Department
for Environment
Food & Rural Affairs

Defra's Payments for Ecosystem Services Pilot Projects 2012-15

Review of key findings

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Contents

Authors: Environment Analysis Unit, Defra.

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University of Exeter and Westcountry Rivers Trust *(Fowey)*

Land Trust, Ursus Consulting, Hull City Council and Groundwork *(North Hull)*

RSPB *(Poole Harbour; Energy for Nature)*

Bristol Avon Rivers Trust*; (Tortworth Brook)*

Canal & River Trust and JBA Consulting *(Leeds-Liverpool canal)*

Montgomeryshire Wildlife Trust and Alison Millward Associates*; (Pumlumon)*

Cranfield University*; (River Lea in Luton)*

Birmingham City Univ, URS Consulting [now AECOM], Nurture Lakeland, ENPAA, and Project Maya *(Visitor Giving)*

FWAG South West and University of Gloucestershire*; (Cotswolds)*

Crichton Carbon Centre, URS Consulting, Birmingham City University, IUCN-UK*; (South Pennines)*

Woodland Trust and 3keel*; (Smithills estate)*

National Trust, JBA Consulting and Penny Anderson Associates*; (Holnicote estate)*

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Executive summary

Payments for ecosystem services (PES) is a specialist term used to describe a range of innovative schemes in which the beneficiaries, or users, of nature's services pay or fund the stewards, or providers of those services. Between 2012 and 2015, Defra commissioned three rounds of "Payments for Ecosystem Services" research pilots to test practical application of the concept in new contexts. All pilots were commissioned following a competitive bidding process. The projects covered a range of habitats, services and spatial scales. This review summarises the main findings and lessons learned; more detail can be found in the individual project final reports. This report is largely a process evaluation – the pilots were generally at an early stage and seeking to demonstrate feasibility – but it also covers aspects of impact and costs and benefits. It should also provide a learning resource for practitioners interested in such approaches.

Several pilot projects were able to demonstrate initial proof of concept. They have made an important contribution to the growing body of evidence on how "natural solutions" can deliver cost-effective environmental outcomes. Catchment-based projects have shown the most potential for PES applications, for example by delivering cost-effective water quality improvements, and can be considered closer to 'market'. Pilots that were unable to develop feasible PES concepts also demonstrated valuable learning. A key finding is that "PES" is a flexible concept which is best situated within a wider context of finding enterprising ways to generate new income streams for investment in ecosystems.

There have been some notable successes, including:

- The development of a **pilot Peatland Code** under the aegis of the IUCN in partnership with UK Governments. Following further research and testing supported by Defra, a first version of the Code was launched at the World Forum for Natural Capital in November 2015.
- The Fowey River pilot project has shown the potential for PES to deliver cost effective water quality investments through **reverse auctions**, a mechanism that could be applied in other contexts including agri-environment schemes.
- The Tortworth Brook PES scheme achieved robust proof of concept for applying PES in context of **sewage treatment** and use of integrated constructed wetlands solution.
- Following completion of the Cotswold pilot there have been promising developments for PES opportunities in the **Upper Thames** with Thames Water linked to pesticides and an innovative green gas mills scheme

- RSPB has developed an innovative "**Energy for Nature**" scheme in the Somerset Levels based on converting surplus biomass from wetland conservation into marketable bio-energy products on a landscape scale.
- A toolkit to assist tourism organisations with **visitor giving schemes** is now on the Visit England website and phone apps for iOS and Android developed
- A pilot in the Winford Brook catchment has developed legal principles for establishing an innovative **multi-beneficiary catchment fund** which could co-ordinate and allocate contributions to reduce reservoir siltation and nutrient removal costs through potential land management interventions.

Despite these achievements, all pilots have faced various barriers and challenges with mixed success in overcoming these:

- Limited quantitative evidence on links between land management and changes in ecosystem services
- Identifying and engaging potential beneficiaries
- Length of contracts potentially required, reluctance in one or two cases to "pay polluters".
- Time and resource required to build trusted relationships and stakeholder buy-in. A critical element for success is the intermediary role, which can take very different forms depending upon the context.
- The need to develop new legal and institutional structures to facilitate PES arrangements
- Developing PES ideas within the context of existing local initiatives and institutional and regulatory arrangements;

Looking ahead, the pilots have left a legacy of innovation for further related projects to build on across a range of areas:

- They have strengthened the case for catchment-based investment by water companies.
- Four of the country's largest environmental charities (RSPB, National Trust, Woodland Trust, Canal & River Trust) have been involved in the pilots and are now actively exploring PES-type approaches.
- The Tortworth project has raised the profile of integrated constructed wetland solutions to wastewater treatment amongst the industry and regulators
- The metrics established by Crichton Carbon Centre to underpin the Peatland Code are now being used in UK greenhouse gas accounting.

- Some pilots have helped to mainstream ecosystems thinking within local authorities
- The Poole Harbour pilot points to wider potential for nitrogen-trading to accommodate development pressures

Some of the lessons on the role for government in developing the potential for PES include:

- Benefits of investing in capacity building through such pilots including the development of proof of concept and trialling new delivery models, and ensuring there are no unnecessary barriers to these.
- Role of government in partnership with others to develop metrics and framework to give assurance and confidence for investment
- Raising awareness of the benefits nature provides, highlighting good practice
- Natural infrastructure brings with it new regulating and consenting issues that need to be better understood
- Recognising that incentives for PES may be affected by rules of, or changes to existing funding schemes (e.g. farm payment eligibility on peatland Code, renewable heat incentive on anaerobic digestion schemes)
- PES schemes are in their infancy so guidance needs to be adapted flexibly.

These pilots have been welcomed by the Natural Capital Committee (NCC) in its State of Natural Capital reports. In its response to the NCC's final report, the Government recognised that its proposed 25 Year Environment Plan would need innovative approaches to funding. The findings of these pilots will inform the development of the Plan.

1. Background and purpose

1.1. What are payments for ecosystem services?

"Payments for Ecosystem Services" (PES) describes a variety of innovative, market-based incentive schemes that reward land managers for maintaining and enhancing environmental benefits ("ecosystem services") such as water quality, flood regulation, climate regulation and certain provisioning and cultural ecosystem services (such as biomass and recreational access). While PES represents a useful and innovative approach to conservation of nature, it should be considered just one approach that may complement rather than replace other approaches, including different forms of regulation and awareness-raising.

PES schemes involve a willing 'buyer', or beneficiary, of an ecosystem service, voluntarily paying a 'seller' (typically a landowner) who is willing to adopt measures to provide a particular ecosystem service or services. Intermediaries (organisations who act as brokers to coordinate buyers and sellers) and knowledge providers are also important actors in the functioning of PES schemes.

PES schemes should be voluntary and should demonstrate "additionality" (i.e. outcomes that are above and beyond what would normally be expected or mandated) and conditionality (i.e. payments depend on verified environmental improvements). These key PES principles are set out in Box 1 below.

Box 1 Key PES Principles

Voluntary: stakeholders enter into PES agreements on a voluntary basis;

Beneficiary pays: payments are made by the beneficiaries of ecosystem services (individuals, communities and businesses or governments acting on behalf of various parties);

Direct: payments are made directly to ecosystem service providers (in practice, often via an intermediary or broker);

Additionality: payments are made for actions over-and-above those usually required from land managers and others (i.e. providers should not be compensated for satisfying regulatory obligations such as meeting 'polluter pays' requirements);

Conditionality: payments are conditional on the delivery of ecosystem service benefits (in practice, often for actions agreed likely to deliver the desired ecosystem services);

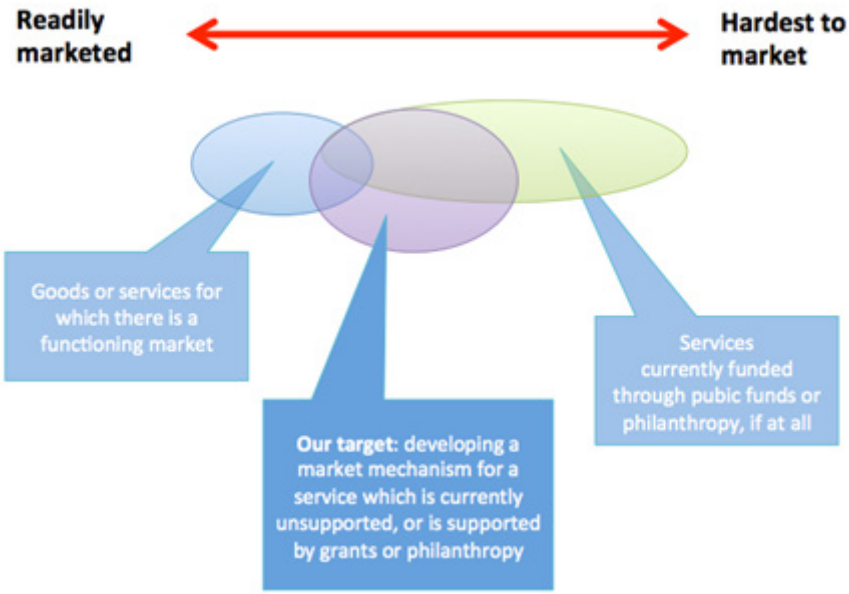
Ensuring permanence: management interventions should not be readily reversible,

Avoiding leakage: PES schemes should be set up to avoid leakage, whereby securing an ecosystem service in one location simply leads to the loss or degradation of ecosystem services elsewhere.

In practice, such characteristics are seldom entirely observed and many schemes are referred to as “PES-like” to acknowledge deviation from the ideal set of criteria. For example, payment is often linked to actions rather than being conditional on service delivery.

Figure 1 below (taken from the Smithills pilot project report) offers a simple, pragmatic way of positioning PES. Whilst conventional thinking sees a clear distinction between public goods that the market cannot provide and goods which have functioning markets, PES thinking sees an opportunity within this spectrum to develop market arrangements for specific ecosystem services (including provisioning services) which are currently unsupported by functioning markets, but have the potential to be independent of grants or philanthropy.

Figure 1 Identifying the opportunity for PES



In practice, identifying this PES opportunity involves overcoming three linked market failures associated with ecosystem services:

- Where ecosystem services have ‘**public good’ characteristics** i.e. everyone benefits from them and incentives to pay are weak (they are “non-rival” and “non-excludable”). They therefore tend to be undervalued and under-provided by existing markets, leading to unsustainable use or neglect of the underlying natural capital. Overcoming free-riding is a particular challenge for PES approaches and demands strong institutional arrangements. The urban-based

Irwell study was unable to make progress largely because of inadequate incentives and collective means for individual firms to fund river improvements.

- Where **information asymmetries** mean that potential beneficiaries of those services lack awareness of what investment in ecosystems can provide or cannot be sure that these investments will deliver. Various pilots have sought to raise this awareness, engage beneficiaries and provide assurance.
- Where **high transaction costs** form a barrier to bringing beneficiaries and providers together. A number of the pilots have begun to develop institutional arrangements to address this including the potential to develop bundled or layered PES schemes[1]. All of the pilots highlight the importance of the intermediary role.

The "PES" label can in principle be applied to publicly funded schemes with central or local government as "buyer" of public goods. Countryside Stewardship could be considered an example of a publicly funded PES scheme to the extent that payments are based on ecosystem services provided by land managers. The focus of this paper is on PES initiatives outside of public funding, although there are links between the two.

Payments for ecosystem services are developing across the world: according to the *State of watersheds payments* report[2] transactions totalled more than $8 billion in 2011 and with evidence of a substantial step up in new investment in 2012. PES schemes are common in the developing world where regulatory frameworks are less mature, and land ownership patterns less complex, than in countries like the UK. In the UK, water catchment schemes, United Utilities' SCaMP and South West Water's Upstream Thinking are well known examples, while the Ofwat Price Review for 2015-2020 (PR14) is expected to see a significant increase in catchment-based schemes from the £60m invested in PR09. Most of the water companies in England have deployed some form of catchment based approaches in their business plans for PR14. The type and extent of activities varies by company.[3]

[1] Bundling in PES is defined as grouping multiple ecosystem services together in a single package to be bought by individual or multiple buyers. Layering (also called "stacking") refers to schemes where payments are made for different ecosystem services separately from the same system.

