



Valuing Environmental Impacts: Practical Guidelines for the Use of Value Transfer in Policy and Project Appraisal

Case Study 1 - Valuing Improvements in Facilities at a Forest Recreation Site

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CASE STUDY 1: VALUING IMPROVEMENTS IN FACILITIES AT A FOREST RECREATION SITE

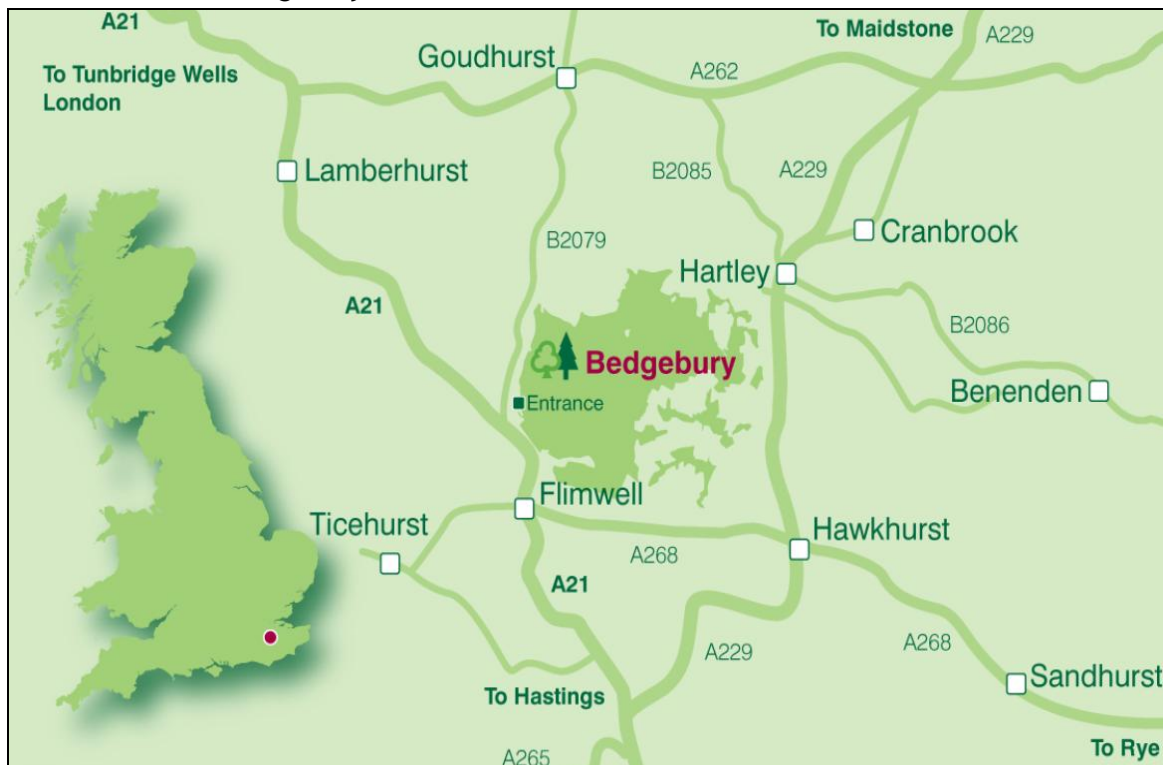
- *Case Study 1 illustrates the use of unit value transfer in the context of the recreational uses of forests in the UK.*
- *The example estimates the benefits of improvements to recreational facilities at a specific site. It is an ex-post evaluation of the improvements but the approach is also applicable to ex-ante analysis.*
- *Values are obtained from a primary study specifically designed to provide average or transferable values, highlighting the benefit of such an approach to primary valuation.*

STEP 1: ESTABLISH THE POLICY GOOD DECISION-CONTEXT

This case study provides an *ex-post evaluation* of investment in recreation facilities at a forest site, comparing the estimated benefits to visitors to the costs of improvements. While the main Guidelines focus on ex-ante appraisal, this case study demonstrates that the eight value transfer steps apply equally in an ex-post evaluation setting. The key difference is that in ex-post analysis recorded data on actual visits can be used instead of the predicted visits data for ex-ante appraisal.

The policy site of interest is Bedgebury National Pinetum and Forest, which is located in Kent, South East England (**Figure 1**). The site is managed by the Forestry Commission England (FCE). Improvements in recreation facilities were part-funded via the Active England programme over the period 2005-8 (FCE, 2008), with the objective of increasing recreational use of such areas to promote health and wellbeing. In total approximately £2.5 million (2008 prices) was spent on the improvements at the site.

Existing assessments of the project have included survey and qualitative research to establish outcomes of the project such as the increase in visitors and purpose for visits (see Forest Research, 2009). This case study utilises data from these assessments in addition to other site-specific reports to provide an economic analysis of the benefits of improved visitor facilities.

Figure 1: Location of Bedgebury National Pinetum and Forest

Source: FC (2009b)

STEP 2: DEFINE THE POLICY GOOD AND AFFECTED POPULATION**What is the good to be valued?**

The Bedgebury site is primarily known for its National Pinetum, which is home to the largest single collection of conifers in the UK and is a collection of international significance with specimens from around the world. The pinetum, however, only covers around 60 hectares (ha) of the site. The majority of the site, 790 ha, is commercial forest with a mix of deciduous and conifer trees, areas of coppiced chestnut and heathland. The forest also lies within the High Weald Area of Outstanding Natural Beauty (FCE, 2008).

