



Department
for Environment
Food & Rural Affairs

Payments for Ecosystem Services: A Best Practice Guide



URS



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Trust



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Foreword by Sir John Lawton

My own primary motivation for protecting the environment has nothing to do with economics. It is deeply rooted in the pleasure I derive from contact with the natural world, and the moral conviction that we hold the environment in trust for future generations. Does this mean that I find the idea of putting a value on 'ecosystem services' repugnant (as some do)? Absolutely not; indeed quite the opposite. There are many reasons for conserving nature, and recognising that the natural world has monetary value is just one of them, but an important one.



Arguing that the natural world is priceless is deeply mistaken. How much is a skylark worth? Well it clearly isn't zero, but nor is it infinite. I don't want to pay to listen to skylarks, and being more precise than this about their value is tricky (to put it mildly), but as this best practice guide shows, it is possible to put a value on many other aspects of nature's services, with varying degrees of difficulty and consensus. Increasingly, paying for ecosystem services will be another powerful reason for society to look after the natural world, and to stop taking for granted the benefits we derive from it.

The Guide is not the last word on the subject. There is still much science to do to identify and quantify more precisely many ecosystem services, and how these might be better protected or enhanced for the benefits of people and wildlife. Recognising the economic value of the natural world for society provides a framework for the voluntary, public and private sectors to work together. For instance, in *Making Space for Nature*, I and my colleagues argued that there is an urgent need to create new markets and payments for ecosystem services that will, at the same time, deliver significant conservation benefits. Planting forests to store carbon, and creating wetlands to store water are but two obvious examples, and this Guide has many others.

Read it. It is a hugely valuable and accessible contribution to a difficult subject, and a way of thinking about the natural world that will, I believe, transform for the better the way we look after it.

Professor Sir John Lawton CBE FRS

Chair of *Making Space for Nature: a review of England's wildlife sites and ecological network*, a report to Defra, September 2010.

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Note this document is not guidance to meet statutory environmental obligations. The guidance set out here relates to voluntary, best practice action by businesses and other interested parties.

Abbreviations

AGREV – Agriculture Environment Vittel

AONB – Areas of Outstanding Natural Beauty

AWT – Avon Wildlife Trust

BEF – Bonneville Environmental Foundation

BESS – Biodiversity and Ecosystem Service Sustainability

CRP – Conservation Reserve Program

CWT – Cheshire Wildlife Trust

CVI – Conservation Value Index

DWPA – Diffuse Water Pollution from Agriculture

EA – Environment Agency

ELS – Entry Level Stewardship

EBI – Environmental Benefits Index

EU – European Union

EWGS – English Woodland Grant Scheme

FCF – Forest Conservation Fund

GAEC – Good Agricultural and Environmental Conditions

HLS – Higher Level Stewardship

ICF – Institute of Chartered Foresters

IUCN – International Union for Conservation of Nature

LCA – Land Conservation Agreement

LWD – Large Woody Debris

MOD – Ministry of Defence

MWT – Montgomeryshire Wildlife Trust

NCA – National Character Area

NEA – National Ecosystem Assessment

NFWF – National Fish and Wildlife Foundation

NGO – Non-Governmental Organisation

NPA – National Park Authority

NYC DEP – New York City Department for Environmental Protection

OECD – Organisation for Economic Co-operation and Development

PbR – Payment by Result

PES – Payments for Ecosystem Services

PP – Pumlumon Project

PWS – Payments for Watershed Services

REDD – Reduced Emissions from Deforestation and Degradation

Relu – Rural Economy and Land Use Programme

RFCC – Regional Flood and Coastal Committees

RSPB – Royal Society for the Protection of Birds

SAC – Special Area of Conservation

SCaMP – Sustainable Catchment Management Plan

SSSI – Site of Special Scientific Interest

TEEB – The Economics of Ecosystems and Biodiversity

UU – United Utilities

VPS – Visitor Payback Scheme

WFD – Water Framework Directive

WRC – Water Restoration Certificate

WRI – World Resources Institute

WRT – Westcountry River Trust

Introduction

This Guide

The purpose of this Guide is to help with the design and implementation of **Payments for Ecosystem Services (PES)** schemes and its publication fulfils a government commitment in the 2011 Natural Environment white paper, *The Natural Choice: securing the value of nature*.

PES schemes involve payments to the managers of land or other natural resources in exchange for the provision of specified ecosystem services (or actions anticipated to deliver these services) over-and-above what would otherwise be provided in the absence of payment. Payments are made by the beneficiaries of the services in question, for example, individuals, communities, businesses or governments acting on behalf of various parties. Beneficiaries and land or resource managers enter into PES agreements on a voluntary basis and are in no way obligated to do so.

Ecosystem services, simply defined, are the benefits we derive from the natural environment. These include, for example, the provision of food, water, timber and fibre; the regulation of air quality, climate and flood risk; opportunities for recreation, tourism and cultural development; and underlying functions such as soil formation and nutrient cycling. Maintaining and enhancing ecosystem services – and restoring them where they have been lost or degraded – is increasingly recognised as essential for sustainable economic growth, prosperous communities and promoting peoples' wellbeing.

Who is the Guide for?

This Guide is aimed at the 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 resource 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 resources. Part 3 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.

Part 1 – An Introduction to PES

Introduction

This part of the Guide provides an overview of PES with sections covering:

- What are ecosystem services?
- Market-based mechanisms for enhancing ecosystem services
- What is PES?
- Key principles and concepts underpinning PES
- Opportunities for PES
- Types of PES scheme
- Scale of PES schemes
- How PES works in practice
- The actors involved in PES schemes
- Key aspects of scheme design
- Opportunities and risks associated with PES
- Using the Guide

What are ecosystem services?

The diverse benefits that we derive from the natural environment are sometimes referred to as **ecosystem services**. Examples of these services include the supply of food, water and timber (provisioning services); the regulation of air quality, climate and flood risk (regulating services); opportunities for recreation, tourism and education (cultural services); and essential underlying functions such as soil formation and nutrient cycling (supporting services). Some of these services are illustrated in Figure 1.

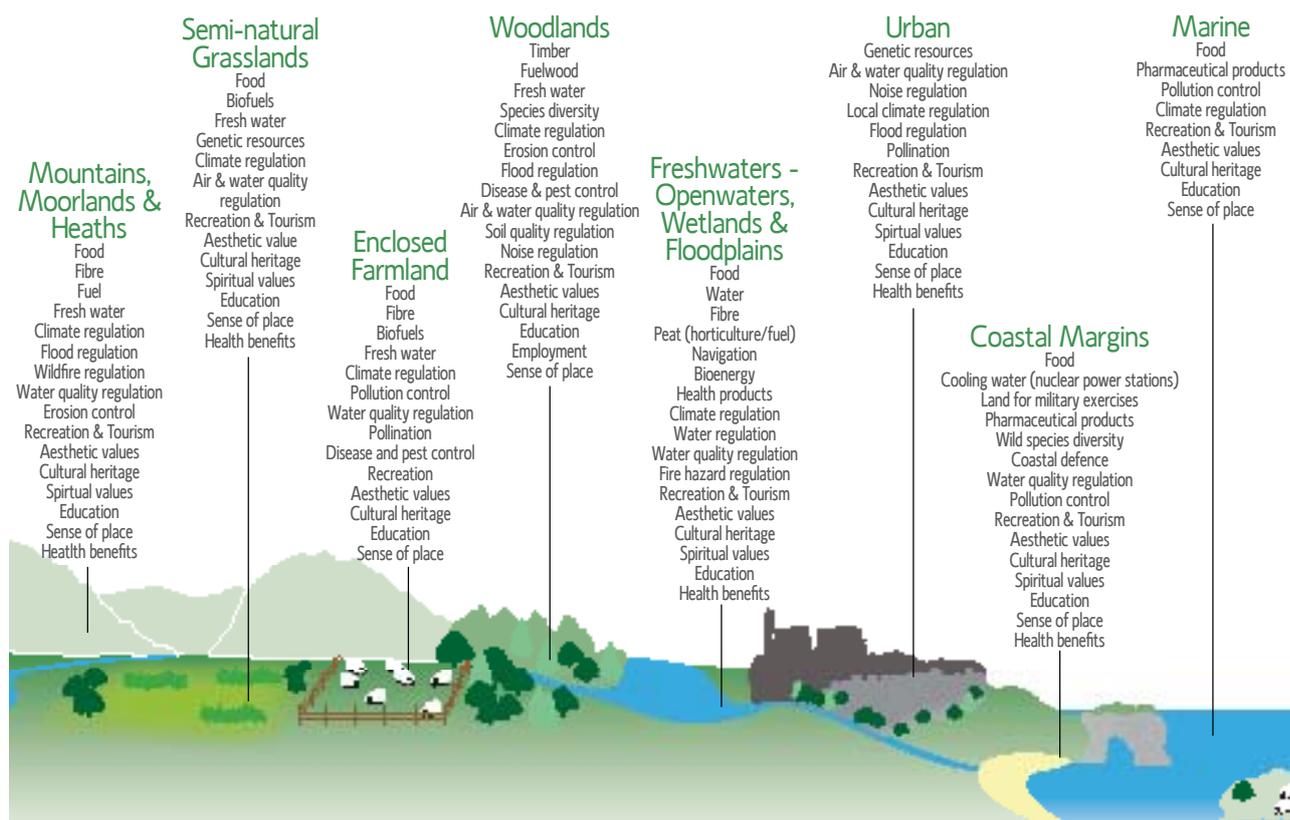


Figure 1: The eight Broad Habitats assessed in the UK NEA and examples of the services derived from each[#].

In 2005, the Millennium Ecosystem Assessment concluded that, on a global scale, whilst some ecosystem services such as food production had increased, the majority of ecosystem services had been degraded.¹ The UK National Ecosystem Assessment (NEA), published in 2011, concluded that, of the range of services provided by eight broad terrestrial and aquatic habitat types in the UK (see Figure 1), about 30% are in decline with many others in a reduced or degraded state, often as a consequence of long-term declines in habitat extent or condition. Long-term declines in habitat extent and condition are, in turn, the result of the emphasis from the late 1940s onwards on maximising the supply of food, timber, energy and water.²

The increase in agricultural productivity in particular was accompanied by a decline in other ecosystem services, particularly those relating to biodiversity and air, soil and water quality, as semi-natural habitats were lost or degraded. Despite improvements in the provision of some ecosystem services over the past 10-20 years, the NEA emphasises that many ecosystem services are still delivering at far below their full potential.³ Moreover, a growing population and the increasing impacts of climate change mean that pressures on ecosystem services are unlikely to diminish. One major challenge is to increase food production while reducing the agricultural sector's impact on other ecosystem services through sustainable intensification.⁴

[#]Supporting services, including amongst others primary production and nutrient cycling, are not listed against individual habitats as they are considered essential for the production of all other ecosystem services.

In practice, land can often be managed such that a variety of ecosystem services (ie multiple benefits) are delivered simultaneously. However, nature is a complex, interconnected system and ecosystem services are not generated independently of one another. Therefore, attempts to maximise the supply of one service are likely to influence the production of other services, either positively or negatively. In some cases, 'win-win' solutions may be possible, for example where river restoration enhances amenity, biodiversity and fishery benefits, while in other instances trade-offs between services may be apparent, for example where non-native tree species are planted with the aim of sequestering carbon. This Guide therefore emphasises the importance of *working with the grain of nature* and identifying any trade-offs between services in the decision to take forward a PES scheme and, where trade-offs do exist, mitigating these as far as possible through careful scheme design and implementation.

Market-based mechanisms for enhancing ecosystem services

The declines in habitat extent and condition and the consequent deterioration in ecosystem services witnessed over the past 60 years ultimately reflect a historic failure to properly value the benefits we derive from nature. *The Natural Choice*, the government's 2011 Natural Environment white paper, emphasises that while some ecosystem services such as food and timber have a financial value in the marketplace, others like climate regulation and flood control that are nevertheless equally vital to our continued wellbeing, do not.⁵ This, in turn, has created an imbalance in the way in which decisions affecting the natural environment are made and, historically, has led to a focus on short-term financial gain and the consequent over-exploitation of many natural assets. However, recent years have witnessed significant advances in our understanding of the science of ecosystem services as well as in our capacity to establish the values that people place on these services. Therefore, we are now in a stronger position to begin to reflect the value of all ecosystem services in decision-making.