[2] For further information, see report published in January 2013 at: www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=9542&section=news_articles&eod=1

[3] See report by Indepen, *The potential for catchment services in England (2014)* http://www.indepen.uk.com/docs/catchment-services-report_july2014.pdf

1.2. The PES pilot research fund

Defra's support to develop the potential for PES was set out in the Natural Environment White Paper in 2011 and looked to build on major studies such as the UK National Ecosystem Assessment and Lawton Review which highlighted the wide range of benefits that people and the economy receive from well-managed ecosystems.

In addition to developing a Best Practice Guide (see Box 3), Defra tested the market for PES ideas and commissioned 16 pilot studies over three competitive rounds between 2012 and 2015. Over the three rounds, 35 proposals were submitted of which 16 were funded, indicating strong interest in PES thinking. Rounds 1 and 2 disbursed approximately £274k for 11 projects, with an average cost per project of around £24,000. The 3rd round disbursed around £144k total for five projects, with average project cost around £28,000. In addition, projects were able to leverage an estimated 50% in co-funding and establish partnerships.

In selecting projects, an important consideration was additionality; i.e. would have gone ahead in the absence of the Defra PES pilot fund. Some strong proposals were received but not funded where it was felt they could succeed without Defra funding. Typically, the majority of spending in each project covered staff time, facilitation and desk studies. The research and development spending on the PES pilots represent good value for money by providing both general and transferable lessons as well as practical plans and frameworks to develop future PES projects.

1.3. Evaluation scope and methodology

The Government's evaluation guidance (*Magenta Book*) distinguishes between types of evaluation that focus on implementation ("process" evaluation), actual changes arising from intervention ("impact" evaluation) or costs and benefits of intervention ("economic" evaluation). This study is largely a process evaluation - with relatively small sums available for a project and a limited time span (12 months), the aim of funding was to test proof of concept at an early stage so that further development of the projects could become self-sustaining. This can be more formally summarised as a "logic model" setting out a "theory of change" (Figure 2). The focus of this report is on the activities, outputs and outcomes.

Figure 2 A logic model for Defra's PES pilot research fund

Inputs	Activities	Outputs	Outcomes	Impact
PES R&D competition Existing partnerships Existing studies	Stakeholder workshops Desk analysis and modelling Surveys	Data generated Enabling tools Strong partnerships	Proof of concept Legacy Sustained momentum Stakeholder buy-in Attitudinal change	Implementation Investment in nature Scalability

A review of the first two rounds of pilots was published in October 2014. This report updates that review to include the third round of pilots. A key aim of this paper is to provide a learning resource for stakeholders interested in the practical development of PES. This means there is less of a focus on the more theoretical aspects of PES.[4]

This evaluation has been undertaken by Defra's Environment Analysis Unit, which has been closely involved in overseeing the various pilots and is well-placed to identify common themes. There have been a number of activities to maximise objectivity and feedback:

- Systematic spreadsheet capture of pilot characteristics, findings and challenges;
- A major workshop on the pilots hosted by the Ecosystem Knowledge Network in Manchester Town Hall.
- Review and feedback on drafts from individual pilots
- Review and contributions from Professor Mark Reed of Birmingham City University
- Review by Defra's Economic Advisory Panel.

It is important to note that this was not a controlled "field experiment" designed by Defra. The pilots were independent proposals and projects which were awarded research funding in a competitive process by Defra on the basis that they would extend our knowledge of the potential for PES in practical contexts. In addition, the pilots were all very different reflecting the localised and diverse nature of PES

[4] For an introduction to the economic framework for PES, for example, see: https://www.gov.uk/government/publications/payments-for-ecosystem-services

opportunities as well as being at differing stages of development (see below). Apart from two projects which focused on evaluation (Fowey and Pumlumon), there were limited opportunities for rigorous assessment of impacts, although a number were able to present evidence of benefits and value for money associated with the pilot PES scheme.

In theory, we would want to assess a range of key indicators to assess the impact of PES schemes, such as:

- Cost-effectiveness or value for money[5] relative to some carefully defined baseline
- Net social benefits of the scheme, including environmental gains
- Degree of participation
- Degree of spatial targeting (where it matters)
- Paying for outcomes vs paying for actions
- The size and role of transactions costs.

Most of the evidence in this report is qualitative, which provides insights into, if not indicators of, these important issues.

[5] An action is termed "cost-effective" if it meets a given objective at lowest cost, compared to alternative solutions providing the same benefit. "Value for money" is used where benefits as well as costs are variable: thus an action may be considered greater value for money than a lower cost alternative if it provides sufficiently greater benefits; these benefits may be financial (e.g. resource savings) or non-market in nature.

2. Overview of the PES pilots

Table 1 summarises the three rounds of pilots. A detailed summary can be found in the Annex. The projects covered a range of habitats, services and spatial scales. Figures 3 and 4 following show the location of the pilot projects and the type of ecosystem service addressed by each project:

Table 1: The PES pilot projects

Pilot Project (and lead)	Description of Project
Round 1	
Fowey River *(UEA; Westcountry Rivers Trust)*	A targeted reverse auction investing in farm infrastructure to improve water quality in the Fowey river.
Hull Flood Risk *(Land Trust; Hull City Council)*	Design of two PES schemes to reduce urban flooding through improved land management
Poole Harbour catchment *(RSPB)*	Design of a PES scheme to reduce nitrogen levels and improve water quality linked to nutrient offsetting of new development
South Pennines *(Crichton Carbon Centre)*	Development of carbon valuation methodology for 'place-based' PES schemes with a focus on climate regulation and benefits to water quality, biodiversity and recreation. This study was commissioned jointly by Natural England and Defra.
Round 2	
Peatland Code *(Birmingham City University)*	Development of a code to facilitate private investment in peatland restoration to reduce net GHG emissions with co-benefits (water quality, biodiversity, recreation)
Tortworth Brook *(Bristol Avon Rivers Trust)*	Ecosystems approach to sewage treatment using Integrated Constructed Wetlands (ICWs)
Leeds-Liverpool Canal *(Canal & River Trust)*	Study of PES mechanisms to support CRT activities in providing ecosystem services (drainage and conveyance; visual amenity, recreation and habitat restoration)
Pumlumon *(Montgomeryshire Wildlife Trust)*	Evaluation of multiple ecosystem services (water quality, carbon, tourism) from a landscape based project

The River Lea in Luton *(Cranfield University)*	Assessment of PES approaches to restoration of the River Lea for multiple social, economic and environmental benefits
Visitor Giving Schemes *(Birmingham City University)*	Research on visitor giving schemes to support cultural and recreational ecosystem services
Cotswolds Catchment *(FWAG South West)*	Development of a PES scheme in the Cotswolds catchment engaging landowners and multiple beneficiaries around water quality and quantity, land management, energy production and landscape.
Round 3	
Energy for Nature *(RSPB)*	Using surplus biomass from land (wetland) managed for conservation to create saleable bioenergy products
Holnicote Estate *(National Trust)*	Exploring PES options to fund natural flood management methods and support biodiversity, carbon storage, soil management and water quality
River Irwell *(Lancashire Wildlife Trust)*	Linking private businesses in the city centre with local river improvements in Greater Manchester
Smithills Estate *(Woodland Trust)*	To find practical, enterprise-based ways to link the site's natural assets to local people and businesses to bring nature and the city of Bolton closer together.
Winford Brook *(Eunomia Research & Consulting Ltd)*	Working with Bristol Water and Wessex Water, the Environment Agency, Natural England, Bath & North East Somerset Council, and North Somerset Council to develop a multi-beneficiary PES scheme initially aimed at water quality and flood mitigation services.

Figure 3: Location of rounds 1 and 2 PES pilot projects

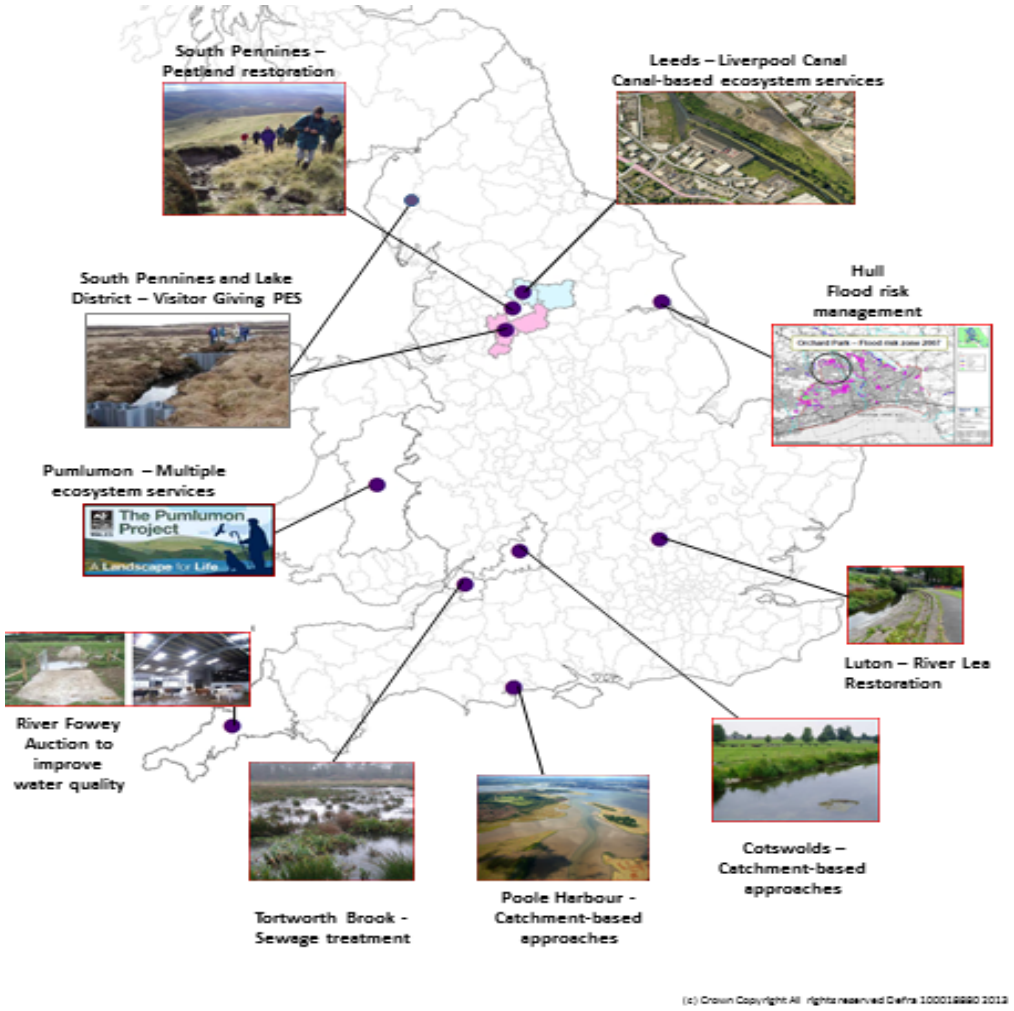
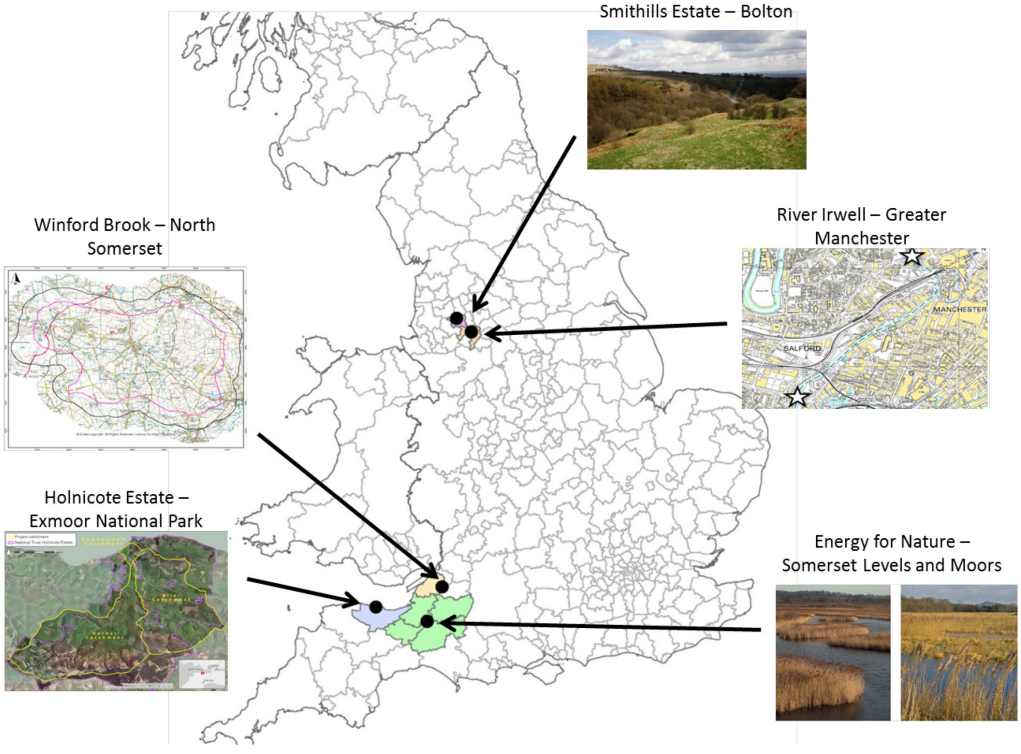


Figure 4: Location of round 3 PES pilot projects



The pilot studies ranged from the largely investigative to those that were closer to market. There are many different ways of characterising the projects, but two important features are:

1. ***How 'PES-like'? -*** This aspect assesses the extent to which the project contains "textbook" PES features, such as being voluntary and demonstrating additionality and conditionality – see the PES Best Practice Guide (Box 3). Yet imperfect PES schemes can still be highly innovative and deliver benefits and cost effective environmental investments compared to traditional approaches. It is clear that PES is an elastic concept with diverse applications.

