Natural England Research Report NERR046

Delivering the ecosystem approach on the ground – an evaluation of the upland ecosystem service pilots

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Natural England

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This report describes a suite of three upland pilot projects undertaken between summer 2009 and March 2011. Each of the pilots has continued to develop and implement the management plans described in this report although the pilot projects have evolved into a variety of new initiatives. The purpose of this report is to document the process undertaken and describe key findings and lessons learned during the initial pilot phase (2009-2011).

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Executive summary

Aims

This report is a record of the experiences gained from implementing the first phase of Natural England's three upland ecosystem services pilot projects (Bassenthwaite, South Pennines and South West Uplands), from summer 2009 to March 2011. The project aims are to:

- To provide practical examples demonstrating how the ecosystem approach can be applied on the ground.
- To use an ecosystem approach to define land and water management based upon consultation with stakeholders and their perceptions of the best options.
- To demonstrate that investment in the natural environment can result in multiple benefits (carbon, water, food, biodiversity, recreational and landscape benefits).
- To work in partnership to deliver a range of ecosystem services in a cost effective way and link these services to the beneficiaries.

Despite the growing body of research into the ecological, economic and, to a much lesser extent, social aspects of the ecosystem approach, there are few practical examples and case studies of areas of land and water being managed using the ecosystem approach.

Project steps

The pilots were established within a national project structure although each pilot was managed and decisions made by a local partnership. The project steps initially identified by the national project are:

1) Develop project and define partnership area;
2) Identify services currently provided and who benefits;
3) Develop a consensus view on future service provision and scenarios to deliver this;
4) Define the land management change required to achieve this vision;
5) Value the benefits of changed land management; and
6) Work with partners to pool resources to contribute to the delivery.

Involving people

Involving people (both suppliers and beneficiaries of ecosystem services) is at the heart of this approach. The pilots took a participatory approach to decision making through working with partners, wider stakeholders, local communities, farmers and other land managers. The pilots worked with existing partnerships and groups of partners, which were expanded to include the full range of interests in the areas of focus. Because each pilot was locally driven, each evolved differently. Although challenging and resource intensive, community engagement is critical. It also helped when addressing trade-offs and conflict; placing provisioning services like food and timber in the same assessment as environmental benefits helped to build bridges. Local people are generally aware of the public benefits that their natural environment provides but not necessarily familiar with the term "ecosystem services"; appropriate language is critical.

Assessing ecosystem service provision

Each pilot produced a map-based assessment of current ecosystem service provision using direct and proxy data. This provided a baseline against which to track future changes and also identified who benefited from the ecosystem services and where they were provided from. The national project also identified metrics for monitoring and tracking change; there is likely to be significant time lag between changes in management and service provision. There are no resources to establish new

monitoring programmes but existing monitoring will be used where possible to track change. As well as monitoring environmental change there is also a need to assess changes in the pilots related to understanding and subsequent decision making of the people involved (social capital).

Implementing delivery

Mapping and the development of other tools was also important for helping to inform decisions on land management. Two of the pilots developed map-based integrated delivery plans with key actions to enhance delivery of a broad suite of services. These plans integrated different existing local projects, land management actions and financial resources. On Dartmoor a refreshed vision resulted in Dartmoor Farming Futures: a stand-alone initiative within the pilot area, where farmers designed their own non-prescriptive agri-environment scheme, to enhance a suite of ecosystem services and public benefits.

Pilot delivery is entirely dependent on the voluntary uptake of agri-environment and other funded management options as part of viable farm businesses. As such, incentives which enable land management have been critical for both engaging farmers and implementing delivery. The projects had no additional new funds to implement delivery; funding resources were combined from a range of public and private sources, as well as other local projects. The link to water company catchment management projects accessed money for capital works to improve water quality; when combined with public funds this will enhance the delivery of a broader suite of ecosystem services. Innovative payments for ecosystem services were also explored, for example through work on visitor payback.

Valuing the benefits

Economic valuation is an important aspect of the ecosystem approach. However, due to limited time and resources this was only done in the South Pennines, where a marginal valuation of two scenarios was undertaken for a water supply catchment. This showed that, even with high management costs and only valuing a limited suite of benefits (water quality, carbon and biodiversity), investment in the catchment was worthwhile in economic terms. This was completed after the delivery plan was developed and as such was important for validating decisions and securing investment.

Key findings

The sections of the report include a summary of the key findings, what was done and lessons learnt from the pilots. The key findings are summarised in the conclusion which also considers whether applying the ecosystem approach added value. The recommendations are set out as a series of prompts for other place based projects wishing to adopt the ecosystem approach.

Each of the pilots has continued to develop and implement the management plans described in this report, although the pilot projects have evolved into a variety of different initiatives.

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Key aims

- To provide practical examples demonstrating how the ecosystem approach could be applied on the ground.
- To use a consultative ecosystem approach to define land and water management based upon stakeholders perceptions of the best options.
- To demonstrate that investment in the natural environment can result in multiple benefits (carbon, water, food, biodiversity, recreational and landscape benefits).
- To work in partnership to deliver a range of ecosystem services in a cost effective way and link these services to the beneficiaries.

Introduction

1.1 This report describes the experiences from Natural England's three upland pilot projects, of implementing the ecosystem approach on the ground. Despite the increasing interest in the ecosystem approach in policy and in academic literature, there are relatively few examples of it being used in the development and design of delivery projects. In the three pilot projects reported on here, we set out to test the ecosystem approach as a practical delivery model in the English uplands.

1.2 Until comparatively recently, most people thought that the conservation of biodiversity was only of benefit to wildlife and the habitats in which they occur. Leading thinkers and environmental policy makers have recently begun to recognise that the natural environment confers many benefits to people as well. These include the reduction of flood risk, supply of water, food and other natural resources, pollination of crops, environmentally based tourism and enjoyment of nature, which individuals value and benefit their health. There is now a recognised need not only to manage the environment sustainably, so these benefits can be enjoyed by present and future generations, but also to engage people in decisions about how the environment is managed.

1.3 With this realisation, the *ecosystem approach* has emerged as a significant driver of environmental policy. It is an integrated approach to the sustainable management of land and sea for the benefit of people, which seeks to combine ecological, social and economic understanding into holistic decision-making. It does this by considering the natural environment as a functioning ecosystem that provides benefits for people. Amongst policy makers and academics these benefits are often referred to as *ecosystem services* and include the benefits listed above and many more. As these services are benefits for people, we can place a 'value' on them (either monetary or non-monetary) which can inform decision making. Through assigning a value to the full range of services, we hope that the worth of these benefits is considered, alongside manufactured goods that have a clear market value. People are central to the ecosystem approach, as managers of the land and sea that provides us with services, but also as people who benefit from these services and legitimately play a role in decision making about the environment.

Convention on Biological Diversity

1.4 The ecosystem approach was adopted by the signatories to the Convention on Biological Diversity (CBD) in 1995, as the primary framework for action under the Convention[1].

1.5 The CBD has identified twelve principles (Appendix 1) which recognise:

- the need for an holistic approach;
- that management of the natural environment is a matter of societal choice;
- that there is an economic context to management decisions and market failures; and
- that humans are dependent upon ecosystems for survival and wellbeing through the provision of 'ecosystem services'.

Millennium Ecosystem Assessment

1.6 Despite its inclusion in the CBD, it took the publication of the Millennium Ecosystem Assessment (MA) in 2005, to really bring the approach and ecosystem services to the fore. The MA was commissioned by the United Nations to assess the consequences of ecosystem change for human well-being. It found that human actions are depleting our natural capital of biodiversity, soils, air and water and that their ability to sustain future generations could not be taken for granted. A new approach to action, the ecosystem approach, needed to be taken.

UK National Ecosystem Assessment and policy framework

1.7 Within the UK, Defra commissioned and developed a range of research and development projects relating to the ecosystem approach and distilled the CBD twelve principles down to six. This work culminated in 2011 with the publication of the UK National Ecosystem Assessment (UKNEA), providing a baseline assessment of the benefits the UK's natural environment provides to society and its contribution to our national wealth (UK National Ecosystem Assessment 2011).

1.8 The principles underpinning an Ecosystem Approach (Defra 2010):

1) Taking a more holistic approach to policy-making and delivery, with the focus on maintaining healthy ecosystems and ecosystem services;
2) Ensuring that the value of ecosystem services are fully reflected in decision-making;
3) Ensuring that environmental limits are respected in the context of sustainable development, taking into account ecosystem functioning;
4) Taking decisions at the appropriate spatial scale, while recognising the cumulative impacts of decision;
5) Promoting adaptive management of the natural environment to respond to changing pressures, including climate change; and
6) Identifying and involving all relevant stakeholders in the decision and plan making process.

1.9 The ecosystem approach now underpins most government policy for the Natural Environment. This includes the policies set out in the 2011 Natural Environment White Paper '*The natural choice securing the value of nature'* (Defra 2011a)and '*Biodiversity 2020 A strategy for England's wildlife and ecosystem services',* the government's current strategy for implementation of the Convention on Biological Diversity in England.

[1] **www.cbd.int/ecosystem/background.shtml**

1.10 The information from the UKNEA was used to inform the development of the 'The Natural Choice', the Natural Environment White Paper which signalled a significant cultural shift in management of the natural environment emphasising the principles of the ecosystem approach.

1.11 The link here to the CBD is significant. The White Paper recognised that nature has value, emphasised the need for ecological networks and identified the need to reconnect people with nature. A number of key actions arose from the paper to progress all of these areas such as the establishment of Nature Improvement Areas, the Natural Capital Committee and the Green Infrastructure Partnership.

1.12 Biodiversity 2020 provides the main practical framework for implementation of the White Paper with an emphasis upon securing and enhancing existing biodiversity, especially though the creation and management of ecological networks, maintaining and enhancing the value to society of a healthy natural environment and engaging people in care for the natural environment. Alongside the White Paper and Biodiversity 2020, the government's emphasis on localism and on engaging communities in decisions about local issues, all mean that the ecosystem approach has resonance with policy makers.

Developing practical examples on the ground

1.13 The twelve principles for implementing an ecosystem approach set out by the CBD provide a useful framework to guide national and local adoption of the approach. In addition there is a significant and growing body of research into ecological, economic and to a much lesser extent social aspects of the ecosystem approach. Despite this, examples where areas of land or water are being managed in a planned way using the ecosystem approach remain rare. Wider adoption of the approach is therefore likely to depend upon practical demonstration projects, as real world examples in which all the many aspects of the approach are brought together and tested. Further, the locally driven and place based emphasis of the ecosystem approach means that generic guidance will never be able to cover all issues in all places, particularly when it does not draw on a body of practical experience alongside research findings. A series of well documented case studies or pilots is seen here as an important resource to support further adoption of the ecosystem approach.

Upland pilot projects

1.14 To meet this objective Natural England initiated three pilot projects in the English uplands (see Figure 1) to test the ecosystem approach through a partnership lead process. We hoped that an inclusive approach to land and water management planning, which focused on ecosystem services, would encourage novel solutions and funding arrangements. Whilst wider adoption of the ecosystem approach is likely to require a range of examples, from all types of landscapes, there are significant benefits to pursuing upland case studies. Upland environments provide a suite of easily recognised and valuable ecosystem services (for example, carbon storage, water supply, timber, food and recreation). Traditional upland land management is also experiencing significant change due to both economic and social drivers and therefore there is great interest in novel, sustainable land uses (Natural England, 2009). We have also commissioned a series of lowland case studies in which an economic valuation of ecosystem services was applied to large-scale conservation projects retrospectively (Tinch *et al*., 2012).

The three broad pilot areas are shown, activity has varied within each of the pilots and in the South West the pilot has progressed in Dartmoor and Exmoor with stakeholders around Bodmin Moor involved as 'learning partners' or observers.

Figure 1 The location of the ecosystem services pilots

Linking to water company catchment management schemes

1.15 Currently by far the largest contribution towards the costs of environmental land management is from public funds, most notably from agri-environment schemes. However England's uplands are important for water supply and many large conurbations, particularly in the west of England, depend upon water from upland catchments. As a result a number of private water companies own land in the uplands or seek to influence land management to secure clean water supplies. Often meeting water requirements is highly compatible with delivering other environmental benefits such as increased carbon storage and improved biodiversity. This situation presents an opportunity for public sector bodies to work closely with the water companies; part of the private sector with a strong interest in safeguarding and enhancing an important ecosystem service (water supply).

1.16 The current institutional arrangements for the water industry have facilitated the adoption of environmental land and water management by water companies. They were set at the time of privatisation (1989) which established 5 year investment programmes, known as Asset Management Programmes (AMP), resourced through periodic pricing reviews. Recent AMP rounds have seen water company funded initiatives which are focused on catchment management solutions to tackle water quality issues, as opposed to expensive and less sustainable artificial filtration and chemical treatment solutions. The most celebrated example of such schemes has been United Utilities SCaMP (Sustainable Catchment Management Programme).