As our scientific understanding of ecosystem services and our capacity to place a value on them improves, a further logical step is to develop market-based mechanisms that enable these values to be reflected in decision-making through incentives and price signals.⁶ Examples of **market-based mechanisms** include trading systems in which damage in one place is compensated for through improvements elsewhere (eg biodiversity offsetting, see Box 1) and certification schemes in which the value of ecosystem services is reflected in product pricing (eg eco-labelled products). PES is a further example of a market-based mechanism.

Box 1: Biodiversity offsetting

While good quality developments may incorporate biodiversity considerations within their design, they may still result in some biodiversity loss. *The Natural Choice*, the Government's Natural Environment white paper emphasises that one way to compensate for this loss is through biodiversity offsetting whereby the project developer secures compensatory habitat elsewhere. *The Natural Choice* defines biodiversity offsets as "conservation activities designed to deliver biodiversity benefits in compensation for losses in a measurable way". A market-based approach to biodiversity offsetting involves landowners registering their wildlife sites so as to provide conservation or offset 'credits' which can then be purchased by project developers to offset their biodiversity impacts. Offsets can involve habitat expansion (creation) or restoration and offset providers must provide additional benefits: offsets cannot be designed simply to maintain current habitat extent or condition.

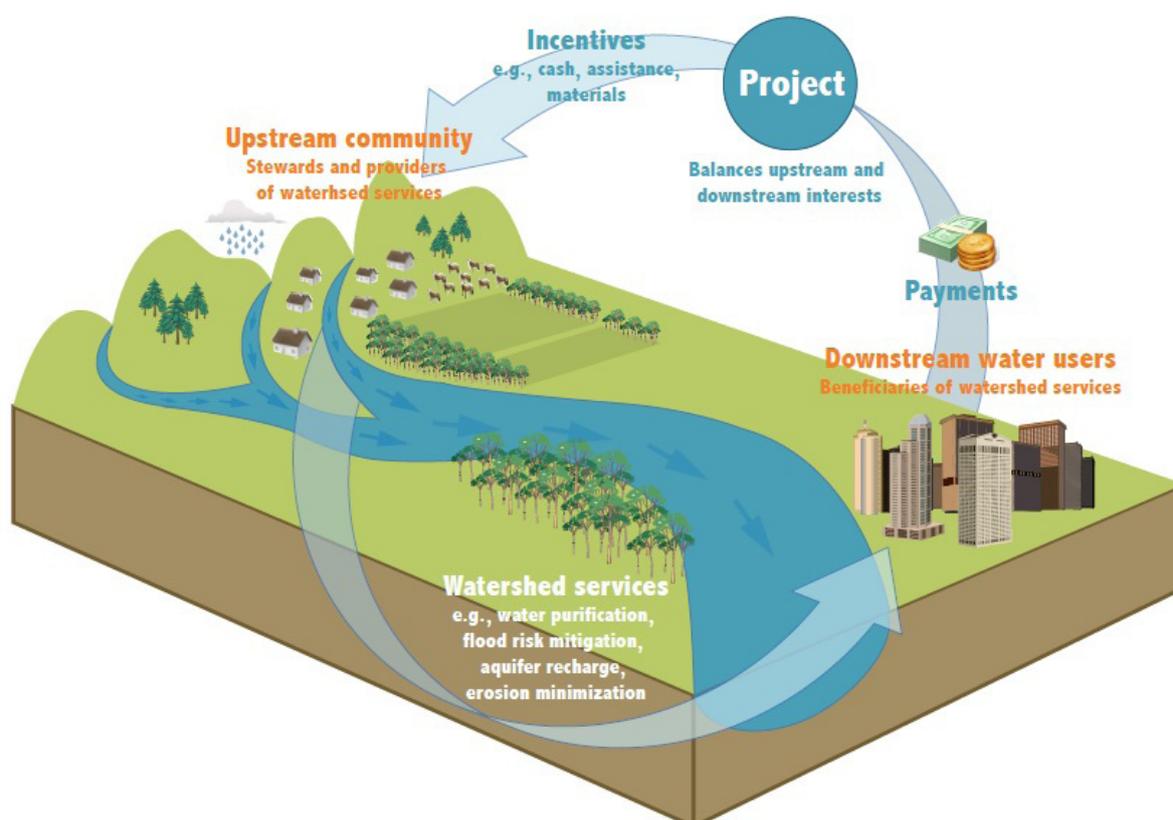
PES differs somewhat from biodiversity offsetting. PES can be distinguished by a particular focus on the 'beneficiary pays principle', whereby the beneficiaries of ecosystem services provide payment to the providers of ecosystem services. Conversely, biodiversity offsetting incorporates an element of the 'polluter pays principle', since developers pay for the provision of compensatory habitat expansion or restoration elsewhere.

What is PES?

Some people use PES as an umbrella term for the entire suite of economic arrangements used to reward the conservation of ecosystem services. However, for the purposes of this Guide, the term PES is used to describe schemes in which the beneficiaries, or users, of ecosystem services provide payment to the stewards, or providers, of ecosystem services. In practice, PES often involves a series of payments to land or other natural resource managers in return for a guaranteed flow of ecosystem services (or, more commonly, for management actions likely to enhance their provision) over-and-above what would otherwise be provided in the absence of payment. Payments are made by the beneficiaries of the services in question, for example, individuals, communities, businesses or government acting on behalf of various parties.

The basic idea behind PES is that those who provide ecosystem services – like any service – should be paid for doing so. PES therefore provides an opportunity to put a price on previously un-priced ecosystem services like climate regulation, water quality regulation and the provision of habitat for wildlife and, in doing so, brings them into the wider economy. The novelty of PES arises from its focus on the ‘beneficiary pays principle’, as opposed to the ‘polluter pays principle’ (an illustration of this difference is outlined in Box 1). The last 10-15 years have witnessed a rapid proliferation of PES schemes around the world. According to the OECD, there were already more than 300 PES or PES-like programmes in place around the world by 2010 at national, regional and local levels.⁷ Figure 2 provides an illustration of the PES concept in relation to payments for watershed services.

Figure 2: The PES concept⁸



It is important to recognise that land or resource managers may be subject to regulation which, if properly enforced, could limit adverse impacts on ecosystem service provision. They may also undertake measures to protect and enhance services where this is in their best interests, for example, through reducing water usage to make cost savings. Many land or resource managers may also seek to protect or enhance ecosystem service provision in their role as custodians. PES schemes should therefore be carefully designed so as not to undermine existing stewardship on the part of land or resource managers.

PES provides one means to increase the supply of an ecosystem service, or services. However, PES is only one instrument among many for combating ecosystem degradation. Others include regulation; the provision of services by government (for example, the Public Forest Estate provides numerous services of public benefit); voluntary efforts on the part of businesses, communities and individuals; and incentive- or market-based mechanisms, including PES – see Figure 3. Case studies of PES schemes are set out in the accompanying annex. Examples of domestic schemes include the publicly funded Environmental Stewardship scheme, which pays about £400 million a year to farmers and land managers in return for more environmentally-sensitive farming.⁹

- Regulation
- Provision of services by government
- Voluntary efforts by business, communities and individuals
- **Incentive or market-based mechanisms**
 - Charges (e.g. taxes and user fees)
 - Tradable permits (e.g. markets for pollution reduction)
 - Certification schemes (e.g. eco-labels)
 - **Payments for Ecosystem Services (PES)**



Figure 3: Components of the 'environmental policy toolkit'¹⁰

“PES provides an opportunity to put a price on previously un-priced ecosystem services like climate regulation, water quality regulation and the provision of habitat for wildlife and, in doing so, brings them into the wider economy.”

Key principles and concepts underpinning PES

A widely quoted definition of PES is:

1. a voluntary transaction where;
2. a well-defined ecosystem service (or a land-use likely to secure that service);
3. is 'bought' by a (minimum of one) ecosystem service buyer;
4. from a (minimum of one) ecosystem service provider; if and only if
5. the ecosystem service provider secures ecosystem service provision (conditionality).¹¹

Drawing on this definition, this Guide identifies seven key principles, which should ideally underpin any PES scheme:

- **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 payment:** 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 which land or resource managers would generally be expected to undertake (note that precisely what constitutes additionality will vary from case-to-case but the actions paid for must at the very least go beyond regulatory compliance);
- **Conditionality:** payments are dependent on the delivery of ecosystem service benefits. In practice, payments are more often based on the implementation of management practices which the contracting parties agree are likely to give rise to these benefits;
- **Ensuring permanence:** management interventions paid for by beneficiaries should not be readily reversible, thus providing continued service provision; and
- **Avoiding leakage:** PES schemes should be set up to avoid leakage, whereby securing an ecosystem service in one location leads to the loss or degradation of ecosystem services elsewhere.

In addition, establishing the **baseline** position, ie the likely future provision of the relevant ecosystem services in the absence of the PES scheme, will be critical since this will allow for accurate monitoring which will, in turn, indicate the level of additionality being delivered, thus reassuring buyers that the requisite services are indeed being provided. In developing a PES scheme, it may also be appropriate to undertake **stakeholder engagement** with those likely to be affected by the scheme.

While these principles should inform the development of PES, in practice schemes may adhere to them to a greater or lesser degree. The literature on PES suggests that few existing schemes fulfil all these principles in practice and, as such, aiming for a 'perfect' PES scheme may create unrealistic expectations.

Opportunities for PES

The government is committed to promoting the emergence of PES schemes. The 2011 Natural Environment white paper, *The Natural Choice: securing the value of nature*, proposes various measures to mainstream the value of nature across society. In particular, the white paper emphasises the "...real opportunities for land managers to gain by protecting nature's services, and trading nature's benefits with businesses, civil society and the wider public sector". The white paper recognises the government's role in facilitating the emergence of PES schemes and includes a commitment to publishing this best practice Guide for designing them.¹²

PES schemes are most likely to emerge in situations where:

1. specific land or resource management actions have the potential to increase the supply of a particular service (or services);
2. there is a clear demand for the service(s) in question, and its provision is financially valuable to one or more potential buyers; and
3. it is clear whose actions have the capacity to increase supply (for example, certain land or resource managers may be in a position to enhance supply).

By way of illustration, planting new woodland can, in some cases, help in slowing down the rate at which rainfall reaches rivers and can therefore help in reducing the risk of rivers bursting their banks and flooding homes and businesses. If the risk of flooding is high, householders and businesses may be willing to pay for new woodland planting to assist in reducing the risk. If it is clear where trees need to be planted to slow future rainfall, it may be possible for householders and businesses to establish a PES deal whereby payment is made to the landowner(s) or manager(s) in question for tree planting and maintenance.

While some ecosystem services may be generated and consumed locally (for example, the benefits of nutrient cycling may be felt by farmers at the field scale), the benefits of others may be felt at considerable distances from their point of origin (in the example above the flood control benefits associated with planting woodland may be felt by downstream communities a significant distance away). PES schemes therefore have the potential to link up geographically disparate providers and beneficiaries.

Types of PES scheme

There are three broad types of PES scheme:

- **public payment schemes** through which government pays land or resource managers to enhance ecosystem services on behalf of the wider public;
- **private payment schemes**, self-organised private deals in which beneficiaries of ecosystem services contract directly with service providers¹³; and
- **public-private payment schemes** that draw on both government and private funds to pay land or other resource managers for the delivery of ecosystem services.

Scale of PES schemes

PES schemes can be developed at a range of spatial scales, including:

- **International:** examples include Reducing Emissions from Deforestation and Degradation (REDD+) whereby developing countries that are willing and able to reduce emissions from deforestation and degradation are paid by developed countries for doing so.
- **National:** for example the Environmental Stewardship programme, a government-financed scheme in which about £400 million a year is paid to farmers and land managers on behalf of the public in return for more environmentally-sensitive farming.
- **Catchment:** for example, downstream water users paying for appropriate watershed management on upstream land. These schemes tend to be private-financed, for example where a water utility pays

upland land managers on behalf of its customers to implement certain measures designed to stabilise or improve water quality.

- **Local / neighbourhood:** for example, a scheme whereby residents collectively fund a warden or environmental organisation to manage local green space for biodiversity, landscape and recreational value.

