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

Case Study 2 – Valuing Benefits of Changes in Upland Land Use Management

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CASE STUDY 5: VALUING BENEFITS OF CHANGES IN UPLAND LAND USE MANAGEMENT

- *Case Study 2 focuses on the benefits of the Sustainable Management Catchment Programme (SCaMP).*
- *SCaMP is a partnership of United Utilities, the RSPB, local farmers and other stakeholders, to invest in conservation of 20,000 hectares of upland river catchment in North West England.*
- *The case study provides a 'rapid assessment' of the potential benefits of SCAMP, drawing on readily available information and data.*

STEP 1: ESTABLISH THE POLICY GOOD DECISION-CONTEXT

The 'Sustainable Catchment Management Programme' (SCaMP) is a flagship conservation initiative in the UK created by a partnership of United Utilities (UU), the Royal Society for the Protection of Birds (RSPB), local farmers and a wide range of other stakeholders. Its purpose is to invest in conservation activities in water catchment land with the aim of securing a wide range of environmental benefits, including water quality and conservation. Specifically, United Utilities states that the objective of SCaMP is to help (UU, 2009):

- Deliver government targets for Sites of Special Scientific Interest (SSSIs);
- Enhance biodiversity;
- Ensure a sustainable future for the UU's agricultural tenants; and
- Protect and improve water quality.

SCaMP is working from 2005 to 2010 to restore and manage 20,000 ha of land in the Trough of Bowland and the Peak District in Northwest England. That area includes 45 land holdings and 21 farms, the holders of which are incentivised to participate in sustainable land management of the area.

This case study provides a rapid assessment of the potential benefits of SCAMP, drawing on readily available data. Using value transfer it provides an indication of the likely significance of changes in the provision of ecosystem services in terms of changes in human wellbeing.

STEP 2: DEFINE THE POLICY GOOD AND AFFECTED POPULATION

What is the good to be valued?

The SCaMP area is mostly upland moorland, farmed primarily for sheep, with some cattle grazing. It is mostly open access land, and has been since before the Countryside Rights of Way (CRoW) Act in 2000. There is also significant use of the land for recreation purposes, including grouse shooting.

Part of the SCaMP land falls within the Bowland Fells SPA (Special Protection Area) (16,000 ha) which is within the Forest of Bowland Area of Outstanding Natural Beauty (AoNB). The land also intersects the Peak District National Park and 13,500 hectares of SCaMP land are designated as Sites of Special Scientific Interest (SSSI).

As indicated by the various designated areas it overlaps, the SCaMP land is important in conservation terms and provides multiple ecosystem services to the local, national, and even global population. The most salient service is gathering and filtering water for human consumption as much of the land consists of peaty, wet soils that can retain, filter and clean rainwater. Habitat degradation, however, can seriously compromise the water functions of the land. Additionally, the peat soils store substantial quantities of carbon. Healthy peat bogs can sequester carbon, while carbon can be lost from degraded areas.

Overall, the most relevant ecosystem services are:

- Provisioning Services: food, fibre.
- Regulating Services: carbon sequestration, water quality and quantity, flood protection.
- Cultural Services: informal recreation, field sports, non-use and option values.

The level of provision of these services is addressed in Step 3.

Who is the affected population?

There is limited information available on the populations benefitting from the ecosystem services identified above.

Most data is available for recreation. The Peak District National Park attracts up to 30 million visits per year[1], largely from nearby population centres. Over 17 million people live within 60 miles of the National Park. Most visitors cite scenery/landscape as a motive, and for 39% this is the primary reason for visiting. In the Forest of Bowland AoNB, 76% of visitors are from Lancashire, with most others coming from surrounding areas. Most visitors arrive by car, with 12% living in the AoNB, 59% being day visitors, and 29% stay overnight. Almost half are regular (i.e. repeat) visitors and visits were mostly for walking and/or general sightseeing[2].

There is some further evidence on the population affected, but it differs by ecosystem service and basic assumptions to service boundaries must be made. **Table 1** presents the affected population for individual ecosystem services.