1.17 Each of the three pilot projects (Figure 1) is closely aligned with a water company catchment management scheme, which is targeting water quality issues (colour, turbidity, sediments, pathogens or pesticides). Natural England has built upon these opportunities to work with the respective water companies (United Utilities, Yorkshire Water and South West Water) and extend the focus to a wider range of ecosystem services. These partnerships ensured that from the start there was the potential to combine private and public funds to secure appropriate land management; water company investment funds and Natural England's agri-environment schemes.

Project structure and governance

1.18 The three pilots were established within a national project to ensure a consistent framework (whilst acknowledging the need for local flexibility) and to share best practice. Each of the pilots was managed regionally with the national project providing technical support and overall project management. In each pilot, a steering group comprising representatives from key partner organisations and stakeholders was established. The exact constitution of these groups differed between pilots, reflecting local circumstances and issues. The pilots were guided by a set of high level project steps and more detailed milestones and tasks. Figure 2 shows the main project steps and emphasises the iterative nature of the approach.

1.19 The pilots were designed to demonstrate how the ecosystem approach could be delivered on the ground, rather than as research projects; though we have sought to involve the research community in the design of the project and looked for opportunities to undertake monitoring or research. The pilots have two distinct phases: a design and planning phase (October 2009-April 2011) and an implementation phase where we will begin to make changes on the ground (from April 2011).

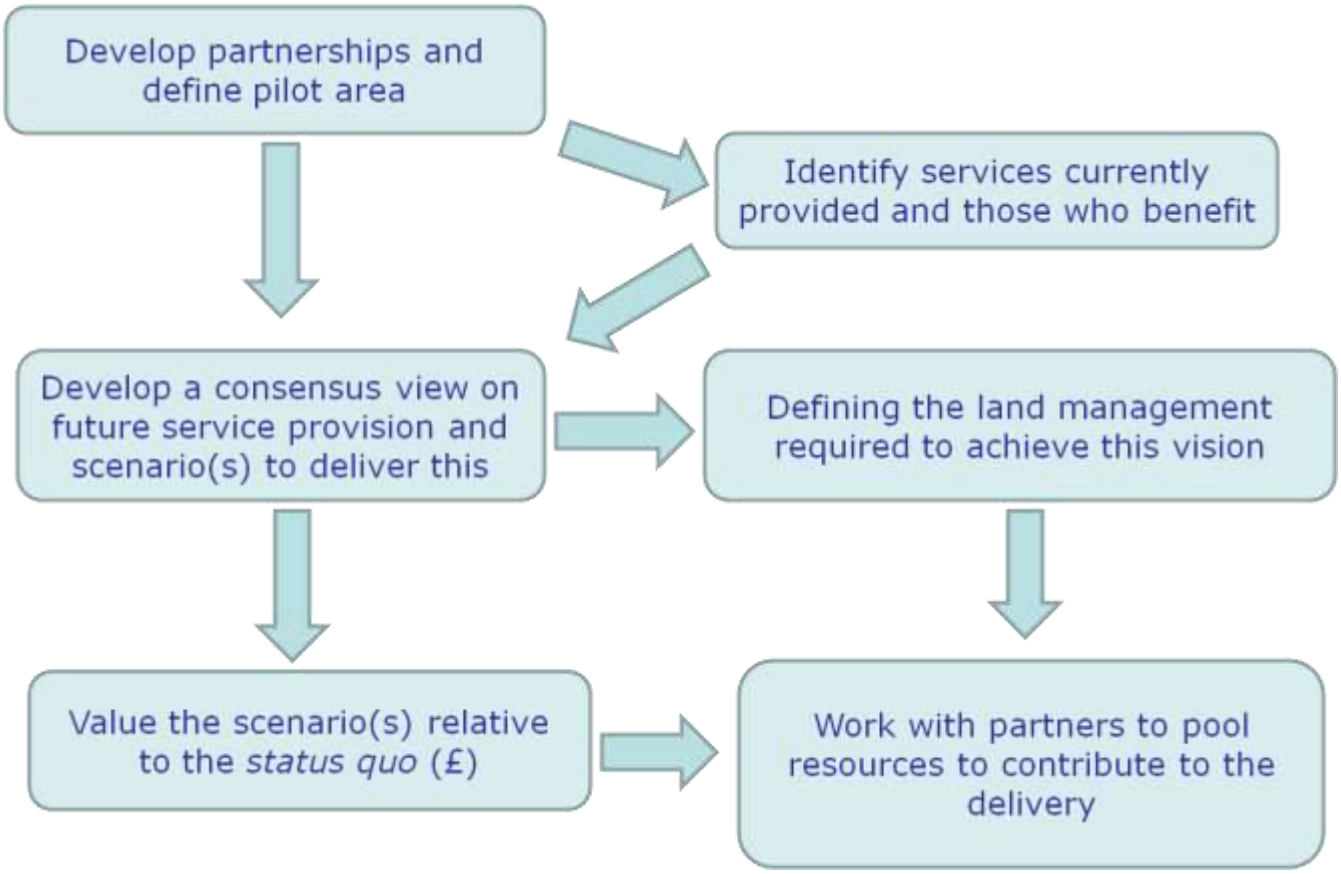


Figure 2 The project steps followed in each regional pilot

2 The geography of ecosystem services: scale, boundaries, beneficiaries and baseline assessments

Key findings

- **Existing partnerships and partner groups, already working within established boundaries, are of critical importance when defining scale and boundaries for applying the ecosystem approach.**
- **Surface water catchments work well as suitable boundaries, especially for water related services.**
- **We need to find ways to involve beneficiaries who live at a distance in making decisions about ecosystem services within an area.**
- **When mapping existing ecosystem services, proxy data needs to be used to depict ecosystem services where direct data is not readily available.**

Introduction

2.1 An ecosystem approach to land and water management, which focuses upon the provision of ecosystem services and the benefits they provide, has an inherently complex geography. It involves understanding the pattern of land management on the ground which might deliver the desired range of services. In addition it is necessary to consider the complex pattern of distribution of people who benefit from specific services. Other than at sea, the largest range of benefits are likely to be enjoyed by those living locally. But this is far from always the case. Many vital services are enjoyed by people living at a distance from the managed area. For example, water supplied from a specific upland location may be consumed by people living in urban areas many tens of miles away; visitors may journey from an even wider area to enjoy the natural beauty or recreational opportunities in our uplands. Managing land and water for a wider range of ecosystem services will require a good understanding of underlying ecosystem processes, where these occur within the landscape and how they reach those who ultimately benefit. This section considers the issues of appropriate scales and boundaries for managing ecosystem services, links to beneficiaries and how we can use existing data and information to plan for future integrated landscape management.

Scale and boundaries

2.2 The three pilot upland projects were initially developed with boundaries based on National Character Areas (NCA). NCAs divide England into 159 natural areas each defined by a unique combination of landscape, biodiversity, geodiversity and economic and cultural activity and as such are likely to provide a valuable framework for management of ecosystem services. However, NCAs are relatively large scale; the limited resources available to the regional pilots combined with a challenging timescale meant that it was not possible to tackle the whole of each NCA within the projects. In each of the three areas the pilot work focused upon a smaller area within the NCA with a view to applying lessons learnt to the NCA as whole.

2.3 In the case of the South West pilot the legacy of a range of partners working within National Park boundaries of Exmoor and Dartmoor meant that there was a strong presumption against using the NCA boundaries. Similarly, the North West pilot was defined by the long history of a multiple stakeholder catchment based approach centred on Bassenthwaite Lake. In the South Pennines

pilot the partnership with two water companies lead to a focus on two small catchments (Keighley and Worsthorne) within the wider South Pennines NCA.

Consideration of National Character Areas as a spatial framework for the 3 pilots

2.4 The integrating nature of NCAs offers considerable potential for considering ecosystem services. However, the following also require consideration:

- Other widely used spatial units such as catchments and administrative boundaries (local authority, national park).
- Ecosystem processes which operate at different scales and within a different framework, for example, the importance of a catchment based approach to deal with hydrological issues.
- Surface water catchments: water is significant as both a service and as a shaper of current ecosystem processes (water flows, nutrient fluxes, sediment transport). Many important drivers for land and water management require addressing at the catchment scale (water supply, erosion control, flood risk management). Catchments are not always relevant to cultural services or even water provision, where this is from groundwater aquifers.
- Existing partnerships and arrangements for planning and/or managing the natural environment are likely to determine the scale and boundary of any ecosystem approach initiative.

Location of beneficiaries

2.5 Managing ecosystem services which result in benefits outside the pilot areas, sometimes quite literally downstream for services which relate to water, presents further challenges. Firstly, adjacent areas may need to be managed compatibly to ensure that benefits are not lost. This is most easily understood for the service of flood risk reduction through land management, where potential benefits from management of the upper catchment may be negated through inappropriate management downstream. Secondly, some services and benefits may be delivered across wide areas and might need to be managed across more than one spatial management unit, for example carbon storage across a large blanket bog plateau. Thirdly, whilst some services may only be enjoyed by people who live locally, such as the local cooling effects and noise reduction from trees and vegetation, others who benefit may live further away from ecosystems providing the service. An example of this is a rural catchment which provides drinking water to people living in an urban area; clearly activities which compromised the quality of this water source would have a detrimental impact upon those in the urban area.

2.6 Given these complex spatial interdependencies, in terms of production and consumption of ecosystem services, local, regional and national scales need to be considered. This requires a careful balance between local communities having influence over how their local area is managed and reflecting the wider regional/national beneficiaries in choices about management. Spatial frameworks for considering ecosystem services and adopting the ecosystem approach need to consider and address these issues.

Establishing a baseline

Establishing a baseline assessment – what did we do in the pilots?

2.7 The baseline for each pilot consists of:

- Introductory text including a background summary on the character of the pilot area.
- A series of maps, aiming to depict individual ecosystem service provision.
- Brief explanatory text for each map.
- Maps of beneficiaries, where available.
- A table analysing the location of beneficiaries for each ecosystem service.

- Appendices with additional relevant data, for example, lists of priority habitats and species, Scheduled Monuments at risk, Water Framework Directive water courses with failing elements.

2.8 The baselines were produced through collation of the following:

- Nationally available map data, starting with pilot specific “cuts” of Mapping values: the vital nature of our uplands (Natural England 2009).
- Additional locally available map data sets from all partners cut to the pilot area boundary.
- Supplementary area specific data not available in map form, for example, tourism data including numbers of visitors and tourism businesses.
- Descriptions within the text of the indirect and proxy data used where direct map representation of ecosystem services was not possible, for example, extent of peat soils as a proxy for soil carbon storage.

2.9 An important step in the three pilot projects was to define and describe the ecosystem services of each pilot area to provide a current ‘baseline’. This baseline is important if we are to understand effectiveness of management changes made, including by economic valuation (Section 5). It also proved an important starting point for the liaison with partner organisations and stakeholders about future options. By systematically looking at the range of ecosystem services currently being provided within each pilot area, partnerships were able to see which services might be under threat or underprovided. In some cases a focus on ecosystem services enabled people to see the links between human activities and impacts more clearly and hence consider the consequences of particular actions.

2.10 An ecosystem services led approach enables all benefits to be considered rather than simplistically presenting production activities as undermining conservation efforts. Analysis of both positive and negative environmental impacts of farming methods or timber production identified opportunities to provide a more rounded package of benefits than arises from a simple focus on production. In workshops in the Bassenthwaite pilot, farmers identified a wide range of ecosystem services that they can supply through their land management whilst commenting that they are keen to ensure the long term continuity of productive hill farming.

2.11 As awareness of ecosystem services is relatively recent many existing spatial datasets do not directly represent ecosystem services (Bellamy *et al*., 2011). In many cases the baseline assessments have relied on indirect measures or proxies for ecosystem services, for example the extent of peat soil has been used a proxy for soil carbon storage. If we are to undertake accurate ecosystem services assessments in future it is likely that new data will need to be collected or existing data will need to be interpreted with new analytical approaches. However the use of a combination of locally and nationally available direct and proxy data, enabled us to produce baseline assessments without the resource intensive generation of new data.