2. ***Market-readiness*** - This aspect does not necessarily apply to all pilots, since some were specifically about providing supporting analysis and research to investigate feasibility rather than actual scheme design.

The illustrative taxonomy in Figure 5 attempts to capture these features:

Figure 5: Taxonomy of pilot projects

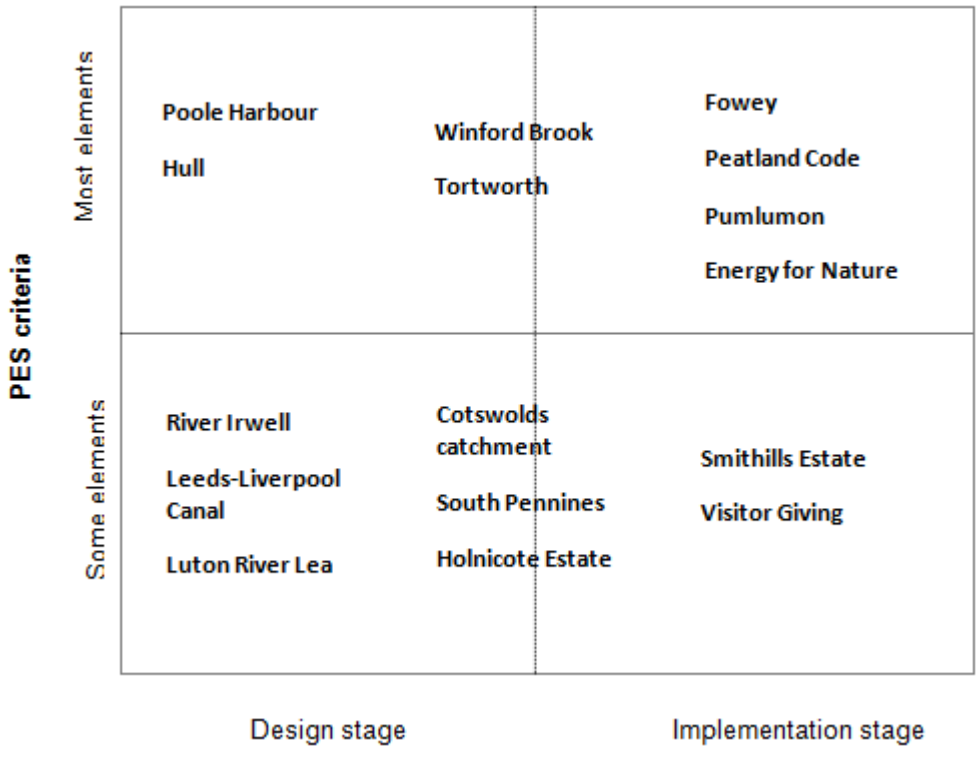


Figure 5 provides only a static representation; there is also a dynamic element whereby various pilots have started moving towards the right-hand quadrants. Moreover, innovative pilots by their nature carry risk and where development of PES

schemes involves commercially sensitive elements, it may not always be possible to communicate precise progress.

Rounds 1 and 2 pilots shared their diverse experiences at a conference and workshop hosted by the Defra-funded **Ecosystems Knowledge Network** in Manchester in November 2013. The Network has also hosted other events on PES and continued to raise awareness of these approaches. An overview of all the pilot projects can be found on the EKN website. Key issues covered include the long-term sustainability of the projects, the qualities of a good intermediary, ways in which PES can be facilitated and mainstreamed. These issues are covered in later sections.

3. Methods and guidance

3.1. Methods underpinning design of PES

Just as the pilots varied significantly in terms of their aims, PES characteristics and "market readiness", so they demonstrated a diversity of methods underpinning design which typifies the experimental, diverse and innovative nature of PES ideas and schemes (Table 2). In particular:

- Developing PES schemes is an **interdisciplinary** challenge, combining the need for economic and scientific evidence with a practical understanding of the needs of people and institutions.
- **Beneficiary mapping** (the demand side) and reviewing **ecosystem service delivery** (the supply side) were key features across the pilots. A range of different methods were used to map beneficiaries and ecosystem services including: literature reviews, surveys, walkover studies and interviews.
- **Ecosystem service valuation** has a role, but there is less emphasis in PES on measuring overall economic welfare, and more on **cost-effectiveness** of ecosystem-based options. For example, is it beneficial for a water company to construct a wetland to treat waste water, or reduce siltation; does a reverse auction offer better value for money than flat-rate grants? For more marketable ecosystem services (e.g. Energy for Nature, Smithills), the issue is about potential demand and cost-effective provision. The challenge for PES is to move beyond "recognising" and "demonstrating" value (where monetary valuation plays a role) to "realising" value in practice by bringing beneficiaries and providers together. In the Tortworth brook pilot, **multi-criteria analysis** was used as part of the options analysis.
- In the pilots to develop a Peatland Code and Visitor Giving PES, few economic methods were required[6]; rather the focus was on delivering **tangible outputs and tools to facilitate PES**.
- **Engaging stakeholders** is a fundamental, but also time-consuming element of developing these sorts of schemes once a concept is identified. Due to the fairly short time span of these projects, engaging the full range of stakeholders was a challenge for those pilots with a "standing start".

[6] In the case of the Peatland Code, the underpinning economics had been developed in previous research e.g. RELU projects and the South Pennines pilot.

Table 2: Summary typology of methods used by the pilots

		Ecosystem service valuation	Cost-effectiveness analysis	Multi-Criteria Analysis	Ecosystem beneficiary mapping	Direct market research	Ecosystem service delivery (supply side)	Stakeholder engagement
Round 1	River Fowey		●			●		●
	North Hull		●		●		●	●
	Poole Harbour		●		●		●	●
Round 2	Tortworth Brook		●	●	●		●	●
	Canal & River Trust	●			●	●		
	Pumlumon	●	●				●	●
	Peatland Code					●		
	Visitor Giving		●			●		
	River Lea in Luton						●	●
	Cotswolds catchment		●		●	●	●	●
	South Pennines	●	●		●		●	
Round 3	Energy for Nature		●		●	●		●
	Holnicote Estate				●	●	●	●
	River Irwell				●	●	●	●
	Smithills Estate		●				●	●
	Winford Brook		●		●		●	●

3.2. Use of the PES Best Practice Guide

Analysis and methodologies within the pilots were informed by Defra's Best Practice Guide to developing practical PES schemes. This was particularly the case for Rounds 2 and 3 once the Guide was published.

Box 2: Defra's Best Practice Guide to Payments for Ecosystem Services

The Guide, which is hosted on the EKN website, is aimed at key participants in a PES scheme. These include the buyers and sellers of ecosystem services, the brokers or intermediaries that can facilitate scheme delivery, and the wide range of actors who can support the emergence of PES schemes, for example scientists, regulators and planners. The Guide may also be helpful for organisations interested in promoting PES schemes in their areas including catchment-level partnerships, Local Nature Partnerships and the partnerships overseeing Nature Improvement Areas. The Guide is divided into three parts:

- Part 1 introduces PES including the key principles and concepts which underpin scheme development, and provides a useful resources for those seeking an overview:
- Part 2 provides more detailed, step-by-step advice for those designing and implementing PES schemes; and
- Part 3 points readers in the direction of further information and sources, and is followed by a glossary of key terms.

The Guide is accompanied by an Annex which sets out case studies of existing schemes. These are referenced throughout the Guide.

According to Part 2 of the Guide, the design and implementation of a PES scheme can be divided into five broad phases:

Phase 1	*Identify a saleable ecosystem service and prospective buyers and sellers*
Phase 2	*Establish PES scheme principles and resolve technical issues*
Phase 3	*Negotiate and implement agreements*
Phase 4	*Monitor, evaluate and review implementation*
Phase 5	*Consider opportunities for multiple-benefit PES*

For pilots such as Luton, Holnicote and the CRT network that were "starting out from scratch", Part 2 of the Guide was less relevant, but Part 1 helped to provide a

consistent framework for thinking about PES opportunities. By contrast, the Peatland Code pilot study drew significantly on the Guide, showing how the nascent Code and the supporting research address each of the five phases. The Tortworth Brook project made extensive use of the Guide in developing its PES concept, in particular Phases 1 and 2.

Whilst the Guide with its descriptions and case studies was found to provide an excellent starting point, the particular experience of the Tortworth Scheme suggested that the Guide could be developed, for example in earlier consideration of multiple ecosystem services and in the long-term sustainability of schemes. The Winford Brook pilot also actively considered multiple beneficiaries at an early stage. This is a reminder that the experience of developing PES schemes is still in its infancy in this country, so learning is evolving, and that guidance needs to be adapted flexibly to particular local circumstances. In the specific case of PES-based Visitor Giving, the pilot effectively incorporated some of the principles of the Defra Best Practice Guide into a series of bespoke help-sheets on Visitor Giving on the Visit England website.

4. Participants in PES

Here we summarise the type of actors involved in the pilots. Challenges arising in each category are covered in more detail in section 6.

4.1. Beneficiaries

Identifying and engaging beneficiaries to become active buyers and investors is a prerequisite for the success of any PES scheme – what is the business case for payment? Ignorance and free-riding of benefits are major reasons why PES schemes do not emerge in many contexts; so a key aim of the pilots was to test the potential market to fund ecosystem restoration and enhancement. The Smithills pilot sums up the challenge and scope for PES: "*Our basic strategy was to create a new venture that sustains the natural capital at Smithills, based on income from payments for the ecosystem services which the site's natural capital provides. Our target services were those that are currently unsupported by functioning markets, but have the potential to be independent of grants or philanthropy*"

The pilots identified and engaged with a wide range of potential "buyers" and their respective motivations.

- **Water companies** continue to be interested and active in PES development. Bristol Water and Wessex Water were closely involved in the Winford Brook pilot but for different reasons: Bristol to reduce siltation costs and Wessex to reduce wastewater treatment costs. South West Water funded the Fowey auction as part of its Upstream Thinking Programme. Yorkshire Water see SUDS-related PES in Hull as an opportunity to reduce the need to invest in sewer capacity whilst at Tortworth Wessex Water look to avoid expensive chemical dosing techniques for wastewater treatment in order to meet new discharge requirements. Peatland restoration can also reduce energy and treatment costs for Water Companies. Within the Cotswold pilot, Thames Water are active partners and see the project as a way of engaging directly with farmers regarding concerns of water quality and how to reduce levels of particular chemicals.
- **Recreational visitors** (Visitor Giving pilot; South Pennines pilot; Pumlumon) who benefit directly from the areas they visit and walk through (e.g. national parks) and, via smartphone apps, can sponsor quantified environmental benefits.