[1] See: http://www.peakdistrict-education.gov.uk/Fact%20Sheets/fz2tour.htm
[2] Forest of Bowland AONB Visitor Survey Report, Summer 2008

Table 1: Population affected by ecosystem services arising from SCaMP land			
Service	***Type of population***	***Scale (Magnitude)***	***Notes***
Food and fibre	Producers (i.e. farms)	21	Tenant Farmers
Greenhouse gas regulation	All	(Global)	All global population affected, but only minimally by this.
Water quality	United Utilities Customers	6.7 million	Customers in NW England (but non-UU customers may also be affected). Note though that SCaMP land is not the only source of supply for the UU area.
Flood Protection	Householders	Large number downstream	High rainfall in this area could create flood risk for some heavily populated areas.
Recreation	Local residents, walkers bikers	Peak District up to 30 million *visits* per year: pro rata by area, suggests c.4 million for SCaMP land.	Primarily from surrounding urban areas, but significant minority from further away. Walking/sightseeing most common use. Many of the *visits* will be repeat (i.e. many fewer than 4 million *visitors*).
Field sports	Grouse shooters	(National)	Best to look at national population of shooters and consider SCaMP land as part of the national stock of shooting areas.
Non-use values from historic and cultural landscapes	Household in Northwest England	≈2.8m households	Some important designated areas, likely to be salient at least to regional population, and potentially to national population.

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

Description of the change and outcomes

This case study seeks to assess the benefits of instituting SCaMP, so the appropriate baseline is business as usual (BAU) without SCaMP. In reality BAU may not be legal given that the Water Framework Directive (WFD) and Government targets for SSSIs may not be consistent with the continuation of the status quo management of what is now SCaMP land. Nonetheless, BAU remains the appropriate counterfactual against which to assess SCaMP, and is particularly so if the WFD and SSSI targets can be interpreted as drivers of instituting the programme.

Prior to SCaMP, the land was managed by tenant farmers with no direct intervention from the primary landowner (UU). It is assumed that under BAU the landowner would have maintained a laissez-faire approach and provided no direct investment in the land. Human activity would continue as normal, including subsidy dependent farming, some forestry, recreation and water extraction. Under this scenario there may be some farm abandonment as the land became less productive and farming, in general, became less profitable. In relation to the natural ecosystem, it is thus assumed that there would be no major impacts, but that the anthropogenic pressures would continue to slowly degrade the surrounding habitats. A more specific picture of the assumptions on provision of ecosystem services under BAU is presented in **Table 2**.

Table 2: Business as usual baseline in SCaMP land			
Ecosystem services	***Pre-project status***	***BAU expectations (without SCAMP)***	***Notes***
Food and fibre	Tenant farmers, primarily impact land through sheep grazing	No change	Assume existing agricultural support would continue. Without subsidy, farming likely not sustainable.
Timber	Forestry on 450 hectares of land	Some decline	Conifer plantations are not replanted but activity is non-commercial.
Greenhouse gas regulation	Overall negative balance due to degraded peat.	Ongoing negative balance, likely to worsen.	-
Water	Major use, but quality poor due to degraded bogs.	Risk of decline in quality/increase in colour.	United Utilities hold the land primarily for water supply purposes. Without action, risk of continued decline (as in other areas).
Flood protection	Risk of flood increased by poor landscape condition.	Potential further increase in risk.	Without action, continued habitat degradation likely.
Informal recreation	Close to major population centres, so good usage	Potential decline in use as habitat degrades	Value of each visit will also decline with continued degradation.
Field sports	Grouse shooting in area.	Possible decline in populations on degraded land	-
Non-use values	Generally high quality area; some parts of particular importance.	Some decline due to degraded landscape.	Landscape is likely the most salient non-use value.
OVERALL	*Multiple uses: not taking much account of sustainable use*	*No major change event but continuing decline*	-

Quantitative assessment

An estimate of the quantitative change is possible in relation to some of the ecosystem services. This is estimated as the difference in provision of ecosystem services currently (under SCaMP) compared to the assumed BAU scenario (**Table 3**). For some ecosystem services, a quantified change is not presented due to lack of data.