How PES works in practice

For a PES scheme to work it must represent a win for both buyers and sellers. PES may be positive from a buyer's perspective if the payments are less than those associated with any alternative means of securing the desired service. For example, it may be less expensive for a water utility to pay land owners for improved catchment management than to pay for additional water treatment. PES schemes may be positive from a seller's perspective if the level of payment received at least covers the value of any returns foregone as a result of implementing the agreed interventions. For example, a farmer may be willing to create ponds for enhanced water storage if the payments received at least cover the costs of doing so, including the costs associated with any lost agricultural production.

Take, for example, a change in farm management to focus on the provision of a greater range of ecosystem service benefits, for example through wetland restoration on existing cropland:

- the minimum PES payment would be generally expected to at least cover any (private) return forgone by the farmer as a result of reduced agricultural production;
- the *theoretical* maximum payment would be the cumulative value of additional ecosystem service benefits which would accrue to the buyer(s) (which might include flood risk attenuation, fresh water supply, habitat for wildlife etc, depending on the services the buyer(s) wished to purchase); however, many of these benefits are hard to quantify, and many are 'produced' by the same types of management intervention; so
- in practice, the level at which PES payments are set would reflect supply and demand for particular ecosystem services and would be at a consensually-agreed intermediate point between the minimum and maximum values.

Figure 4 illustrates these principles, based on this example.

Different methods of land management have a significant impact on ecosystem service delivery and the associated benefits to individuals, communities and businesses. For example, Figure 5 depicts potential measures to enhance ecosystem service delivery within the farmed environment. An appropriately-designed PES scheme could provide the necessary incentives to foster better land management and enhanced ecosystem service delivery.

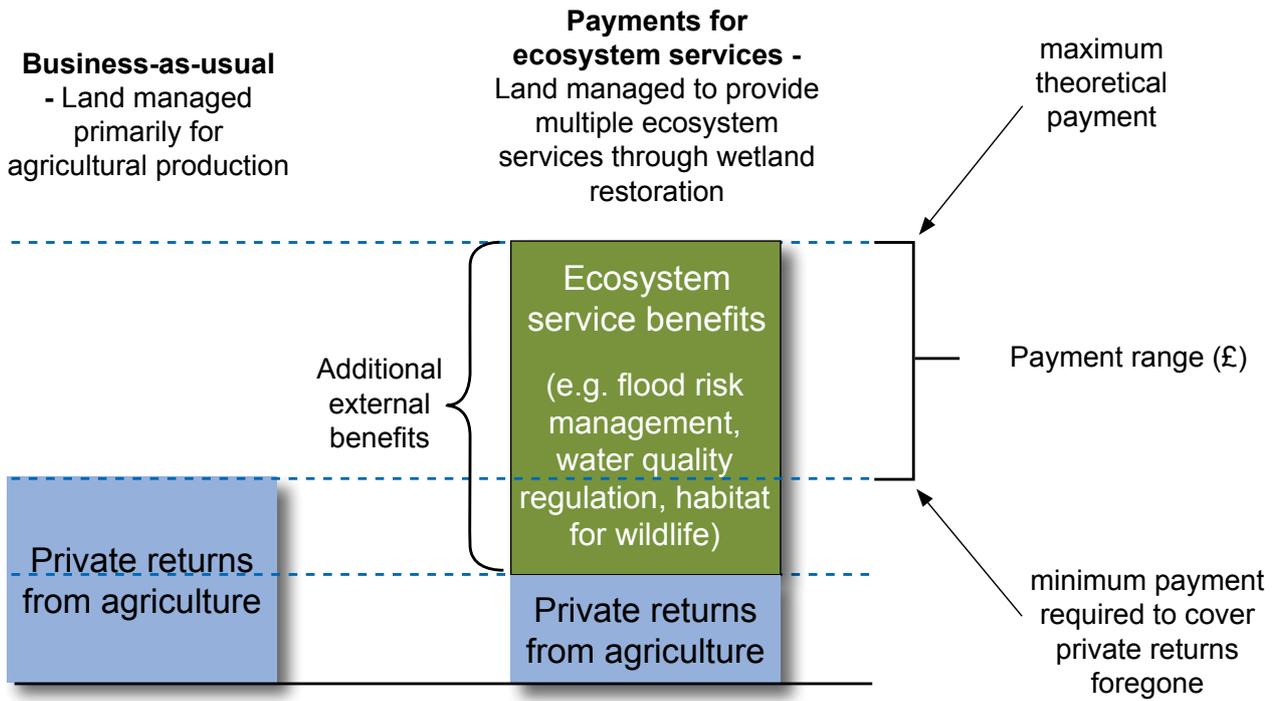


Figure 4: Land managed primarily for agricultural production vs. land managed to provide multiple ecosystem services under a PES scheme¹⁴



Soil management

- (A) Cultivate and drill across the slope
- (B) Avoid over-winter tramlines
- (C) Establish in-field grass buffer strips
- (D) Adopt minimal cultivation systems
- (E) Avoid high risk crops next to river

Livestock management

- (A) Reduce overall stocking rates on livestock farms
- (B) Reduce field stocking rates when soils are wet
- (C) Move feeders and water troughs at regular intervals
- (D) Construct troughs with a firm but permeable base
Reduce dietary N and P intakes

Fertiliser management

- (A) Do not apply fertiliser to high-risk areas
Avoid spreading fertiliser to fields at high risk time
- (B) Use clover in place of grass

Farm infrastructure

- (A) Fence off rivers & streams from livestock
- (B) Construct bridges for livestock crossing streams
- (C) Re-site gateways away from high-risk areas
- (D) Farm track management
- (E) Establish new hedges
- (F) Establish Riparian buffer strips
Establish & maintain artificial wetlands

Manure management

- (A) Increase the capacity of farm manure (slurry) storage
Install covers on slurry stores
- (B) Site manure heaps away from watercourses
Site manure heaps on concrete and collect effluent
- (C) Minimise volume of dirty water and slurry produced

Figure 5: Enhanced land management within the farmed environment

The actors involved in PES schemes

Four principal groups are typically involved in a PES scheme:

- **'buyers'**: beneficiaries of ecosystem services who are willing to pay for them to be safeguarded, enhanced or restored;
- **'sellers'**: land and resource managers whose actions can potentially secure supply of the beneficial service;
- **'intermediaries'**: who can serve as agents linking buyers and sellers and can help with scheme design and implementation; and
- **'knowledge providers'**: these include resource management experts, valuation specialists, land use planners, regulators and business and legal advisors who can provide knowledge essential to scheme development.

It is important to note that some organisations could conceivably play different roles in different PES schemes. For example, a wildlife charity might: sell ecosystem services in its role as a land owner or custodian; take on the role of intermediary to facilitate delivery of a PES scheme; buy ecosystem services on behalf of its membership; or provide knowledge and advice on appropriate management practices.

The way that buyers and sellers can be configured in scheme development can also vary. For example:

- **'one-to-one'**: for example, where a company enters into a contract with a single major land-owner to provide enhanced carbon sequestration;
- **'one-to-many'**: for example, where a water utility makes arrangements via a broker to pay many farm businesses for water-sensitive management practices in a key catchment;
- **'many-to-one'**: for example, where multiple buyers together invest in the development and maintenance of urban green space; and
- **'many-to-many'**: for example, where government pays farmers for sympathetic land management practices on behalf of the wider public.

These configurations are illustrated in Figure 6. For any of these configurations, an intermediary or broker may form a key part of the PES scheme and undertake various tasks including overall scheme administration. In particular, where multiple suppliers or buyers are involved, the intermediary may act on their behalf to arrange exchange and distribution of payments.

Key aspects of scheme design

The mode of payment is one of the key variables in PES design. A distinction can be drawn between 'output-based' and 'input-based' payments:

- **'Output-based' payments** are made on the basis of actual ecosystem services provided. For example, payments might be made for a certain level of carbon sequestration or a measured increase in biodiversity. In an ideal world, output-based payments would form the basis for all PES schemes.
- **'Input-based' payments** are made on the basis of certain land or resource management practices being implemented. For example, payments might be made for the creation and maintenance of buffer strips along watercourses or the restoration and upkeep of green spaces in residential areas.

A PES scheme based on input-based payments will only emerge if buyers are content that the specified management practices will indeed deliver the required ecosystem services. In practice, input-based payments are more common than output-based payments as contracting for a prescribed level of ecosystem service provision may be impractical or unacceptable to the parties.

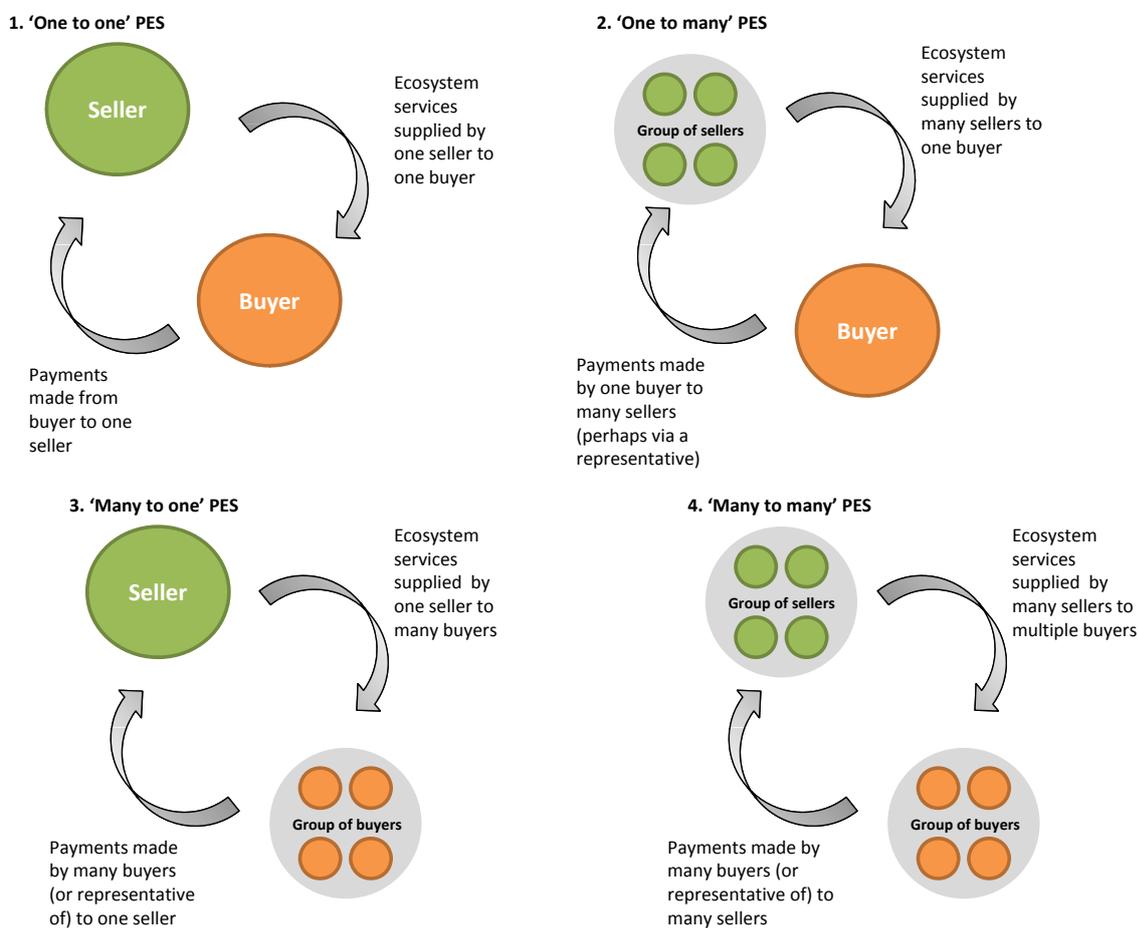


Figure 6: Possible configurations of PES schemes

A PES scheme can focus on more than one ecosystem service. Those services being sold are then described as having been 'packaged'. Ecosystem services can be packaged in three distinct ways:

- **Bundling:** a single buyer, or consortium of buyers, pays for the full package of ecosystem services that arise from the same parcel of land or body of water.

For example, an agri-environment scheme funded by government on behalf of the wider public. In this case, payments are made for the full suite of ecosystem services provided, as all will benefit some proportion of the population (eg landscape benefits may be felt by local people and water quality benefits by people across the relevant catchment).

- **Layering:** multiple buyers pay separately for the ecosystem services that arise from the same parcel of land or body of water; layering is also sometimes referred to as 'stacking'.