The Bedgebury project involved the creation or improvement of various recreational facilities (O'Brien and Morris, 2009a):

- Walking: surfaced walking trails;
- Cycling: surfaced track for family cycling (10 km); free ride area; mini North Shore (mountain bike trail); dirt jump course; cycling club; single track trail for mountain bikers (12 km); bike hire facility (at visitor centre);
- Horse riding: toll riding for equestrian activity; and
- Facilities: children's play area; visitor centre and café; classroom/community room; showers for riders and bikes.

Overall, the ‘good to be valued’ is the improved quality of recreation at Bedgebury generated by the improvements to facilities. Recreation provides a non-consumptive use value and improvements are assumed to increase visitor welfare from pre-improvement to post-improvement.

The change in welfare is measured by the change in the consumer surplus of visitors. In this context, consumer surplus is the amount of welfare received by visitors by being able to visit the forest for a price that is less than they would be willing to pay. The access cost does not change because of the improvements, but the quality of the recreation increases both for the existing visitors and new visitors attracted to the site.

The change in the consumer surplus has two components: (i) the additional consumer surplus gained by existing visitors as a result of the site quality improvements; and (ii) the consumer surplus gained by new visitors to the site¹. With regards to (ii) new visitors may actually be transferring their recreation activities from an alternative site to Bedgebury, so the gain in consumer surplus is net of the value of activities at the substitute site. The extent to which existing and new visitors can be differentiated and net consumer surplus for the latter can be estimated depends on the available data, as reviewed in Step 3.

Who is the affected population?

The relevant population for improvements at Bedgebury is the user population, which comprises of visitors to the site. Data from a survey undertaken after the improvements were completed indicate that the majority of visitors are local, travelling to the site from within an approximate 10-12 mile radius (O’Brien and Morris, 2009a). The majority of users are residents in South East England (82%), followed by visitors from Greater London (11%) with a few coming from further away in England (6%)(Table 1).

Note that data presented in Table 1 are based on a small sample size for a visitor survey (238 observations). Despite this small size, the observed distribution of visitor residences conforms well to expectations for a site such as Bedgebury where the majority of visitors come from the local area. The proportion of visitors from further afield is indicative of the increasing availability of substitute sites as distance of residence from Bedgebury increases.

¹ In actual fact the distinction between ‘existing’ and ‘new’ users is somewhat artificial. Forest recreation users are unlikely to confine their activities to a single site over a given time period, such as a year. If improved facilities at Bedgebury generate greater consumer surplus then the welfare gain to be valued is the additional amount generated by: (i) a greater number of visits; i.e. increased participation; and (ii) the improvement in experience per visit that was already undertaken (regardless as to whether this was at Bedgebury or an alternative site). The approach taken in this case study is a practical simplification that makes best use of available data.

Table 1: Area of residence of visitors to Bedgebury (sample size = 238 visitors)

<i>Region</i>	<i>Location</i>	<i>% of Visitors</i>
South East England	Sub-total	82
	Tunbridge Wells	46
	Rochester	24
	Dartford	5
	Brighton	3
	Canterbury	3
	Other South East	<1
Greater London	Sub-total	11
	Bromley	6
	South East London	2
	Other Greater London	2
Rest of England	Sub-total	6
	East of England	4
	North West England	1
	Yorkshire & Humberside	1
Don't know/not stated		2
Total		100

Source: TNS, 2008.

STEP 3: DEFINE AND QUANTIFY THE CHANGE IN THE PROVISION OF THE POLICY GOOD

Information and data sources

A number of reports that assess the impact of the Bedgebury project are available:

Reports on the Active England project available through the Forestry Research Agency²:

- *Active England - The Woodlands Project Report* (O'Brien and Morris, 2009b): this provides an overview and assessment of entire Active England project (Bedgebury was one of five sites funded), focusing on the general outcomes such as increase and changing profile of visitors.
- *Active England - Bedgebury National Pinetum and Forest* (O'Brien and Morris, 2009a): this provides a more detailed assessment of the portion of the Active England project implemented at Bedgebury.

Additional reporting provided by the FCE

- *Monitoring the Quality of Experience in Bedgebury Forest* (TNS, 2008): A survey of the quality of visitor experience, visitor profile and activities undertaken at Bedgebury. The sample size is very small (283, ~0.1% of visitors in 2007/2008).
- *Bedgebury National Pinetum and Forest Report (April 2007 - March 2008)* (FCE, 2008): A summary of the outcomes of recreational improvements from the perspective of FCE employees directly

² <http://www.forestresearch.gov.uk/activeengland>

responsible for Bedgebury Forest. Useful for providing a timeline of the improvements and descriptions of the new recreational programmes (such as the Bedgebury Forest Cycle Club).

Description of the change and outcomes

Studies assessing the outcomes from improvements in facilities at Bedgebury indicate that the annual number of visits to the site increased significantly post-improvements (O'Brien and Morris, 2009a). Although a significant increase in visits could have a negative consequence due to congestion, for the purpose of the analysis it is assumed that the level of visitors at any one time is not high enough to cause overcrowding. Moreover, the improvements in facilities have increased the use capacity of the site such that existing and new users benefit from an improved recreational experience. Consequently the improvements are assumed to have generated gains in consumer surplus.

Quantitative assessment

The number of annual visits increased over the development of the project from approximately 52,000 in 2005 before it started, to over 273,000 in 2007 once completed (Table 2). This represents a five-fold increase in annual visits to the site³.