Table 3: Quantitative estimates of changes in ecosystem services as a result of SCaMP		
Ecosystem Service	***Assumed Change***	***Notes***
Food and fibre	Negligible	Short-term loss from lower (more sustainable) stocking is balanced by increased productivity in the long-term.
GHGs	2,000 tonnes carbon dioxide (tCO_2) sequestered in years 5-40	MFF (2007) states Peak District moorlands *on average* fix 19tC/km^2 in pristine condition or emit 7tC/km^2 in worst case. Allowing for less extreme change, assume 10tC/km^2 difference between baseline and SCaMP, over 55km^2 restored bog, which is ~550 tC ≈ 2000 tCO_2/year. This is a rough assumption that ignores details of ongoing deterioration in the baseline. To account for delays in recovery of bog habitats, assume no benefit until year 5.
Water quality	Most of the management changes have potential to improve water quality (dissolved oxygen content and colour) due to improved bog condition.	Requires measurement of water quality. Assessments so far indicated signs of stabilisation of colour, versus increase in non-SCaMP areas.
Flood protection	Unknown	No data available on risk reduction
Informal recreation	4 million visits	Assume number of visits remain the same, but value of the visit would change.
Field sports	Negligible	Likely neutral net change, plus substitutes available.
Non-use values	SCaMP area is approximately 4% of Northwest SPA area, valued over 2.8 million households	Valuation evidence is available for improvement of conservation status of Northwest SPAs.

STEP 4: IDENTIFY AND SELECT MONETARY VALUATION EVIDENCE

Sources of valuation evidence

There is ongoing research on the economic value of upland ecosystems. Natural England's (NE) Upland Vision for 2060 project (Natural England, 2009) is part of this research and has been aimed at better understanding changes in ecosystem services function in the uplands. Part of the brief for that research is to develop an approach and methodology for valuing the impacts (costs/ benefits) that a series of changes to land use and management might have on the delivery of ecosystem services and benefits (see eftec 2009). The changes to be examined were:

- Afforestation;
- Restoration of damaged blanket bog habitats;
- Changes to livestock grazing;
- Reduction of the regular burning of moorland and blanket bog habitats; and
- Re-wilding.

The potential impacts (positive and negative) of these changes were assessed in terms of the value of variations in:

- The quality of drinking water supplied to downstream catchments;
- Impacts of downstream flood events;
- Use and enjoyment of these environments (including impacts on the historic and cultural landscapes) for recreation;
- Regulation of greenhouse gas emissions;
- Food and fibre (and associated industry) provided by the uplands; the potential for renewable energy provision; and
- Biodiversity.

The provision of these ecosystem services is particularly relevant in the context of rural development, with many disadvantaged and severely disadvantaged areas in England's uplands.

As part of that project, the value of SCaMP was explored. The values selected and presented in that study are applied here to permit a rapid assessment of the potential magnitude of benefits associated with SCaMP. **Table 4** presents a series of unit values for the ecosystem services of interest. Ecosystem services for which the change is negligible or unknown from Table 3 are not included.

Table 4: Quantitative estimates of changes in ecosystem services as a result of SCaMP (2008 £)

Ecosystem Service	*Unit Value*	*Notes (Source)*
GHGs	~ £25- 50 per tCO_2/year, increasing years 5-40.	Based on DECC carbon valuation guidelines (DECC, 2009)
Water quality (treatment)	Unknown	It is possible that SCaMP's impact on water colour could lead to delayed or perhaps even avoided costs for upgrading some treatment works in the future. Current data show some signs of stabilisation in water colour in restored plots, compared with deterioration elsewhere. However there is very high uncertainty whether any water quality improvement will be detectable on the catchment scale, thus it is not possible at this stage to determine with any accuracy the expected level of cost savings. Savings could potentially be significant if upgrades were avoided, however due to the complicated nature of an interconnected water supply it is impossible to quantify potential at this time.
Informal recreation	~ £1- 2 per person per visit (assume ½ day visits)	Assume 5-10% improvement over normal visit valued at US$60.5 per person per day (Kaval, 2006), which was £38.67 in 2006[3]. This is conservative compared to estimated £2-5 value of recreational facility improvements (Christie, 2000)
Non-use values	£0.19 (£0.06-£0.32) per year per household in North West	Stated preference study valued change from rapid decline to better conservation for all North West SPAs at £4.75 (£1.50-8.00) per household (eftec, 2006)

[3] Purchasing power parity in UK in 2006 was 0.6391 based on OECD Statistics.