For example, an area of peatland is restored and yields a range of saleable ecosystem service benefits. The carbon sequestration benefits are purchased by a business, the water quality benefits by a water utility, the flood risk management benefits by the government on behalf of downstream

communities, and the biodiversity benefits by a wildlife charity on behalf of its membership. Although some examples of layered PES schemes exist, these remain somewhat hypothetical.

- Piggy-backing:** in this case, not all of the ecosystem services generated from a single parcel of land or body of water are sold to buyers. Instead, a single service (or possibly several services), is sold as an umbrella service, whilst the benefits provided by other services accrue to users free of charge (ie the beneficiaries 'free ride').

For example, a business pays an upstream land manager for riparian restoration work to reduce the downstream flood risk to its bankside facilities. These improvements simultaneously improve water quality, enhance recreational values and provide habitat for wildlife. However, no buyers are found for these additional services and the benefits they provide are received at no cost to end users.

These possibilities are illustrated in Figure 7.

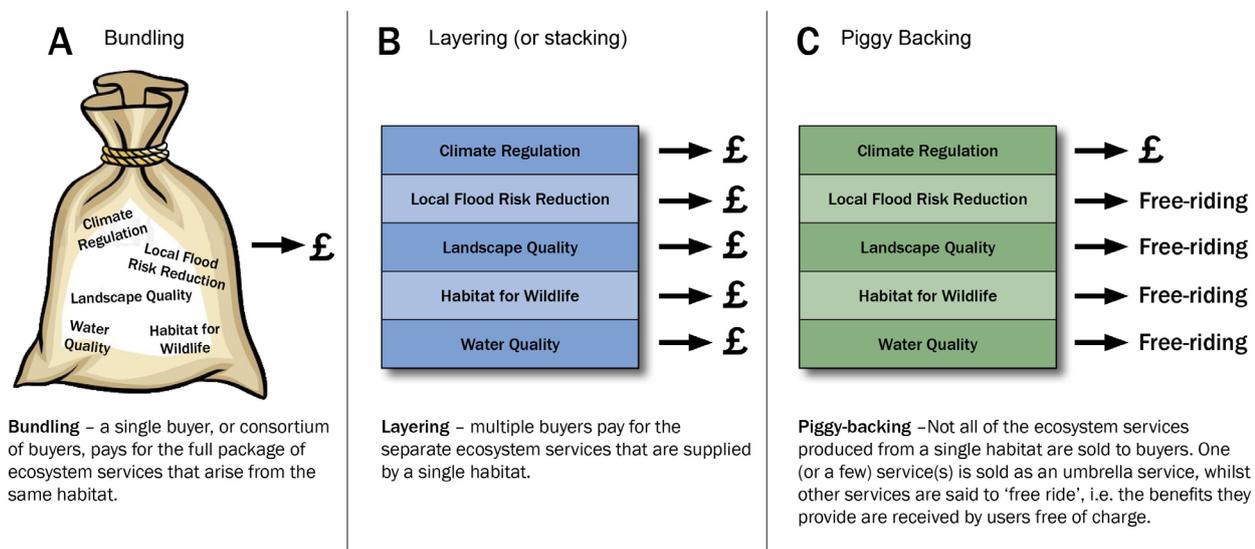


Figure 7: Different approaches to 'packaging' ecosystem services¹⁵

Opportunities and risks associated with PES

Crucially, PES schemes may provide the opportunity to contribute to wider environmental and sustainability objectives. For example, the government is promoting a catchment-based approach to the management of land and water, based on a mutually agreed vision developed by stakeholders within individual catchments and captured within 'catchment plans' which set out the road map for achieving future aspirations. A hundred Water Framework Directive Management Catchments have been defined across England and Wales (see Figure 8) and many water-related problems are best understood, and tackled, at the catchment scale. England is also divided into 159 distinct natural areas known as National Character Areas (NCAs) (see Figure 9), the boundaries of which follow natural lines in the landscape rather than administrative boundaries and so provide a further decision-making framework for the natural environment. Profiles will be available for each NCA and these include a description of the key ecosystem services provided by each area and how these provide benefits to people, wildlife and the economy as well as potential opportunities for positive environmental change. In seeking to establish a PES scheme, proponents should ideally take

into account the wider environmental and sustainability objectives reflected in catchment plans, NCA profiles and other initiatives, for example, local authority green infrastructure strategies. This will help ensure that PES schemes are consistent with existing goals and maximise their contribution to sustainable development. As such, the development of any PES scheme should ideally be informed by a clear **opportunities assessment**.

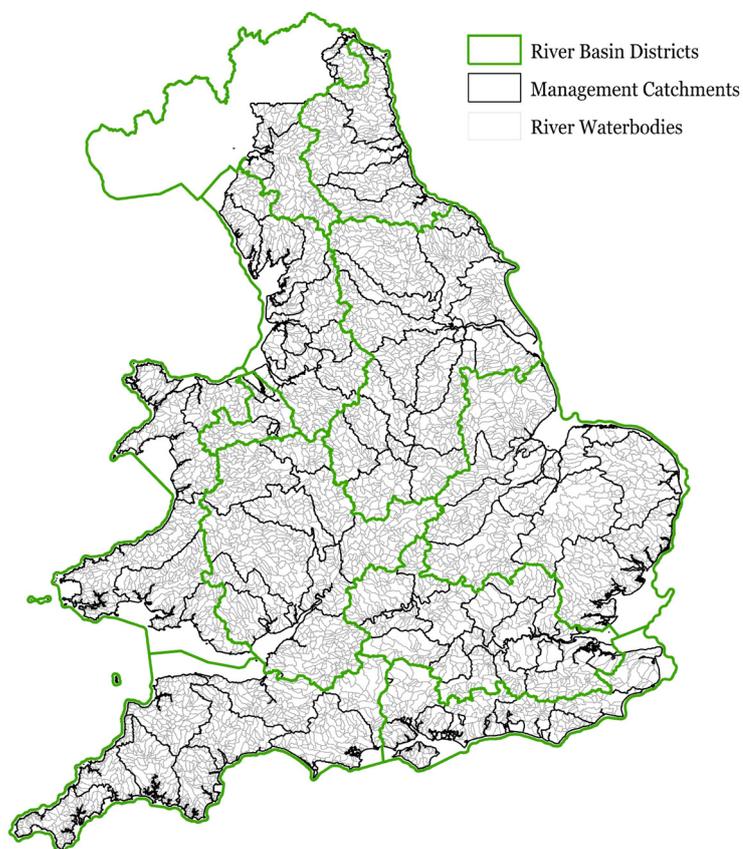


Figure 8: Water Framework Directive Management Catchments[†]

[†] Water Framework Directive (WFD) Management Catchments have been delineated by using WFD River Waterbody Catchments, which are often very small and localised, as 'building blocks' that have been aggregated together to form larger catchments of similar size, which have meaning for people on the ground. Map available from the Catchment Change Management Hub (<http://ccmhub.net/>).

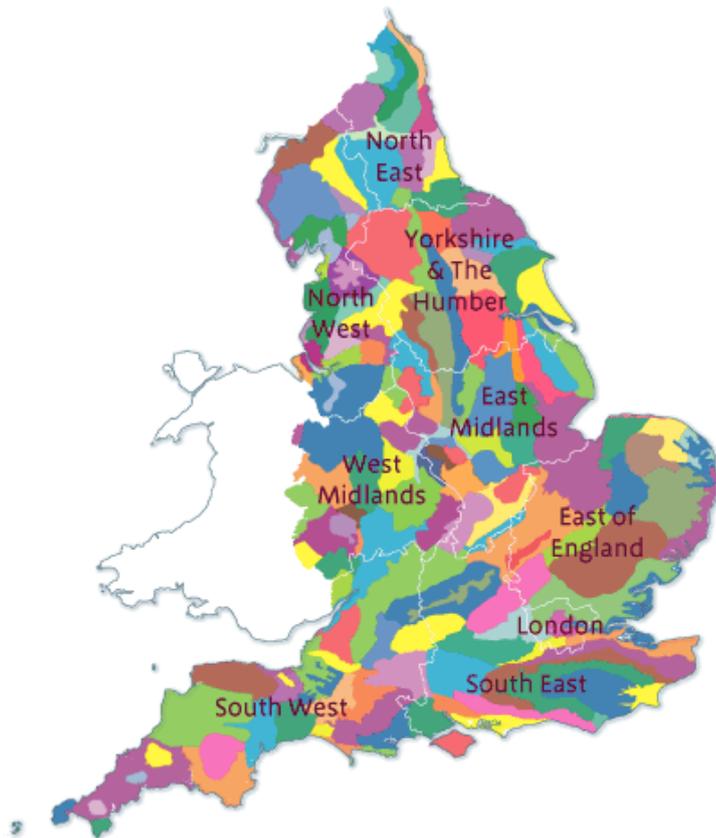


Figure 9: National Character Areas¹⁶

In seeking to establish a PES scheme, it is also critical to explore possible unintended consequences. Factors to consider include:

- Is there a risk that increasing the provision of an ecosystem service in one area will lead to pressure on ecosystem services elsewhere (leakage)? For example, payments for enhanced service provision on one parcel of land might provide the income needed to begin harmful activities on another or an adjacent land use may be intensified to compensate for reduced output in the area covered by the PES scheme.
- Is there a risk of the PES scheme being perceived as unfair? For example, to maximise the provision of additional ecosystem services, the funds available through a PES scheme would be best directed to those whose land or resources had the greatest potential to deliver additional services and away from those whose land or resources already provided the required services. This could lead to payments being made to land or resource managers who had not previously managed their land or resources in an environmentally-sensitive manner and so prompt accusations of unfairness.
- Is there a risk of creating perverse incentives? For example, land or resource managers paid to sequester carbon might plant non-native tree species which sequester carbon at a faster rate than indigenous species, yet broad swathes of non-native vegetation might lead to detrimental impacts on biodiversity and contribute to wider problems such as acidification, disease transmission or fire risk.

When designing PES schemes safeguards should therefore be put in place to minimise the risk of trade-offs and this, in turn, suggests that the development of any PES scheme should be informed by a comprehensive **risk assessment**.

Using this Guide

This Guide is intended to support the development of PES schemes and the four groups of PES actors:

- prospective **'buyers'** of ecosystem services;
- prospective **'sellers'** of ecosystem services;
- prospective **'intermediaries'** or 'brokers' of agreements linking buyers and sellers;
- prospective **'knowledge providers'**, who can support the development of PES schemes, including:
 - environment or community-based organisations that may be affected by, or interested in PES (and which could potentially occupy any one of the key roles);
 - researchers interested in the science underpinning PES;
 - legal specialists interested in land conservation agreements; and
 - economists interested in valuing ecosystem services.

The kinds of questions that these actors might ask include:

Buyer	Seller
"How can I secure the long-term provision of the ecosystem service that I depend on?"	"Is there a buyer for the additional ecosystem services that my land or water can generate?"
Intermediary	Knowledge provider
"How can I act as a 'broker' to facilitate the generation and sale of ecosystem services and so help protect the environment?"	"How can I help in ensuring that an appropriate and viable PES scheme is put in place?"

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. Policy-makers concerned with the contribution of PES to policy objectives may also be interested in the Guide as well as regulators concerned with the role and cost-effectiveness of PES.

Part 2 of the Guide sets out a step-by-step, practical approach to developing and implementing a PES scheme with reference to a series of case studies. The key case studies are briefly introduced in Table 1 and further information on each one can be found in the accompanying annex. It is important to note that while the case studies vary in the extent to which they satisfy the key principles of PES, they nonetheless provide useful insights for would-be scheme promoters.