Table 1 Ecosystem services compiled for Bassenthwaite pilot baseline assessment

Ecosystem service	Data sources	Direct measure or proxy
Food provision	Density of breeding ewes (Defra data) Summer/winter stocking levels (NE local team)	proxy
Timber provision	Woodlands over 10 ha (FC)	proxy
Water provision	Annual water abstraction in litres (EA) Raw water colour (UU)	direct
Climate regulation	Peat soils (BGS/Cranfield University) SSSI blanket bog condition (NE)	proxy
Flood regulation	Flood risk chance from rivers and sea (EA)	proxy
Soil erosion regulation	Sediment supply risk ratings (Orr et al 2004) Soil vulnerability (Forest Research and Lancaster University)	proxy
Water quality regulation	WFD status of water bodies (EA)	direct
Biodiversity	Broad habitats (BAP inventories) Designated sites: SSSI, SAC (NE) SSSI condition (NE)	direct -partial data
Cultural heritage	Scheduled Monuments at risk (EH) Historic Environment Record (LDNPA) Historic landscapes (LDNPA)	direct -partial data
Tranquillity	Perceived tranquillity (CPRE)	direct
Inspiration from landscape	Sites of significance to key Lake District artists and writers (LDNPA)	proxy
Recreation and tourism	Public Rights of Way (Crown copyright) Footpath restoration type (LDNPA) Tourism businesses (Mersey Forest Green Infrastructure Section)	proxy

NE: Natural England, FC: Forestry Commission, EA: Environment Agency, BGS: British Geological Society, BAP: Biodiversity Action Plan, SSSI: Site of Special Scientific Interest, SAC Special Area of Conservation, EH English Heritage, LDNPA: Lake District National Park Authority, UU: United Utilities, CPRE: Campaign to Protect Rural England

What have we learnt from the pilots so far?

- **Established partnerships or partner groups with already agreed boundaries are critical in determining the scale and boundary of the pilots. They enhance the "buy-in" to the projects with partners already committed to working together. This avoids the time-consuming process of developing new effectively functioning partnerships.**
- **With limited resources there is a need to concentrate efforts on focal areas with resonance for local partners, for example, the Keighley and Watersheddles water company catchments in the South Pennines, the two separate national parks of Exmoor and Dartmoor in the South West, the Bassenthwaite Lake catchment.**
- **Surface water catchments work well as suitable boundaries, especially for water related services.**
- **Baseline assessments are an important starting point for liaison with partner organisations and stakeholders about future options.**

- **Baseline assessments help in the consideration of the effectiveness of land management changes.**
- **Geographical Information expertise needs to be dedicated to a project to complete a baseline assessment.**
- **Data on the existing assets of the catchment does not always directly relate to the ecosystem services provided however use of a combination of locally and nationally available direct and proxy data, enabled us to produce baseline assessments without the resource intensive generation of new data.**
- **Biodiversity is one of the more straight forward services to capture in map form (due to the availability of data) however the mapped data is unlikely to provide complete information on habitat condition.**
- **The cultural services are difficult to separate from one another and show on a map; a series of maps can help to portray these interlinked services.**
- **The location of beneficiaries needs to be considered as part of the spatial framework. Map data on the location of beneficiaries can be limited, for example, for Bassenthwaite: visitor origin and downstream flood risk.**
- **For future accurate assessments of ecosystem services it is likely that new data will need to be collected or existing data interpreted in different ways.**

3 People

Key findings

- **Different partnerships will make different decisions about how to apply the ecosystem approach in their area.**
- **Effective engagement with farmers and land managers needs to be undertaken in the formative stages.**
- **Community engagement, although challenging and time consuming , is worthwhile; people want to be engaged and consulted and when they are their enthusiasm for environmental projects increases.**
- **Further engagement is required with wider beneficiaries.**
- **Local people are generally aware of the public benefits that are provided by the natural environment but not familiar with the term "ecosystem services"; appropriate language is important.**
- **Taking a fully participatory approach can feel uncomfortable as the outcomes are unpredictable, but it led to a co-created delivery plan which is more resilient because of the high level of engagement.**

Introduction

3.1 People are at the heart of the ecosystem approach. Most of our natural environment is managed in one form or another by people. People value and enjoy benefits from nature and critically we make decisions about its current and future management. The Convention on Biological Diversity articulates this by stating that environmental management is a matter of 'societal choice' but seeks to ensure that it is managed in a fair and equitable way. Involving people in decisions is desirable on both ethical and practical grounds. People have the right to be involved in decisions that impact on their well-being. Practically, decisions that are transparent and inclusive lead to better trust, better buy-in and less conflict. Not only that, by including a range of participants, the decisions are more informed both in terms of their values and priorities and also in terms of their expertise.

Participatory approach

3.2 There are some risks perceived around taking a participatory approach to decision making. Often it is considered to be more time consuming and requiring more skill and money to implement. It is less predictable and can result in un-anticipated outputs that don't fit neatly into existing decision-making processes. Finally, it can test 'accepted wisdom' on how things should be done and as such, be seen to open up more conflict. Nevertheless, by drawing out these issues, the decisions are potentially more robust and have greater longevity.

3.3 Within the pilots, we were seeking to make a step change in involving people in the decisions about future land management. We wanted to involve a broader range of people both in terms of stakeholder representatives but also take local views on board too. Not only that, we wanted to raise awareness of the benefits that people get from the natural environment. We also wanted to start to think about how we might make the links between the managers that provide services with those that benefit from them. For example, are Yorkshire Water customers aware that the management of uplands in the South Pennines is relevant to them and their water?

Existing partnerships

3.4 In the South West and Lake District, the projects were built on existing partnerships. In the South West, this was initially the Upland Task Force and in Bassenthwaite, it was the Bassenthwaite Lake Restoration Programme. In both cases these partnerships were broadened. In the South Pennines the pilot worked with Pennine Prospects to bring stakeholders together. In general, key partners were representatives of public, private or third sector organisations who had some responsibility for decisions in the pilot areas (such as Environment Agency and National Parks), representatives of the land owners and managers (Dartmoor Commoners Council, the Heather Trust, The Wildlife Trust) or represented beneficiaries (such as the water companies, RSPB, and the tourist industry).

3.5 Working with existing partnerships was critical to the success of the pilot projects and saved a large amount of time and effort in establishing new partnerships. Existing partnerships have already established working relationships and a focus on the project area. This also meant that pilot projects could fit into the existing governance structure of the partnership group. However working with existing partnerships means that you need to consider who else to involve. In each case, the membership was reviewed given the wider scope of taking an ecosystem approach. Input from under-represented sectors/interests was encouraged and through joint activity and learning, the partnerships strengthened.

3.6 In the Bassenthwaite pilot, partners were already engaged in some ecosystem services linked work. The Bassenthwaite Lake Restoration Programme (BLRP) is focused on tackling problems through catchment management and the partnership was already delivering a wide range of additional ecosystem services. The many stakeholders and sectors involved in the Lake District also work together via the Lake District National Park Partnership, facilitated by the National Park Authority. This partnership has also developed a set of shared 'land management principles' that have a strong focus on ecosystem services.

How we engaged people in the Bassenthwaite pilot

- Partners' steering group established, as a new task group within the existing Bassenthwaite Lake Restoration Programme, with agreed Terms of Reference, governance structure, regular meetings and updates.
- Key ecosystem services agreed with partners' steering group. At initial workshops, all participants contributed to scoping the full range of ecosystem services provided by the pilot area.
- Engagement included a focus on bringing under-represented sectors, particularly the farming and the tourism sectors into the process.
- Farmers' views sought on how provision of ecosystem services could fit with farm businesses, joint survey with University of Cumbria (Mansfield 2010).
- Land management options defined and locations identified through partner opportunity mapping workshop. Further developed through individual meetings with partners and a follow-on workshop.
- Two farmer workshops to gain input and buy-in to the delivery plan (19 farmers attended). Farmers identified the public benefits that their management of the land could provide and considered how land management options to enhance the provision of ecosystem services (with potential funding from the Higher Level Stewardship agri-environment scheme) could fit with their farm business.
- Three wider partner workshops (over 50 participants from over 20 organisations) including a workshop on the economic benefits (tourism, agriculture and health benefits).
- Nurture Lakeland pilot work with 35 tourism businesses, raising awareness with business owners and their visitors of the multiple benefits provided by the natural environment, signing them up to the visitor pay-back scheme and assessing how visitor pay-back could be developed as a payment for ecosystem services.

- Presentation to Nurture Lakeland Low Carbon Tourism Seminar on how appropriate land management can help to store and sequester carbon and provide other multiple benefits (43 tourism businesses/stakeholders attended).
- Wider public engagement through the Bassenthwaite Lake Restoration Programme's annual public conference (c.50 attendees) and a workshop with local sixth formers. Members of the public identified the ecosystem services provided by the Bassenthwaite catchment, who the beneficiaries are and where they live, on a local to global scale.

Wider engagement

3.7 Alongside the partnership, a number of other organisations and people were consulted during the development of the project. In each case it was important to tailor the language used to the audience. When asked, members of the public could readily identify what the natural environment of the pilot area did for them, without reference to the term "ecosystem services". Alongside the partnership and stakeholder working, the pilots had to integrate with a number of existing projects and their partners broadening the engagement further.

Beneficiaries

3.8 Part of the work of the pilots was to understand who received ecosystem services from the pilot areas, the 'beneficiaries'. For example, who benefits from the flood alleviation, cleaner water, recreation or climate regulation? In addition to the limited available mapping of beneficiaries undertaken as part of the baseline assessment (Section 2), in the Bassenthwaite pilot, workshops with members of the public, partners and local sixth form students helped to identify where beneficiaries live, on a local to global scale. In the South Pennies project some of the local people were interviewed to help us understand their particular appreciation of cultural services of the South Pennines (The Research Box, 2011).

Differences of approach between the pilots

3.9 The provision of a Natural England funded project officer acted as a catalyst (rather than project-lead) for the projects within the pilot areas. Involving local people and partnerships in the decision making meant that each pilot project evolved differently.

3.10 The South West pilot, in particular, followed a different route to the initial national project plan. Two partnership groups, one for Dartmoor National Park and one for Exmoor applied the approach in different ways. On Exmoor the partnership chose to focus on the land around Wimbleball Reservoir, which is mostly enclosed farmland so there were opportunities to work with individual farmers. On Dartmoor the National Park were trying to set up a project on the long term future of hill farming and common land grazing. The pilot project initiated a refreshed "Dartmoor Vision" that encompassed ecosystem service delivery. The pilot then worked with the Dartmoor Farming Futures Project, through a facilitated mapping exercise and meetings with commoners to draft a new type of agreement to deliver ecosystem services (Section 4).

3.11 Another area where the pilot projects varied in their development, through local participatory decisions, was with respect to the valuation work (Section 5). In the South Pennines there was considerable focus on the valuation (Harlow *et al*., 2012) whereas in the other two pilots the valuation was not found to be influential in driving the decision making process or delivery of the pilot.

Lessons learnt from the pilot projects on engaging people in ecosystem approach

- **There is a need to invest sufficient time and resource in building and working with the partnerships and local communities, through group and individual meetings, particularly at the start of the project.**

- **Building on existing effective partnerships saved time in setting up the pilots as partners were already working together within agreed boundaries and governance structures. The existing good relationships and trust encouraged partners to remain engaged.**
- **There is a need to focus engagement activity on key sectors that are under-represented in the existing partnership.**
- **Having a Natural England funded project officer for each pilot acted as a catalyst for partnerships to develop the pilot projects. A balance needed to be sought to ensure the project officer was useful to the partnership in running the project without undertaking the work single-handed.**
- **Some partners were more actively involved than others; it was difficult to actively involve health sector representatives.**
- **Local community engagement was critical for input to and delivery of the project; people want to be engaged and consulted and when they are, their enthusiasm for environmental projects increases.**
- **Community engagement can be delivered in different ways. A small amount of facilitation funding for a 'neutral' 3rd party, seen as trustworthy by stakeholders, can help deliver the local engagement effectively.**
- **Local people are generally aware of the public benefits that are provided by the natural environment but not familiar with the term "ecosystem services"; appropriate language is important.**
- **Whilst there was some analysis of appropriate partners and stakeholders, there wasn't an initial assessment of who we needed to engage with and how. We didn't fully consider and appraise the range of participatory and deliberative techniques that were available to us, and we didn't measure the change in people's learning and engagement as the work progressed.**