Table 2: Annual number of visitors to Bedgebury	
<i>Year</i>	<i>Annual Visits</i>
2005/6 (pre-improvements baseline)	51,837
2006/7	182,426
2007/8 (post-improvements)	273,081
<i>Change in visitors (2005 to 2007)</i>	221,244

Source: O'Brien and Morris, 2009a.

It is important to distinguish between the annual number of visits and visitors (**Box 1**), as visitors may make multiple visits in any single year. In estimating annual visits, it must be kept in mind that repeat visits by same individual are typically subject to some level of diminishing marginal utility; i.e. each visit is valued at slightly less than the previous visit.

As highlighted in Step 2, for the practical purposes of the analysis a distinction can be drawn between the gains in consumer surplus to 'existing' (pre-improvement) users and 'new' (post-improvement) users to the site. The 2005 visitor total is assumed to provide the baseline for the analysis in terms of 'existing' visitors. The difference between the 2005 and 2007 (post-improvement) is 221,244 visitors. This is taken as the change in visits arising from the improvements to facilities (i.e. 'new' visits). This is assumed to be a fair representation of the baseline visitor rate prior to 2005 which was relatively stable over time (pers. comm. D. Hiscock, Forestry Commission, July 2009).

Further data for Bedgebury list all activities carried out at the site by visitors in 2007/8 (**Table 3**), but do not report the primary purpose for visits. Again these data are based on a very small sample size; for example there are no observations of horse riding activities even though facilities are available.

³ On-site sampling of visitors will invariably include a greater proportion of frequent relative to infrequent visitors in the sample, compared with the actual proportion of visitors of different frequencies to the site. This can result in an over- or under-estimate of the aggregate value of a site, depending on how visitor value is measured.

Table 3: Participation in activities at Bedgebury Forest in 2007/2008 (sample size = 238)	
<i>Type of User</i>	<i>% visitors participating in activity</i>
Walking*	52
Walking without a dog	42
Dog walking	13
Hill walking/ rambling	3
Running	1
Cycling*	42
Cycling on surfaced roads	21
Cycling on un-surfaced roads/tracks/trails	19
Off-road cycling	21
Visited the café	38
Freeride & dirt jump area	3
Horse riding	0
Nature watching	-
Other wildlife watching	4
Bird watching	2
Nature/ natural history visit	2
Follow the seasonal trail	7
Visited Pinetum	15
Other Uses	-
Use play trail	20
Picnic or barbeque	15
Go Ape course	5
Seeing something in the forest (e.g. a sculpture)	3
Photography	2
Children's play area	1
Orienteering	1
Educational visit	<0.5

Source: TNS (2008)

* Percentages in the table do not sum to 100% since visitors may participate in more than one type of activity, or sub-activity.

Box 1: Quantifying the user population - visits and visitors

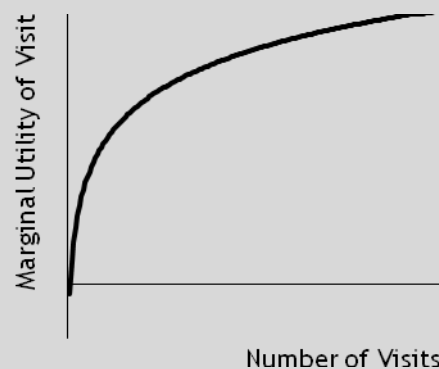
When valuing recreation benefits it is important to differentiate between *visitors* and *visits* to a site. In particular, the number of visitors will be less than the total number of visits to site, accounting for multiple visits by some individuals. On an annual basis:

- Visitors are the number of people that visit a site each year; and
- Visits are the number of visits completed in a year, not considering whether multiple visits are attributable to single individuals.

This has implications for assessing the value of a visit. In particular diminishing marginal utility implies that:

- Visitors who make multiple visits to the site should typically value each additional visit less than the previous visit (i.e. the n^{th} visit is worth less than the $n^{\text{th}}-1$ visit).

Diminishing marginal utility is one of the primary tenets of microeconomic theory that is empirically supported (see figure below). Because of diminishing marginal utility, transferring the unit value of a visit (£per person per visit) from the study site to all visits at the policy site, irrespective of whether they are first or repeat visits of a visitor, would likely result in an over-estimate of the value of the site.



A further complication is added by the issue of heterogeneity *between* and *within* visits.

- Visitors and visits are both heterogeneous over a number of dimensions, but perhaps most importantly in terms of the *purpose* of visit.
- Both visitors and visits can be classified by primary purpose (e.g. cycling, walking, etc) - this is heterogeneity between visits.
- Transferring an average value for a recreational visit is likely to be inappropriate in cases of heterogeneity between visits, since each category of visitor will likely place a different value on the site and its recreational attributes (in effect these are different user populations).
- Diminishing marginal utility is also experienced over the use of multiple facilities, but it is often difficult to identify the secondary and tertiary purposes of a visit; this is heterogeneity within visits (Christie et al., 2005 indicate an average of 2.5 activities per visit).
- Transferring a value only based on primary purpose of visit will likely underestimate the value of the site to each visit made in the case of heterogeneity within visits.

STEP 4: IDENTIFY AND SELECT MONETARY VALUATION EVIDENCE

Requirements

Based on Steps 2-3 an estimate of the recreation use benefits to visitors to Bedgebury is required. Strictly the requirement is to estimate the *additional* consumer surplus generated by the improvements to facilities:

- For *existing visits* (pre-improvements) estimated consumer surplus should be net of consumer surplus derived prior to the improvements.
- For *new visits* (as estimated by the difference between 2005 and 2007 visitors in Step 3) estimated consumer surplus should be net consumer surplus derived from use of alternative sites that visitors have transferred from.