Table 1: PES case studies referenced in the Guide ('B' = buyer, 'S' = seller and 'I' = intermediary)

Case Study	Who?	What?
Angling Passport (South West England)	B = Anglers S = Farmers & landowners I = West Country Rivers Trust	Landowners improve fishing beats through capital investment in infrastructure such as fencing and coppicing. Access to fishing beats is sold to anglers as tokens via the Westcountry Rivers Trust. Anglers deposit the tokens at fishing beats used; landowners then redeem the value of the tokens from the Trust.
Bonneville Environmental Foundation (BEF) Water Certificates (USA)	B = Private sector business S = Landowners with water rights I = Bonneville Environmental Foundation (BEF)	Enables private sector urban water users to invest in critically and chronically dewatered ecosystems. Water users purchase Water Restoration Certificates (administered by the BEF) which compensate landowners for transferring their water abstraction rights to serve environmental purposes; and importantly, to 'leave the water in the stream'.
Bush Tender (Australia)	B = Victorian State Government S = Landowners I = Victorian State Government Department of Sustainability and the Environment	Landholders competitively tender for contracts with Victoria State Government to be paid for protecting and improving the native vegetation on their land. The scheme uses a reverse auction-based approach, in which landowners propose conservation activities and their cost. The scheme aims to facilitate better management of native vegetation on private land.
Catskills (USA)	B = New York City S = Landowners in Catskills catchment I = Watershed Agricultural Council and Catskill Watershed Corporation	The New York City Department for Environmental Protection funds a Watershed Protection Program to provide high quality drinking water for nine million water consumers. Landowners in the Catskills supply catchment are paid to implement measures which reduce diffuse pollution.
English Woodland Grant Scheme - EWGS (England)	B = UK Government (Defra) S = Woodland owners I = Forestry Commission	Scheme aiming to sustain and increase public benefits through maintaining existing woodlands and investing in woodland creation. Six distinct grants are available to woodland owners.
Environmental Stewardship - ELS and HLS (England)	B = UK government (Defra) on behalf of taxpayers S = Farmers and landowners I = Natural England	Agri-environment scheme run by Natural England since 2005. Agricultural landowners and managers across England are paid for management practices that provide ecosystem services.
Lysekil Nutrient Trading Scheme (Norway)	B = Lysekil community S = Mussel farmers I = Community board	Trial scheme whereby payments were made to mussel farmers to encourage the cultivation of Blue Mussels which filter excess nutrients and reduce eutrophication, thereby improving water quality. However, a lack of demand for the mussels meant that revenue could not be guaranteed and the trial scheme was unsuccessful.

Case Study	Who?	What?
<p>Natural England Uplands Ecosystem Service Pilots (Lake District National Park)</p>	<p>B = Multiple (public and private) S = Land owners and managers I = Natural England and partners</p>	<p>Pilot in the catchment of Bassenthwaite Lake, taking an integrated approach to managing the catchment for multiple outcomes. This is a catchment-scale example of spatially prioritising land management actions for multiple ecosystem services through partnership working. Combines public and private funding sources (Environmental Stewardship, English Woodland Grant Scheme, water utility company investment).</p>
<p>Nurture Lakeland (Lake District National Park)</p>	<p>B = Visitors to Lake District National Park S = Local conservation projects I = Nurture Lakeland charity</p>	<p>Visitor Payback Scheme supporting the ecosystem services pilot in Bassenthwaite Catchment (see above). Visitors donate money to promote landscape management via participating local businesses, providing a mechanism for tourists who benefit from the natural environment to directly support it.</p>
<p>Pumlumon Project (Wales)</p>	<p>B = Biffaward and Waterloo S = Land owners and managers I = Montgomeryshire Wildlife Trust (MWT)</p>	<p>Scheme taking an economic-based approach to ecosystem management with landowners in the Cambrian Mountain range and addressing multiple ecosystem services. Scientifically validated monitoring ensures improvements to ecosystem service delivery are demonstrated to funders. Beneficiaries include residents downstream (water quality and supply), tourists and visitors, and the general public (carbon storage and sequestration).</p>
<p>SCaMP I (North West England)</p>	<p>B = United Utilities (UU) S = Tenant farmers on United Utilities land I = United Utilities and RSPB</p>	<p>The Sustainable Catchment Management Programme (SCaMP) takes a partnership approach to improving raw water quality and the condition of Sites of Special Scientific Interest (SSSI) within United Utilities' (UU) water supply catchments. UU incentivises tenant farmers to improve land management to deliver ecosystem services.</p>
<p>Slowing the flow at Pickering (North Yorkshire)</p>	<p>B = Defra, Natural England, Forestry Commission, North York Moors NPA, the Environment Agency and Ryedale District Council S = Private and public land owners I = Forest Research</p>	<p>A scheme investigating whether better land management can enhance flood protection for Pickering and deliver co-benefits for water quality, wildlife and soil protection. The scheme aims to achieve protection for 1 in 25 year flooding events through a mixture of land management measures and woodland creation. Multiple funding sources support the project on the behalf of beneficiaries such as local residents and businesses (flood protection).</p>

Case Study	Who?	What?
Upstream thinking (South West England)	B = South West Water S = Farmers in target catchments I = Westcountry Rivers Trust	Co-developed between South West Water and a broker (the Westcountry Rivers Trust) to encourage and/or incentivise farmers to implement land management actions to improve raw water quality, with many management measures locked into 10 or 25 year covenants.
US Conservation Rewards Programme (USA)	B = US government S = Landowning farmers I = Four US government agencies	Nationwide land retirement programme which incentivises landowners to change land use on highly erodible and environmentally-sensitive cropland and pasture via inverse auctions.
Vittel - PES for water quality (France)	B = Vittel (bottled water company) S = Farmers in source catchment I = Agriculture-Environment-Vittel (AGREV)	To address problems relating to the aquifer from which Vittel's bottled water is drawn, principally rising nitrate concentrations from agricultural intensification in the area, Vittel paid above-market prices to purchase land around its water springs and signed contracts with other farmers to use more sustainable dairy farming techniques and to improve farm facilities. The net result of these initiatives has been a reduction in non-point source groundwater pollution.
Wessex Water (South West England)	B = Wessex Water S = Farmers in the catchment I = Wessex Water	Wessex Water invests in catchment management for the benefit of improved raw water quality. An action plan aims to protect water quality in catchments serving Wessex Water abstraction points and to mitigate the impacts of low flows in rivers. Payments are made to farmers to implement improvements to farming operations which can contribute to improved water quality by reducing nitrates, phosphates, agrochemicals and sediment in surface run-off.
Woodland Carbon Code – Warcop Training Area pilot (Cumbria)	B = Retail companies and North Pennines AONB S = Ministry of Defence (MOD) I = Woodland Trust and Forestry Commission	The Forestry Commission's Woodland Carbon Code provides standards for woodland creation for carbon storage. This pilot was developed between the MOD and the Woodland Trust to develop new woodlands on MOD training areas at Warcop. Funding comes from retail companies wanting to mitigate carbon emissions and also from the North Pennines AONB.

Part 2 – Step-by-Step Advice on Designing and Implementing PES Schemes

Introduction

This part of the Guide sets out a phased approach to designing and implementing a PES scheme. Advice is also provided on identifying opportunities for developing PES schemes in the first instance. The Guide draws on practical experience in developing PES schemes and key messages are illustrated with reference to case studies wherever possible. The accompanying annex provides details of 17 case studies which could offer inspiration or models for scheme development.

A phased approach

The design and implementation of a PES scheme can be divided into five broad phases - see Figure 10.

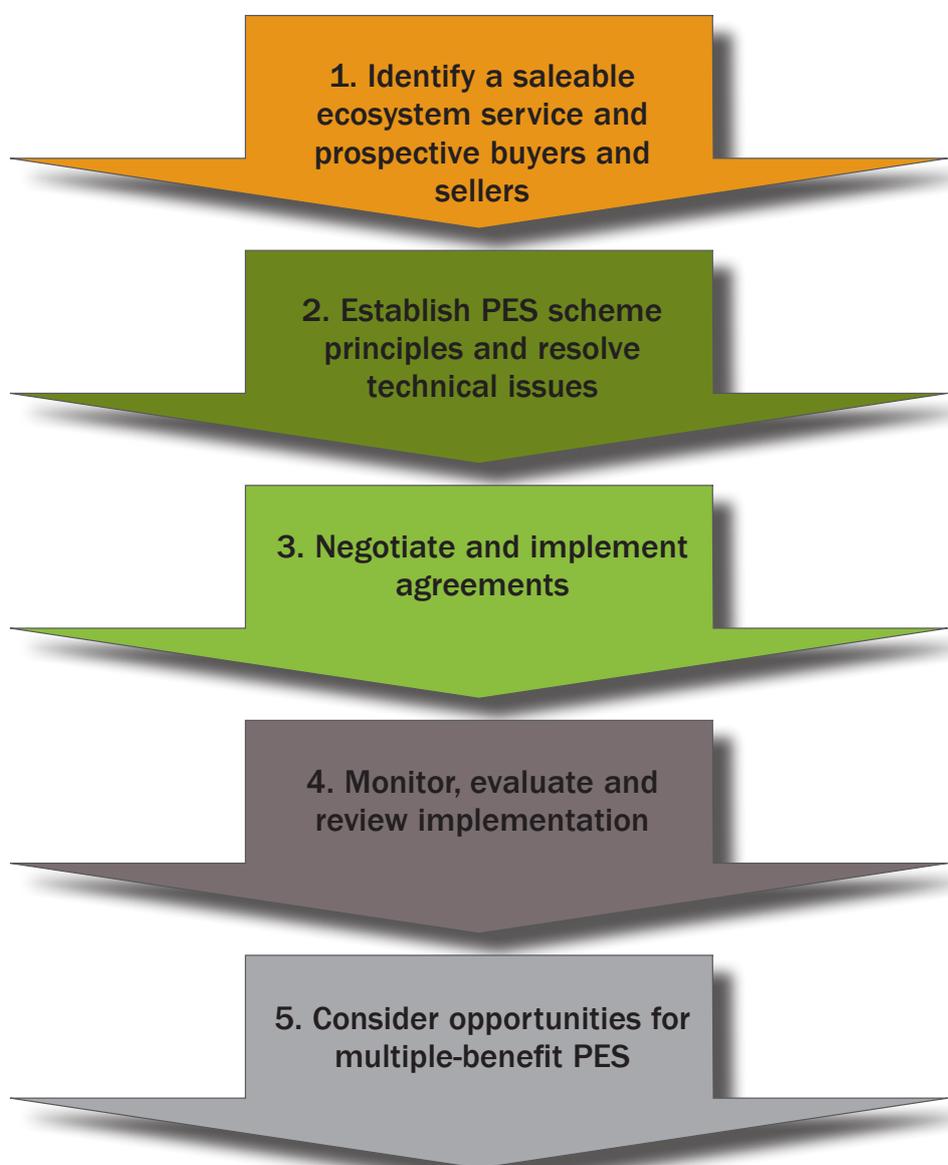


Figure 10: Five broad phases for designing and implementing a PES scheme

Although the consideration of opportunities for multiple-benefit PES is included as a final phase, in some cases it might frame scheme design from the very outset while in others it may be immaterial if a scheme is clearly premised on a single service. Developing a PES scheme may not necessarily be straightforward and, inevitably, feedback loops will exist between the different phases. In particular, monitoring, evaluation and review should facilitate adaptive management and appropriate revisions to the scheme.

PHASE 1: Identify a saleable ecosystem service and prospective buyers and sellers

The first phase involves determining the prospects for establishing a PES scheme in the first instance. This includes: identifying a potentially saleable ecosystem service(s) (ie a potentially deliverable service of value to at least one buyer); the range of possible buyers and sellers of that service(s); and the prospects for trade between them.

Identifying a saleable ecosystem service

In order to identify a saleable ecosystem service, there are three questions to consider. The ability to answer yes to all three is a prerequisite for the development of any PES scheme.

1. Are there specific land or resource management actions that have the potential to secure an increase in supply of the service?

In order to provide a level of service over-and-above what is already being provided, assuming at the very least that all regulatory obligations are being met, the means must exist to increase the supply of the service in question. A clear relationship must therefore exist between land or resource management intervention (cause) and service provision (effect). What is sold can be a directly measurable service (eg additional tonnes of carbon sequestered through peatland restoration) or a land use or other resource management intervention likely to promote service provision (eg wetland restoration to enhance water storage). Establishing cause-and-effect means that buyers can be confident that what is purchased will deliver the benefits required. While some resource management activities have well-documented links to increased service provision (eg in-field buffer strips can reduce pollution and promote water quality through slowing run-off and intercepting sediment¹⁷), others may require further research to establish their effects in practice (eg research on the links between woodland creation and flood management is being undertaken as part of the Slowing the Flow at Pickering project – see Box 2). Although further technical research may, in some cases, be a necessary precondition for scheme development, in other instances, buyers may be content to tolerate a degree of uncertainty around cause-and-effect if the weight of evidence suggests that benefits are likely to emerge. Nevertheless, the less realistic the scientific basis for a potential PES scheme, the more difficult it will be to attract buyers.

