

Natural England Commissioned Report NECR101

Valuing Ecosystem Services: Case Studies from Lowland England

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

These suite of six case studies were commissioned to address a perceived gap in the literature. The ecosystem approach and in particular, the concept of ecosystem services is gaining momentum in policy circles (see for example the recent Natural Environment White Paper and new England Biodiversity Strategy). However, practical application of the ecosystem approach lags behind these aspirations, largely due to uncertainty about how to implement the approach and the value of doing so. In addition to tools and guidance to help practitioners, we believe that case studies are a powerful communication tool, allowing others to see how concepts have been adopted and highlighting potential for their own particular situations.

There are few examples of the ecosystem approach in practice in a UK context and hence most existing case studies are retrospective studies of projects viewed from an ecosystems approach perspective. The Natural England led Ecosystem Services Pilots (Delivering Nature's Services) are an attempt to approach land and water management through the ecosystems approach and are demonstration project for upland situations. The six case studies described in this report are intended to complement the pilots by providing an insight into how ecosystem services might be viewed in lowland and urban-fringe contexts. The case studies were also selected to add value to an existing suite of Environment Agency case studies which are focused on river and coastal projects.

The six projects selected are existing environmental and social projects which have not explicitly adopted the ecosystem approach or focused on ecosystem services but are thought to have the potential to deliver a wide range of societal benefits. In each of the projects the potential ecosystem service benefits were described and then valued. The valuation was carried out according to Defra's best practice guidelines for value transfer and as such the case studies have secondary value – as a test of these guidelines.

By identifying, quantifying and attempting to value the multiple benefits that these projects will deliver and comparing this to the likely costs this report hopes to demonstrate whether the projects are 'worth doing' in monetary terms, whilst recognising that monetary value is not always the sole driver in decision making. Many of the projects have a biodiversity focus combined with some other benefits such as access or landscape improvements but will also lead to other benefits, such as enhanced carbon storage. The six case studies that follow aim to consider these wider benefits. Each case study is presented individually so that it can be used outside the overall report.

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Further information

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Preface

This report has been commissioned by Natural England under the contract reference number of 23092.

The work aims to present how a combined ecosystem services and economic valuation approach can be used to understand the implications of different environmental conservation plans. Guidance from Defra on ecosystem services and value transfer is followed (Defra, 2007, etec, 2010). The approach is used to assess and, where possible, value the likely changes in ecosystem services resulting from an intervention. In most cases the 'plans' assessed are not specifically targeted at ecosystem service delivery; the purpose of this work was to determine whether additional benefits might arise, when an ecosystem services framework is used and the value of these benefits.

The information thus generated can be incorporated into decision-making or support tools such as cost benefit analysis. This information could also inform the way in which the management and conservation projects are designed to maximise the ecosystem service generation.

The approach is applied in a set of case studies which illustrate the application of the same approach in different contexts. The individual case study reports are intended to be stand-alone reports in addition to being components of this larger report. Individual case studies may therefore be communicated and used in different ways. The case studies presented here were selected to address gaps in the current suite of UK case studies and have a more lowland focus.

The work has benefited greatly from the ideas, knowledge, data and critique provided by numerous individuals in Natural England and other organisations. In particular to:

Stewart Clarke, Julian Harlow, John Hopkins and Ruth Waters.

Individuals who helped with specific case studies are acknowledged in each separate case study report. We know that some others have provided advice or data to those who helped us and though we cannot list these people here, our sincere thanks go to them too. And our sincere apologies to anyone inadvertently omitted from the list above. Needless to say, any remaining errors are the fault of the authors alone.

Dr Robert Tinch, Adam Dutton, Laurence Mathieu (authors) and Ece Ozdemiroglu (internal reviewer).

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Introduction

Background

The benefits of adopting the ecosystem approach for environmental management are increasingly being recognised. Defra published guidance in 2007 seeking to embed an ecosystems approach across its work and that of its agencies (Defra, 2007). The recent Natural Environment White Paper also signals the importance of this approach in future policy making (Defra, 2011). In addition Defra launched the Natural Value Programme as a way of coordinating various ecosystem services and valuation related work across the Defra family (Natural England, Environment Agency and Forestry Commission). The publication of the UK National Ecosystem Assessment (NEA, 2011) and TEEB (The Economics of Ecosystems and Biodiversity) (2011) is generating further interest in the potential for economic valuation to play a key role in wider implementation of the ecosystems approach.