However, as Step 3 shows, data on the visits made by existing or new Bedgebury visitors to other sites (pre- and post-improvements) is not available. It is also not known if the existing visitors changed the number of visits they each make post-improvements. Thus, in order to proceed with value transfer, two key assumptions are needed:

- i). There is no gain in consumer surplus to *existing visits*: this is likely to under-estimate the benefit of improvements to the site for this subset of the user population.
- ii). The consumer surplus of *new visits* is assumed not to have been transferred from elsewhere: this is likely to over-estimate the benefits of improvement to the site for this subset of the user population.

Assumption (i) potentially offsets part of the over-estimate of benefits that may arise via (ii), but in effect assuming no additional gain in consumer surplus implies that marginal utility for existing visits is non-decreasing. Even if slightly offset by assumption (i), assumption (ii) is still particularly strong and in Step 7 is subject to sensitivity analysis in relation to the benefits threshold in the calculation of the net present value of the project. This assumption essentially holds that Bedgebury is non-substitutable and that all new visits were explicitly generated by improvements to recreational facilities.

The substitutability of Bedgebury is discussed in more detail in **Box 2**. The changing visitor profile shows that new visits were indeed generated. Specifically, there was a large increase in family visits associated with the site. In fact, part of the Active England project was to make it easier for specific groups to visit the site that normally have difficulty not just visiting forests, but any outdoor site. These target groups included those with disabilities and those on low income.

On the basis of the above assumptions, the relevant monetary value evidence is presented in the rest of this Step.

Box 2: Substitute sites for Bedgebury

For new visitors/visits to Bedgebury, the actual benefits of recreational facility improvements are the total benefits of those facilities less the benefit of visits lost at previously visited alternative sites; i.e. the *net* benefits.

To better understand the magnitude of net benefits compared to total benefits, it is essential to understand the alternative options to visiting Bedgebury. These options are the *substitutes* for Bedgebury. Substitute sites could be considered across all Forestry Commission sites, or at least those in England that offer similar facilities (Table 4).

Table 4: Proportion of FC sites that offer specific recreational facilities		
<i>Facility Type</i>	<i>All Sites (%)</i>	<i>England Sites (%)</i>
Cycling	42.0	44.2
Horse-riding	32.5	31.2
Wildlife	25.3	30.8
Walking	79.3	71.2

Source: FC, 2008.

However, since the majority of visitors to Bedgebury live close to the site, only local substitutes should be considered. While the substitutability of Bedgebury among sites within the region was previously high, it is now very low (pers. comm. D. Hiscock, Forestry Commission, July 2009).

In particular, prior to the Active England project, Bedgebury was not known among the general public for its scientific value, but instead competed with all other managed garden sites in the area (of which there are many, particularly National Trust sites). Now Bedgebury is the top attraction in the region for active outdoor family outings. There is some competition with:

- A few other forest areas, such as *Groomebridge Place*, but none of which are of the same scale as Bedgebury;
- *Bewl Water*, which is focused on water-based rather than land-based recreation; and
- *Leeds Castle*, which only has one truly *active* outdoor facility that Bedgebury also has (a 'Go Ape' course).

Overall the investigation of availability of substitute sites to Bedgebury supports the assumption that a large proportion of the increase in visits is *new* visits as opposed to *transferred* visits.

Sources of valuation evidence and screening candidate studies

The primary source of valuation evidence related to forest recreation in the UK is provided by previous research carried out by the Forestry Commission. A series of reports have focussed on the non-market benefits of forests (Box 3). For this case study, the review of existing studies (see below) focussed primarily on Forestry Commission research and other UK studies published in the past 10 years.

A considerable number of North American and European studies are also available. These are excluded from the study search due to potentially significant differences between the study sites and a site such as Bedgebury. In this context Bedgebury is a relatively small managed site with mainly informal (walking) and day-trip activities (e.g. cycling, horse-riding), while it is not uncommon for Northern American studies to consider large wilderness areas that provide opportunities for camping, trekking and hunting (e.g. valuation of remote 'fly-in' fishing sites, Hunt et al., 2005).

Box 3: Non-market Benefits of Forests

Forests provide a bundle of social and environmental benefits (SEBs) that are predominantly non-market in nature. The FC has been proactive in recognising this and using economic valuation in the appraisal of their activities.

In 2003, the FC released a report titled *The Social and Environmental Benefits of Forests in Great Britain* (Willis, et al., 2003) that explored seven primary SEBs arising from woodlands in Great Britain: recreation; landscape; biodiversity; carbon sequestration; archaeological preservation; pollution absorption; and water supply and quality.

An estimation of the total annual and capitalised value of each of the SEBs (Table 5) indicated that recreational value is the greatest non-market benefit of forests in Great Britain.

Table 5: SEBs of forests in Great Britain (£ millions, 2002 prices)

<i>Environmental Benefit*</i>	<i>Annual Value</i>	<i>Capitalised Value</i>
Recreation	392.65	11,218
Biodiversity	386.00	11,029
Landscape	150.22	4,292
Carbon sequestration	93.66	2,676
Air pollution absorption	0.39	11
Total	1,022.92	29,226

*Only lists the benefits identified as most important in Phase 1 of this study.