Box 2: Slowing the Flow at Pickering

Context:

Slowing the Flow at Pickering seeks to demonstrate how better land management can help to reduce flood risk in Pickering, North Yorkshire, and deliver other benefits to water quality, wildlife, and soil protection. The project aims to protect Pickering from up to 1 in 25 year flooding events through a mixture of management measures including flood storage bunds, debris dams and woodland creation. These measures aim to increase the time it takes for rain falling on the upper catchment to reach surface water running through Pickering.

The project began as one of three pilots funded by Defra in response to the Pitt Review of the 2007 floods in England and Wales, which called for Defra to work with partners to make better use of natural flood risk management opportunities. Pickering has been flooded four times in recent years with the last flood the most serious to date, causing damage to homes and businesses valued at about £7m.



One of >150 large woody debris dams constructed in woodland streams to 'slow the flow' (source: Forestry Commission)

Delivery:

This project is helping to establish the causal link between land use and land management changes in the catchment and local flood risk. In the past, inappropriate cultivation of arable soils, overgrazing of grassland, excessive moorland and forestry drainage, and poor river management contributed to flood risk in Pickering by promoting rapid rainwater runoff. The project is putting in place various measures, including low-level flood storage bunds, woodland creation and large woody debris (LWD) dams to slow down the rate at which rainfall on the upper catchment reaches the flood-prone surface waters flowing through Pickering. Forest Research performs the role of intermediary and knowledge provider, coordinating the various partners and undertaking mapping, monitoring, and evaluation work. Durham University also acts as a knowledge provider and has developed a coupled hydrological-hydraulic model, which simulates how each stream in the catchment contributes to flood risk downstream at Pickering. The outputs of the model are being used to identify optimum locations to slow run-off. The effects of the land use changes on the baseline are being assessed through evaluating monitoring data, which is being collected at the Environment Agency's river gauging stations and seven additional water level recorders installed by Forest Research.

Sources:

Reports and papers on the 'Slowing the Flow at Pickering' web pages of the Forestry Commission website (online) available [here](#).

2. Is there a clear demand for the service in question and is its provision financially valuable to one or more potential buyers?

Without a willing and able buyer, there is no prospect of a PES deal. Beneficiaries are most likely to consider entering into a PES agreement if they are experiencing problems with the supply of a particular ecosystem service (eg clean water, habitat for wildlife or greenspace for recreation). Moreover, PES may be attractive from a buyer's perspective if the payments are less than those associated with any alternative means of securing the desired service. Ultimately, there must be a clear demand for the service being proffered for sale, and its provision must be financially valuable to one or more buyers, ie their demand for it must be such that they are willing to pay to secure it. Furthermore, the buyer(s) must be in a position to at least cover the opportunity costs incurred by the seller(s) in providing the service (NB opportunity costs are discussed later in the Guide).

All of this presupposes that beneficiaries are aware of their dependency on particular ecosystem services. If beneficiaries do not recognise the value of these services to them, it is unlikely that a market will arise in the absence of intervention (most likely on the part of an intermediary/knowledge provider including government). As such, capacity building and outreach may be an important precursor to scheme development. For example, to promote Payments for Watershed Services (PWS) in the Upper Neuse River Watershed of North Carolina, the World Resources Institute (WRI) conducted a 'beneficiary analysis' that identified major users of water from a reservoir in the catchment. These included residents, universities, food and beverage companies, electronic and semiconductor companies, and manufacturers of health

care and textile products. WRI concluded that clear documentation of the risks that beneficiaries faced from water pollution, drought and watershed degradation would help jump-start their participation in emerging PWS programs (see Box 3).

Box 3: Payments for Watershed Services in the USA

The World Resources Institute (WRI) is piloting three Payments for Watershed Services (PWS) initiatives within two major watersheds in Maine and North Carolina, USA. While the project is not yet a functioning PES scheme, the focus so far on building demand for watershed services provides an important foundation and has highlighted several useful lessons.

One of the three pilots is in the Upper Neuse River Watershed where an approach to **beneficiary analysis** has been developed to identify the major public and private users of a reservoir within the watershed. A broad range of beneficiaries were identified through this analysis. These included universities, electric and semiconductor companies, healthcare and textile manufacturers, and food and beverage companies. A preliminary assessment was then prepared, which identified the water-related risks that these parties might face in future years, through, for example, water pollution, drought and watershed degradation. Importantly, this risk assessment was accompanied by an evaluation of the opportunities for economically-beneficial investments in green infrastructure, such as in the restoration and conservation of forests. The next stage of the project will be to identify those green infrastructure options most relevant to the circumstances of particular users.

Key lessons learnt at this stage include:

- Identifying the key beneficiaries of an ecosystem service, and helping them to understand the risks they face if those services are degraded, is vital if they are to invest in a PES scheme.
- A broad range of users may emerge from a beneficiary analysis of an ecosystem service. It is important to identify the needs and interests of these users as they relate to the service, and then to design PES schemes tailored to specific users.
- It is important that the demand for improved watershed services is robust and likely to continue over the long term. Otherwise there is a risk that buyers will reduce or stop payments and that the transaction costs associated with setting up the PES scheme will not have been worth it.

Sources:

Talberth, J., Gray, E., Branosky, E and Todd, G (2012). Insights from the Field: Forests for Water (online) available [here](#).

Gray, E and Talberth, J (2012). Payments for Watershed Services: Pilot Projects for Watershed Protection (online) available [here](#).

University of North Carolina (2012). Upper Neuse River Basin Watershed Protection Revenueshed Analysis (online) available [here](#).

3. Is it clear whose actions have the capacity to increase supply of the service in question?

The complex nature of ecosystem service provision means that it can be difficult to identify which land uses and/or managers are providing a particular service(s). As such, identifying who should be paid can be potentially problematic. For example, determining those land managers whose land plays a key role in water purification may necessitate monitoring over an extended period of time which could, in turn, significantly increase the costs associated with a scheme or significantly delay its inception. In the case of biodiversity, the impacts of individual actions can be hard to separate from those undertaken on neighbouring landholdings¹⁸. In some cases, catchments may serve as a useful basis for facilitating negotiations between beneficiaries and providers since the geographical boundary is relatively clear and the linkages between management practices and service provision are also relatively clear even if the specific contribution of each individual land manager is not.

Box 4 illustrates the three prerequisites for the development of a PES scheme with reference to the Catskills Long-Term Watershed Protection Program in the USA.

Box 4: Catskills Long-Term Watershed Protection Program, USA

Context:

Since the 1980s there have been concerns about the quality of the drinking water supplied to New York City. Increasingly intensive agricultural practices in the Catskills watershed caused non-point source pollution issues that water quality regulations were proving ineffective in resolving. To address this challenge, the New York City Department for Environmental Protection (NYC DEP) implemented a PES scheme to maintain and protect the source of the city's drinking water. The way in which the three key prerequisites for a PES scheme were met in respect of the Catskills scheme are set out below.



Source: New York City DEP

(1) management actions have the capacity to increase service supply

- A clear relationship was established between three land use management interventions that could secure provision of the ecosystem service. Pollution in the catchment was reduced through acquiring environmentally-sensitive watershed lands; purchasing conservation easements on land in the catchment in return for landowners surrendering development rights; and helping farmers with the development and implementation of comprehensive pollution prevention plans.

(2) a service of value to one or more buyers

- Clear beneficiaries were identified: the nine million consumers of the urban water supply in New York City.
- Beneficiaries are dependent on the ecosystem service provided by the Catskills as this is the primary source of water for the city. An alternative means of achieving the necessary level of water quality for public supply was the construction of a water filtration plant estimated to cost \$8-10 billion (with substantial operational expenditure) thus making the value of the ecosystem service clear.

(3) a service over which potential sellers have clear influence

- A clear ecosystem service was defined: maintaining water quality in the Catskills watershed through reduced pollution from nitrates, phosphates and agrochemicals.
- Individual providers were identified: landowners and farmers within the Catskills watershed.

Sources:

Appleton, A.F. (2002). How New York City used an Ecosystem Services Strategy carried out through an Urban-Rural Partnership to preserve the pristine quality of its drinking water and save billions of dollars (online) available [here](#).

Identifying potential buyers and sellers and other actors

If the three prerequisites for PES can be satisfied, there may be the potential for a PES scheme to be established. In answering the three questions, potential scheme proponents will already have a reasonable understanding of the potential actors involved, particularly the potential buyer(s). However, it will also be important to identify other actors, particularly intermediaries and knowledge providers, relatively early in scheme design as they can play a key role in facilitating scheme emergence. The four principal groups of PES actors are further introduced below and Figure 11 provides examples of each of the four groups.

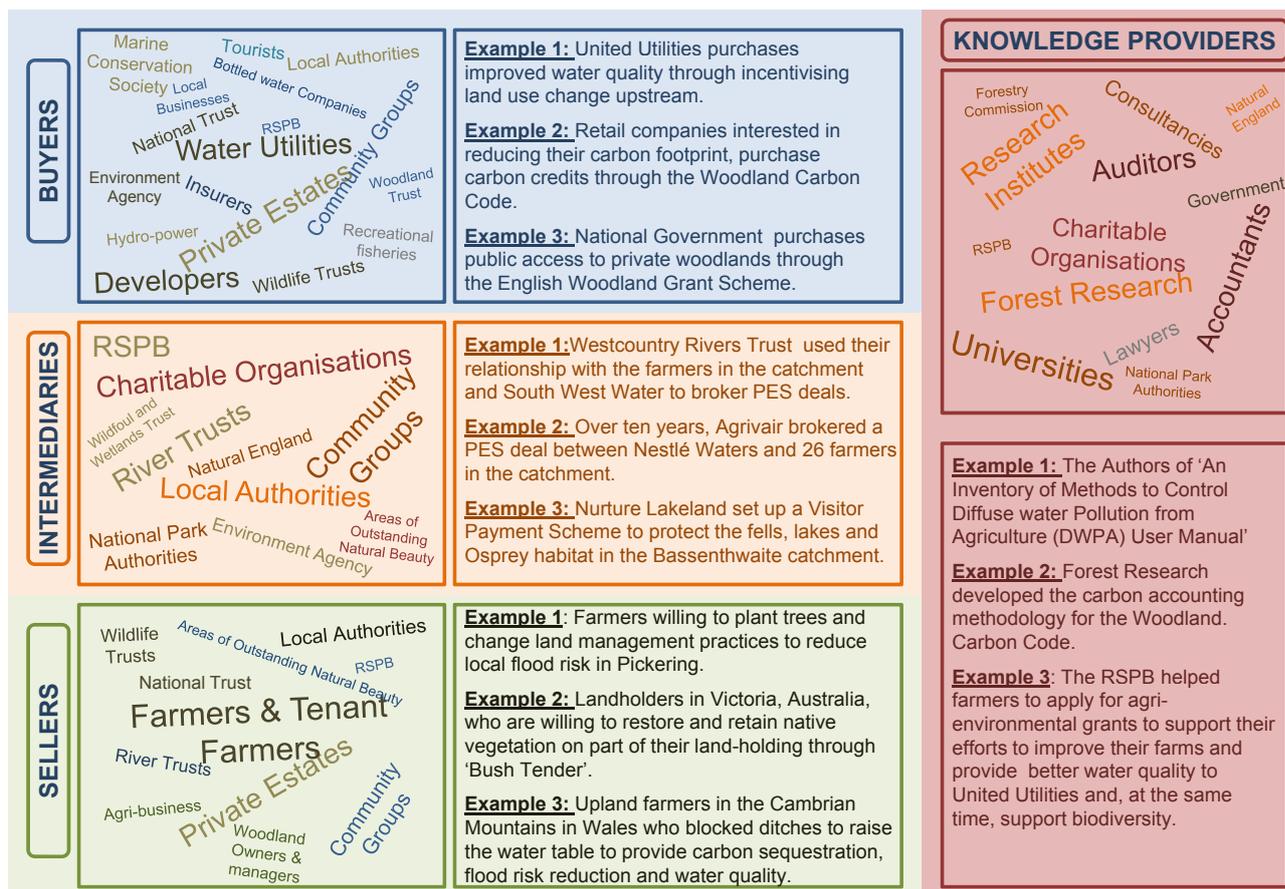


Figure 11: Potential PES actors

Buyers

Buyers of ecosystem services can be broken down into three broad types:

- **'Primary buyers'**, including private organisations and individuals who benefit directly from, and pay directly for, improved ecosystem service provision (eg reduced flood risk, clean water, recreational access, etc);
- **'Secondary buyers'**, including organisations that buy improved ecosystem service provision on behalf of sections of the general public. Secondary buyers can include water utilities, insurance companies, NGOs, etc; and
- **'Tertiary buyers'** who purchase improved ecosystem service provision on behalf of the wider public, ie the government.