4 Ecosystem services & management options

Key findings

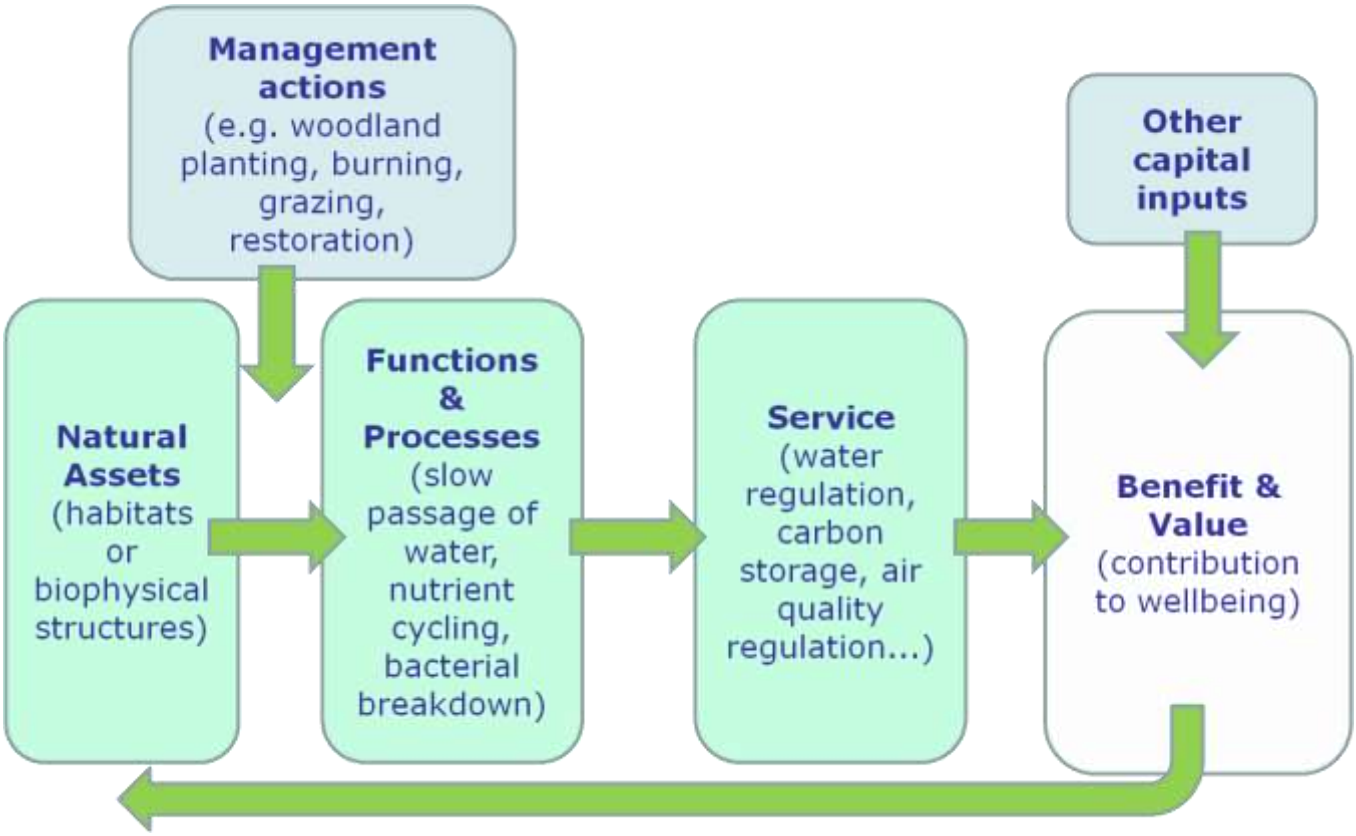
- **The ecosystem approach can integrate different initiatives and land management actions, to enhance delivery of multiple ecosystem services.**
- **Different approaches were taken in each pilot, determined by local participatory decision making.**
- **It is important to engage farmers and other land managers early on, to ensure their ownership of the project from the formative stages.**
- **Management tools can be very useful for communicating how land management affects ecosystem service provision and supplying supporting evidence for decision making.**

Introduction

4.1 The underlying hypothesis for our pilot projects was that in the future, management of land and water could provide a greater range of ecosystem services than at present. This reflects a belief that at present, land and water was not managed optimally for multiple ecosystem services. In each of the pilots a future land management plan was developed through discussion and consultation with key partners and stakeholders. The degree to which the final plan reflected the views of a wide range of service providers, beneficiaries and local people varied between the pilots. The aim of the plan was to safeguard and enhance ecosystem services within the area in question through sustainable land management. Our working hypothesis was that by looking after the natural environment and investing in sustainable land management, we could look after biodiversity, deliver a range of benefits for people whilst securing viable farm businesses. This section describes the process through which the future land and water management options were developed and some of the challenges associated with linking management to ecosystem services. The term management is used is the broadest sense to cover both management practices and changes in land and water use.

Linking environment, management and benefits

4.2 Ecosystems provide a range of benefits to individuals and society. These benefits are called ecosystem services and they are derived from the natural environment. The management of the natural environment influences how the ecosystem functions and the biophysical processes that occur there, and consequently influences the flows of services and the benefits we get. The ecosystem services cascade (Figure 3) provides a useful conceptual framework to help understand the link between the nature of the environment, how we manage it and the subsequent flow of ecosystem services and benefits. The cascade indicates the points at which human activities can impact and alter the flow of services. It emphasises that we can influence the flow of services and benefits through our management of the natural environment (natural assets) and impacts upon functions and processes.



(modified from Haines Young and Potschin, 2010)

Figure 3 The ecosystem services cascade

4.3 The model for the pilots (Section 1) envisaged the partnership developing scenarios for future service provision and then considering how to implement this, in other words identify and agree the ecosystem services to safeguard/enhance, then determine which land management or land use changes might deliver these services. In practice these two steps were blurred with many individuals having clear ideas about the management changes they would like to see within the pilot area, for example more trees or restored blanket bog. These views were frequently underpinned by a good level of understanding of the potential ecosystem service benefits associated with the changes. Also people understood that some of the same management interventions would deliver several ecosystem services (for example, restoring blanket bog would improve water quality, carbon sequestration and biodiversity). It's important that we continue to improve our understanding around the links between management and ecosystem service delivery to avoid relying on perceived wisdom rather than robust evidence.

4.4 Irrespective of the starting point (management actions or ecosystem services), it is important that we understand the links between the assets, how they are managed and the ecosystem services that result. This understanding and its application in ecosystem management is fundamental to a different, more holistic approach to environmental management. In some senses the knowledge and evidence required is not particularly different to that which has been required for traditional environmental management. Therefore, we have a good level of understanding of the links between a particular land use or management practice and certain environmental parameters. For example, there is a body of knowledge about the impacts of different agricultural practice upon surface water quality though we have little or no evidence of the impact of these practices on cultural services.

Climate change and adaptive management

4.5 Decisions about future land and water management were made with some reference to likely future changes. For example, many people felt that measures to reduce flood risk were important because flood risk was perceived likely to increase with climate change. Similarly, water companies are investing in blanket bog restoration to offset future increases in water colour which is predicted to deteriorate further with climate change. In this way planning for ecosystem services was able to take account of climate change and developing a more adaptive approach to management.

Integrated delivery of multiple ecosystem services

4.6 A principal aim of the pilots was to enhance the delivery of multiple, rather than single, ecosystem services through land management. In all three pilots, key land management actions were identified that could enhance more than one ecosystem service. Through the integration of a number of key land management actions the pilots sought to enhance a broad suite of ecosystem services. The process of looking at land management options encouraged people to think about 'bundles' or a 'portfolio' of ecosystem services. For example, in the South Pennines it was generally agreed that restoration of functioning blanket bog was likely to be 'good' for a number of ecosystem services – carbon storage, water quality, biodiversity and water supply. Where one management option or approach can deliver a bundle of ecosystem services in this way, it seems likely that it will be easier for people to reach decisions. In contrast where one ecosystem service can only be enhanced at the cost of degrading another, decisions become more difficult and different groups and sectors of society may have different views. In theory, economic valuation can help in such situations by demonstrating the costs and benefits of different options. In practice, a range of other issues come into play such as individual livelihoods, national and local priorities and legislation.

Addressing synergies and trade-offs between services

4.7 Through collaborative working the pilots aimed to identify "win-win" management actions, where benefits could be identified by farmers, land managers and other partners. The main land use in the pilots is traditional hill livestock farming, as well as shooting estates in the South Pennines. In all three pilots, farmers are concerned about the future of upland hill farming; as a farmer said in a workshop in the Bassenthwaite pilot "Farmers are farmers and want to farm livestock". In the South West, the pilot was seen as an opportunity to demonstrate the public benefits that farmers can provide in addition to food, as a cornerstone to underpinning viable farm businesses in the future.

4.8 As well as seeking the overall "win-win" of the delivery of multiple ecosystem services forming a part of economically viable farm businesses, the pilots also sought individual management options that benefited land managers. As an example, effective management of nutrient inputs on grassland, following soil testing, can ensure that uptake of nutrients by grass and other plants (such as clover) is maximised, excess application avoided and diffuse pollution from run-off is reduced.

4.9 The delivery of multiple ecosystem services as part of viable farm businesses can also be considered as a trade-off between food production and a wider range of services. Farmers make complex financial decisions to ensure viable farm businesses, balancing management for meat production for market with management required to receive agri-environment payments. As part of this, they also want to ensure that they maintain a viable livestock flock or herd. Managers of shooting estates will make equivalent decisions in relation to their shooting management and agri-environment schemes.

4.10 Delivery to enhance the provision of ecosystem services within the pilots is therefore entirely dependent on the voluntary uptake by farmers and other land managers of agri-environment and other funded management options. In the South West two workshops were held initially to

discuss the principals and the aims of the pilots. Some members of the group were initially sceptical of the approach but did have a desire to address issues around upland hill farming. These early discussion fed into the development of the Dartmoor Farming Futures, initiated by the Dartmoor Commoners' Council and the Dartmoor National Park Authority (DNPA), which became a stand-alone strand within the pilot.

What we did in the South West pilot: working with Dartmoor Farming Futures

4.11 Dartmoor Farming Futures is an initiative which seeks to involve farmers fully in designing and monitoring a new agri-environment scheme on two Dartmoor commons. The land management necessary to deliver the outcomes is determined by the farmers and the owners of the common, using their existing skills and knowledge of the area. There are no prescriptions within the agreement. The new design aims to enhance a suite of ecosystem services and public benefits, whilst encouraging farmers to take ownership of the scheme.

4.12 This was achieved through:

- Engaging a consultant to create a refreshed Vision for Dartmoor that encompassed ecosystem services delivery.
- Engaging a facilitator to conduct a mapping exercise and meetings with commons graziers to draft a new type of agreement for delivery of ecosystem services.
- Inviting partners onto a steering group to oversee the Farming Futures element of the pilot.
- Agreeing two pilot areas on Dartmoor: Forest of Dartmoor and Haytor.
- The participants then agreed what ecosystem services were important on the land they managed, mapped them and drafted a set of outcomes for delivering those ecosystem services.
- Preparing a monitoring and evaluation programme to assess: delivery of agreed outcomes; changes in vegetation as a result of management; whether the Farming Futures approach is improving understanding of ecosystem services; costs of implementing this approach.
- Commissioning of a report on the processes of creating the Farming Futures agreements.
- Granting derogations to the two pilot commons, to depart from the Environmentally Sensitive Area and Higher Level Stewardship agreement prescriptions, to carry out the agreed management practices.

Linking with existing initiatives

4.13 Development of the pilots highlighted the importance of not only working with existing partnerships, with established boundaries, but also of linking to other existing delivery initiatives, including single issue projects. This enabled the pilots to make the most of existing delivery and funding mechanisms. The pilots also acted as a means of linking together different parts of the delivery "jigsaw", to provide an integrated package of land management actions for enhancing multiple ecosystem services. As with the farming sector, this was achieved through seeking synergies, enabling existing initiatives to identify how the integrated approach of the pilot could benefit them. In the Bassenthwaite pilot, a matrix was developed as a tool to clearly show how key land management actions could enhance multiple ecosystem services and contribute to partners' objectives (Table 2).

Table 2 Bassenthwaite pilot matrix of land management actions, ecosystem services and partners objectives

Land management action	Ecosystem services and benefits									Partner objectives										
	Water provision	Food and fibre	Carbon storage and sequestration	Erosion control	Water quality	Flood regulation	Cultural landscape, historic environment	Recreation, inspiration, education and health	Biodiversity	SSSI PSA target	Cumbria BAP targets	Climate change adaptation	Landscape Character Assessment targets	Catchment Sensitive Farming	Improved access to natural environment	SCaMP2	Catchment Flood Management Plan	Water Framework Directive	Heritage at Risk	Lake District National Park Partnership Principles of Land Management
1. Increase woodland cover	x	x	x	x	x	x	x	x	x		X	X	X	X		X	X	X		X
2. Achieve sustainable grazing	x		x	x	x	x	x		x	X	X	X	X	X		X	X	X		X
3. Sustainable river management			x	x	x	x			x	X	X	X		X			X	X		X
4. Restore Scheduled Monuments at risk				x	x		x	x				X	X						X	X
5. Improve access			x	x	x		x	x	x						X					X
6. Manage nutrients on improved grassland			x	x	x		x		x	X	X			X				X		X
7. Improve biodiversity of valley habitats				x			x	x	x	X	X	X	X			X				X

Differing approaches between the pilot projects

4.14 As outlined in Section 3, through local participatory decision-making processes, the three pilots took different approaches to determine land management options and delivery on the ground. The Bassenthwaite and South Pennines pilots both produced integrated map-based delivery plans of key land management actions, which enhance the provision of multiple ecosystem services. The integrated plan consists of an opportunity map for each land management action and a side of text. This explains which ecosystem services will be enhanced, outlining "what", "where" and "how" land management action will be undertaken, including how this can fit with farm businesses. The South West pilot adopted a farmer led approach through Dartmoor Farming Futures and working with individual farmers around the Wimbleball Reservoir, on Exmoor.