- **Local tourism business** (Visitor Giving pilot) are showing an increasing interest in supporting local environment and social initiatives for corporate responsibility reasons and which would be of interest to their customers.
- **Local authorities**, funded via "Section 106" agreements and Community Infrastructure Levy instruments (Leeds-Liverpool Canal; Luton) - where local authorities have an interest in enhancing the public goods provided by ecosystems, in local regeneration. At Hull, 1644 houses in the study area were exposed to flood risk to the tune of £44m damages for a 1 in 100 year flood event. In the Cotswold pilot recent flooding instances have increased the level of engagement from local authorities regarding what PES can offer in this area. Local authorities were also interested in the Winford Brook scheme but their needs for the catchment did not align spatially with the relevant water companies.
- **Developers**, funded via Section 106 and CIL (Leeds-Liverpool Canal study), but also directly (Poole Harbour pilot). New developments at Poole must be "nitrogen neutral" under the Habitats Regulations to be permitted, which creates the opportunity and incentive to achieve this through upstream land management. The Poole study found that nitrogen mitigation through reducing agricultural pollution in the catchment could cost £4.6m less over 50 years than Nitrogen stripping alternatives.
- **Industry and corporate buyers:** peatland restoration and the associated carbon savings can be attractive for certain types of businesses, including water companies (in addition to water quality and retention benefits) and SMEs with strong regional links through brand**,** product lines and staffing (Peatland Code pilot; Pumlumon). An energy producer is working with the Cotswold pilot to investigate the possibility for a sustainability good practice code to accompany energy production from anaerobic digestion.
- **Central government** via agri-environment schemes, although the additionality here is unclear (Leeds-Liverpool). The potential for multiple benefits from Environmental Stewardship (e.g. grass seed mixtures benefiting soil organic matter as well as pollination) offers an opportunity to demonstrate these to agri-industry buyers (Cotswold pilot); the Peatland Code can also provide a common tool for public and private buyers. On potential flood risk benefits, the Environment Agency could be a potential buyer (as explored in the Winford Brook pilot)
- **Consumers and local communities** are the final potential buyers in some of the round 3 pilots projects for enterprises based on new provisioning services (e.g. Energy for Nature, Smithills Estate). In the case of Energy for Nature, retail channels could potentially be national as well as local, depending upon scale and business model.

Some limits to the potential to turn beneficiaries into buyers of services were identified:

- A number of pilots (e.g. CRT, Holnicote, Irwell) highlighted the difficulty of bringing potential beneficiaries to the table in the early stages of PES development.
- The absence of robust mechanisms to overcome free-riding incentives (Fowey beneficiaries; Leeds-Liverpool Canal).
- The Hull pilot identified ability to pay issues on the part of beneficiaries in deprived communities in Hull City.
- Resistance on the part of Poole Borough Council to pay farmers for marginal improvements when farming is the principal cause of legacy (existing) pollution.
- Locating/contacting potentials buyers is not always straightforward, especially in an urban context. This was the case in Luton's River Lea study. The River Irwell study found ownership around the targeted section of river was fragmented with much of the surrounding property tenanted. This made it difficult to know who to engage but also many tenants felt a sense of physical and economic detachment from the river so were less willing to engage.

Box 3: Wider research on PES beneficiaries

To complement the pilot fund in exploring the potential for PES, Defra commissioned a research team led by URS (now AECOM) to investigate how wider participation in PES schemes might be encouraged with a focus on (i) business sectors with dependencies on natural capital/ecosystem services; (ii) local authorities who might be in a position to procure ecosystem services on behalf of local residents and businesses.

Although the research was unable to be comprehensive – the main sectors explored were food and beverage manufacturing, chemicals and paper manufacturing - a clear finding was the need to identify a credible economic case for businesses to be engaged, either at sector or spatial level. Prior to this, however, addressing the "foundational" issue is key – i.e. raising awareness of the natural environment benefits, dependencies and natural solutions with key audiences, and targeting particular areas or sectors with notable dependencies on ecosystem services.

The project also used its evidence to extend the section on identifying beneficiaries within Defra's Best Practice Guide for PES.

4.2. Potential providers

Developing PES schemes should find it less of a challenge engaging providers, for whom potential revenue streams and business opportunities are presented, than engaging potential buyers.

With regards to **land managers**, some pilots bear out the theory that the challenge is to remunerate them above their opportunity and supply costs, whether this is expressed through an auction (as in Fowey) or discussion and negotiation (as in Poole, and with the Peatland Code). Evidence of engagement with potential suppliers from other pilots related to catchments (e.g. Cotswolds, Winford Brook) appears positive, particularly where trusted intermediaries are involved.

In other cases the potential "seller" is an **environmental charity** which is looking for increased resources to enhance ecosystem services across a particular area e.g. Montgomeryshire Wildlife Trust in the Pumlumon Project; National Park authorities for visitor giving schemes; the National Trust at Holnicote; the Woodland Trust at Smithills (though one step removed); the Canal & River Trust; the RSPB in the "Energy for Nature" project; and landowning conservation charities more generally for peatland restoration projects under the Peatland Code.

In **urban contexts** (Hull, Luton, Irwell), the sellers are less obvious. These could be householders selling to water companies; or the local authority, where the service may or may not be "soft" (e.g. providing a country park vs. fixing misconnections).

4.3. The role of intermediaries

The intermediary role can take various forms, but is usually critical. Intermediaries will have some interest in the successful outcome of PES (be it financial, reputational, environmental or political) but also need to be seen as impartial. The pilots demonstrate that a variety of organisations can act as intermediaries:

- **environmental charities** (such as the Rivers and Wildlife Trusts in Cornwall, Tortworth, Winford Brook and Irwell; FWAG in Cotswolds);
- **businesses** (e.g. in visitor giving schemes; woodland and peatland carbon brokers);
- **local authorities** (as in the Poole and Hull pilots).

The intermediary role requires a range of skills:

- Environmental knowledge is essential but business acumen is also important to assess how the scheme can be taken to the market and what types of business will invest. Nurture Lakeland was an example of doing this.

- An intermediary needs to understand how to access different funding streams within sectors and industries

- Empathy and trust building are important - organisations cannot simply tell farmers to do something for the good of the environment. An example was Forest Carbon Ltd, which is trusted by both landowners and investors.

The role of intermediaries was less explored where PES schemes were at the scoping stage (e.g. Luton) or where specific tools were being developed (Peatland Code). In the early scoping stages of PES schemes, the "intermediary" is essentially a facilitator, bringing relevant parties together to identify the opportunity (as envisaged by the Best Practice Guide). The Peatland Code pilot noted the likely importance of intermediaries working with corporate investors and landowners under the Code, given its complexity and the need to minimise transaction costs, together with the assistance of land-based professionals such as chartered surveyors.[7] The RSPB Poole Harbour pilot distinguished between initial intermediaries (those who raise awareness of PES measures, and signpost providers towards potential buyers) and ongoing intermediaries who would need to monitor and enforce a PES scheme – and found that the latter role was more difficult to fill. RSPB itself considered that the species and wildlife benefits of a nutrient management scheme did not justify its long-term involvement as an intermediary.

Round 3 pilots were notable for ideas for new formalised intermediary structures to facilitate PES activity:

- The Smithills pilot has designed a "Natural Enterprise Catalyst" which takes on the role of an intermediary to use social and private micro-enterprises to mobilise natural capital in a city fringe landscape.

- RSPB's Energy for Nature pilot has identified the need for a full-time local "Energy for Nature Co-ordinator" to raise awareness, reduce search and transaction costs, bring community buyers and sellers together and negotiate contracts.

- The Winford Brook pilot has begun to develop the concept of a "Natural Capital Trust Fund", a not-for-profit entity to facilitate the strategic

[7] Government agencies can act as an intermediary to private sector PES, for example the Forestry Commission developing the Woodland Carbon Code.

development of markets for natural capital investment in the West of England. One of its aims would be to broker PES schemes, including the creation and management of a multi-beneficiary contributory PES fund. The pilot has developed a replicable legal framework and principles for such a multi-beneficiary fund, although the Trust itself needs separate funding to be established.

5. Pilot achievements

5.1. Direct outcomes

The pilots have sought to apply general principles on the ground and to tackle real-world challenges. In most cases, success has been limited to making practical progress on initial ideas rather than actually generating self-sustaining market returns. There have been a range of tangible successes and legacies.

- The Fowey River pilot project has shown the potential for PES to deliver cost-effective water quality investments through a **reverse auction mechanism**, a mechanism that could be applied elsewhere and has been explored further in an agri-environment context.[8] This pilot involved real money previously earmarked by South West Water for catchment management. Several other projects such as the Tortworth Brook, River Lea, Winford Brook and Cotswolds projects, showed the important role that catchment based interventions can play with regard to water quality and flood risk management.
- Originating with the PES pilot studies on peatland and the South Pennines, and following a IUCN-led testing phase supported by Defra research to develop carbon metrics and financial tools (2013-15), a first version of the **Peatland Code** was launched at the World Forum on Natural Capital in November 2015. There is emerging interest from potential investors. The Code aims to encourage investment in peatland restoration by giving investors confidence that they are making a cost-effective, measurable and lasting difference to peatland carbon, along with wider natural capital benefits.
- Wessex Water has put forward a business case for PR14 to develop a **wastewater PES scheme** in Tortworth Brook in Gloucestershire.
- The Visitor Giving project produced a guide for app developers to integrate PES payment functionality into existing or future apps (for iOS and Android). It also produced a series of help sheets on **Visitor Giving** which are hosted by Visit England, and can be used by destination managers across the UK to initiate PES-based visitor giving schemes.
- The Cotswolds project is developing a PES-based water quality scheme with additional benefits such as sustainable renewable energy (using anaerobic digestion) and the successful testing of an “Integrated Local Delivery” framework

[8] In contrast, the Winford Brook catchment pilot identified that an adviser-led approach may deliver a more cost-effective outcome than a reverse auction, owing to the smaller number of farmers involved and the more spatially specific nature of the issues. This finding was in fact anticipated by the Fowey pilot which favoured reverse auctions on the basis of numerous sellers and clear interventions.

to determine the saleable ecosystem services. Since the Defra-funded pilot completed, a renewable energy company working with the pilot announced plans in 2015 to build three "green gas" mills

- The River Lea in Luton pilot led to the development of a **Catchment Partnership for the Luton Lea**, and the partnership now involves Luton Airport and Vauxhall, a major local business.
- The Energy for Nature project has developed a **conservation biomass calculator** which provides a way for other land managers to view the costs and potential profits of the scheme based on their land cover. RSPB have also established interest in the scheme throughout Somerset, identified the key players and roles needed to develop the market going forward.
- The Smithills Estate PES pilot legacy is being actively progressed by the Woodland Trust, with the support of heritage lottery funding. A **Community Interest Company** is planned which is necessary in order to develop the social enterprises for the site in 2017.
- The Winford Brook pilot has put in place the groundwork for establishing a **multi-beneficiary PES fund.**

Understanding the additionality of each pilot relative to the counterfactual (what would have happened in its absence) is a key issue but is not possible where schemes are still at the scoping or research stage or seeking proof of concept. Monitoring and evaluation within schemes as they mature will be essential in order to demonstrate their effectiveness and prompt wider uptake. The rigour of such monitoring will depend upon the needs of the investor / buyer.

A number of pilots have also developed the evidence base for 'natural solutions' providing evidence on net social benefits or value for money assessments which is an important element in making the business case for PES (Table 3).

Table 3: evidence of benefits and value for money associated with the pilot projects

Project	Evidence on benefits and value for money
Poole Harbour	Nitrogen mitigation through reducing agricultural pollution could cost £4.9m less than Nitrogen stripping alternatives over 50 years and a benefit-cost ratio of **2.6 to 1** (benefits £4.9m, costs £1.9m)
Fowey River	A targeted auction significantly increased the value for money with which funds can be allocated to projects (environmental improvements per £),

	estimated at between **20-40%** greater value for money compared to a fixed-price, advisor-led scheme[9].
Tortworth Brook	Integrated constructed wetlands (ICW) solution **expected to provide significant cost reductions** for Wessex Water compared to P-stripping plant - very indicative estimates suggest construction costs of 50% less and annual operating costs of only 10% of an end of pipe solution.
Pumlumon	2012: estimated value of ES outputs due to the project was £266,533 (about 2/3 increased visitor spend and 1/3 carbon and a small amount of increased water table volume); benefit-cost ratio of around **3 to 1**
Energy for Nature	The pilot developed a **business case for converting surplus biomass into bioenergy products**. Land management costs in the pilot area are estimated at £70,000 annually, whilst revenues of £150,000 - £5m from bioenergy are expected, dependent on the processing method. In addition, there are co-benefits of increased biodiversity, and reduced greenhouse gas emissions through the reduction of fossil fuel use in local communities.
Winford Brook	The avoided costs of sediment removal provide a clear indication of the marginal financial benefits associated with reduced levels of erosion within a catchment. The present value to Bristol Water associated with each cubic metre reduction in erosion per year is estimated to lie between £666 and £1,025. Wessex Water anticipate that the cost of managing soil nutrients on land in the catchment is **one-sixth of treatment infrastructure costs**.