Buyers might also include businesses that are generally keen to invest in ecosystem service provision from a Corporate Responsibility perspective.

Sellers

Sellers are predominantly landowners and resource managers including:

- farmers;
- agribusinesses;
- institutional landowners (examples might include Crown Estate, Forestry Commission, Ministry of

Defence, the National Trust, local authorities, utility companies);

- large estates;
- woodland owners
- pension funds;
- environmental organisations (examples might include RSPB, the Wildlife Trusts, the Woodland Trust); and
- shoreline owners and management authorities.

Sellers can be either individual landowners or resource managers or organised groups acting collectively.

Intermediaries

Successful PES schemes often involve intermediaries, or 'honest brokers'. These can perform a variety of tasks including¹⁹:

- helping sellers assess an ecosystem service 'product' and its value to prospective buyers;
- introducing buyers and sellers and building rapport between them;
- establishing ecosystem service baselines and the scope for additionality;
- identifying specific resource management interventions that will deliver service provision;
- aggregating multiple landowners/managers for more complex schemes;
- assisting in determining prices, accessing grants, structuring agreements and agreeing a mutually acceptable payment regime;
- activities related to implementation (including monitoring, certification, verification, etc); and
- overall scheme administration.

An evaluation of the Vittel PES scheme in France concluded that *"Trust-building through the creation of an intermediary institution (locally based and led by a "champion" sympathetic to the farmers' cause)"* was a fundamental condition of success.²⁰

Knowledge providers

Knowledge providers include a wide array of specialists whose responsibilities and expertise can help facilitate scheme development. These include:

- scientists researching ecosystem service provision (eg the authors of the NEA, the Centre for Ecology & Hydrology, Forest Research) who can, in particular, help demonstrate the links between land or resource management interventions and ecosystem service outcomes;
- resource management specialists;
- statutory environmental bodies (eg English Heritage, Environment Agency, Forestry Commission, Natural England);
- local authorities (eg planning departments);
- agricultural and rural valuers;
- representative bodies including the National Farmers Union and the Country Land & Business Association which have close links to potential sellers; and

- legal advisors (eg in relation to contracts).

Other interested parties in PES may include regulators (eg Ofwat, the Drinking Water Inspectorate) as well as organisations interested in promoting PES schemes in their areas including catchment-level partnerships, Local Nature Partnerships and the partnerships overseeing Nature Improvement Areas.

Box 5 introduces the range of actors involved in the BEF Water Restoration Certificates scheme in the USA.

Box 5: BEF Water Restoration Certificates, United States

<p>Rationale: In the US, thousands of miles of rivers, streams and wetlands are critically dewatered due to over-abstraction of water by landowners with 'senior water rights'. The Bonneville Environmental Foundation (BEF) set up the Water Restoration Certificate (WRC) scheme to allow private sector water users to invest in the restoration of dewatered rivers through purchasing WRCs. Each WRC represents 1000 gallons of water that water-right holders leave in the stream rather than abstracting.</p>	 <p>Landowners were abstracting water from Prickly Pear Creek at unsustainable levels, which resulted in it running dry during the summer months (Source: BEF)</p>
<p>Delivery:</p> <p>i. Buyers Purchasers of WRCs are corporations seeking to reduce their residual water footprint. They include high tech companies, brewers, beverage companies, outdoor retailers and sports teams.</p> <p>ii. Sellers Landowners abstracting water from the waterways, predominantly comprising farmers with 'senior water rights' which they risk losing if they do not use the water.</p> <p>iii. Intermediaries WRCs are created by the not-for-profit BEF which acts as an intermediary between buyers of restoration credits and sellers who reduce their abstraction in return. BEF approaches corporations, businesses and individuals to offer WRCs and contracts water trust organisations to undertake the water restoration projects.</p> <p>iv. Knowledge providers BEF works with water trusts and other NGOs across western America with specific geographical expertise. The National Fish & Wildlife Foundation (NFWF) certifies and endorses the standards used by BEF for selecting projects. NFWF also reviews potential projects based on the extent to which they satisfy the established criteria.</p>	
<p>Sources: Harmon, R. (2012). How the market can keep streams flowing (online) available here. Bonneville Environmental Foundation (online) available here.</p>	

Assessing the prospects for trade

There are a wide range of situations which might provide the impetus for trading to take place and for PES schemes to emerge, for example:

- where there is a **deficit** in the supply of an ecosystem service (for example, recreational services in the vicinity of heavily urban areas);
- where the supply of an ecosystem service is under **threat** (for example, the provision of habitat for wildlife as a result of changes in agricultural practice);

- where there is an opportunity for land managers to **increase the supply** of an ecosystem service (for example, carbon sequestration through woodland creation);
- where the **science** of ecosystem service provision improves and clearer links emerge between land management activities ('cause') and beneficial outcomes ('effect') (for example, the links between land management and declines in bee populations);
- where a beneficiary has a clear **dependency** on the provision of an ecosystem service (eg water quality regulation on the part of water utilities);
- where the **costs of an alternative** means of securing the supply of an ecosystem exceed the costs associated with a PES scheme (eg where water treatment facilities are more expensive than incentivising changes in upland land management activities – a 'grey/green trade-off');
- where a change in government **policy or regulation** increases the demand for an ecosystem service (eg where climate change targets prompt businesses to invest in carbon sequestration);
- where **new housing or employment development** creates a pool of potential buyers that might be willing to pay for the provision of green infrastructure;
- where **investment in ecosystem services** offers businesses a means to manage stakeholder expectations or promote Corporate Responsibility; and
- where means emerge to **aggregate** buyers and/or sellers of ecosystem services and establish PES schemes where this would be previously challenging (eg where an intermediary is able to establish a pool of willing land managers and co-ordinate service delivery).

As an example, the development of Upstream Thinking, a PES scheme co-developed by South West Water and the Westcountry Rivers Trust, was driven by several factors including: the threat to the supply of an ecosystem service (raw water quality from diffuse agricultural pollution); the dependency of the beneficiary on the provision of an ecosystem service (South West Water on water quality); the cost of alternative means of securing an ecosystem service (the cost of additional water treatment facilities to South West Water); and the means to aggregate sellers of ecosystem services (through the Westcountry Rivers Trust's longstanding relationships with farmers in relevant catchments).

As a further example, the development of the Woodland Carbon Code was driven by a series of factors including: an opportunity for land managers to increase the supply of an ecosystem service (carbon sequestration through woodland creation); advances in the science of ecosystem service provision (the capacity to gauge carbon sequestration through woodland creation, eg using the 'Carbon Lookup Tables' developed by the Forestry Commission); and changes in government policy or regulation (for example, organisations that invest in, or are directly associated with, projects certified according to the Woodland Carbon Code are able to report these carbon savings as part of their net emissions under the government's greenhouse gas emissions reporting guidelines).

Establishing a **business case** which sets out the justification for initiating a PES scheme will be critical, particularly where funding needs to be secured to cover initial start-up costs. For example, to establish the business case for the Peatland Carbon Code, the scheme proponents undertook market research to gauge the extent to which the private sector would be willing to invest in peatland restoration as a means to sequester carbon – see Box 6.

At this point, it is obviously important to consider how the scheme will be **financed**. There are two categories of costs to consider: short-term design and capacity building costs; and longer-term implementation costs which cover the payments necessary to generate additional ecosystem service provision. In particular, the design and capacity building stage may require a relatively large sum of up-front finance. Up-front costs may include funding for research (for example, to create metrics for

measuring ecosystem service outcomes); data collection to establish the baseline position; stakeholder engagement; and contract preparation. If participation in the scheme entails high initial costs on the part of sellers (for example, to create new habitat), scheme proponents will also need to consider the need to 'frontload' payments in the early years of the scheme and plan accordingly. In addition, if finance is limited, proponents may need to consider prioritising between potential sellers to maximise ecosystem service benefits. The longer-term implementation costs will need to cover the actual payments for ecosystem services as well as the costs of maintaining the scheme itself (eg the costs of monitoring, evaluation and review).

The **transaction costs** associated with PES schemes can be potentially substantial and every effort should be made to minimise these. Potential measures might include using existing payment and cost recovery schemes, or aggregating buyers or sellers. For example, small woodland creation projects may come together in a group scheme for the purposes of certification to the Woodland Carbon Code in order to make the process more cost-effective for smaller projects.²¹

Early in scheme preparation, those leading development will need to determine the most appropriate means for bringing together potential buyers, sellers, intermediaries and knowledge providers. The aim in assembling the different players should be to generate and exchange ideas, build trust and, ideally, establish a willingness to explore and pilot opportunities to trade services. In the case of the Vittel PES scheme in France, the approach focused initially on understanding the history, geography and social characteristics of the area; scientific and economic research were only introduced later after a dialogue had been successfully established between Vittel and the farmers, compatibility between farmers' and Vittel's objectives had been demonstrated, and the idea of a mutually-beneficial partnership accepted.²² Generally speaking, once the central principles behind the development of a scheme have been established on the basis of consensus, the technical steps that follow are likely to be considerably easier to implement.

Box 6: Developing the Peatland Carbon Code

Context:

A UK Peatland Carbon Code is being developed to provide an open, credible and verifiable basis for business investment in UK peatland restoration. The Code will assure that restoration delivers tangible benefits for climate change, alongside other benefits such as restoring habitats for protected species and improving water quality. The Code aims to encourage early investment in peatland restoration to help demonstrate peatland benefits and build a more robust evidence base and methodology for future carbon funding initiatives during Code development.

In the first instance the UK Peatland Carbon Code is designed to facilitate business investment including with respect to Corporate Responsibility and is not intended for use in offset schemes, corporate carbon accounting or to be traded on international carbon markets. However, the Code provides guidance on quantifying climate and other benefits, so that it may be possible to count these benefits in corporate carbon accounts or trade on carbon markets in future, if government guidelines and rules allow. It may also be possible to trade these benefits in future through additional verification (e.g. by Verified Carbon Standard) to access voluntary carbon markets.

Peatlands are the UK's largest soil-carbon store and substantially exceed the total carbon stored in living biomass. Peatlands sequester carbon slowly over millennial timescales, but in their damaged state they can release this carbon store rapidly. The International Union for the Conservation of Nature's (IUCN) Commission of Inquiry on Peatlands highlighted in 2011 that around 80% of UK Peatlands have been damaged in some form. In recent years however, restoration techniques have been developed and used across the UK that can help repair the damage.

Using good practice restoration techniques, restoring damaged peatlands can help mitigate climate change by preventing carbon loss from these systems, whilst creating healthy peatlands that can absorb and lock up carbon dioxide from the atmosphere. Peatlands are also the UK's most extensive semi-natural habitats supporting internationally important wildlife. In addition, they are also source areas for the majority of the UK's drinking water, and degraded peatlands create water quality problems that restoration can safeguard against.

Across the UK there is considerable potential for peatland restoration with excellent demonstration projects. These include single sites managed by wildlife conservation charities and partnership projects involving several private and public land managers working together to restore large tracts of land. Market research suggests that investors are prepared to pay premium prices for local peatland carbon projects that provide additional benefits (in particular biodiversity) (unpublished).

Sources:

Bain, C.G., Bonn, A., Stoneman, R., Chapman, S., Coupar, A., Evans, M., Gearey, B., Howat, M., Joosten, H., Keenleyside, C., Labadz, J., Lindsay, R., Littlewood, N., Lunt, P., Miller, C.J., Moxey, A., Orr, H., Reed, M., Smith, P., Swales, V., Thompson, D.B.A., Thompson, P.S., Van de Noort, R., Wilson, J.D. & Worrall, F. (2011). IUCN UK Commission of Inquiry on Peatlands. IUCN UK Peatland Programme, Edinburgh.
Cris R., Buckmaster S., Bain C. and Bonn A (eds.) (2011) UK Peatland Restoration – Demonstrating Success. IUCN UK National Committee Peatland Programme, Edinburgh.