4.15 The South Pennines pilot also followed the initial national project steps of identifying land management options or scenarios and then undertaking economic valuation of these to inform the decision making process. In the other two pilots, although there was interest in the valuation process, (particularly in the South West) it was not the major driver for determining land management options. This is discussed in more detail in Section 5.

What we did in the Bassenthwaite pilot – developing an integrated delivery plan

4.16 The map-based delivery plan was developed with partners, farmers and land managers through a series of workshops and individual meetings:

- Farmers views on the provision of ecosystem services and how delivering these can be incorporated within their farming businesses, sought through a questionnaire jointly with the University of Cumbria (10% of all farmers in catchment responded).
- Partner opportunity mapping workshop, one of a series of 6 workshops across the Lake District, for prioritisation of Higher Level Stewardship with the mass expiry of Environmentally Sensitive Area Schemes in the period 2012-14.
- Partners identified land management actions that would enhance ecosystem services. The ecosystem services were based on the agreed Principles of Land Management of the Lake District National Park Partnership.
- Matrix table created showing which land management changes would contribute to which ecosystem services.
- Partners used existing map data from the baseline assessment and annotated large scale maps with potential areas for land management actions to enhance ecosystem service provision.
- Seven key land management actions were identified: new woodland creation; sustainable grazing; sustainable river management; restoring Scheduled Monuments at risk; improving access; managing nutrients on improved grassland and improving biodiversity of valley habitats.
- Two- farmer workshops with 19 farmers attending out of a total of 104 invitees (18%). Focussed on how the seven land management actions, with Higher Level Stewardship funding, could fit as part of viable farm businesses.
- Further individual meetings and a partner workshop (20 participants) identified mechanisms for delivery and how actions could be embedded within partner organisations.
- Priority Higher Level Stewardship agreements to implement the delivery plan embedded in future Natural England delivery through the Higher Level Stewardship prioritisation process.

Developing management tools

4.17 There is a large body of evidence describing some of the links between management activity and environmental quality i.e. natural assets but this evidence is not always relevant to ecosystem services. As a consequence even in areas where we have reasonable scientific understanding of mechanisms it is not always possible to relate this to ecosystem service provision because our knowledge is not 'framed' in this way. Therefore, there was a need to consider existing knowledge in light of ecosystem services.

4.18 As an initial step we developed a matrix of likely land management changes and impact upon ecosystem services delivery. For each land management-service combination we made an assessment based on expert judgement and literature sources as to whether the impact upon ecosystem service was likely to be positive, negative or unknown; a simple +/- or ++/-- scheme was used to indicate the projected scale of the change. The matrix was validated through consultation with a number of specialists in Natural England. This was then further progressed through the development of an Ecosystem Services Transfer Tool (Cascade *et al* 2011).

Ecosystem Services Transfer Tool

4.19 This spreadsheet based tool is designed to help in land management decision making to determine:

- Which land management methods can be used to enhance particular ecosystem services?
- Whether these services can be delivered using the same land management methods in different places?

4.20 The tool is based on an extensive literature review, mainly of published evidence, examining whether the same management methods generate the same ecosystem services in different situations.

4.21 The first iteration of this tool is focussed on upland environments and considers the effects of variations in grazing, burning, forestry and access on the provision of ecosystem services.

4.22 For each land management method, the tool identifies whether in different places, the effects on ecosystem services are likely to be similar or different. It then draws broad conclusions on which land management methods would be expected to produce similar effects if transferred between different locations.

4.23 The tool includes a summary of the findings, matrices for each management method and reviews of all individual papers providing supporting evidence. A further iteration of the tool to include more management interventions across more broad habitat types is expected in 2013.

Using mapping as a management tool

4.24 Using the map-based baseline assessment as a starting point, each pilot project considered where changes in land management could potentially enhance the provision of ecosystem services. In the South Pennines and Bassenthwaite pilots, the baselines were used to undertake opportunity mapping of potential areas where land management changes could enhance the provision of ecosystem services. It is important that these are considered as just potential areas; any changes in land management in these pilots are dependent on the voluntary uptake of agri-environment schemes and other funding options by farmers and other land manager. As an example, partners in the Bassenthwaite pilot used the baseline assessment and local knowledge to map opportunities for woodland and scrub creation based on:

- Areas of bracken beds: among the least important agricultural areas and past woodland sites which support the deepest soils as well as remnant woodland ground flora.

- Extensions to and connections between existing woodlands, to enhance habitat connectivity and adaption to climate change.
- Avoiding areas of deep peat which are important for carbon storage and sequestration.
- Soil erosion risk maps. Gills, as a priority to reduce coarse sediment transport and subsequent deposition on valley bottom fields during floods.

4.25 In addition, to address a gap in the evidence base in relation to land management impact on downstream flooding in this catchment (an effect that varies considerably between different places) hydrological modelling work was commissioned to identify locations where reductions in flood flow, through woodland creation, could reduce downstream flood risk (Atkins, 2012).

Lessons learnt on developing management options for delivery of multiple ecosystem services

- **Through seeking synergies, the ecosystem approach can integrate different initiatives and land management actions to enhance delivery of multiple ecosystem services.**
- **Linking land management changes to ecosystem service improvements via a simple matrix was a useful communication tool.**
- **It is important to engage farmers and other land managers early on, to ensure their ownership of the project from the formative stages. This was achieved in the South West but not the other two pilots.**
- **Demonstrating the multiple public benefits that upland hill farming can provide in addition to food, can be seen as beneficial to the sustainable future of hill farming.**
- **Farmers are interested in the actions that they can deliver, and the support they will receive for that as part of their farm income. It was important that we communicated with them about their role in managing the landscape at a scale they related to.**
- **Although the pilots have not increased the funding available for land management, farming sector enthusiasm in the south west was potentially in part due to perceptions that agri-environment payments would increase if it could be shown that ecosystem service delivery was highly valuable.**
- **Different approaches were taken in each pilot determined by local participatory decision making.**

5 Valuing ecosystem services and benefits

Key findings

- **Economic valuation is novel to environmental management but an important aspect of the ecosystem approach. In our experience, it was ultimately less important to local partners and communities than we first envisaged.**
- **Discussing benefits with local groups was a good way of getting everyone to recognise and understand the value of their environment**
- **A marginal valuation of two scenarios in the Keighley and Watersheddles catchment has demonstrated that, even with costly management interventions, restoration of habitat structure and functions yields significant benefits and this is worth doing in terms of wider economic welfare.**
- **In this limited application, economic valuation was most powerful in terms of validating decisions and securing investment.**

Introduction

5.1 The introduction of economics to environmental management and decision making is seen by many as the most novel (and perhaps most contentious) aspect of the ecosystem approach. CBD Principle 4 recognises the need to understand and manage ecosystems in an economic context and argues that markets and incentives may need to be modified to secure biodiversity and ecosystem services. This recognition stems from the knowledge that many decisions in society are driven by market forces and regulation. Traditionally the benefits provided by environment have been poorly represented in both markets and policy decisions. The international study 'The Economics of Ecosystems and Biodiversity' (TEEB) describes a three tier approach to valuation of the environment – recognising, demonstrating and capturing value (TEEB, 2010). In terms of decision making it argues that 'recognising' that the environment has value can sometimes be enough, in other cases 'demonstrating' that value in economic terms can help people reach decisions (such as through cost-benefit analysis). By developing mechanisms (incentives or pricing structures) it is possible to 'capture' this value. Natural England's work in the pilot areas focused on recognising and demonstrating the value of the environment, with the aim that this would then be captured through existing incentives (agri-environment schemes) and funding mechanisms such as the water company asset management planning process; these are discussed in Section 6.

Recognising and demonstrating value in the pilots

5.2 The process of discussing ecosystem services and benefits with key partners and members of the local community (see Section 3) allowed groups to explore and recognise value in the broadest sense. Partners and community members identified benefits from their local environment through discussion and structured exercises. This can be seen as equivalent to the recognising value tier in the TEEB hierarchy. People were generally happier placing monetary values on those ecosystem services that are already traded in markets (food, timber, water) and felt less comfortable about trying to quantify the value of less tangible benefits. This particularly applied to some cultural ecosystem services which tend to be more difficult to define and sometimes more personal (tranquillity, sense of place, escapism). This difficulty in valuing the cultural services was of concern to many in the partnerships, as they were worried that an inability to express a monetary value would diminish the worth of cultural services in decision making. In an attempt to consider this, an exercise in the South Pennines explored some non-

monetary values through focus group work on cultural ecosystem services, getting people to describe their interaction with the landscape and identifying those attributes which provided certain benefits (The Research Box, 2011).

5.3 It was clear from early discussion with partners that economic valuation was seen as both a novel aspect of the approach we were testing and an important element to include. As understanding amongst the groups increased and people began exploring possible land use and land management options the importance they placed on economic valuation to inform decision making diminished. In part this was due to increasing awareness and confidence in different management options but also a feeling that the valuation was too technical for them to engage with and would not particularly help their decision making. With more time and resources we may have been able to undertake a more participatory approach to valuation with partners and communities which may have overcome this latter issue and secured more buy-in. The original project structure (Section 1) had envisaged a decision on future land management being informed by an economic valuation of different land management options but in practice it was not possible to complete the valuation work in time to inform these options. As a result the valuation was seen as a potentially useful validation or confirmation of the favoured land management options; we were unable to use it to inform the selection of those options. To date one full economic valuation has been undertaken, this focuses on the Keighley and Watersheddles catchment in the South Pennines pilot area.

Valuing land management changes in the Keighley and Watersheddles catchment

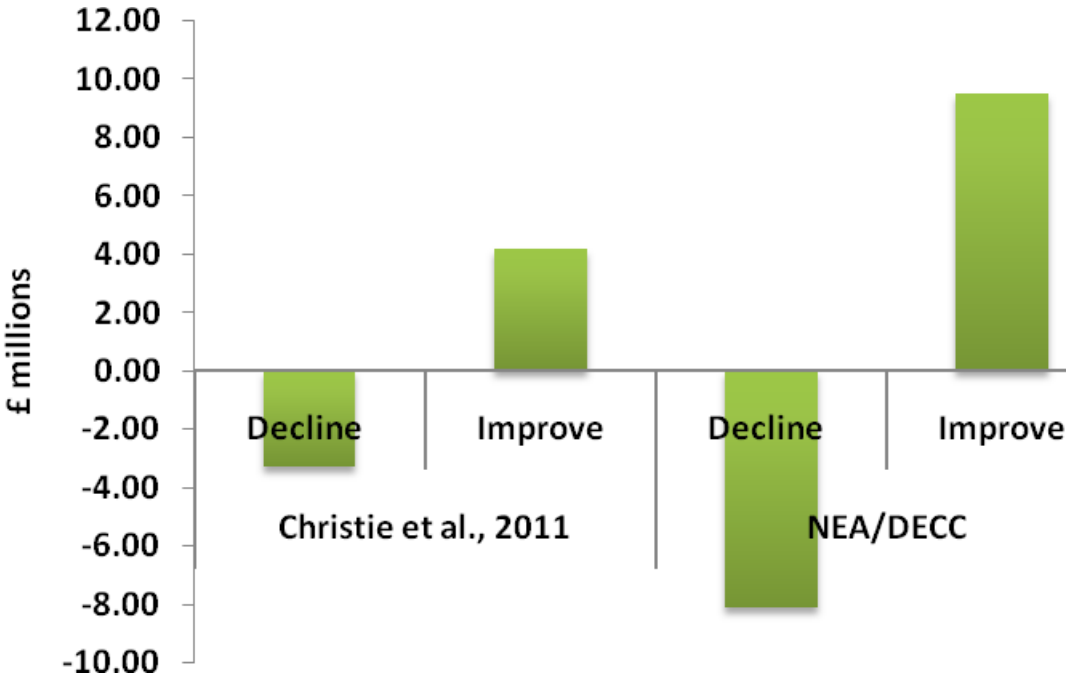
5.4 The map based delivery plan for the South Pennines Pilot (Section 4) identifies key land management actions to enhance a range of ecosystem service benefits. In the Keighley and Watersheddles catchment we worked in partnership with Yorkshire Water to quantify and value the changes in these benefits for two different scenarios (Harlow et al., 2012). We valued potential changes in the ecosystem services (water quality, biodiversity and carbon) provided by the catchment by developing two future scenarios: 1) an 'improve' scenario where habitat restoration and changes to land use occur; and 2) a 'decline' scenario in which there was a general withdrawal of investment and only minimum environmental regulations were applied. These two scenarios were compared with a 'business as usual' baseline over 25 years. The approach followed that described in Defra's value transfer guidelines (Eftec, 2010), full details are given in Harlow et al. (2012). This is an example of a marginal valuation in which the differences between scenarios are enumerated, such an approach is much more useful for decision making than attempts to place a total value on an area which is difficult and ultimately unhelpful to decision making.