5.2. Wider benefits

Looking ahead, the pilots have helped to mainstream ecosystem thinking in their respective spheres of influence, and have left a legacy for further related projects to build on across a range of areas:

- They have strengthened the case for catchment-based investment by water companies. According to South West Water, the Fowey Auction and Peatland Code pilots have strengthened the case for catchment-based investment in the next investment cycle (2015-20) for water companies.

[9] South West Water's Upstream Thinking programme has typically delivered strong benefit to cost ratios - SWW indicate that reducing pollution at source rather than investing in engineering solutions to treat polluted water downstream has a benefit-cost ratio of some 65 to 1.

- Four of the country's largest environmental charities (RSPB, National Trust, Woodland Trust, Canal & River Trust) have been involved in the pilots and, to varying degrees, are further exploring PES-type approaches based on a greater understanding of ecosystem services.
- Some pilots have helped to mainstream ecosystems thinking within local authorities. For example, the North Hull study raised the profile of sustainable urban drainage approaches with the City Council and the ecosystem approach more generally.
- Although a proposed full nitrogen-mitigation PES scheme in the Poole Harbour catchment was not developed, local authorities and local developers are looking to land use and management changes to offset new nitrogen discharges. Wessex Water have piloted a new nitrogen offsetting scheme with land managers to reduce excessive nitrate entering Poole Harbour.
- The Tortworth Brook project has raised awareness in the Environment Agency, water industry and Ofwat of the potential of constructed wetlands to enhance ecosystem sustainability in the treatment of wastewaters.
- Ecosystem restoration objectives in the Luton River Lea project have raised mutual awareness of multiple local projects and provided a basis for strategic thinking across institutional barriers.
- The peatland carbon metrics established by Crichton Carbon Centre are now being used in UK greenhouse gas accounting.[10] The South Pennines pilot was the first time that emissions savings from peatland rewetting had been quantified using a pragmatic yet scientific approach, creating standard values that could be used across the UK. This approach has been further developed by Defra research for the Peatland Code. Both the concept and the outline emissions factors were welcomed by stakeholders, and have now been broadly accepted as helpful for UK natural capital accounting and UK greenhouse gas accounting. The approach may also have potential use in future agri-environment schemes.
- The Holnicote pilot has raised the profile of PES thinking within the National Trust. It has helped inform its "Land Choices" strategy for Holnicote, ensuring that an ecosystems approach and the PES concept are at the heart of its land management strategies. Following the PES pilots, the National Trust partnered

[10] See C. Evans et al. *Initial assessment of greenhouse gas emissions and removals associated with managed peatlands in the UK, and the consequences of adopting Wetland Drainage and Rewetting as a reporting activity in the UK Greenhouse Gas Inventory*. 2014b. Report to the Department of Energy and Climate Change, November 2014;

DECC Project TRN860/07/2014 *Scoping the use of the methodology set out in Chapters 2 and 3 of the '2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands in the UK GHG Inventory: Land Use, Land Use Change and Forestry*. Project ongoing.

with the Green Alliance to develop thinking and practice further around the concept of "Natural Infrastructure Schemes" so as to mainstream markets for land and nature, focusing upon flood regulation and water quality in catchments.

5.3. Transferability to other contexts and places

All pilots were selected for funding partly because of their potential for wider applicability. For example, the Peatland Code and Visitor Giving pilot studies were conceived broadly as providing tools to facilitate ecosystem restoration and enhancement in many contexts, in particular uplands and tourism. The various place-based pilot studies have also the potential for their learning to transfer to other sites, thus offering the possibility to scale up PES more broadly:

- The Fowey water quality auction demonstrated the potential to deliver improved value for money in water quality investments (of up to 40% compared to a fixed-price, advisor-led scheme) and offers valuable experience and a model that can be explored and adapted in many other catchments. One notable example is an innovative nitrogen offsetting scheme piloted by Wessex Water.
- The Fowey project also identified an opportunity to develop a future PES auction targeted at buffering agriculture from rivers. In such an auction, farmers would be able to bid for funding to fence off their river at 1m, 5m or 10m from the top of the river bank; this would benefit water quality, wildlife and woodland provision, appealing to a range of potential purchasers.
- At the time of the pilot, Yorkshire Water was exploring the application of the Hull street level PES concept to other parts of the city;
- The Poole Harbour study points to the wider potential for nitrogen-trading to accommodate development pressures as well as water quality limits. The concept of a constructed wetlands approach to wastewater treatment, developed at Tortworth Brook, has the potential to be implemented in many other catchments and sub-catchments.
- The Leeds-Liverpool Canal study identified a number of PES-type opportunities that the Canal & River Trust can explore further across its 2000-mile network.
- The Pumlumon Project has been specifically developed as a model that can be transferred to other upland contexts.
- The successful testing of an Integrated Local Delivery framework in the Cotswold pilot is something that would be transferable to other lowland

catchments in order to determine the saleable ecosystem services. If successful, the green gas mills could have much wider applicability.

- The Energy for Nature project is immediately transferable to the 1297ha of wetlands managed by RSPB and larger wetland landscapes of which they form part. It could also be adapted for use on other land covers such as heathland. The biomass calculator could support other landowners to pursue similar projects.
- The model being developed by the Smithills Estate could be applied in other neglected peri-urban sites across the UK. Improving the natural capital of such sites is particularly important in view of their potential value to local populations.
- The multi-beneficiary funding model and methodology for determining avoided dredging costs developed in the Winford Brook pilot are widely transferable; although that study also highlighted the need for a bespoke walkover survey to determine appropriate interventions for the catchment.

Like the pilot areas, any new context would provide its own challenges. The aim of the pilots is to show that there are PES opportunities that can be explored in a wide range of different contexts by various actors. These broader lessons can be valuable even where pilots themselves have found progress difficult.

6. Barriers and challenges

Whilst a lot has been achieved across the pilots, all have faced a range of barriers and challenges, and there has been mixed success in overcoming these. Earlier research commissioned by Defra on the potential for PES in England provided a detailed assessment of barriers and challenges. This framework has been used to structure our review of barriers and challenges identified in the pilot PES projects.

6.1. Information and awareness challenges

This has been a common area of challenge for the pilots. A lack of understanding of the benefits delivered by the natural environment, or of changes to land management practices, often made it difficult to engage crucial stakeholders.

- This might operate at a general level in terms of lack of awareness of the benefits delivered by the natural environment among stakeholders such as identified by the Cotswold pilot (although this was overcome through experienced facilitation) and in the Canal & River Trust study.
- In urban Luton, ensuring a broad spectrum of stakeholder participation and identifying the right people in organisations to input was identified as a key challenge, in particular engaging local businesses. Similarly, the River Irwell pilot suffered from a lack of solid evidence that enhancements to the river would translate into higher footfall and revenue for city centre businesses. The unclear sense of additionality made it difficult to engage buyers past the first stage of interviews.
- The Fowey evaluation study also explored potential investors in improved water quality other than South West Water. It found that awareness among other potential downstream beneficiaries was either very low, or the scale of beneficiaries was too small.
- The project to develop the pilot Peatland Code found a lack of business awareness especially among SMEs of the benefits of investment in peatland carbon projects in the UK. However, the Woodland Carbon Code is helping to improve awareness and credibility of land-based carbon projects, and the Peatland Code has been promoted to businesses via IEMA and the World Forum on Natural Capital.
- In the context of developing “natural solutions” such as integrated constructed wetlands in the Tortworth pilot, a lack of awareness was evident among a range of stakeholders including the EA and the water industry on the applicability of integrated constructed wetlands for dealing with wastewater. Similarly, the Hull

pilot sought to raise awareness of the benefits of sustainable drainage approaches to land management.

6.2. Technical and scientific challenges

Addressing technical and scientific challenges are critical to the success of PES schemes, and these arise in various forms:

Identifying baseline services

- The Canal & River Trust pilot found identifying baseline ecosystem services can be a particular challenge;
- The testing of water quality within the Cotswold pilot has been of particular interest and has highlighted the lack of understanding as to how chemicals like metaldehyde behave in the natural environment and what impact land management activities have on their levels in the water body. This pilot has also revealed the role played by grassland with a good soil structure but measuring this remains a challenge for PES.

Establishing links between interventions and outcomes

- The development and launch of the Peatland Code has been able to progress because of additional Defra commissioned research to develop robust peat and carbon metrics for blanket bog peat and its restoration. Further technical work may be needed over the pilot phase to ensure there is sufficient practical assurance for businesses to invest in peatland restoration projects.
- In catchment schemes, generic interventions are may not be appropriate. South West Water's Upstream Thinking programme has developed good scientific understanding of the links between capital investment and outcomes, but recognises this is still an area in development (Fowey). In the Winford Brook pilot, the project team initially expected to use existing data on areas at highest risk of soil erosion, combined with information on the likely effectiveness of generic measures. It became clear, however, that identifying the precise sources and pathways was key to ensuring that beneficiaries would not simply be paying for actions that delivered limited benefits. To address this, the project team commissioned a walkover survey to identify the specific locations where measures were most likely to be effective. This would also be a key component of determining a baseline and potentially also in monitoring subsequent interventions.
- Whilst successful in applying an integrated constructed wetlands approach, the Tortworth pilot identified that there could be a potential barrier to their wider application, where their physical requirements, such as land availability and

suitability could prove a challenge to meet. Such innovative ecological approaches need specific testing: a systematic evidence review by the Centre for Ecology and Hydrology for the Poole Harbour pilot revealed that, although functional wetlands generally contribute to an overall decline in nutrient concentrations, not all wetland types can be assumed to function in the same way.

- In the Energy for Nature pilot, where there is a clear link and market, a key ongoing challenge is the variability of biomass which can be harvested and the uncertainty in the quality and quantity of each bioenergy product it will create. Such challenges to create "a consistent product" are similar to those faced in other manufacturing sectors.
- The Hull pilot found limited quantitative evidence on the links between urban sub-habitat management and ecosystem services delivered (other than flood alleviation). Within the Winford Brook pilot, whilst the business case for avoiding soil erosion through PES was strong, the effects of the land management interventions on algal blooms and flood risks were less clear.

Payment mechanisms

- The visitor giving pilot identified that payments in visitor giving schemes were often not conditional upon outcomes and there could be potential to link more to ecosystem service outcomes in terms of specific projects. The use of apps in such schemes is considered to be a useful development (for example it could potentially reduce administrative costs) but in some of the pilot apps there were technical issues (particularly relating to payment functionality) needing resolution.
- Complexity of auction design in the Fowey project. Although value for money was shown to compare favourably to an advisor-led approach, there was room for improvement (see Box 4 below).

Box 4: Fowey auction evaluation – areas for improvement

Evaluation of the Fowey auction highlighted the complexity of auction design. Although value for money was shown to compare favourably to an advisor-led approach, there was room for improvement. For example, farmers were allowed to apply for a number of different capital investments but their bids were evaluated as a whole; they either got all the investments or none. A better alternative would have treated each investment as a separate bid; this might have encouraged bids for projects that were of little benefit to the farm business but would deliver more substantial water quality improvements (and therefore be reflected in higher grant rates requested). The report noted issues over 'additionality'- some of the capital investments may be taken forward in the absence of funding. In addition, the post auction survey revealed that while competition had played a role in keeping bids down, some farmers would have accepted lower amounts than bid for, demonstrating that the auction was not able to drive out all the 'surplus'. Finally, the

evaluation highlighted that auction-based mechanisms would not be preferred in all situations compared to an advisor-led scheme and it was important to understand the context so that the appropriate mechanism is designed.

6.3. Contractual issues

A range of potential issues are relevant here linked to achieving long-term improvements in ecosystem services.

- A key challenge for land-based PES is the need for long-term contracts. In the Poole Harbour pilot, agricultural market volatility and the need to manage their farms as a single system made farmers unwilling to take on the risk of a long-term contract in the context of permanent nutrient offsetting of new development. This issue was also identified as a potential challenge under the Peatland Code, but subsequent work during the pilot phase of the Code suggests many landowners find the prospect of stable long-term payments attractive in the context of their farm business (although concerns were raised about associated or potential land management restrictions). The Cotswold pilot has shown that farmers are willing to engage with and constructively discuss PES and offer possible long-term management scenarios of 20-25 years linked to the development of AD infrastructure.