The study compared a contingent valuation approach and a benefits transfer approach, and found similar values for recreational benefits as previous studies: £1.25-£3.41 per person per visit (2008 prices) (from Scarpa, 2003; the sub-report to Willis et al., 2003 that focuses on recreational benefits).

Existing UK valuation studies

Table 6 reports unit value estimates of recent UK studies estimating the recreational value of UK forest and woodland sites:

- Bateman and Jones (2003) provide a meta-analysis of forest recreation values for the Forestry Commission. It includes 13 different studies published before 1997, covering 21 different forests that provide a total of 77 different estimates of the per-person per-visit recreational benefits from both travel cost and contingent valuation methods. The majority of these values relate to use value, although 16 are classified as relating to use plus option values. Of the 61 value observations related to current use values, estimates range from £0.07 to £3.14 per visit (1990 prices).
- Scarpa (2003) similarly reports values of £1.66 - £2.78 per visit based on contingent valuation data for woodland sites (2002 prices).
- Christie et al. (2005) estimate the value of recreational improvements to forest sites for different user types (walkers, cyclists, horse riders, nature watchers) ranging between £7.90 - £14.99 per visit (2005 prices) via travel cost. Contingent behaviour and choice experiment analyses are used to estimate changes in visitor welfare associated with improvements to specific recreational facilities (e.g. value of paved cycle track to cyclist).

A number of observations from this survey of the available literature are:

- Consumer surplus estimates included in Bateman and Jones (2003) are based on relatively old data sets (greater than 10 years old).
- Except for Christie et al., all studies estimate the value of a non-specific visit. In contrast, Christie et al. distinguish between different types of visitor, even though the value estimates for the different types are rather similar with the exception of the value for nature watching (£7.90 per person per visit for nature watching compared to approximately £14 to £15 per person per visit for all other activities).
- Function transfer does not appear to be feasible in this case study because other studies estimated consumer surplus based on functions that included relatively generic parameters for characteristics of the site and did not include parameters for the presence of specific recreational facilities. Also from a practical perspective, the key aspect from decision-making is to ascertain whether the net benefits of the improvements at Bedgebury are positive. Given this a unit value transfer approach is viewed as appropriate and commensurate with required level of effort in the analysis.
- The estimates provided by Christie et al. are greater than those reported by all other studies summarised in Table 6. Other than the Christie et al. estimates, there is a great deal of consistency in terms of per person per visit estimates reported by the available studies (the ranges of estimated values fall within the bounds of approximately £0.00 to £4.00 per visit). Some reasons for this difference are discussed below and different estimates are used for sensitivity analysis.

Matching the study good to the policy good

Taking a unit value transfer approach, the key determination for choosing between available studies is whether to apply a non-specific visit value or whether to distinguish between visit types, since survey data for Bedgebury includes a breakdown of different activities (Table 3).

The meta-analysis by Bateman and Jones (2003) finds that the value of recreational forest visits is, in the main, not determined by the facilities at a particular site. Specifically, no statistically significant differences in reported values were found across the 21 forest sites that featured in the meta-analysis data. This finding follows previous studies (Brainard, et al., 1999, 2001 as cited in Bateman and Jones, 2003) suggesting site location provides a much stronger predictor of demand than facilities available, where there is little distinction between sites. In particular Bateman and Jones (2003) note that the sites included within the meta-analysis all provide the same basic walking and recreational amenities and hence sites closer to larger populations are more likely to experience greater visitor numbers than those further away.

The findings of Bateman and Jones (2003) imply that unless there is sufficient justification - in terms of facilities available - there is little practical need in a value transfer exercise to distinguish between visitor types and activities. With respect to recreation facilities, Bedgebury does in fact represent a 'superior' quality recreation site in relation to alternatives in the local area/South East (as discussed above and in **Table 7**) and therefore distinguishing between visitor types in the analysis is appropriate.

Table 6: Summary of existing studies and study good(s) not included in Bateman and Jones (2003) meta-analysis						
Study	Study good context and methodology	Definition of the Good	Study good site	Substitutes	Mean WTP (per visitor per trip, as reported in study)	Sample size
Bateman, I. and Jones, A. (2003)	Meta-analysis of informal recreational value of woodlands (CV, VT)	Generally rural forest, with generic recreation benefit	Mix of commercial forest and nature reserve sites, FC and other	In many	Estimates range from £0.07 to £3.14	Meta-analysis - 21 sites
Scarpa, R. (2003)	Compensating variation for recreational visit to woodland (CV, VT)	Rural forest with generic recreation benefit	CV over 7 FC sites: Brenin (Wales), Dartmoor, Delamere, Epping, New Forest, Thetford	Not considered	CV: £1.66 - £2.78 VT: £1.10 - £3.00	n=428 (for CV)
Zandersen M. and Tol. R.S.J. (2005)	Meta-analysis of forest recreation in Europe (TC studies only)	All types of forest with generic recreation benefit	Sites covered in 25 studies in 9 countries	Considered	Median: US \$ 4.90 (2000 prices)	n=251
Christie, et al. (2005)	Value of recreational improvements of forest to specific user types (TC, CB, CE)	Rural forest and rural forest with specific recreational amenities	Cwm Carn, Dyfnant, Glentress, New Forest, Rothiemurchus, Thetford, Whinlatter	Considered	Average values by TC method over 7 sites: Cyclists - £14.97 Walkers - £14.51 Other Visitors - £14.99 Nature Watchers - £7.90 Horse Riders - £14.20 (CE, CB provided various values for specific site attributes)	n=1,568 For TC: Cyclists - 322 Walkers - 416 Other Visitors - 416 Nature Watchers - 104 Horse Riders - 81
Zandersen M. and Tol. R.S.J. (2005)	Meta-analysis of forest recreation in Europe (TC studies only)	All types of forest with generic recreation benefit	Sites covered in 25 studies in 9 countries	Considered	Median: US \$ 4.90 (2000 prices)	n=251