STEP 5: TRANSFER EVIDENCE AND ESTIMATE MONETARY VALUE

Unit Values

Of the unit values reported in Table 4, two are judged to be sufficiently matched to the policy good population, given the 'rapid assessment' context of the case study: GHGs are based on guidance for carbon valuation (DECC, 2009); and non-use values are based on a stated preference survey carried out in Northwest England. The value for informal recreation, however, is applied from a US study to a UK study based on national-level purchasing power parity. The value of informal recreation is estimated to be £0.97-1.94 per person per visit, on the basis of assuming that the improvements from SCaMP result in a 5-10% increase in the value derived from a visit. For all values, the best case or lower-bound estimates are used as the main case to remain conservative in the overall approach.

A key unresolved issue is that of water treatment costs. Water treatment can be very expensive, in particular where capital investment is required to increase treatment capacity, so this is clearly of great potential importance. There is a general trend of increasing water colour from upland peat areas, and this can lead to the existing treatment infrastructure having insufficient capability to remove all of the colour and other (often uncoloured) organic material from the treated water. There is then a risk that this material can react with chlorine, added for disinfection and (in the uplands) manganese removal, to form a class of compounds called trihalomethanes. The concentration of this class of compounds permitted in potable water is very tightly regulated at no more than 100ug/l. The potential benefits of controlling and stabilising (or reducing) raw water colour include reducing the risk of an infringement of this standard, and potentially reducing the need for investments to increase water treatment capacity.

There are initial indications that SCaMP is stabilising water colour from the area – set against on-going increases in non-SCaMP areas – and water colour could potentially improve further in future. There are long-term physical and ecological processes at work and it is too early for data to show clear results, and therefore the future benefits remain uncertain. Estimating changes in future costs is extremely difficult, not least because the additional treatment required to deal with increasing colour and organic load varies from site to site and depends on factors as diverse as the existing treatment process, location, alternative supplies, site constraints, production volumes, sludge treatment processes and host of other site specific issues. Although it is clear that water quality benefits could be very significant, there can at present be no certainty that such benefits will exist. Water quality monitoring is of course ongoing and better estimates of future cost savings may become available in time.

STEP 6: AGGREGATION

Table 5 summarises present value estimates for the costs and benefits of SCaMP. The results are reported:

- Over a 50 and 100 year time frame;
- With a changing discount rate according to Government guidance (HM Treasury, 2003): 3.50 percent for years 1-30; 3.00 percent for years 31-75; and 2.00 percent for years 76-125; and
- With unit values based on 2008 prices.

It is assumed that the delivery of all services increases incrementally until reaching full delivery in year 40. That is, it is unrealistic to assume that the full benefit of sustainable land management will be realised immediately. The reality is that it takes time for full recovery of ecosystems. As such, the benefits are assumed to not be delivered until after year 5 (2010), when restoration is due to be completed, and are evenly phased in until reaching full benefit level at the end of year 40.

Table 5: Estimated present value costs and benefits of SCaMP (£ million)

Ecosystem Service	*Unit Value (2008)*	*Annual**	*NPV (50 year)*	*NPV (100 year)*
Greenhouse gas regulation	~ £27 - 50 per tCO_2/year	0.05	0.86	1.92
Water	n/a	-	-	-
Informal recreation	~ £1 per person per visit	~0.50	4.7	7.3
Non-use values	£0.19 per year per household	~0.50	4.7	7.3
Total Benefit (PVB)			10.2	16.4
Costs (PVC)			15	16
Net Benefit (NPV)			£-4.8	£0.4

Note: *Annual benefits are not a representation of value of the site (as they do not take account of the phased delivery, discount rate, but are listed for comparison.