- In the Fowey pilot, the auction adopted most of the legal apparatus developed by the Westcountry Rivers Trust in the Upstream Thinking initiative: farmers were required to sign a contract with contract length dependent on the particular capital item (between 10 – 25 years) while grants of over £5,000 required a covenant to be added to the land deeds requiring future land owners to abide by terms of contract.

- Ensuring GHG emissions reductions from peatland restoration projects were not reversed was a key issue which the Code has sought to practically address through a process of assessing and managing the risks of restoration being reversed, in particular through setting aside a certain amount of projected emissions savings as a "buffer". For the Smithills Estate project, a key challenge which the Woodland Trust is working through is how it can establish and support an independent social enterprise without the risk that it compromises its charitable responsibilities.

- The Winford Brook pilot made a ground-breaking contribution to addressing the contractual challenge of multi-beneficiary contributory PES fund by exploring the legal issues surrounding its establishment.

Box 5: Action-based or outcome-based payments

The Fowey pilot considered whether the PES should have an input-based (action) or outcome-based design. While an outcome based design - making payments conditional on the levels of water quality improvement resulting from the actions – has clear advantages, the evaluation report highlighted a number of serious difficulties which meant that this approach would be impractical. These challenges include the highly variable nature of water pollution outcomes depending not only on farmer actions but also a variety of stochastic natural processes. The Cotswold pilot proposed input-based payments but also is exploring further ideas around retaining a proportion of funds that could be put into a 'risk fund', which might pay out to either party if certain conditions were breached. This output based aspect can act as an incentive if there was a guaranteed payment after an agreed number of years for good behaviour, or increased certainty for a particular buyer.

6.4. Financial barriers

Financial barriers can include issues relating to high start-up and transaction costs and requirements for maintaining sustainable long-term sources of financing to cover ecosystem service provision (including monitoring and verification costs). Specific findings emerging from the pilots include:

- The Pumlumon pilot identified a key challenge in terms of future funding moving beyond the pilot stage where the funding includes various grants towards longer term funding solutions that might include greater PES elements. The report noted that currently the market mechanisms are weak although it did recognise there are continuing developments such as the pilot Peatland Code.
- The Visitor giving pilot project noted a number of financial barriers that can arise with such schemes, in particular a discrepancy observed between visitor willingness to pay surveys and actual funds received. Businesses may be reluctant to participate in such schemes due to fear of reduced price competitiveness. The resources for taking forward a successful visitor giving scheme can be significant. Finally, membership and donation schemes yield poor results if not well designed.
- The Hull pilot identified issues relating to complexity in how to layer different funding sources and recognition of the challenge in dealing with different and often siloed local authority budgets. Similarly the Luton pilot identified a challenge around framing viable PES options within the context of LA planning and budgetary constraints.
- The Energy for Nature pilot estimated purchasing an AD system alone would cost upwards of £800,000. Combined with the uncertainty of the quality of the biomass

and policy uncertainty about subsidy levels, these start-up costs can be a significant barrier for landowners and communities to get involved.

- For water catchment schemes (such as the Tortworth pilot), it is up to Ofwat to authorise funding. A key issue in such schemes is attributing improvements in water supply to changes in farm management.
- Embedding schemes in parish plans can give people the skills to sustain a project. This approach was taken in the Cotswolds project.
- The South Pennines and Peatland Code pilots both indicated that the present low carbon price is a challenge. A higher price for carbon, and creating a formal carbon market trading system (in addition to the voluntary system presently used by the Peatland Code), would allow the market to grow.

6.5. Cultural and equity considerations

Lack of trust between potential players and aversion to paying for ecosystem services can hamper the progress of PES schemes. Specific examples from the PES pilots include:

- The Poole Harbour pilot identified a resistance by the local authority to pay farmers for cost-effective land management actions to reduce diffuse pollution as an offset to new development because farming was the dominant contributor of existing diffuse pollution i.e. rewarding the polluter.
- The Bristol Avon Rivers Trust in the Tortworth Brook pilot found itself in a demanding role where maintaining perceptions of impartiality was an ongoing challenge. Whilst Defra funding can support impartiality, BART was also supported by Wessex Water, and this in itself compromised the intermediary's impartiality in the mind of the seller, who had the impression that BART was employed to act directly on behalf of the buyer's interests. In the event, the nature of the financial agreement between the Buyer and Seller in the Tortworth scheme was felt by both parties to be a confidential matter and not one for the intermediary or other players to be heavily involved in negotiating.
- In the visitor giving pilot, existing schemes noted a marketing challenge around visitor perceptions - if schemes are seen as a tax or charge this may reduce the 'feel-good' factor and incentive to give. The Leeds-Liverpool Canal project faced a similar challenge: how to communicate, at a very early stage of investigating feasibility, a difficult concept to local stakeholders that could be misunderstood.

- Both the River Irwell and Holnicote pilots found strong views that it was the role of the public sector to manage the catchment for flood risk and other benefits. In both of these pilots most property in the area was tenanted, which can have a significant influence on attitudes and incentives to pay for flood risk management, compared with privately owned and insured residents and businesses;

- The River Irwell project in particular was hampered by local businesses' disengagement with a poorly maintained river which was seen as a liability rather than an asset. This type of challenge was recognised from the outset in the Luton River Lea pilot, which began by developing a positive vision for the river that interested stakeholders, and eventually businesses, could buy in to. This shift of perception from "liability" to "potential asset" is key for the Energy for Nature scheme, in which biomass is seen as having value rather than "waste".

6.6. Institutional challenges

An obvious challenge is the need for collective action where multiple players are involved. The South Pennines study identified this action as a significant challenge for bundled or layered schemes where the appropriate spatial scale is large (particularly water quality and flood risk reduction services). Box 6 discusses layered versus bundled PES approaches drawing upon key findings from the study. Theoretical work as part of the Fowey evaluation explored the classic challenge of overcoming free-riding in multi-purchaser market structures concluded: "without further structure to the market mechanism, the public good nature of actions delivering ecosystems services are likely to lead to only one purchaser investing in those actions. That purchaser will be the purchaser that gains the most value from those actions … other purchasers will simply free-ride."

In addition to these basic challenges, other issues arising from institutional and regulatory contexts were identified:

- In the Tortworth pilot, a significant risk identified to constructed wetland-based PES schemes for agricultural and sewage effluent treatment related to consenting by regulatory bodies. Moreover, during that project, the regulatory framework changed fundamentally when the entire Tortworth Estate became designated as a Nitrate Vulnerable Zone (part of the Estate was designated prior to this work). This had significant financial implications for the Tortworth Estate, primarily relating to the provision of slurry storage and on-going administrative management.
- Developing innovative PES schemes may often rely on one or two committed individuals in a local government, water company or environmental charity, and

this becomes a risk for fledgling projects e.g. local authority staff changes and budget cuts appear to have stalled progress with the Hull City pilot.

- The Winford Brook pilot project explored the option of combining PES funds with funds from the Catchment Sensitive Farming scheme (now Water Capital Grants under Countryside Stewardship) running in the area but there is currently no mechanism in place for this kind of co-ordination.
- The Peatland Code is initially designed for business corporate responsibility investments since UK-based carbon projects do not qualify as carbon offsetting and because the Code is yet to be included within the GHG reporting guidelines for companies. However companies may still want to report on basis of £/C saved for investment purposes and further work in the pilot phase aims to provide the tools to estimate this. Another concern for the Peatland Code is the potential risk that payments to re-wet agricultural land (in order to restore peat) could make that land ineligible for CAP Pillar 1 payments under minimum activity thresholds.

Box 6: Layered versus bundled PES

The Place-Based PES project led by Natural England investigated bundling and layering of payments of ecosystem services, using the South Pennines uplands as a case study. It drew a number of conclusions:

- Place-based PES schemes offer an opportunity to access and co-ordinate between multiple sources of funding, to pay for the restoration of degraded land and the sustainable management of land that can provide a wide range of ecosystem services
- By running individual PES schemes focusing on the provision of single ecosystem services in parallel with one another (a "layered" PES scheme), it may be possible to tailor the marketing of these services more effectively to specific types of investor e.g. water utilities, corporations and developers. However, there are a range of challenges identified with taking forward layered PES schemes:

- Careful co-ordination is necessary to ensure that the benefits each investor pays for are truly additional (i.e. avoid double-counting).
- The transaction costs of establishing, managing and co-ordinating schemes that target many different ecosystem services are likely to be significantly higher than for bundled schemes.
- It may prove difficult to layer water quality and carbon schemes, because of the difficulties in proving additionality. It may instead be necessary to map out (on the ground) which parts of the restoration project are being done in order to improve water quality, and only use carbon funding for the areas which are being "additionally" restored (for example, a water quality project might want to re-vegetate the peatland with the cheapest practical vegetation, whereas a carbon scheme might be used to increase the funding and pay for re-vegetation with sphagnum moss, the 'best' vegetation for carbon)

- Bundling ecosystem services with co-benefits can allow sellers to charge a premium for the ecosystem services, as long as those co-benefits can be clearly identified and quantified. Bundling ecosystem services can reduce the transaction costs associated with establishing a market for multiple ecosystem services.
- Whether ecosystem services are marketed in bundles or are separately, to be successful, place-based PES schemes must be able to identify management interventions that can provide a range of ecosystem services, without leading to trade-offs that are problematic. There is evidence in peatland such as the South Pennines NCA, that peatland restoration can simultaneously provide a range of ecosystem service benefits (e.g. carbon, water quality and recreation, alongside benefits for certain species and habitats), whilst trade-offs for provisioning services (principally hill farming) and cultural ecosystem services (such as sporting interests, recreation and sense of place) are likely to be relatively minor on blanket bogs.

7. Mainstreaming and scaling up

In spite of various challenges and their embryonic nature, Defra's PES research pilots have identified a wide range of contexts in which new forms of private sector funding are possible. Drawing upon this evidence as well as experience in other contexts, scaling up innovative funding mechanisms will be a key theme within the forthcoming 25 Year Environment Plan.

Given the challenges identified in section 6, mainstreaming such schemes will take time and effort, and will not be universally appropriate or feasible. Whilst catchment management initiatives by water companies are growing as evidence for cost-effectiveness of natural solutions strengthens (including the pilots here), even here evidence needs to be sufficiently robust and risks manageable to justify investment.[11] So there is no single or simple solution to "scaling up" PES. Rather it makes sense to consider a number of linked dimensions along which such schemes could be facilitated and mainstreamed, recognising that PES is a set of principles rather than standards.

7.1. Demonstrating and replicating success

Piloting, however it is funded, must play a key role in order to build capacity and develop proof of concept. Defra's pilots have strengthened the case for catchment-based investments, reverse auction approaches, demonstrating new forms of enterprise and raising awareness of the potential of natural solutions.

With PES schemes very much in their infancy, learning is evolving and guidance needs to be adapted flexibly. Various issues raised in the context of Defra's PES Best Practice Guide highlight areas for improvement around multiple ecosystem services and sustaining over the long-term. A rigorous evaluation evidence base on PES programmes will also be needed to be built in to scheme design if application is to be widened. In general, the pilots have collectively boosted and broadened interest in PES approaches, with the Ecosystem Knowledge Network leading the way in dissemination, field visits, knowledge exchange and new interest being shown by a range of organisations and stakeholders.

As section 6.1 showed, raising the profile of the efficacy of natural solutions and building awareness among beneficiaries – to match the growth in our knowledge - is key to the long-term success. For example, the Holnicote study recommends a

[11] For example, see report by Indepen (2014), Discussion paper on the potential for catchment services in England

renewed campaign to raise awareness of natural flood management solutions amongst landowners and the general public. In the pilots at Poole Harbour and Tortworth Estate, each investigated the role of functional wetlands in removing nutrients. The Poole pilot did not progress this option in practice because of inconclusive evidence whereas the Tortworth Estate pilot developed a PES concept based on an Integrated Constructed Wetlands (ICW) which was included in Wessex Water's proposals for PR14. One solution could be the development of a best practice ICW guide to reassure investors that the evidence base is robust and so encourage further uptake of these natural solutions where appropriate.

Engaging businesses is important, but as research for Defra concluded (Box 3), this may be more effectively done at a spatial and landscape scale, rather than through a general sector approach. The forthcoming Pioneer project areas which aim to test the principles of the 25 Year Environment Plan offer an opportunity to adopt this approach. They include a "catchment" Pioneer in Cumbria, a "landscape" Pioneer in North Devon, an "urban" Pioneer in Greater Manchester, and a "marine" Pioneer across two sites, one in East Anglia and the other in North Devon.

