family play areas, and for nature watchers if new wildlife hides are constructed in the forest (although the% increase in visits for this group is smaller than for cyclists in Scenario A (4.5% relative to 5%), this is based on a higher absolute increase in trips due to a higher initial predicted trip count).

Table 4 – Results from the contingent behaviour models

Improvement scenario	Predicted% change in trips over base	Increase in annual consumers' surplus per visitor (£)*
Cyclists: New optional trail obstacles built alongside existing bike trails.	+5.0	3.46 (2.46, 5.62)
Cyclists: New shower and changing facilities provided at the forest.	+0.3	0.66 (0.52, 0.90)
General Visitors: New art/sculpture trails.	+4.5	2.79 (1.83, 5.71)
General Visitors: New family play areas provided at the forest.	+10.2	8.75 (4.77, 70)
Nature Watchers: several new hides built in forest	+4.5	7.89 (5.35, 18.73)
Nature Watchers – new wildlife centre built	+2.0	3.30 (1.85, 15.42)

*95% confidence interval in parenthesis

5. DISCUSSION AND CONCLUSIONS

The results from this study 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 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 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.

It is clear from the data that the more specialist users attain relatively high consumers' surplus from the provision of activity specific facilities. 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 with other user groups. We would argue that small scale forestry would be ideally suited to cater for the separate specialised user groups. Small scale forestry could maximise its recreational potential and create a niche market for a specialised forestry product by concentrating on one recreational activity per forest site.

Much of the small scale forestry in Britain and Ireland is found in areas bypassed by recent economic growth, where farming continues to be a marginal activity and which have endured population decline. Furthermore, much of this small scale forestry is planted on farm land of marginal quality; often rocky, hilly ground, the type of terrain highly prized by specialized recreational groups such as mountain bikers and horse riders. Policy makers are increasingly recognising the value of open-air outdoor recreation as a means of supporting rural incomes through niche tourism; environmentally guided farming; rural diversification; job creation and rural regeneration. They should also recognise the fact that small scale and farm forestry could be used to provide some recreational services in rural areas. The activities could provide additional income locally while the forests are still maturing to an age for harvesting. 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 not only large forests but also small scale forestry by enabling forest managers to develop forest recreational facilities to target different forest users.

REFERENCES

Arrow, K., Solow, R., Portney, P. R., Learner, E. E., Radner, R. & Schuman (1993). "Report of the NOAA Panel on Contingent Valuations". Resources for the Future: Washington, D.C.

Bateman, I. J., Carson, R. T., Day, B., Hanemann, W. M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S., Özdemiroglu, E., Pearce, D., Sugden, R. & Swanson, J. (2002). Economic Valuation With Stated Preference Techniques. A Manual. Edward Elgar: Cheltenham.

Bishop, K. D. (1992). Assessing the Benefits of Community Forests: An Evaluation of the Recreational User Benefits of Two Urban Fringe Woodlands. Journal of Environmental Planning and Management, 35, 63-76.

Forestry Commission (2004). Forest visitor surveys 2002. Forestry Commission: Edinburgh.

Hanemann, W. M. (1994). Valuing the Environment through Contingent Valuation. Journal of Economic Perspectives, 19-44.

Hanley, N. (1989). Valuing Rural Recreation Benefits: An empirical comparison of two approaches. Journal of Agricultural Economics, 40, 361-374.

Hanley, N., Bell, D. & Alvarez-Farizo, B. (2003a). Valuing the Benefits of Coastal Water Quality Improvements Using Contingent and Real Behaviour. Environmental and Resource Economics, 24, 273-285.

Hanley, N. & Ruffell, R. (1993). The Valuation of Forest Characteristics. In Adamowicz, White & Phillips (Eds.) Forestry and the Environment - Economic Perspectives.

Hanley, N., Shaw, W. D. & Wright, R. E. (2003b). The New Economics of Outdoor Recreation. Edward Elgar: Cheltenham.

Herriges, J. A. & Kling, C. L. (1999). Valuing Recreation and the Environment: Revealed Preference Methods in Theory and Practice. Edward Elgar: Cheltenham.

TNS Travel and Tourism (2004). Leisure Day Visits: Report of the 2002-3 GB Day Visits Survey. The Countryside Agency: Cheltenham.

Willis, K. G. & Benson, J. F. (1989). Values of user benefits of forest recreation: some further site surveys. Forestry Commission: Edinburgh.

Willis, K. G., Benson, J. F. & Whitby, M. C. (1988). Values of user benefits of forest recreation and wildlife. Forestry Commission: Edinburgh.