The costs of SCaMP activity are split between UU funds (£9m) and public support (£3.5m); enabling expenditures such as farm buildings and fencing are £2m, while habitat restoration expenditure is £10.5m.

Overall the present value estimates in Table 5 need to be treated with caution, given all the assumptions and simplifications that underlie them. It is not possible to draw firm conclusions on the net present value, or the cost-benefit ratio, since it is not possible to value the water quality benefits that could potentially be substantial.

STEP 7: CONDUCT SENSITIVITY ANALYSIS

This case study is intended to illustrate quite a rapid appraisal applied at a wide-scale, with very uncertain data on services and values. Therefore it is particularly important to consider how the results vary as assumptions are adjusted. The first point to note is that the SCaMP potentially results in positive NPV over 100 years, just on the basis of those service categories for monetary benefits are estimated. Since it is likely that there will be some water quality benefits in future, overall it is likely that SCaMP will provide net benefits to society over the long term. In particular, the present value of water quality benefits need be in the region of low £ millions over 100 years (in effect this is the 'benefit threshold' for water quality benefits).

Over the shorter evaluation period of 50 years, the NPV is negative on the basis of the service categories valued. Generally, it is to be expected that investments in improving long-run ecological processes in habitats such as blanket bogs may take a long time to generate benefits. As water quality improvements are linked to these biological processes it is unlikely that SCaMP will produce short-term monetary payback. The front-loading of project costs, and the delay before benefits arise, mean that it is necessary to consider the longer time periods to get a full appreciation of the net impacts of the project.

An additional point to note is that the greenhouse gas regulation estimates are rather uncertain, not because of the monetary value but rather because of uncertainty about the exact amounts of carbon sequestered / emitted in the SCaMP and baseline scenarios, and in particular because of uncertainty about methane emissions from restored bogs. However the total value arising through the GHG regulation service is likely to be a relatively small fraction of total benefits. For other areas, where the greater distance from population centres makes recreation less important, and/or where no water quality benefits can be expected, carbon values (along with biodiversity values) could be important in justifying moorland restoration expenditures, and further research here is clearly justified.

The non-use (cultural heritage) values are significant, even though conservative assumptions are used: the average value is under 20 pence per year per household for the region, based on SCaMP covering 4% of the SDA in the region. But it could be argued that this land is of higher than average cultural value, given the SSSI, AoNB, National Park designations of large parts of the site. This could also mean that there may be some cultural/heritage value accruing outside the region, if these designated areas are considered of national importance. Similarly, the recreation benefits are based on a quite conservative assumption, that the improvement in recreation experience amounts to only 25 pence per visit, and higher values might be justified. Nevertheless, even at these levels, the non-use and recreation values provide significant support for the scheme.

The costs of SCaMP are estimated at £12.5 million, for the various restoration and construction expenditures. This value has been rounded up to £15 million present value (over 50 years; £16 million over 100 years) to make an ad hoc allowance for ongoing expenditures after the restoration is complete – for example for monitoring. The ongoing expenditures could be higher though it is not possible to be precise. In practice, there will probably be additional work going forward, with additional costs, but also additional benefits not considered above. We have not considered discounting of the costs (not knowing the precise years in which they arise), which would reduce their present value somewhat.

STEP 8: REPORTING

The purpose of this case study is to illustrate the potential benefits of the SCaMP project via a rapid survey of available evidence. It is likely that SCaMP has net benefits to society, compared with the business as usual counterfactual, and it is possible that the net benefits will be significant. However, the scheme does not necessarily pay back immediately. On the basis of the analysis presented, it takes over 50 years for positive returns; though in fact payback may be faster, since impacts on water quality have not been evaluated, and values may be higher. Overall the analysis suggests that the time delays are a key sensitivity that should be explored further.

There is however substantial uncertainty about both the physical and monetary values of service changes. Considering only those service categories for which a monetary value has been estimated, SCaMP appears beneficial over the long-run, but this is not a firm conclusion. SCaMP has the potential to generate significant water quality benefits in the future, and although it is not possible at present to be confident of this, or to estimate a value, it seems likely that even relatively modest water quality savings could be enough to ensure that SCaMP produces net benefits for society overall.

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