This business perspective highlights the importance of credible metrics, assurance and verification of services provided. Standardisation of biophysical metrics can enable wider reach of market approaches. Carbon gains from land-based activities such as woodland creation or peatland restoration have been mainstreamed into codes. There might also be opportunity to apply this to other habitats such as coastal saltmarsh. The Peatland and Woodland Codes demonstrate how government in partnership with others can develop metrics and framework to give assurance and confidence for investment in nature. Another good example is the Wetland Biomass calculator developed by the RSPB which provides a transferable tool for land managers to estimate costs and benefits of this resource. Outside of the Defra pilots, a consortium led by Oxford University is developing a web-based market platform called "NaturEtrade" using consistent metrics and digital datasets to bring together buyers and sellers of ecosystem services.[12] Development of more transferable tools and metrics such as these, with appropriate assurance and robust data, will be necessary if PES approaches are to be scaled up.

[12] NaturEtrade is a LIFE+ project funded by the EU. By accessing the platform, landowners will be able to measure the services provided by their land and set a price to maintain those services for a given period of time, whilst interested buyers will be able to search the platform for relevant services and land they wish to see protected or enhanced.

7.2. The regulatory and legal framework

PES arrangements should be voluntary and in addition to any regulatory baselines. At the same time, the incentives for buyers to participate can be affected by regulatory frameworks. Water company demand for PES solutions is driven by the need to meet minimum water quality targets. The Poole Harbour pilot was effectively a nutrient offsetting scheme, driven by regulatory needs, but potentially developing a market in which natural solutions could meet these cost-effectively. Again, demand for woodland or peatland carbon markets will partly depend upon traded carbon prices, which in turn are affected by regulatory framework. Requirements and opportunities for companies to report on land-based carbon reduction activities can also strengthen incentives to invest.

Fiscal incentives and eligibility can also affect the viability of PES schemes. For example, the Energy for Nature report noted that an important potential barrier to scheme success was that the burning of wetland biomass products was not yet approved for the Renewable Heat Incentive scheme. Satisfying the emissions standards and attaining this approval would make biomass to bioenergy via combustion more profitable and facilitate scheme development and delivery.

A number of pilots highlighted the challenge of ensuring permanent land management or land use change. Following a detailed Review, the Law Commission has made recommendations for the introduction of a new statutory scheme of **conservation covenants** in England and Wales.[13]

Innovations in ecosystem approaches can bring with it new regulating and consenting issues as demonstrated in pilots such as Tortworth that need to be better understood and where there is a potential role for government and agencies. In the Energy for Nature scheme, classification of some of the biomass by the Environment Agency as a 'waste' material currently results in the material being subject to waste rules which could have serious consequences in relation to acquiring the necessary permissions for developing a conservation biomass to bioenergy scheme.

[13] A conservation covenant is a voluntary agreement between a landowner and responsible body (charity, public body or local/central Government) to do or not do something on their land for a conservation purpose. This might be, for example, an agreement to maintain woodland and allow public access to it, or to refrain from using certain pesticides on native vegetation. These agreements are long lasting and can continue after the landowner has parted with the land, ensuring that its conservation value is protected for the public benefit.

7.3. Developing new governance models

As section 4.3 shows, a notable feature of the pilots is the range of governance models explored and developed to fulfil the intermediary role and develop a market. PES ideas need to fit within existing and evolving institutional contexts which can provide constraints and opportunities. For example, there could be opportunities in a post-CAP world for linking public and private funds together for ecosystem-enhancing land management. Research for Defra assessing private-funded PES in relation to agri-environment schemes concluded that:[14]

- there are opportunities for leveraging increased funding for environmental land management through private PES, but links to public schemes are currently very ad hoc with multiple barriers to bringing these together;
- potential private funders should be brought into public PES discussions to help scope and develop coordination of funding with agri-environment schemes;
- immediate priorities include scoping and co-design of a model for public/private PES and developing a common framework for governance, operation and evaluation.

In an urban context, the Smithills and Irwell pilots noted that greater local devolution could enable more joined-up approaches to the natural environment (including urban fringe areas) not just by councils, health authorities, and the Environment Agency, but also including private businesses. The proposal for a Natural Capital Trust in the West of England (Winford Brook pilot report) offers one means of proactively developing ecosystem markets at a strategic scale, and broadening PES out beyond a potentially narrow focus on a single service to include developer compensation schemes. It may be that finding institutional mechanisms to facilitate a blend of finance capital from different sources – private, public, philanthropic and so on – could offer an important way forward.

7.4. Next steps

An interesting finding of the pilots is that “PES” is a flexible concept which is best situated within a wider context of finding enterprising ways to generate new income streams for investment in natural capital. Indeed, “PES”, which is a means to an end, can actually be a confusing or restricting concept. So in the forthcoming 25 Year

[14] ADAS,UEA and FERA, *Scoping the strengths and weaknesses of different auction and PES mechanisms for Countryside Stewardship* (2015)

Environment Plan, the emphasis is more simply and broadly on “funding and financing environmental improvement”, identifying what measures can do most to unlock a significant scaling-up of private investment in this nascent market. Indeed, the evidence from these pilots has provided an important stimulus for renewed and wider thinking about how private funding and investment in natural environment projects can be scaled up. For example, Defra will be further exploring the potential for the concept of a Natural Capital Trust to develop new markets on a regional basis.

The 25 Year Environment Plan provides a real opportunity to develop ways to facilitate growth of innovative funding schemes, identifying what government, investors, environmental organisations and others can do to develop and scale up markets. The Plan’s Pioneer project areas potentially offer a test bed for identifying potential private funding opportunities or new mechanisms for co-ordinating beneficiaries and providers of natural capital. Knowledge exchange, a comprehensive understanding of what works, a focus on the needs of potential investors and funders, and raising awareness of what nature provides will all be important enablers of new markets for investment in nature.

Annex - Detailed summary of pilot projects

The following tables provide further details of the various pilot studies and schemes. We are grateful to those project contacts who provided post-contract updates to Defra during the course of 2016. Owing to the lapse of time since the completion of the earlier research contracts, we cannot guarantee that the details here are up to date, particularly regarding the outcome and legacy of the projects. Any corrections or updates should be notified to the Environment Analysis Unit at Defra: colin.smith@defra.gsi.gov.uk

Interested readers seeking more information on a specific project are advised to consult the full report (hyperlinks can be found in Table 1 of this document), and may wish to contact the authors for the latest position.

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
Fowey River *UEA*	Water quality issues in Fowey Catchment;	To test out the use of a reverse auction approach as a PES delivery mechanism. In particular, to evaluate whether an auction mechanism could be used to distribute funds to farmers and to look at the outcomes and value for money compared to an advisor led approach. Assess scope for wider purchasers to fund water quality improvements and deliver multiple environmental benefits.	The evaluation demonstrated that an auction-based PES mechanism can successfully distribute funds to farmers for investment in capital items that improve water quality. The auction after 3 rounds was 2.2 times over-subscribed. The evaluation showed that the auction significantly increased the value for money with which funds can be allocated to projects estimated at between 20-40% greater value for money in terms of environmental improvements per £ spent. Scope for wider funders limited through lack of awareness / benefit / incentives	The project has demonstrated that an auction based mechanism can successfully distribute funds to farmers for investment in capital items to deliver water quality improvements. There is potential to deliver improved value for money compared to advisor led scheme.	Auction design is complex and a range of design factors to work through. Although value for money was higher under auction, competitive pressure was not the only factor in bids and risk that farmers would bid above 50% even if prepared to contribute more.
Hull Flood risk *Land Trust*	Flood management, but also more broadly how to maximise ecosystem services from green and blue space for residents.	To enable better delivery of ecosystem services (with focus on flood alleviation) through better management of green and blue urban sub-habitats in N. Hull area. Two PES-type schemes designed for flood alleviation and multiple benefits (i) country park scheme (ii) street-level interventions.	The Pilot initially achieved its three aims. Yorkshire Water is keen to assess prospects across Hull; developing partnerships with LEPs and other LAs. Hull CC originally committed to taking two PES schemes forward but personnel changes and budget cuts have halted progress.		Limited quantitative evidence on links between urban sub-habitat management and ecosystem services delivered (other than flood alleviation). Layering complexity; inability-to-pay; different siloed LA budgets. Reliance on key personnel to take schemes forward.

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
Poole Harbour *RSPB*	Reduce nutrient discharge into Poole Harbour that is prohibiting new developments.	To examine the feasibility of a "nitrogen trading" scheme around Poole Harbour. Land management changes would reduce Nitrogen and be sold as "mitigation credits" to potential developers, allowing their projects to proceed at lower cost than if they had to prevent / mitigate themselves.	Poole BC have converted farmland to parkland to reduce N and used to offset new development discharges (£102k credits purchased for a 268 dwelling development via CIL) - but not as cost-effective as land management change. Full N scheme not set up, but some PES-like deals occurring and key lessons learned.	PES-type agreements have a key role to play in permitting development in the catchment - the £102k deal should be the first of a number. Ongoing discussions with West Dorset Council on whether to purchase land management change for farmers - need to decide first on mitigation needs before consulting with farmers on a PES contract. LAs' preferred route to Nitrogen mitigation is purchasing and reverting land.	Length of contracts, different regulations for farmers and developers; reluctance to “pay polluters”. LAs are not experts in nutrient geology so there is a challenge on the evidence base.
Tortworth Brook *BART*	Purification of treated sewage effluent to remove nutrients, particularly phosphorus and nitrogen, entering Tortworth Brook from Cromhall sewage treatment works (STW).	Proof of concept for application of PES to sewage treatment using Integrated Constructed Wetlands (ICWs) to tackle STW effluent and delivering reduced costs compared to traditional end of pipe solutions (in this case chemical dosing P stripping plant).	Proof of concept achieved. Overall 'best 'option was a Cromhall-only, demonstration ICW, to treat sufficient effluent in order that Cromhall STW would achieve an overall P concentration of below 2 mg/l, which could be evaluated for wider, future application by the company. The pilot project confirmed the costs are likely to be considerably lower compared to chemical-dosing P stripping plant.	Wessex Water has included a provision for this scheme in their application to Ofwat for funding in PR14 (2015-20). The primary legacy of the project is helping to raise awareness amongst the Regulator, the water industry and OFWAT of the potential to use natural infrastructure-based ICW techniques that enhance ecosystem sustainability in the treatment	Physical requirements for ICW, such as land availability and suitability can be a challenge to meet. Most significant risk to developing ICW-based PES schemes related to consenting by regulatory bodies. In addition, the regulatory framework changed fundamentally during the project, when the entire Tortworth Estate became designated as a Nitrate Vulnerable Zone (NVZ).

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
				of waste-waters.	
Canal & River Trust *JBA Consulting*	As a new charity, the Canal & River Trust is looking to generate new income streams in order to maintain and enhance the multiple ecosystem services provided by its 2000-mile network of inland waterways.	Scoping study, using 4 case-study stretches of waterway (Leeds-Liverpool Canal; Aire & Calder Navigation) to investigate potential PES mechanisms to support CRT activities in maintaining and enhancing ecosystem services associated with the Trust's network.	Based on the 4 case studies, potential PES-type mechanisms identified, including planning payment vehicles, environmental stewardship and catchment-management type funding mechanisms.	New awareness in CRT of possibility for PES approach to increase income. The Trust recognises the value of PES, while also appreciating the challenges within individual funding schemes; Research programme to examine the social, environmental and economic impacts of waterways across the UK will build on PES pilot; CRT also keen to learn from Visitor Giving pilot.	Identifying baseline for services; payment mechanisms are unlikely to be purely voluntary on the part of payers (e.g. CIL); bringing potential beneficiaries to the table
Pumlumon *Montgomeryshire Wildlife Trust*	An interim evaluation of a place-based PES. The Pumlumon PES project involves layered/ multiple ecosystem services.	An ecologically diverse and robust natural environment that can sustainably deliver a wide range of ecosystem services This can be used to support economically and socially vibrant local communities - these communities recognise the value in further investment in the natural environment through habitat restoration and sustainable land management.	The project has worked with a wide range of partners including 13 landowners to deliver ecosystem services over seven years. The quantity and value of this additional service provision has been measured using best current evidence. Opportunities have been identified for investment in PES approaches to the project.	Ecosystem services delivered include: provisioning services (cattle stocking, tree planting, increased water storage); cultural (increasing visitor access, more education); supporting (re-wetting of peat, species support) and regulating (climate storage, flood regulation, reduced erosion).	Currently market mechanisms are weak (though there are continuing developments i.e. the Peatland Code). The project remains in development including considering opportunities with new markets. There are continued funding challenges for the project.