While the research and policy literature on ecosystem services is growing, Natural England is attempting to trial the ecosystems approach through three demonstration pilots in the English uplands¹. There is also a growing body of UK ecosystem services/approach case studies even though these have a strong upland or flood risk management focus. Convincing decision makers that the approach has wider application will require compelling examples from a range of different situations, in a UK context. Practical demonstration projects are costly and take time to implement and assess; a short-term alternative is to develop a suite of case studies, aiming to describe, quantify and value the wider benefits of a more integrated approach. This project is designed to review the experience of a small sample of the existing landscape scale projects in light of the ecosystem approach.

Objectives

This project analysed six case studies which are environmental management projects (completed, underway or, in one case, planned) that are changing land use or management options. None of these projects are explicitly focused on ecosystem services but each has the potential to deliver a range of benefits to people. One criterion was to develop case studies that demonstrate the potential application of the ecosystem approach in contexts for which there are currently few examples, in particular lowland and urban fringe situations.

Structure of the report

The report contains this general introduction and six case study reports. It is intended that each of the case study reports works as a stand alone document; in this way we hope that the case studies will be more widely used. Each report is organised in

¹ <http://naturalengland.etraderstores.com/NaturalEnglandShop/NE225>

sections that follow the steps of the value transfer approach as recommended by Defra (eftec, 2010). This involved the following steps:

- Step 1:** Establish the decision-context in which the case study analysed is based
- Step 2:** Define the ecosystem services and the population that will be affected by the case study
- Step 3:** Define and quantify the ecosystem changes that will be brought about by the case study relative to the baseline of 'no-case study'
- Step 4:** Identify and select the appropriate monetary valuation evidence
- Step 5:** Transfer evidence and estimate monetary value
- Step 6:** Aggregate monetary values
- Step 7:** Conduct sensitivity analysis
- Step 8:** Reporting (of the analysis and conclusions)

The headings used in the case studies for each of the above steps have been changed to phrases that are more suitable for case study reporting. But the content of each sub-section corresponds to what is required by each step.

Following these steps means that each case study:

- a) **Explains the baseline situation for the case study area:** a clear description of the current level of ecosystem service provision and a description of the planned activity or policy intervention;
- b) **Describes the change in ecosystem service provision expected** to result from the project: a narrative explanation of what the project's ecological / environmental impacts are and how they can be linked to changes in services provided to humans;
- c) **Summarises the valuation evidence** available for these changes and appropriate for the case study;
- d) **Applies the most appropriate evidence to value the marginal change in ecosystem service provision** resulting from the project activity. Where benefits could not easily be monetised these are clearly described;
- e) **Reports in full** the resulting value estimates, assumptions, sensitivities and caveats; and
- f) **Draws conclusions.**

Scope

Selecting the boundaries for value transfer or a Cost Benefit Analysis presents considerable challenges, particularly for relatively small scale projects. Any attempt to reduce environmental impacts in one place may simply displace production of that damage elsewhere. The seriousness of this issue might best be illustrated when we consider biodiversity conservation in the UK. In the UK biodiversity and endemism is relatively low compared to other nations such as Brazil. UK wildlife must compete directly with alternative land uses and any reduction in agricultural production could lead to increased agricultural production which may lead to deforestation abroad.

If we are to assume that the UK ought not simply farm heavily in order to protect biodiversity hotspots then there is some implicit assumption that we might not consider all impacts from a global perspective. It is reasonable, provided it is made clear, that this is what is being done, to restrict the analysis largely to the site in which the changes are being made and that is what we do here. This might be both because from a regulatory point of view the policy has control only over its own jurisdiction and because resource restrictions prevent a more in-depth analysis of all of the complex interactions through the globalised world.

The concern about displacement is also valid for activities such as recreation and tourism. Displacement in this context refers to the cases when the improvement in a given area attracts visitors who would have visited somewhere else anyway. So there is no net increase in the national number of visits but there is a change in the distribution of destinations. There are two ways of thinking about these. If the local economic impacts of a project are analysed, then any change in the local activity is a net change and should be included. For a cost benefit analysis, an increase in recreation / tourism (and any other) activity should be included as a benefit only if it is a new increase and not displaced from elsewhere. Displacement, in this context, refers to the situation when a new recreation opportunity attracts visitors from existing opportunities.