5.5 Changes in ecosystem services under each of the scenarios were quantified by determining likely habitat changes and translating these into flows of services. Habitat changes were mapped and the extent and condition of habitats extrapolated for each of the two scenarios. This approach requires knowledge of the relationship between habitat type/condition and ecosystem services, in many cases these relationships are poorly understood. To help address this a matrix, of land management changes and likely impact upon ecosystem services delivery, was drawn up based on literature sources and expert judgement (Section 4). Subsequently this has been further developed through the Ecosystem Services Transfer Tool (Section 4).

5.6 As a result we focused on those services for which there was an established relationship and hence where modelling future ecosystem services could be undertaken or changes could be described through reference to the literature. We were able to quantify carbon storage and sequestration, and changes in water quality. It was not possible to quantify potential changes in biodiversity, access and recreation, flood risk management and provisioning services due to lack of data, unknown relationships or both. However, using value transfer based on habitat types (Christie *et al*., 2011; UK NEA, 2011) we were able to place a monetary value on biodiversity

changes for some habitats. Value transfer involves the application of values from other studies to a new but comparable situation.

5.7 The proposed management changes in the catchment will require both capital and maintenance expenditure and involve some costly remedial works to restore upland blanket bog. These costs were estimated over the same 25 year period to enable a cost:benefit analysis to be undertaken. Costs were estimated on the basis of agri-environment schemes using the payment rates for different management options. Three different approaches to estimating costs were investigated along with two different approaches to valuing benefits. Using different approaches enabled a sensitivity analysis to be undertaken and gives a range of final benefit:cost figures. All figures showed that benefits outweighed costs if the catchment was 'improved'. The highest figures suggest a cost:benefit ratio of almost 1:3 for the improved scenario compared to costs outweighing benefits by over 5 times in the decline scenario.



Christie *et al*., 2011 based on habitat type and condition; NEA/DECC based a UK National Ecosystem Assessment approach. See Harlow et al., 2012 for full details

Figure 4 Monetary values for ecosystem service benefits under decline and improve catchment management scenarios in Keighley and Watersheddles as determined by two different valuation approaches

Monetary value and decision making

5.8 The application of economic valuation to the Keighley and Watersheddles catchment demonstrates that even costly management interventions can be worthwhile if a wider range of benefits are quantified. Water quality cost savings for the improve scenario could range between £0 and £3.9m over the 25 years showing that the work is financially viable even without the wider benefits being taken into account. The range of ecosystem services assessed was limited to those for which changes in flows could be quantified and where there were monetary values that could be applied (carbon, water and biodiversity). Work with partners and communities indicates that there is a much broader range of benefits which cannot be quantified or valued. The valuation of benefits could therefore be considered a cautious underestimate.

5.9 Although local groups in all of the pilots appeared comfortable with the idea of deciding on future land management options in the absence of such cost-benefit information, it is clear that

evidence such as that compiled for the Keighley and Watersheddles catchment could be powerful in supporting decisions and convincing agencies and businesses to invest. In our experience, people living or working in the pilot area were most concerned about changes in their local place, whereas those outside the pilot areas were interested in the economic valuation for its potential to contribute to the development of national policy. As an example, the South Pennines economic evaluation is included as a case-study in the Water White Paper, *Water For Life* (Defra 2011b). Economic valuation also appealed to local economic interests.

5.10 The limited application of economics in one pilot area seems to support the view that a more holistic evaluation of societal benefits can be a helpful aid to making decisions and justifying investment. Nevertheless, our experience suggests that a much wider view of benefits is necessary and that some of the less tangible benefits are very important in determining people's choices about environmental management. For example, the work on cultural services in the South Pennines clearly demonstrates the non-monetary value that local people place on landscape character, historic features, tranquillity and sense of place (The Research Box, 2011). It is important that these difficult to quantify values are not lost in an attempt to distil benefits into a single monetary value. Whilst techniques for valuing these cultural services do exist and are constantly being refined, quantifying changes in the delivery of these services remains challenging and people seem less likely to place confidence in the resulting figures than for more tangible benefits that have obvious market values (food, carbon, water).

Lessons learnt from the pilots on valuing ecosystem services and benefits

- **Valuation of the ecosystem services and benefits arising from investment in land management is a useful tool that helps justify further investment. It appealed to specific sectors particularly local economic interests and national policy delivery.**
- **The South Pennines economic valuation showed that even with high management costs the benefits gained were worthwhile in terms of wider economic welfare.**
- **A number of people were uncomfortable with the concept of economic valuation and the partnerships required support and information about what it could and couldn't do.**
- **Discussing benefits with local groups was a good way to recognise and understand the value of the local environment. Valuation methods do not have to be based on money.**
- **People living or working in the area were most concerned about changes in their local place, whereas those outside the pilot areas were particularly interested in the potential of the economic valuation to help inform national policy.**
- **Valuation relies on good environmental data, this takes time to collect and we don't always have it in the right form. This includes accurate habitat maps, without overlaps between different habitats.**
- **Gaps in knowledge surrounding how the environment would change under different scenarios required the use of a number of informed assumptions in the valuation work.**
- **The economic valuation took considerable time, expertise and resource to prepare accurate habitat maps, address knowledge gaps on likely future changes in ecosystem services provision and complete the economic analysis.**
- **For future evaluation work, quick and easy to use decision support tools could help groups to systematically capture values.**

6 Financial resources and mechanisms

Key findings

- **Existing mechanisms and incentives enable the implementation of an ecosystem approach although it can be difficult to align the different opportunities.**
- **Incentives are critical for farmers and land managers in delivering ecosystem services.**
- **Existing mechanisms such as agri-environment schemes are important for embedding delivery, ensuring ownership, longevity of implementation and monitoring of management actions.**
- **Funding resources need to be integrated from a range of different initiatives to enable full implementation of the delivery plans.**
- **Incentives have been the main mechanism for engaging farmers with the pilot project and for implementing the agreed management to enhance ecosystem services.**
- **Incentive mechanisms are not currently designed for multiple farm agreements at a landscape scale, which are needed to enhance multiple ecosystem services.**

Introduction

6.1 To enable the delivery of enhanced ecosystem services we need a source of attractive funds and incentives to pay for them. Some ecosystem goods are already paid for in markets such as food and wood. Many others aren't and are produced for free as a by product of existing management. It has been argued that the lack of recognition that other ecosystem services have value, and the lack of markets for these services, has led to their erosion over time and a skew to those that make money. Issues of resource scarcity and resource reliability are beginning to impinge on businesses who are becoming aware that many of their activities depend on our natural environment. Making these links across sectors and connecting people and businesses with nature and the ecosystem services it provides, is critical for informed decisions. Alongside integrated thinking and integrated decision making, we are seeking integration across our institutions, resources and mechanisms.

6.2 The pilots did not have any designated funding. Funding for management changes all had to come from existing funding opportunities or through new innovative approaches.

Combining a range of incentives and mechanisms

6.3 We aspired within the projects to have one combined funding pot across the partnership so that land managers received one cheque for the management changes requested. We weren't able to do that, but we were able to identify the range of potential funding sources that could be combined together to pay for land management to enhance multiple ecosystem services. However, there were still some services and some aspects of the delivery plan that we didn't find funding sources for, for example improving access. The existing mechanisms are also predominantly focused on individual farm holdings, however to enhance the provision of a number of services, multiple farm, landscape scale agreements are needed, for example, for restoration of blanket bog. This is also true for rivers, where as well as requiring linked multiple farm agreements, there is also a lack of tailored options for sustainable river management, particularly for river re-naturalisation.

Consideration of existing funding mechanisms and projects

6.4 In each of the pilots, there were already a number of existing projects that were seeking a range of positive outcomes from the natural environment. These were considered as part of the integrated package for delivery. Existing partnerships were also important mechanisms for embedding delivery, ensuring ownership, longevity of implementation and monitoring of management actions.

6.5 Implementation of the land management options and Delivery Plans is dependent on the voluntary uptake of the Higher Level Stewardship (HLS) agri-environment scheme and other funding by farmers and other land managers. HLS is the main funding mechanism for the Delivery Plans. We used the existing agri-environment scheme to offer incentives for farmers to increase service provision as part of their farm business. We also combined this with funds from England Woodland Grant Schemes, Water framework Directive and other public funds as appropriate to the desired management changes we wanted to see.

6.6 To deliver multiple benefits farmers need to be able to balance management for food production with HLS and other funding schemes providing wider benefits. As such, the delivery of ecosystem services can only be achieved where it forms a part of economically viable farm businesses. The South West Upland Task force undertook an economic analysis of hill farming in this area to identify the level of financial support required to sustain reasonable farm incomes and traditional farm practices. Agri-environment schemes make a significant financial contribution to many upland hill farms; in the Bassenthwaite catchment over 90% of farms were within the Environmentally Sensitive Area scheme (now being replaced by HLS).

6.7 Different management options provide different financial support, although broadly for agri-environment schemes: the more management undertaken to enhance the natural environment, the greater the financial reward. Again, the suite of management options selected by farmers as part of their HLS agreement is dependent on the negotiation of individual agreements between farmers and Natural England HLS advisers. Enhancing the provision of ecosystem services relies not just on the coverage of agreements but also ensuring that appropriate options are applied in appropriate places.

Private investment

6.8 In each pilot the water companies had secured some funding for capital works through the pricing review undertaken by Ofwat. In the Bassenthwaite Pilot, United Utilities Sustainable Catchment Management Programme (SCaMP2) will provide funding for capital works on 19 tenanted farms and commons in the Thirlmere water supply catchment. United Utilities investment in farm infrastructure and other capital items is in addition to HLS and this combination of private and public funds is being used to pay for the enhancement of ecosystem services.

Table 3 Resources and mechanisms identified for implementing Bassenthwaite delivery plan

Land management action	Funding						Mechanisms for embedding delivery							Other
	Higher Level Stewardship	England Woodland Grant Scheme	SCaMP2	Nurture Lakeland Visitor pay-back	Water Framework Directive	Upland Entry Level Scheme	Lake District National Park Plan	RSPB Future Scapes	Bassenthwaite Lake Restoration Programme (BLRP)	Forestry Commission Carbon Task Force	Derwent Rivers Trust	Whole Valley Planning Groups	Catchment Sensitive Farming	
1. Increase woodland cover	x	x	x	x			X	X	X	X	X	X	X	Engagement with farmers, Cumbria Commoners Association Newton Rigg, University of Cumbria. Volunteering opportunities to plant/ maintain woods. Investigate accreditation for businesses for woodland planting.
2. Achieve sustainable grazing	x		x				X	X	X			X		Engagement with farming community, Cumbria Commoners Association.
3. Sustainable river management	x	x			x		X		X		X	X	X	Environment Agency (Flood Risk Management, Water Framework Directive).
4. Restore Scheduled Monuments at risk	x						X					X		Land owner action (UU, NT, FC). Volunteering opportunities. LDNPA.
5. Improve access	x	x		x			X		X			X		Land owner (FC, NT, UU) action. Community led projects. Local public realm funding. LDNPA.
6. Manage nutrients on improved grassland	x	x	x			x	X	X		X		X		(Upland) Entry Level Stewardship.
7. Improve biodiversity of valley habitats	x	x					X		X			X	X	Other BAP funding, , Cumbria Wildlife Trust, EA, NE. Cumbria Woodlands under-managed woodland and Previous Ancient Woodland Site projects. Woodland Improvement Grant for BAP 50% funding, wood fuel (proposed 60%).

Innovative approaches

6.9 The pilots considered a number of innovative approaches as ways of incentivising an increase in quality and quantity of ecosystem services. These were:

Payments for ecosystem services (PES)

6.10 PES schemes enable investment in the natural environment for outcomes (Dunn, 2011). They link people or businesses that benefit ecosystem services more directly with the sellers through voluntary market-like transactions. Because both buyers and sellers benefit from the transaction, it incentivises sustainable management. The pilots' timescale didn't enable us to set up a PES scheme but we were able to use the existing agri-environment as a PES type scheme. Within the Higher Level Scheme, management options exist to improve a range of ecosystem services and as well as paying for changes that are attractive to businesses such as the water industry. They can also pay for other services which are harder to identify a discrete group of 'buyers' for, as they are public goods and services, such as biodiversity.