Notes:

1. CE = choice experiment; CV = contingent valuation; TC = travel cost; VT = value transfer, CB = contingent behaviour; 2. Some studies not included because they were urban or urban fringe; 3. Some studies not included because they estimated household values (e.g. Bateman, et al., 1996) or once-and-for-all willingness-to-pay values (Hanley and Spash, 1993), here focus is on per visitor per trip values.

On this basis, the valuation context of the Christie et al. may be a suitable match to Bedgebury context, where the aim of the study was to understand how the recreational values differed between activities and with improvements to specific recreational facilities. Of the seven sites included in that study, all seven had walking facilities, six had cycling/mountain biking facilities and five had horse-riding facilities, making the sites reasonably comparable in their mix of facilities to Bedgebury.

Following the criteria for matching the study good to the policy good detailed in the main guidelines document, **Table** provides a comparison of the Bedgebury valuation context to that of Christie et al. and the other non-specific visit studies.

Table 7: Comparing policy good context and study good context(s)			
<i>Selection Criteria</i>	<i>Bedgebury policy site and good</i>	<i>Christie et al.</i>	<i>Previous Studies (Undifferentiated users or activities)</i>
i). Similarity of the policy good and study good	Differentiated recreational activities	Differentiated recreational activities	Undifferentiated recreational activities
ii). Similarity of the change in provision of the policy good and study good	Site visitors differentiated by activity type	Differentiated by visitor type, includes specialists	Generic, non-specific activity visitors
iii). Similarity of the sites where the policy good and study good are found	Forestry Commission site (commercial forest, but with recent investment in recreation)	Forestry Commission sites (7 forest in Great Britain chosen for recreational activity)	Forestry Commission sites and other sites (mix of commercial forest and nature reserve sites)
iv). Similarity of the policy good and study good affected populations	Majority of visitors originate from local area with small towns and larger urban areas	49 percent of visitors are self-reported day-trippers	Majority of visitors originate from local area
v). Similarity of the number and quality of substitutes for the policy good and study good	Some alternative recreational sites nearby, but nothing directly comparable based on size, type of activity, and diversity of available activities	Considers substitute sites such as other nearby woodlands, by including variable of travel distance to nearest substitute in travel cost model	Many of the studies consider substitutes such as other nearby woodlands
vi). Similarity of the policy good and study good market constructs	Open-access site with minimal entry fee (car parking charge). The policy context is concerned with improvements to site quality	Open-access sites with minimal entry fee. Study context is concerned with site quality	Open-access sites with minimal entry fee. Study contexts are largely concerned with demand for visits
Study quality	N/A	A robust study with a full account of validity and potential biases in estimates	Generally a robust set of studies although typically based on older data sets

On the basis of the comparisons drawn in Table 7, the Christie et al. study is selected for transferring unit values to estimate the benefits of improvements to recreation facilities at Bedgebury. Generally the match to the Bedgebury policy site across all studies reviewed is good. The advantages of the Christie study are that it is based on more recent survey work compared to studies of significantly older vintage and it provides a close match to the Bedgebury context in terms of valuing improvement to recreation facilities for different visit types.

As detailed above, the unit value estimates provided in Christie et al. are higher than previously reported values. They discuss a number of methodological issues which could have a positive or negative effect on estimated values. For example, the total travel cost was estimated by doubling the distance travelled to the site (to estimate total travel distance) and multiplying by a single average per mile travel cost parameter. However, two ‘real-world’ causes of higher values in Christie et al. for the travel cost method estimates were also identified:

- Travel costs are affected by the increase in fuel prices between the Christie et al. study (2005 data) and earlier studies carried out in the 1980s and early- to mid-1990s; and
- Specialist users, such as cyclists and horse-riders, do pay more than general users to visit facilities (and this would be particularly true for new, high-quality facilities such as those at Bedgebury).

Given the higher observed unit value estimates in the Christie et al. study, a lower bound estimate in line with previous studies is applied for sensitivity analysis in relation to investigating the benefits threshold in the calculation of the net present value of the project (see Step 7). The value used for this sensitivity analysis is the mid-point of the previously estimated values: £2 per person per visit.

STEP 5: TRANSFER EVIDENCE AND ESTIMATE MONETARY VALUE

Travel cost and choice modelling unit value estimates

Transferring unit values from Christie et al. to estimate the value of improvements at Bedgebury is not straightforward. A series of considerations to address in the analysis are:

- *Visit Type*: The data available for Bedgebury indicate the proportion of visits that involved each activity. It allows for the reality that visitors can participate in multiple activities on each visit, but does not categorise visits based on their *primary* purpose. Unit value estimates provided by Christie et al. do, however, categorise based on primary purpose of visit, defining visits by ‘visitor type’ (cyclists, walkers, nature-watchers, horse-riders, and general visitors). The task for the analysis is to categorise visits at Bedgebury by primary purpose (addressed below).
- *Primary ‘sub-activity’*: Results reported by Christie et al. from the choice experiment exercise do not simply consider the value of cycling to cyclists, but consider heterogeneity of activities within each visitor type, estimating the value of, for example, specific cycling facilities (e.g. downhill track, etc.) to cyclists. For appropriate transfer of these values, assumptions would have to be made not only about visitor type at Bedgebury (i.e. the primary activity of each visitor), but also about the specific primary ‘sub-activity’ carried out.
- *Marginal value of secondary activities*: It would be inappropriate to arithmetically aggregate the values of each of the specific facilities over total number of users in each user type. Each visitor

will have one primary activity (or sub-activity) they participate in and all other facility improvements will have a diminishing marginal value. To aggregate the value of all facilities over all visits within the relevant visitor types, assumptions about the level of diminishing value would have to be made.