Case studies

On a shortlist of potential case studies, each was described in terms of the available data and what they would cover as a case study. The final list was chosen as a broad set of case studies able to provide new insights into how value transfer might be applied to different types of project and provide a useful narrative, seeking to complement existing case studies (see links to some of these in Appendix 2). The selected studies were:

Saltram Countryside Park (Plymouth Green Infrastructure Delivery Plan) - Plymouth

A suite of projects aiming to deliver a range of benefits through the creation of green space in Plymouth. Given the breadth of work planned and variety of levels of planning completed this case study focused upon the Saltram Countryside Park.
<http://www.plymouth.gov.uk/greeninfrastructureproject>

Reconnecting the Broads and Fens - Norfolk

Initially we considered Barton Broad Clear Water project, a lake restoration project aiming to recreate habitat and improve water quality whilst retaining recreational access. Following discussions, it was decided to focus instead on the reconnection of Broads and Fens.

<http://www.broads-authority.gov.uk/managing/rivers-and-broads/broads-restoration.html>

<http://www.broads-authority.gov.uk/managing/rivers-and-broads.html>

Little Ouse Headwaters project – Suffolk / Norfolk border

A community led wetland recreation and restoration project linking remnant valley fens in the headwaters of the Little Ouse and Waveney rivers.

<http://www.lohp.org.uk/>

Knepp Castle Estate Re-wilding - Sussex

A rewilding project on a private estate using a mixture of grazing animals at low densities.

<http://www.knepp.co.uk/>

Dearne Valley Green Heart – Yorkshire

A partnership project to redevelop post industrial sites, recreating and enhancing green spaces.

<http://dearnevalley.org>

Reconnecting the Culm project - Devon

A recently completed project providing advice to land managers encouraging appropriate management of culm grassland habitat.

http://www.butterfly-conservation.org/downloads/265/reconnecting_the_culm.html

Reporting and outputs

The case studies are presented as a set of stand-alone reports and hence there is some repetition from study to study. The level of detail is dependent on the data and time resources available. Together, the studies are intended to demonstrate the range of possible applications – including small to large geographical scales, and specific interventions to general long-term visions. The methodology can be useful in all scenarios, but the scale of challenges faced varies significantly.

The case studies have been prepared by a small team using information provided by various people involved in management of the case study areas, supplemented with information from literature and internet searches. We have spoken to primary contacts for each area but have not conducted detailed interviews with land managers or users, organised workshops, carried out field work, or completed multiple iterations of the analysis, or various other work that might be expected in a 'full' assessment for decision support purposes. Such an assessment would probably result in reduced uncertainty over some important factors, or at least in consensus among stakeholders regarding the most likely scenarios, and this would enhance the robustness of, and confidence in, the results of assessment.

Concluding Remarks

In this set of case studies we aimed to:

- Present a set of case studies based around the Value Transfer Guidelines produced in 2010 (eftec 2010);
- Provide a write-up of this process to show the level of evidence available and the type of expert judgements that need to be made about the selection and adaptation of such evidence; and
- Add to the stock of case studies – in particular to address the range of land use management decisions that are relevant to lowland areas.

This section briefly outlines the lessons we have learnt in the process and their implications for the future use of ecosystem services and economic valuation for decision-making.

In the year that the UK National Ecosystem Assessment (NEA, 2011) and TEEB (The Economics of Ecosystems and Biodiversity, 2010) were published, the increasing acceptance of ecosystem services and economic valuation as analytical tools is clear. Applying these tools in practice however remains a technical challenge due to the following main factors:

- **Insufficient knowledge of ecosystem functions and services:** Despite the increasing scientific evidence, there are still many uncertainties about how different ecosystems function and in turn provide ecosystem services;
- **Inadequate knowledge of how management change affects ecosystem service provision:** There is uncertainty about how particular land use management decisions may affect a given ecosystem. It is, on the whole, easier (especially if substitutes are available) to assess what the loss would be if an entire habitat is lost than to determine the impact of a change in management type or intensity. It is much more difficult to estimate what the impact of smaller changes (positive or negative) may be. If the site is unique or provides critical services then values of a total loss could be very non-linear, perhaps with thresholds, and it might be easier to value a small change than to contemplate a total loss. In short, the ease with which service changes can be valued depends on the uniqueness of the site and scale of change and these in turn depend on many local factors which are not necessarily analysed as a matter of course;
- **Difficulties in defining individual ecosystem service changes:** In some cases, the effect of management changes on ecosystem services can only be expressed in aggregate terms such as area of habitat created or lost. Also given the insufficient knowledge of ecosystem functions and services, valuation of habitats is not always possible to disaggregate at the level of individual services. Fortunately, knowing the overall costs and benefits of a management change may suffice for some decisions; and

- **Inadequate economic evidence limit value transfer:** There are gaps in the economic value evidence base. These gaps manifest themselves in two ways: there is an imperfect geographical / ecosystem coverage by economic value evidence. This requires expert judgement in selecting and adjusting the appropriate evidence. There is also a paucity of evidence when it comes to more intangible services, such as the catch-all term of cultural services, which are a significant driver for some of the case studies analysed here.