Dartmoor Farming Futures

6.11 Through Dartmoor Farming Futures, farmers were fully involved in designing and monitoring a new agri-environment scheme on two Dartmoor commons. The new design aims to enhance a suite of ecosystem services and public benefits. The land management necessary to deliver the outcomes was determined by the farmers and the owners of the common, using their existing skills and knowledge of the area. There are no prescriptions within the agreement; derogations were granted to the two pilot commons, to depart from the Environmentally Sensitive Area and Higher Level Stewardship agreement prescriptions, to carry out the agreed management practices.

Visitor payback schemes

6.12 Visitor payback enables tourism businesses and their visitors to contribute to environmental projects through a range of donation methods. As well as generating funding, Visitor Payback can also raise awareness in tourism businesses and visitors of the range of benefits provided by the natural environment. In the Bassenthwaite pilot, one of the key partners, Nurture Lakeland (formerly the Tourism and Conservation Partnership), runs the largest visitor payback scheme in the United Kingdom. This scheme currently generates c.£250k per annum for environmental projects. Through the pilot project, Nurture Lakeland undertook work with 35 businesses in the Bassenthwaite catchment to explore how to further develop the visitor payback scheme to pay for ecosystem services (Nurture Lakeland 2011). This work has identified that visitors prefer to contribute to visible capital projects such as footpath repair/improvements and woodland creation.

What have we learnt about resources and mechanisms from the pilots so far?

- **Existing mechanisms are important for embedding delivery, ensuring ownership, longevity of implementation and monitoring of management actions.**
- **Funding resources need to be integrated from a range of different initiatives to enable full implementation of the delivery plans.**
- **Incentives have been the main mechanism for engaging farmers with the pilot projects and for implementing the agreed management to enhance ecosystem services. The majority of farmers want to get into Higher Level Stewardship as it can constitute a major and stable component of their farm income.**
- **Incentive mechanisms are not currently designed for multiple farm agreements or effective management options for rivers, that are needed to enhance multiple ecosystem services.**

- **Higher Level Stewardship agreements need to be outcome focussed, with the right options, in the right agreements, in the right place, to enhance the provision of ecosystem services. Through Dartmoor Farming Futures, commons graziers agreed a redesigning of their agri-environment agreements, to be less prescriptive and more outcome focussed on the enhancement of ecosystem services.**
- **Although the pilots have not increased the funding available for land management, farming sector enthusiasm in the south west was potentially in part due to perceptions that agri-environment payments would increase if it could be shown that ecosystem service delivery was highly valuable.**
- **For some ecosystem services, particularly those that are considered public goods (for example some cultural services), it is unlikely that a practical market based solution will be found. Other forms of incentives are required.**

7 Monitoring and evaluation

Key findings

- **There are a range of existing datasets and monitoring programmes that could potentially help us track changes in ecosystem services within the pilot areas. Some of these are better measures or proxies than others.**
- **The time lag associated with land use and management changes is likely to be considerable and we may not detect changes for some time.**

Introduction

The pilots are intended to be learning experiences but to also change land and water management within their boundaries. We can therefore learn from both the process of actually undertaking work (engaging local people, building consensus) as well as measuring the outcomes in terms of changing ecosystem service provision. Both of these are important in determining whether we have 'done the right things' and whether we can conclude the pilots have been successful but measuring the process and the outcomes require different approaches. This section briefly considers lessons we have learnt from the work so far and how we can begin to monitor the outcomes of land and water management changes that are beginning to be implemented. Ideally, we would be able to design and implement a bespoke monitoring programme for the pilots but there were no resources to do this. As a result we have had to focus on existing monitoring and scale ambitions accordingly.

What is success?

7.1 It is important to understand that demonstration or pilot projects can still be a success even if they fail to achieve the original objectives and deliver the expected outcomes. The purpose of testing new approaches and ways of working is to determine whether they will work and as such 'failure' is a perfectly valid outcome, providing we are able to understand why the outcomes did not meet our expectations and we learn from this. Our pilots developed in ways that were unforeseen and project steps were adapted to take account of partner aspirations, data availability and specialist capacity. Within this context we have defined success for the three pilots in the following way:

- A natural environment which provides a wider range of services and benefits to people.
- A community of people who understand the consequences of different management decisions for their local environment and act accordingly (social capital).

7.2 There are therefore two aspects that we need to consider when monitoring and evaluating the outcomes of the pilots, these correspond to the changes in the nature of natural and social capital (Figure 5). In addition to the outcomes we have also recognised the need to understand and 'measure' the process in order to learn from this. This has been pursued through a process of reflection and evaluation on the pilots and the process we have followed. Each pilot area has undertaken and written up an evaluation of their pilot and this current report represents a summary of a national level reflection and evaluation.

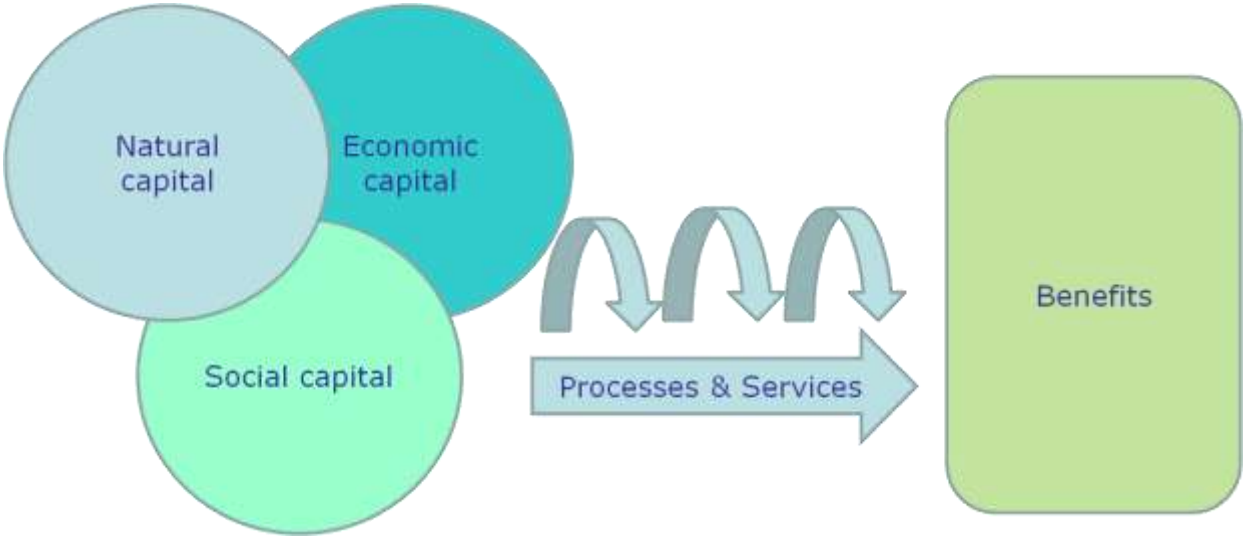


Figure 5 The three types of capital that generate environmental benefits for society

Monitoring changes in ecosystem services

7.3 Land and water management changes that have been proposed within each of the three pilot projects are expected to result in changes to the quality of natural assets and the flow of services from these assets (see Sections 2 and 4). Therefore, a key test of the success of the three pilots is whether these land and water management changes result in changes to ecosystem service provision, for example how much more carbon has been sequestered as a result of land management changes.

7.4 Monitoring change in ecosystem services in each of the three pilot areas requires an understanding of the baseline (or starting point) and some measure at the end of a specified period or a measure of the rate of service provision. Different ecosystem services or benefits may be suited to different approaches. For example, if we are interested in measuring the change in carbon storage we could estimate the volume of carbon stored at the start of the pilots and again at the end of a defined period, alternatively we could measure the rates of carbon flux before and after land management interventions. The baseline assessments produced for each of our pilot areas attempted to characterise the current level of ecosystem services using existing data to do this. In many cases we were able to use or build on existing Natural England and partner data to establish these baselines and will be able to use the same data to monitor change. However, there are many situations where existing data is a poor surrogate for ecosystem services and others cases where the changes in management may take longer to affect ecosystem services forcing us to predict or model outcomes. This was necessary for the economic valuation work described in Section 5.

Metrics for ecosystem services

7.5 Some previous work has considered the development of metrics for ecosystem services (for example, Linstead *et al.*, 2008) and as part of this work we commissioned Cranfield University to review existing datasets and monitoring initiatives which we might employ to monitor the outcomes of our pilots (Bellamy *et al.,* 2011). This work has highlighted some of the problems with using established datasets to measure processes or states that they were not designed to measure. As such whilst there is a wealth of environmental data and information being collected across the UK and within our pilot areas, this is not always appropriate for measuring ecosystem services. Much of our existing monitoring effort is intended to measure change in the quality of assets (for example, species composition) or measure environmental impacts (for example, pollution effects). Water quality monitoring is a good illustration of this paradox. Whilst the Environment Agency collect data on the quality of water in rivers and lakes this tends to be focused on measures of ecological quality and to detect the presence of polluting substances.

These are clearly important in terms of the provision of clean water and water purification functions but at present these data do not reflect the water colour issues that have the greatest impact upon water supply within upland catchments (particularly, in the South Pennines pilot area). Many existing monitoring programmes are not designed with the measurement of ecosystem services in mind.

7.6 We have managed to identify a suite of possible datasets and metrics that may be broadly indicative of changing service provision within the three pilots areas (Bellamy *et al*., 2011) but it is likely that bespoke monitoring may be required to fully describe the outcomes.

Time lags in changes in ecosystem services

7.7 A further complication arises because of the potential time lag in land management changes affecting ecosystem service delivery. The most obvious example of this is planting new woodland which will not begin to affect key ecosystem processes (which in turn affect ecosystem services) until the stands are relatively mature, the rate at which this new woodland begins to provide the services will vary according to the particular service in question so the benefits of the soil surface remaining undisturbed under new woodland may be realised earlier than any carbon sequestration benefits. This time lag is likely to be most significant where habitats are being created or restored. In the context of the pilots, blanket bog which has been restored is not likely to function as an intact system (with the carbon sequestration and hydrological characteristics of this) for a number of years. In such cases it may be possible to predict likely changes through a modelling approach.

Modelling changes in ecosystem services

7.8 Modelling the relationship between land and water management changes and resulting ecosystem services may be helpful both in predicting likely success, or otherwise, of our pilots but might also present a useful tool for helping people make decisions about different options. Bellamy et al. (2011) included a review of modelling approaches and concluded that, given limited input data, the need to link multiple processes and limited scientific understanding for certain processes, a Bayesian belief network (BBN) might be the most suitable modelling approach. The value of BBN's to predict ecosystem services and serve as a decision making tool has been acknowledged before (Haines-Young et al., 2008) but has not yet been progressed through the pilot projects. Investigating simple modelling approaches should be considered a key area for further tool development.

Social capital

7.9 Measuring the change in understanding and attitudes is more difficult but given the investment that Natural England and partners have made in talking and listening to people within the pilot areas it is likely that some progress has been made. We have gauged attitudes to ecosystem services as a concept with groups of farmers (Dwyer and Short 2011, Mansfield 2010) but have no baselines with which to compare this. In spite of difficulties in monitoring these changing attitudes it is important that this aspect of the pilots is not overlooked. Securing wider commitment to novel ways of approaching land management is recognised as an important step in adopting the ecosystem approach and behavioural change may be as important as securing funding in realising the necessary land and water management change.

7.10 The importance of social capital and building this through the work of the pilots has only become apparent as we have progressed and as such we did not collect any information about the baseline state. Future projects of this nature could measure changes in understanding and attitudes through questionnaires or interviews. An alternative would be to use embeded researchers within the process observing how different stakeholders and partners respond to different stages of the process.

What have we learnt from the pilots so far?

- **There is a need to understand and measure changes in both the social capital process (engaging people, building consensus) and the natural capital outcomes (changes in ecosystem service delivery).**
- **A baseline assessment produced for each pilot, using existing data to characterise current ecosystem services provision, provides a baseline against which to monitor change.**
- **Existing datasets and monitoring initiatives often monitor change in the quality of natural assets or environmental impacts; these were not designed to measure changes in ecosystem service delivery and are not effective at monitoring this.**
- **Bespoke monitoring may be required to fully describe the outcomes.**
- **For many services there is a time lag between changes in land management affecting ecosystem service delivery; modelling may be required to predict likely changes.**
- **Measuring changes in understanding and attitudes is difficult but needs to be built in from the outset.**

8 Conclusions and recommendations

Conclusions

8.1 The Delivering Natures Services programme was developed to test the ecosystem approach as a delivery model, and more specifically:

- To use a consultative ecosystem approach to define land and water management based upon stakeholder's perceptions of the best options;
- To demonstrate that investment in the natural environment can result in multiple benefits (carbon, water, food, biodiversity, recreational and landscape benefits); and
- To work in partnership to deliver a range of ecosystem services in a cost effective way and link these services to the beneficiaries.