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
Peatland code *Birmingham City University*	Peatland restoration to reduce carbon emissions from degraded peatlands; deliver a range of other services (e.g. water quality, biodiversity). IUCN estimates that 80% of UK peatlands degraded.	To develop a peatland code that could facilitate private investment in peatland restoration. There is a need to develop guidance, frameworks and monitoring to provide sponsors with the confidence necessary to restore peatlands on any significant scale.	Successfully identified the components required for a pilot phase UK peatland code. For example, how to take account of additionality and tests required to integrate within code. Research achieved an improved understanding of different preferences of potential buyers and how the code could help to facilitate their investment.	IUCN launch of pilot code in 2013 in partnership with Defra and devolved administrations. 2-year pilot phase following developed th Code and governance, and supported by further Defra research to refine Peatland Code metrics. Full Code launched at World Forum on Natural Capital in November 2015.	Business incentives to fund peatland restoration projects Robustness of peat carbon metrics; need to develop metrics for non-carbon benefits. Peatland restoration in the UK would not qualify as carbon offsetting; however companies may still want reporting on basis of £/C saved for investment purposes
Visitor Giving PES *Birmingham City University*	Funding for environmental benefits such as habitat protection and maintenance, awareness and information, and tourism.	Funding of tourism sites in Lake District area - local schemes. Aim: to investigate whether PES can provide a mechanism for new investment in environmental schemes by businesses and visitors.	Literature review of visitor giving schemes - 32 schemes catalogued; barriers and opportunities for each identified Survey of visitors and businesses in Lake District carried out Two 'apps' for smart phones developed - for tourists cycling and walking in South Pennines and Lake District.	2 mobile apps developed - one in South Pennines, 1 in the Lake District. Help sheets produced for visitor giving schemes on Visit England website Visitor Giving learning network proposal developed	Design of VGS schemes often lack long-term financial sustainability. PES conditionality requirement often not met. Some schemes are not voluntary and not linked to a specific ES. Some technical issues with the app. Marketing challenges around visitor perceptions.
River Lea in Luton *Cranfield University*	Improving the degraded River Lea in the Luton area.	Developing tools and methods for designing and implementing a PES scheme in a complex urban setting via case study of Upper Lea in Luton which	Strong commitment of project partners - 4 workshops involving LBC, C Beds DC, EA, Groundwork, Friends, wildlife trusts, Vauxhall.	Project partners are now working together under a Catchment Partnership to implement project proposals.	Ensuring broad spectrum of stakeholder participation in workshops; identifying the right people in organisations to input into PES; framing viable options within

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
		addresses strategic objectives of LBC and regional EA. A "Vision" of a sustainable river frames the project.	Cost impact analysis gives structure - a wide range of potential projects can contribute to the Vision. Exploring with TW the eco-plumber issue. Vision to be embedded in local Planning Strategy (taking Vision to Chief Planning Officer).	Improvements to Leagrave Park have been successfully implemented following successful funding bids. A habitat improvement programme is being developed with Affinity Water and a feasibility study for SUDs in green spaces is proposed in association with the Environment Agency.	the context of LA planning and budgetary constraints; engaging local businesses; selecting initiatives to take forward that can be framed as PES projects.
Cotswolds Catchment *FWAG South West and CCRI*	The project was a direct result of the Upper Thames Catchment WFD pilot that had identified key threats and opportunities in the catchment. One threat was around grassland reversion to arable with impacts on a wide range of ecosystem services.	Development of a PES scheme in the Cotswolds catchment engaging landowners and multiple beneficiaries around water quality and quantity, land management, energy production and landscape	Proposed draft PES plan would operate as a 'many to many' layered PES agreement. Priorities for land management include: approved soil management practice; introduce a grassland code; add energy production component to arable rotation; Influencing application management. Potential buyers/ beneficiaries include: Thames Water – for management of pesticides to solve potential drinking water quality issues; Ecotricity – for development of energy through anaerobic digestion using a code of good practice linked to sustainable land management.	A central legacy of the pilot is the successful testing of the Integrated Local Delivery (ILD) framework in enabling the identification appropriate ecosystem services, associated sellers, beneficiaries and buyers and establishing the principles of a PES framework. Using ILD has resulted in the establishment of a forum at which the proposed options have been discussed and established. High levels of engagement and interaction between sellers, buyers and intermediaries have been secured and represent a	Stakeholder engagement is possible but takes time and has to build trust with e.g. farmers and land managers (sellers); this is seen as critical to the future success of this PES scheme. One particular challenge is how to secure the continued contribution of existing land use practices. However, unless additional obligations are required or the area is under threat there is an issue of not being able to demonstrate additionality.

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
				significant achievement.	
South Pennines *Crichton Carbon Centre*	Development of peat and carbon metrics and new approaches for aggregating buyers and accounting for multiple ecosystem services. Peat bogs in South Pennines are degraded	Case study of 'layered' PES approach delivering multiple ecosystem services focused around peat re-wetting and tree planting - leading to carbon sequestration, water quality and flood management (generally supporting and regulating ecosystem services)	Credible estimates of carbon (CO2 and CH4) reductions/ storage - metric developed can become the basis for a carbon calculator. This was the first time that carbon emissions reductions from peatland restoration had been quantified in a pragmatic but scientific way, so that they were applicable across the UK Relationship observed: carbon storage increases with the quality of peat bogs (acts as a net sink if good quality and well maintained)	Creation and development of peat and carbon metrics that form the basis for the Peatland Code and for UK greenhouse gas accounting. This formed the basis for further in-depth research to refine metrics and field protocols for use in the Peatland Code.	Options for layered and bundled provide a useful guide to some of the options but these now need to be achieved in practice. Layered schemes can present a collective action problem as they involve multiple buyers and sellers. Also occur over large areas (particularly water quality and flood risk). There is therefore a need to be co-ordinated.
Energy for Nature *RSPB*	Management interventions necessary to maintain habitats for wildlife are costly and produce surplus biomass which is currently costly to dispose of.	To create saleable bioenergy products from the 'surplus' biomass resulting from land management to generate income. Funds from the sale of these bioenergy products could be used to fund further habitat management. Energy for nature could help conservation organisations generate an ecologically	A full business case indicated that, the scheme could turn wetland management costs in the pilot area of £70k into revenues of £150k - £5m (depending on chosen conversion technology and biomass available).The monitoring programme developed ensures that biomass to bioenergy is also ecologically sustainable. The conservation biomass calculator helps land managers to assess the	The pilot's strong business and environmental case means they can implement the scheme once some initial funding is received to cover start-up costs. If successful on the Somerset Levels and Moors, RSPB are looking to roll this scheme out to their other suitable sites in the UK (they	A key scientific challenge was the variability of biomass which can be harvested and the uncertainty in the quality and quantity of each bioenergy product it will create. The high transaction and set up costs (e.g. purchasing an AD system), with the uncertainty around incentives are also a challenge to others setting up the scheme.

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
		sustainable income stream to fund this essential habitat management	potential of their biomass for producing bioenergy products by estimating potential GHG savings (compared to burning fossil fuels), monetary costs and benefits from information which the land manger inputs.	manager 150,742 ha of land). There are also other significant land holders and conservation managers who are interested in co-ordinating with RSPB in Somerset. The conservation biomass calculator should also allow single land managers to apply this process to their land.	
Holnicote Estate *National Trust*	Funding for the Holnicote flood demonstration project, which was successful in decreasing flood risk. The pilot hoped to use PES as a way to continue funding improvements to flood risk and other ecosystem services.	The PES pilot research project aimed to identify potential markets for financial investment to allow for the long term continuation and expansion of the natural flood management project.	The pilot has raised the profile of PES and an ecosystem approach within the National Trust at a local and national level. Visitors to the Estate identified as a major untapped source of funding and it is likely that a Visitor Giving Scheme could encourage donations, capitalising on public interest in natural flood management and biodiversity gains in particular.	The pilot has raised the profile of PES thinking within the National Trust and helped to inform its Land Choices strategy Though it is unlikely that PES alone will be sufficient to support continuation of the Flood Project. The pilot established how PES could be used to generate funding as part of a package of potential funding sources.	Although potential buyers are supportive of the concept of natural flood management, difficult to engage them. A key reason for this is a strong feeling that others should take responsibility for managing flood risk.
River Irwell *Lancashire Wildlife Trust*	The heavily modified urban river has low aesthetic value,	The pilot aimed to use a bottom up approach (interviews) to explore the feasibility of establishing a new PES	The pilot helped to build a better understanding of the issues of setting up PES in an urban context.	The findings of this study will be shared and discussed with key stakeholders and partnerships including	The main barrier was getting buyers to engage. Partly because of a belief that it was the responsibility of

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
	poor water quality and poor biodiversity. The catchment is also subject to flooding. PES could provide a means of funding improvements in the river's ecosystem services.	scheme funded by the private sector businesses in Manchester and Salford city centre adjacent to the river for enhancements to the river. The fund would be used for enhancements to the river to improve its ecosystem services	The first stage interview results identified that there was real opportunity to improve the rivers services as many of the businesses see it as creating a disservice.	Manchester City Council, Salford City Council, Irwell River Partnership, Local Nature Partnership and the Environment Agency with a view to assessing the feasibility of identifying a lead organisation / partnership who can advance the issues and modicum of motivation amongst businesses to support the development of a practical PES scheme.	others to maintain the river. Many of the surrounding businesses were tenants who were unconcerned about the local environment. Many of the buildings adjacent to the river Irwell were built facing away from it so the local community felt disengaged from the river.
Smithills Estate *Woodland Trust*	Need for investment and regeneration in the Smithills Estate; newly acquired by Woodland Trust.	Smithills Natural Enterprise Catalyst attempts to use social and private micro-enterprises to mobilise natural capital in a city fringe landscape for the benefit of people living nearby. The pilot aimed to create a new venture that sustains the natural capital at Smithills based on income from PES.	The PES pilot has convened interest and gained buy-in from local stakeholders who may support the scheme in future. The pilot established the basic model for an enterprise catalyst and scoped out the practical possibilities for the first two PES enterprises.	The project as Smithills is ongoing to develop a cluster of PES enterprises using a local social venture as a catalyst. The pilot has strengthened the support for PES within the Woodland Trust who are keen to pilot the approach in other areas. Its strong foundation of cultural services will help also build the Smithills local "brand" recognition and	Legal challenge of how WT can establish and support an independent social enterprise without compromising charitable responsibilities - working through this with lawyers. They are now facing the financial challenge needed for support in the early phases.

Project	Problem being addressed	Aim and concept	Key achievements and progress against objectives	Legacy	Main challenges and barriers
				value.	
Winford Brook *Eunomia*	There are a number of issues within the Winford Brook Catchment south of Bristol. Elevated nutrient levels and soil erosion in the catchment is costly for Bristol Water. Wessex Water interested in catchment solutions to reduce or avoid costs of wastewater treatment. EA identified Winford Brook as a floods rapid response catchment.	PES pilot is looking to identify cost effective catchment solutions for delivering multiple benefits to multiple beneficiaries. A key aim of the pilot was to set in place the foundations for a multi-beneficiary PES scheme.	The pilot provided a clear indication of the marginal financial benefits associated with reduced levels of erosion within a catchment and can be used to justify interventions. Estimates suggest value to Bristol Water of reductions in erosion per annum at £666 - £1,025 per m3. The pilot also provided valuable insights on developing a multi-beneficiary fund and exploring the legal issues surrounding fund set up.	To date the proof of concept has been demonstrated but with further work ahead to achieve a formal PES scheme. The strong case for PES in reducing dredging costs could be applied more widely in terms of developing a case for action in catchment schemes. The approach taken could be highly replicable, and scalable, and could readily be applied more broadly across England. Linked to concept of a “Natural Capital Trust” to develop regional natural capital markets.	Setting up a multi-beneficiary funding arrangement is complex and takes time including developing the right legal structures. Interactions with Catchment Sensitive Farming (CSF) fund need to be taken into account carefully. Evidence and data challenges which means that the light touch approach to use of existing evidence needed to be supplemented by walk over survey. Scientific challenge to quantifying the expected reduced risk of algal blooms. Also uncertainty around the impacts of land management on flood risk.