To simplify the analysis this case study only attempts to transfer values based on one type of value heterogeneity, that of visitor type (i.e. primary purpose of visit), rather than attempting to account for visitor type *and* sub-activity. Transferred values are from the travel cost model by Christie et al. as reported in Table 5. These estimates are reported in 2005 prices and are inflated to 2008 prices (Table 8) to be consistent with cost of improvements at Bedgebury (reported in Step 1).

Table 8: Estimated unit values for recreation activities by visit type for Bedgebury based on Christie et al. (2005)

<i>Visit type</i>	<i>Estimated consumer surplus (£ per person per visit)</i>	
	<i>Christie et al. (2005 prices)</i>	<i>Values applied at Bedgebury (inflated to 2008 prices)</i>
Cycling	14.97	16.23
Walking	14.51	15.73
Other	14.99	16.25
Nature watching	7.90	8.57
Horse riding	14.20	15.40
Average*	14.15	15.03

Note: Confidence intervals of 2005 values not reported in Christie, et al.

*Average is weighted by estimated number of visits by primary visit type.

Estimating visitor type numbers at Bedgebury

Transferring visitor-type unit values requires classifying visitors at Bedgebury as cyclists, horse riders, nature watchers, walkers and others. Data for site visitation at Bedgebury report primary purpose of visit, however, they indicate that no horse riding takes place, despite the availability of horse-riding facilities and knowledge of staff that it does take place (Table 9). The available data at Bedgebury are based on a very small sample size ($n = 238$, $<0.1\%$ of annual visitors), so it should be applied cautiously, and without including horse-riding, the value estimated will be slightly more conservative.

Table 9 Estimated increase in visitors to Bedgebury Forest by visitor type (adapted from O'Brien and Morris, 2009a)

<i>Visit Type</i>	<i>Percent Visits (in 2006)</i>	<i>Number</i>
Cycling	43	37,611
Walking	17	95,135
Other	13	59,736
Nature watching	27	28,762
Horse riding	0	0
Total Increase in Visitors	100	221,244

STEP 6: AGGREGATION

Following the visitor-type approach, the benefit of recreational improvements can now be viewed as the value to visitors based on travel cost and aggregated across different types of visits:

$$\text{Benefit (£/yr)} = (n_{\text{cyclists}} \times v_{\text{cyclists}}) + (n_{\text{walkers}} \times v_{\text{walkers}}) + (n_{\text{others}} \times v_{\text{others}}) \\ + (n_{\text{nature-watchers}} \times v_{\text{nature-watchers}}) + (n_{\text{horse-riders}} \times v_{\text{horse-riders}})$$

Where, n = annual number of visits, v = consumer surplus per person per visit. Initial values were estimated for 2007/2008 as the completion year of the project. Overall, the annual benefit to visitors of the recreational facility improvements at Bedgebury National Pinetum and Forest is estimated as £3.3 million (Table 10).

Table 10: Estimating value of recreational improvements at Bedgebury Forest			
Visits		Consumer Surplus (£)	
Type	Number (per yr)	Inflation Adjusted per visitor (in 2008)	Cumulative (in 2008)
	<i>a</i>	<i>B</i>	<i>c = a x b</i>
Cycling	37,611	16.23	610,454
Walking	95,135	15.73	1,496,644
Other	59,736	16.25	970,841
Nature	28,762	8.57	246,350
Horse Riding	0	15.40	0
Average		15.03	
Total			3,324,289

The value of the recreational improvements can be aggregated over a period of years to determine its present value (PV). The PV of the benefits can be compared to the initial costs, constituting a partial cost-benefit analysis, where it is determined whether or not the improvements were cost-beneficial (i.e. positive net present value). The following assumptions are made to calculate PV:

- The project lifetime is 20 years (e.g. 2008-2027); and
- Discount rate over that period is 3.5% (HM Treasury, 2003).

Based on those assumptions the PV was calculated for each visitor type as in the above equation and then aggregated over 20 years. Overall, the PV based on consumer surplus is approximately £48.4 million (Table 11). With an annual benefit of £3.3 million, the project was cost-beneficial in the first year it was completed. Sensitivity analysis in Step 7 explores how alternative assumptions affect this result.

Table 11: Present value of recreational Improvements at Bedgebury Forest based on visit type		
	Total Consumer Surplus (million £)	
	<i>Annual benefit</i>	<i>Present value (20-year)</i>
Cycling	0.6	9.0
Walking	1.5	22.0
Other	1.0	14.3
Nature	0.2	3.6
Horse Riding	0	0
Total	3.3	48.9

STEP 7: CONDUCT SENSITIVITY ANALYSIS

Sensitivity analysis was conducted over:

1. Applying lower unit values from earlier studies that are undifferentiated by visitor type;
2. Determining value at which project becomes cost-beneficial (i.e. threshold value) assuming various timescales; and
3. Some further considerations about the assumptions involved in this value transfer.