8.2 The ecosystem approach is just that, an approach. It is not prescriptive and there is no 'right answer' but there are a number of elements that need consideration in the process. The pilots showed that the Ecosystem Approach is an excellent delivery model to integrate a range of demands from the land and bring stakeholder and community involvement into decision making. It is resulting in a healthier natural environment that provides a wider range of services and benefits to people. It demonstrated that the ecosystem services can be better delivered and offer better value for money through the integration of land management and rewards and incentives to those providing the services.

8.3 Each of the three pilots set out to test the approach, develop a methodology and deliver better integrated management for wildlife and people. Two of the pilots (Bassenthwaite and the South Pennines) followed the proposed project steps through to an integrated delivery plan whereas the South West pilot took a different approach, which on Dartmoor has resulted in Dartmoor Farming Futures. Throughout the report we have explored the different steps and the issues and successes that we found in using this approach. In summary they are as follows:

- Existing partnerships and partner groups are important when applying the ecosystem approach on the ground.
- Different partnerships, through local participation, will make different decisions about how to apply the ecosystem approach in their area.
- Community engagement, although challenging and resource intensive, is worthwhile. People want to be engaged and consulted and co-created delivery plans are more resilient because of the high level of engagement.
- Local people are generally aware of the public benefits that are provided by the natural environment although not familiar with the term "ecosystem services"; appropriate language is important.
- Effective engagement with farmers needs to be undertaken to ensure their ownership of the project from the formative stages.
- Further engagement is required with beneficiaries who live at a distance to involve them in decision making regarding ecosystem service provision within an area.
- Management tools can be very useful for communicating how land management affects ecosystem service provision and supplying supporting evidence for decision making.
- Economic valuation is an important aspect of the ecosystem approach and in this instance was most powerful in terms of validating decisions and securing investment, while less essential for local partners and communities than we first envisaged.
- The Keighley and Watersheddles catchment valuation work shows that, even with costly management interventions, restoration of habitat structure and function provides significant benefits and is worth doing for wider economic welfare.

- The ecosystem approach can integrate different initiatives, mechanisms, resources and land management actions, to enhance delivery of multiple ecosystem services.
- Incentives are critical for farmers and land managers in delivering ecosystem services; they have been the main mechanism of the pilots for engaging farmers and implementing the agreed management.
- Incentive mechanisms are not currently designed for multiple farm agreements at a landscape scale, which are needed to enhance multiple ecosystem services.
- There are a range of existing datasets and monitoring programmes that can be used to produce baseline assessments and track changes in ecosystem services. Some of these are better measures or proxies than others. For future accurate assessments it is likely that new data will need to be collected or existing data interpreted in different ways.
- The time lag associated with land use and management changes is likely to be considerable and we may not detect changes for some time.

Did taking an ecosystem approach add value?

8.4 As discussed in previous sections, the suite of pilots did achieve the three key specific outcomes we were looking at and did use all the Convention on Biological Diversity and Defra principles in their work. But did taking an ecosystem approach really add value and if so how?

Were there benefits in considering ecosystems and systems thinking?

8.5 Changing the emphasis from habitats and species to one of ecosystems was important as it brought into consideration the ecological processes and interactions. It moved the focus onto issues of functionality (for example, hydrology and soil science), which have not been as prevalent in biodiversity action planning. This systems thinking and integration of the ecology suggested that the resulting management is more resilient and effective as it is based on a more complete picture of what is going on ecologically. For example, the Bassenthwaite partnership initiated work on hydrological modelling of land management (particularly woodland creation) to reduce flooding in the River Derwent catchment (Atkins 2012). Typologies of ecosystem services don't typically deal with issues of landscape character, heritage and geodiversity other than considering the cultural services they provide. In reality by taking a broader systems approach within the partnerships, issues of heritage, landscape and geodiversity were brought into the mix for consideration alongside the other services and were integrated into the delivery plans. So whilst specialists in these areas have concerns that these issues are forgotten, in our experience they were picked up by the stakeholder group.

Did it better inform and achieve goals more effectively?

8.6 Bringing a wider group of stakeholders together across sectors enabled dialogue in a way that hadn't happened before. It facilitated group learning particularly during the workshop sessions (for example where attendees identified the local service provision). It made explicit to the group the links between the natural environment and the benefits it provides, something that many members hadn't considered before. This group learning took time but was well worth it both in terms of potential future partnership working but also in their better understanding of each other and the natural environment.

Did it involve new and innovative problem solving? Did it resolve conflict?

8.7 Having a broader group of stakeholders across public, private and third sector involved in the debates encouraged new and innovative problem solving. At the very least, the scope of the issues and trade-offs was better understood and a wider range of possible solutions were considered. This led to consensus, and whilst the development of options and scenarios was suggested initially to address possible differences of opinion, in effect this wasn't required as by working through the options in facilitated workshops, the group moved to a position of agreement.

How well did the pilots connect with the beneficiaries?

8.8 Connection with the beneficiaries varied between the three pilots. Each pilot identified where the beneficiaries were located; in the Bassenthwaite pilot this was done through workshops with local people. In general, developing connections was most effective with local beneficiaries within the pilot areas and we didn't successfully engage with beneficiaries located at distance. This was in part due to time constraints on the projects. Further work is needed to explore how to effectively involve distant beneficiaries within local decision making in relation to ecosystem service provision.

How was development of an agreed and joint evidence base useful?

8.9 The baseline documents which described the project areas and the current service provision was the focus for the initial group learning, but was critical to moving forward on the development of the future agreed management and delivery plan. It articulated the current state of knowledge and identified the uncertainties and possible trade-offs. The uncertainties around the data, trade-offs and future service provision were then part of the decision making process. It also provided the necessary baseline data for undertaking the valuation exercise in the Keighley catchment of the South Pennines pilot.

Did it help to value the natural environment?

8.10 The TEEB report recognised three tiers of value: recognising value, demonstrating value and capturing value. Across all of the pilots, the work to identify the benefits from the pilot areas in itself contributed to the group 'recognising' the value of the ecosystem services to themselves, their customers and society. As the TEEB report suggests, this in itself is extremely helpful and can be sufficient to inform better decision making. We only 'demonstrated value' through cost benefit analysis in one pilot (Harlow et al. 2012) and whilst this was beneficial to show that the investment was worthwhile, the analysis took so long that the valuation didn't inform the consensus building and the decision making. It is questionable whether or not it would have informed the decision because the group had already prioritised management and ecosystem service outcomes that they were particularly interested in achieving in the pilot area. We didn't manage to 'capture' the value of the environment in markets in any of the pilots although we are considering how this might be progressed in the future through another piece of work this year. The valuation exercise required in depth ecological knowledge of expected service changes and also the availability of information for benefits transfer. It also took some time, and whilst it was useful for the private businesses to understand the cost benefit ratios, it did mean that this kind of valuation would be prohibitive if the approach is rolled out more widely. A simpler valuation tool is required.

Did it achieve integrated delivery to enhance a range of ecosystem services?

8.11 Both the Bassenthwaite pilot and the South Pennines pilot used the ecosystem approach to design and deliver a shared delivery plan for the project. Taking an ecosystem approach to management of three upland sites has been challenging but has in two places, resulted in integrated management plans that are being delivered on the ground. In the Keighley catchment we have demonstrated that the suggested improvements in catchment management would delivery benefit ratios of 1:3 over a 25 year period in other words for every £1 invested we would receive £3 of improved services. In addition the Bassenthwaite and South Pennines projects managed to successfully integrate the project aims and outcomes with the range of other projects in the area, and demonstrate the areas where there were common aims and goals, so the projects could work together. Investment in the partnership was key and this took more time than was initially envisaged. This was partly as the concepts were new and some of the partners were new members. Alongside the partnership, a participation plan would have been helpful from the outset to ensure that we involved the local community and farmers as effectively as possible.

Was it possible to monitor change in ecosystem service provision?

8.12 Monitoring of the pilots was dependant on existing monitoring regimes due to lack of funding for new data collection. The existing data sets and monitoring initiatives were reviewed for each of the three pilot projects by Cranfield University (Bellamy et al. 2011). This report highlighted that although background data is available it was not collected for this purpose and is not designed to monitor ecosystem services. It also concluded that bespoke monitoring would be required to fully describe the outcomes of the pilot projects.

Recommendations

8.13 The recommendations below are the culmination of the lessons learnt from the first phase of the three upland ecosystem services pilot projects. They are framed with the aim of being useful to other place based projects wishing to adopt a partnership approach. In the pilots these project steps were progressed through a series of workshops and individual meetings with partners, farmers, other land managers and members of the local communities.

8.14 Recommended project steps with prompts for consideration:

1. Develop partnerships and define the pilot area

- What is the relevant geography for the project and why? For example is it catchments, National Character Areas, Institutional boundaries (local authority, existing partnership areas, national parks etc), habitats or ecosystems etc?
- Who are the relevant partners associated with the geography?
- Have you considered how the partnership will work, and what participatory and deliberative techniques need to be included from day one? (The research report 'Participatory and deliberative techniques to embed an ecosystems approach into decision making' (Fish et al. 2011) is a useful source for pursuing stakeholder engagement around the ecosystem approach.)
- Have you considered collating baseline information from the partners around their expectations of the project and their current state of knowledge for planning management options future evaluation purposes?

2. Identify services currently provided and those who benefit

- What are the services provided and where from?
- If you are using proxies for services, what are these and how good are they?
- Are the providers of services adequately represented in the partnership?
- What are the heritage, geodiversity and landscape issues?
- Who benefits from these services and where are they?
- Are the beneficiaries adequately represented in the partnership?
- What existing monitoring is taking place that can be used and what further monitoring needs to be put in place?
- Have you considered the links between the project area and adjacent areas in terms of services provided and received? For example, the project area being on the receiving end of flood waters.
- What are the uncertainties in this data and how is it being addressed?

3. Develop a consensus view on future options

- What services have to be provided from particular areas within the project (usually based on the ecosystem processes)?
- What services are more flexible in terms of where they can be provided?
- What are the implications of climate change?

* (see comment in 5)

- What are the bottom lines that partners bring to the table?
- What does this mean for the aspirations for the project?
- What are the synergies and trade-offs between aspirations?
- Can you reach a more mutually beneficial solution?
- How do the service values inform this process?

4. Value the options relative to the status quo

- What are the changes in ecosystem services expected under the different options?
- If using habitat proxies for services what is the change in areas of habitats and their quality?
- How does this relate back to changes in services?
- What are these changes worth (consider value transfer techniques if primary date is not available)?
- If it's not possible to value these services, can you express their worth in a narrative? (Is there evidence for this non-monetary value?).
- What are the costs of delivering these services?
- What is the cost benefit analysis?

5. Defining the land management required to deliver the consensus view

(In the Bassenthwaite and South Pennines pilots this was iterative and combined with 3, see *).

- What services do you want from where? Consider ground truthing this with local knowledge.
- What management will deliver these service changes?

6. Work with partners to pool resources to contribute to delivery

- What mechanisms and existing initiatives are available to implement delivery?
- What funds are available across the partnership and how can they be deployed?
- What other opportunities could be created to bring in funds, for example money from business, grants, visitor payback schemes etc?

7. Monitoring and Evaluation

- What are the lessons learnt from the process?
- What does the monitoring tell you about changes in service provision and do you need to adapt the management?

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Appendix 1 12 principles from the Convention of Biological Diversity

Principle 1: The objectives of management of land, water and living resources are a matter of societal choices

Different sectors of society view ecosystems in terms of their own economic, cultural and society needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Principle 2: Management should be decentralized to the lowest appropriate level

Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems

Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.

Principle 4: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

- Reduce those market distortions that adversely affect biological diversity;
- Align incentives to promote biodiversity conservation and sustainable use; and
- Internalize costs and benefits in the given ecosystem to the extent feasible.

The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favor the conversion of land to less diverse systems.

Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (for example, pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.

Principle 5: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach

Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Principle 6: Ecosystem must be managed within the limits of their functioning

In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable of artificially maintained conditions and, accordingly, management should be appropriately cautious.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales

The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems.

Principle 8: Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term

Ecosystem processes are characterized by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.

Principle 9: Management must recognize the change is inevitable

Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change.

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity

Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices

Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter alia, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines

Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

Natural England works for people, places and nature to conserve and enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas.

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