The case studies have been useful in both illustrating how the value transfer guidance can be used and documented (eftec, 2010). In addition, these case studies provide further examples of the application of certain value evidence, for example, carbon sequestration values. While it is not always clear if nature conservation generates net carbon sequestration benefits compared to intensive land use (they would not be if the current activity simply shifts somewhere else – though this itself is a simplification), there is now more evidence to estimate carbon sequestration potential of different land uses (for example, NE, 2010, Cantarello et al, 2011, Alonso et al 2011, Williams 2006). These estimates are location and context specific. Where case study specific information is not available to adjust these estimates, they are used as illustration of magnitudes.

The experience of these six case studies produces some lessons for how this type of analysis should be undertaken and how economic valuation studies that feed into it should be undertaken and reported. The key lessons include:

- **Better primary economic valuation studies mean better value transfer:** Economic valuation studies that are designed according to best practice require less expert judgement for adjustment during value transfer. 'Best practice' in this context means studies that use generalizable variables in their value functions for which it is easier to find data for comparison between the original valuation site and the site of value transfer. For example, studies should show how the value estimate changes with easily measurable population statistics (for example, average income, education, household size etc.) rather than details of tastes and habits of the population they study, which are difficult to measure elsewhere and hence difficult to adjust for.
- **Value transfer process should be transparent:** It is important that all of the reasoning and information gathered for value transfer are reported in a clear way. In fact, this thought process is perhaps more important for bringing different parts of a project and different stakeholders together than the final cost benefit results produced.
- **The scale of a project and the types of ecosystem service benefits it generates are very important factors in interpreting the cost benefit results.** An example of this is the Little Ouse project. This impressive voluntary project has over a number of years acquired and begun to manage land which had either been farmed or left derelict and damaged. The scale of the project meant that if the decision making is limited to the benefits that can be quantified, the project may have failed a cost benefit analysis. However this would be partly because it is currently not possible to measure the increased social capital provided by such

a community-run project. Given the current localism agenda, it is likely to become necessary to estimate the added value of community organisation.

- **A major gap in the quantitative impact and economic value evidence remains the value of social capital generated by community projects, and in general, values for intangible cultural and spiritual services of ecosystems (and how these may change with a given project).** Whilst the quantitative changes brought about by environmental damage are at least measurable, the less formal relationship between trust within a community and its ability to do business is less so. This means that social capital continues to be ignored in these calculations and this may be a significant loss as the way a project is developed can be as important as the physical changes it can bring about.
- **Another gap in the value evidence base is the value of lowland grassland.** There are several studies measuring the willingness to pay of the public for conservation of uplands or woodlands as well as recreational and amenity values for the same places. Such studies are less common for the lowland areas. Value transfer work relies on there being a range of studies in different circumstances which help an analyst to combine and contrast to estimate what the value might be for the project at hand. More valuations of options for lowland rural areas would be of great use.

The key recommendation from these case studies is not to put all the emphasis on the numerical results (both quantitative and monetary) but to take note of the entire analytical process from defining the project, the baseline, the impacts of the project, the affected population and valuation. If this whole process were made part of decision-making, stakeholders who may have different interests would find it easier to negotiate about the project and those who design the project may find it easier to struck a better balance between potentially conflicting outcomes of the project.

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Appendix 1 – Ecosystem Services Approach Used for the Case Studies

In recent years, and in particular since the publication of the Millennium Ecosystem Assessment (MA 2005), there has been a strong emphasis on the theoretical and practical development of approaches based on identifying, measuring and in some cases valuing the goods and services provided by ecosystems (Boyd and Banzhaf 2007; Fisher et al, 2009; Haines-Young *et al.* 2009, TEEB 2011).

The concept of ecosystem services captures the dependence of human well-being on natural capital and on the flow of services it provides (MA 2003; MA 2005). This development has occurred alongside a progression in biodiversity science, policy and management over the last two decades, shifting from a relatively simple framing in purely conservation terms focusing mostly on species and habitats, to a framing in terms of conservation, sustainable uses and benefit sharing and a more systemic approach in terms of socio-ecological systems.

Table 1 compares the typology and definitions of the ecosystem services approach developed by a few of the key and recent studies:

- Uplands project - eftec, 2009;
- Ecosystem services transfer – Cascade Consulting, 2011;
- TEEB (2011), and
- NEA (final service and goods) – NEA, 2011.