Applying values from earlier studies

Following the concern that the values provided by Christie et al. are higher than those previously estimated it is appropriate to apply these previously estimated values as a basis for comparison. In 2008 prices, previous estimates of the recreational value of woodlands in Great Britain were between £0.10 and £4.77 per person per visit. Here, the sensitivity analysis takes a consumer surplus of £2 per person per visit as a reasonable mid-point of those values and applies it as a lower bound value for this study. Based on this analysis, the annual benefit estimate is £0.4 million with a PV over 20 years of £6.4 million and a seven year payback period (the point at which the present value of annual benefits outweigh the upfront costs).

Determining threshold values

Applying upper and lower bound values as above is a useful start to understand the range of potential values, but it is necessary to determine threshold values to produce a better picture of what is required for the project to be considered cost-beneficial (i.e. positive net present value, which occurs when benefits exceed the project costs of approximately £2.5 million). As previously discussed, applying values from Christie, et al. makes the project cost-beneficial in year one.

It is possible to identify based on different project timescales, the unit value per visit required for the project to display positive net present value. The results of this analysis (Table 12) show that over a 20-year timescale, it only requires a recreational value of improvements at Bedgebury to be £0.77 per person per visit to make the project cost-beneficial. To put that in perspective, of the 66 values presented in the Bateman and Jones meta-analysis (for use values only) only 12 were below £0.77 when adjusted to 2008 prices.

Table 12: Threshold values for recreational improvements at Bedgebury Forest

<i>Year project becomes cost-beneficial (PV benefits > costs)</i>	<i>Recreation value (£ per person per visit)</i>	<i>Total consumer surplus (million £)</i>	
		<i>Annual Benefit</i>	<i>PV (20-year)</i>
20	0.77	0.17	2.48
15	0.94	0.21	2.46
10	1.30	0.29	2.46
5	2.39	0.53	2.47

Further Considerations*Consumer Surplus Compared to Visitor Spend*

A consistency check for validity of the transferred consumer surplus (WTP) estimate for recreational visits is provided by comparing it to actual spending by visitors. In particular the average £2 per person per visit from the literature and even higher activity specific estimates from Christie et al. (2005) compare favourably to the spending data from Bedgebury. The survey work at Bedgebury (TNS, 2008) found the average visitor spend to be £26 per person per day. Here, entry fees can be considered the market price of the good; recreational facilities at Bedgebury. There is an entry fee of £20-25 for the Go Ape course, but only a small proportion of visits include use of this facility (5 percent according to TNS, 2008). Averaged over all visits, the entry fee is £1.00-1.25. The main site has no admission fee, but does charge for parking at £7.50 per car per day. Overall, the average entry fee is a maximum of £8.75. Applying that to each visit will be an over-estimate as parking fees are shared among multiple visitors, but still shows an average spend above entry expenditures of £17.25 (= 26.00 - 8.75). Therefore, estimates of average consumer surplus up to this amount are reasonable and highlights that the threshold and lower-bound values applied in the sensitivity analysis are markedly lower-bound estimates.

Constant consumer surplus over time

It is assumed in calculating the cumulative consumer surplus that the unit value will remain constant into the future. It is difficult to judge if this is the case. It is reasonable to assume that degradation of facilities over their lifetime will decrease the value of visits (assuming no re-investment for upkeep). It is for this reason that the case study is time limited (20 years) and carries out sensitivity analysis to explore the threshold value over different timescales. Even looking over a 5-year lifetime of the facilities, the threshold individual consumer surplus is £2.30 per person per visit, which is still much lower than the roughly estimated potential upper bound of visitor spend of £17.25.

Change in Annual Visits

It is also assumed in all of the calculations that the number of annual visits will remain constant into the future. As with constant unit values, it is difficult to judge what the actual level of visits will be in the future. Currently, the site staff are considering increasing parking fees to reduce the number of visits and avoid congestion at the site in future. While in general, an increase in parking fees would reduce individuals' consumer surplus, less visitors on site at any given time will likely increase the value per visit (if congestion is a significant factor).

STEP 8: REPORTING

The purpose of this case study is to illustrate how the recreational value of forests can be analysed. Recreational facility improvements at Bedgebury National Pinetum and Forest are correlated with an increase in the number of visitors. On the basic assumption that the increase in visitors above historic (e.g. 2005/2006) levels is caused by such improvements, it is possible to estimate whether or not those improvements were a worthwhile investment.

The recreational value of woodlands in Great Britain is relatively well studied. However, previous studies have focused on generic values that are not differentiated by visitor type or recreational facility. In reality, the value is different based on the type of person using it and the specific activity being carried out or facility being used.

Estimates of the aggregate consumer surplus associated with recreational facility improvements at Bedgebury were developed based on different value estimates from the literature. The important point in this case study, however, is not specifically to determine the exact value of those improvements, but mainly to show that they are cost-beneficial.

The main case unit value estimates for different recreational activities are taken from Christie et al. (2005). Using these estimates means that the benefits of the improvements in recreational facilities at Bedgebury are about £3 million per year or about £48 million in present value terms over 20 years. These estimates transfer unit value from Christie et al. that differentiates between visitor types. Several other assumptions (all conservative) are tested to generate alternative aggregate benefit estimates. All of these indicate that the project yields positive net present value over reasonable timeframes.

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