Value transfer, in general, and the scope of this project, in particular, has limited capacity to differentiate between some ecosystem services. Therefore, we have used a simplified set of broader ecosystem services and goods. This set is mostly based on the uplands and ecosystem services transfer projects recently completed for Natural England:

- Food and Fibre
- Timber
- Renewable Energies
- Fresh Water Quality
- Water Flow Regulation
- Soil and Erosion Control
- Climate Regulation
- Air Quality
- Recreation*
- Education and Knowledge
- Cultural and spiritual
- Landscape and Aesthetics
- Biodiversity/Habitat

*: Recreation also includes health benefits of recreational activities where relevant.

Not all of the above is relevant for all case studies. Where a service does not exist in an area or does exist but is not affected by the change analysed in the case study, it is not included in the case study report. Therefore, the sub-headings for these services in particular in Section 3 of the case study reports are not the same across all reports.

Table 1: Some recent relevant classifications of ecosystem services

Services / References	NECR029 Uplands project	NE Ecosystem services transfer tool	TEEB	NEA (final service)	NEA (goods)
Provisioning	Food and fibre	Food	Food	Production of crops, plants, livestock, fish, etc.	Food, fibre, energy, genetic resources, industrial inputs, fertiliser, avoidance of climate stress, recreation, tourism, physical&mental health knowledge, etc.
	Renewable energy	Fibre-wool	Raw materials	Production of trees, standing vegetation and peat	Timber, avoidance of climate stress, energy, noise regulation, recreation and tourism, etc.
	Water quality to downstream catchments	Timber	Fresh water	Production of wild species diversity including microbes	Natural medicine, disease and pest control, genetic resources, wild food, bioprospecting, recreation and tourism, physical health, ecological knowledge, etc.
		Fuel	Medicinal resources	Production of water quantity	Potable water, Industrial use of water, flood protection, energy, recreation and tourism, physical health, ecological knowledge, etc.
		Genetic resources			
		Biochemicals			
		Ornamental resources			
Regulating	Cost associated with downstream flood risk	Air quality	Local climate and air quality	Regulation of the climate	Avoidance of climate stress, physical and mental health, ecological knowledge, etc.
	Regulation of greenhouse gas emissions	Climate regulation	Carbon sequestration and storage	Regulation of hazards; related vegetation and other habitats	Coastal protection, erosion protection, flood protection, avoidance of climate stress, physical and mental health, ecological knowledge, etc.
		Flood regulation	Moderation of extreme events	Breakdown and detoxification of waste	Pollution control, waste removal, waste degradation, physical and mental health, ecological knowledge, etc.
		Low flow regulation	Waste water treatment	Purification processes	Clean air, clean water, clean soils, physical health, ecological knowledge, etc.
		Water purification	Erosion prevention and maintenance of soil fertility		
		Water quality	Pollination		
		Erosion control	Biological control		
		Natural hazard regulation - slope			
		Natural hazard regulation - fire			
		Disease control			
		Pest control			
	Pollination				

Services / References	NECR029 Uplands project	NE Ecosystem services transfer tool	TEEB	NEA (final service)	NEA (goods)
Cultural	Use and enjoyment for outdoor recreation	Recreation and tourism	Recreation and mental and physical health	Generation and maintenance of meaningful places; socially valued landscapes and waterscape	Recreation and tourism, physical and mental health, ecological knowledge, etc.
	Use and enjoyment for field sports	Landscape	Tourism		
	Non-use values of historic and cultural landscape	Cultural/spiritual	Aesthetic appreciation and inspiration		
		Knowledge	Spiritual experience&sense of place		
		Health			
Supporting	Biodiversity and wildlife		Habitats for species		
			Maintenance of genetic diversity		

Appendix 2 – Links to existing case studies

Natural England - NECR029 - Economic valuation of upland ecosystem services
(report by eftec)

<http://naturalengland.etraderstores.com/NaturalEnglandShop/NECR029>

Tamar and Alkborough flats

<http://publications.environment-agency.gov.uk/pdf/SCHO0409BPVM-E-E.pdf>

River Glaven sea trout restoration project

<http://publications.environment-agency.gov.uk/pdf/SCHO0110BRTZ-e-e.pdf>

Bristol Avon buffer zone

<http://publications.environment-agency.gov.uk/pdf/SCHO0210BRXW-e-e.pdf>

Wareham managed realignment

<http://archive.defra.gov.uk/environment/policy/natural-environ/documents/eco-valuing.pdf>

Economics of Managed Realignment in the UK

<http://www.coastalfutures.org.uk/pdfs/EconomicsOfManagedRealignment.pdf>