PHASE 2: Establish PES scheme principles and resolve technical issues

The second phase in developing and implementing a PES scheme involves establishing the principles that will underpin the scheme and resolving key technical issues. Prospective buyers and sellers may need to invest considerable time and effort in building sound working relationships and crafting a mutually beneficial deal.²³ Table 2 lists some of the key questions that buyers and sellers will need to address to negotiate a viable scheme. Resolving key technical issues is potentially the most resource-intensive step in scheme development and involves a range of tasks including: determining the scheme's geographical coverage; establishing the baseline; undertaking opportunities and risk assessments; identifying appropriate interventions; determining the mode of payment; and establishing arrangements for monitoring, evaluation and review. Building trust among the different parties will be critical for resolving these issues.

Table 2: Key questions for buyers and sellers

Buyers
What benefits are you likely to derive from the scheme? Are there any other more cost-effective means of securing the service(s) in question?
How much are you willing to pay for the service or services in question?
Would you be prepared to pay for specified land or resource management interventions or only actual changes in ecosystem service provision?
If you are content to pay for specified interventions, how much uncertainty in terms of the science of cause-and-effect are you willing to accept?
Would you prefer to deal with sellers directly or through an intermediary (broker)?
Do you understand the motivations of potential sellers and how best to engage them?
Over what timescale do you need to see ecosystem benefits emerge?
For how long are you willing to commit funds?
Do you require the outcomes of the scheme to be verified and/or certified by a third party?
Sellers
What is the value of your product to potential buyers?
What is the minimum level of payment would you will be willing to accept?
What payment terms would you expect? (eg would you want payments to be frontloaded?)
Would you be willing to part-fund certain interventions on the basis that they will also provide you with benefits?
Over what timescale are you willing to deliver ecosystem service benefits?
Will you require any training to implement the necessary interventions?
What, if anything, might disrupt your capacity to deliver the necessary interventions?
Would you be happy to potentially enter into a land conservation agreement?
Have you considered the possible impacts of the scheme on longer-term land values?

Establish PES scheme principles

It is advisable to map out early on the principles that will underpin the scheme as well as develop a project plan for delivering the scheme in practice. Table 3 sets out some of the key principles that will need to be established. A project plan might include, for example, the key deliverables, the responsibilities of the individuals or organisations involved and the project timeline including important milestones. The plan could also cover other aspects of scheme delivery including financial management and stakeholder engagement and communications.

Table 3: Establishing scheme principles

Ecosystem service(s):	Eg water quality, climate regulation, habitat for wildlife, landscape aesthetics
Buyer(s):	Eg Private company, government agency, environmental NGO
Seller(s):	Eg farmers, private woodland owners
Intermediary (where applicable):	Eg environmental NGO, government agency
Key knowledge providers:	Eg regulator, research centres
Geographical scale:	Eg catchment, sub-catchment, neighbourhood
Contractual period:	Eg ten years, 15 years, in perpetuity
Agreed interventions:	Eg buffer strips, hedgerows, tree planting, waste storage, facilities to promote public access
Measures to minimise trade-offs:	Eg monitoring framework
Any 'packaging' of ecosystem services:	Eg bundling, layering
Type of payment approach:	Eg input- or output-based payments, uniform or differentiated payments

In drawing up a project plan, scheme proponents should consider the range of issues set out below. However, it is important to note that a proportionate approach should be taken; for example, the institutional arrangements governing a neighbourhood-scale PES scheme are likely to be relatively straightforward.

- Should a **steering group** be established to oversee scheme development and implementation? Should this be supported by a **scientific advisory panel** to provide confidence in the scheme's capacity to deliver additional ecosystem service provision? In the case of the Woodland Carbon Code, for example, a Forestry Commission Steering Group was established supported by a Carbon Advisory Group to advise on the Code's development. The latter included members from the Forestry Commission, NGOs (Woodland Trust and RSPB), professional bodies from the forestry industry (ICF and ConFor) and independent advisors (including the former Sustainable Development Commission). A management group involving the Forestry Commission and experts and representatives from the forestry and low carbon investment sectors now oversees the Code's management following its launch in summer 2011.
- Is **primary evidence-gathering** a prerequisite for scheme development? For example, is original research demonstrating the links between management interventions and ecosystem service outcomes necessary to reassure prospective buyers or is existing evidence sufficiently persuasive? If new evidence proves inconclusive vis-à-vis the links between management interventions and ecosystem service outcomes, scheme proponents may need to revisit the approach to scheme design originally envisaged. Ultimately, much will depend on the level of certainty which buyers demand with respect to the delivery of ecosystem service benefits. If buyers are content to tolerate a degree of uncertainty in the first instance, the demonstration of links between management interventions and ecosystem service outcomes could, for example, be deferred and provide the focus for later monitoring and adaptive management.
- In schemes involving multiple buyers and/or sellers, who will be responsible for **liaison** with the various parties? Will the buyer(s) approach the seller(s) directly or vice-versa or will an intermediary (broker) act as the go-between? Is one 'anchor' buyer necessary to secure the participation of other buyers?²⁴ Are there existing organisations with strong links to sellers that could act as intermediaries? Is one intermediary sufficient or are multiple intermediaries necessary, for example to cover different geographical areas? The roles and responsibilities for two existing schemes are introduced in Box 7.
- Are the necessary **skills** in place to develop and implement the scheme? Establishing a PES scheme involves a range of activities, many of which may require specialist knowledge and expertise. These may include: establishing an ecosystem services baseline; identifying appropriate land management interventions; preparing a business case for investment on the part of buyers; negotiating potentially complex agreements extending over many years; handling financial transactions; and undertaking monitoring, evaluation and review. As such, establishing a PES scheme is likely to require a wide range of competencies including technical, financial, negotiating and engagement skills.
- Should the emerging scheme be **piloted** prior to being rolled-out more widely? For example, the Forestry Commission trialled the Woodland Carbon Code with reference to around a dozen woodland carbon projects working towards certification. This piloting process tested, amongst other things, the requirements of the Code and the application process and led to amendments to the Code prior to its launch.
- To what extent should the proposed scheme be subject to **consultation** with stakeholders and the public? For example, the draft Code of Good Practice for Woodland Carbon Projects (now known as the Woodland Carbon Code) was issued for public consultation in summer 2009. The launch of Upstream Thinking involved a series of evening workshops held in local pubs to inform people that the scheme was operational. These provided the Westcountry Rivers Trust (the scheme's broker) with the opportunity to advertise the nature of the scheme and discuss any potential issues or conflicts. It may be helpful to conduct a 'stakeholder analysis' in which all those likely to be affected by the scheme are

identified and subsequently prioritised for engagement according to their impact on the scheme and the impact of the scheme on them. A stakeholder engagement and communications plan can then be drawn up and implemented as part of scheme design.

- Who will be responsible for **monitoring** and **verifying** ecosystem service benefits? What level of monitoring will be sufficient to reassure buyers that benefits are indeed being delivered? What scale and frequency of monitoring will be acceptable to sellers? To ensure the scheme's credibility and promote investor confidence, it may be helpful if the ecosystem service benefits arising from the scheme are certified by an independent third party. In order that buyers (and, in some cases, their regulators) are provided with the appropriate level of certainty vis-à-vis the delivery of ecosystem service benefits, they should be involved in decisions over the extent of the monitoring undertaken.

Box 7: Organisational arrangements for the Pumlumon Project and Wessex Water's catchment management

Context:

In any PES scheme, getting the right individuals and organisations – particularly the buyers, sellers and intermediaries – arranged in a functional way is essential for further progress. Roles and responsibilities of the key actors will vary across PES schemes and need to be established to meet the challenges particular to each scheme.



Source: Montgomeryshire Wildlife Trust

Delivery:

i. Pumlumon Project (PP), Montgomeryshire, Wales

- The PP is run by Montgomeryshire Wildlife Trust (MWT) to incentivise landowners to provide multiple ecosystem services such as carbon storage and sequestration, tourism, reduced flood risk, improved water quality and habitat for wildlife.
- Ecosystem services are provided by multiple sellers including private landowners, farmers, Forestry Commission Wales, Crown Estate and MWT itself. These ecosystem services are bought by multiple buyers including charities, local and national governments, and statutory agencies.
- In order to deal with this complex arrangement, MWT has adopted a very flexible role, acting as the key intermediary. MWT facilitates arrangements between private sector/statutory agencies and landowners; undertakes monitoring and evaluation within the project areas; and acts as a direct buyer by developing agreements with farmers to carry out land management works.
- This flexible approach has allowed MWT to negotiate a payment mechanism with the Welsh Government whereby farmers within the project area already engaged in agri-environment schemes receive additional habitat-based payments.
- MWT is also seeking to expand the scheme and secure a significant increase in funding from private sector interests; promote better targeting of public payments; and incorporate the Welsh Glastir agri-environment scheme.

ii. Wessex Water's catchment management programme, South West England

- Developed by Wessex Water, a water service company, this project invests in catchment management and works with farm businesses to reduce pollution and improve water quality.
- One of the key challenges was developing a way of working between a private company and multiple farm businesses, a role which extends beyond the traditional behaviour of a private company.
- Wessex Water adopted the role of both buyer and intermediary, also using its internal expertise as principal knowledge provider. For example, the Wessex Water catchment team provides data demonstrating the relationship between groundwater contamination and land management to pinpoint where problems exist, enabling the company to engage with land managers to discuss potential improvements.
- Over the past seven years, strong relationships have been developed between Wessex Water and farmers in target catchments across the area by sharing best practice advice, investing expertise, aiding access to grant schemes and leveraging capital grants.
- Engagement is based on trust and mutual benefit, and payments are administered between the farmers and water company advisers. A positive relationship between buyers and sellers is therefore imperative.

Sources:

Montgomeryshire Wildlife Trust (2010), 'Living Landscapes' (online) available [here](#).

Reports on the Wessex Water web pages (online) available [here](#).

Personal communications from Ruther Barden at Wessex Water and Dr Liz Lewis-Reddy at the Montgomeryshire Wildlife Trust.

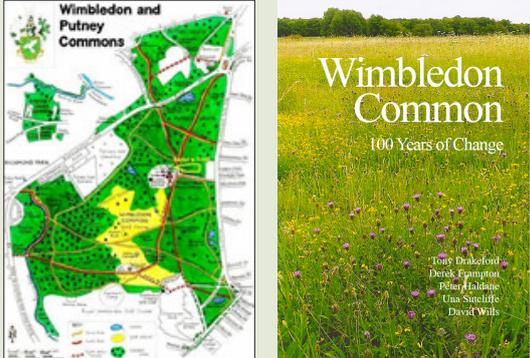
Technical issues

A wide range of technical issues need to be addressed in developing and implementing any PES scheme. Critically, the emphasis should be on undertaking sufficient technical work to allow a PES scheme to get up and running rather than focusing on excessive evidence gathering. This section sets out some of the key technical issues that may need to be tackled. Note these are not necessarily represented in chronological order and the sequence of tasks will vary between schemes.

Scale

Delineating the **geographical area** over which the PES scheme extends will be crucial. PES schemes can be established at a wide range of spatial scales, for example at national, regional, catchment, local and neighbourhood levels. Generally speaking, size can bring economies of scale (for example, lower running costs) and can help guard against leakage (see below). Smaller schemes, however, may have advantages including relative flexibility, more opportunities for targeting interventions, better prospects for engaging with individual sellers and reaching negotiated solutions as well as increased capacity for experimentation and learning and therefore adaptability. However, if a scheme is too small and includes insufficient sellers, there is a risk that unpaid providers might jeopardise service delivery. In some cases, the scale of a PES scheme will reflect the spatial scale at which the benefits of the ecosystem service(s) in question accrue. For example, the flood risk benefits arising from improved upstream management are likely to accrue at the catchment scale and a catchment might therefore represent a suitable geographical area for a PES scheme premised on flood risk management. As a further example, the cultural benefits arising from improvements in the management of green space are likely to accrue at the local scale and local - or neighbourhood-based schemes might therefore be appropriate. Box 8 introduces two local/ neighbourhood-scale PES schemes.

Box 8: Local/Neighbourhood PES schemes: Portbury Wharf Nature Reserve and the Wimbledon and Putney Commons Levy

Portbury Wharf Nature Reserve	Wimbledon & Putney Commons
	
<p>Source: Alicia Canter for the The Guardian</p>	
<p>Buyers: Persimmon Homes; Port Marine Residents Seller: Avon Wildlife Trust Intermediaries: North Somerset Council; Port Marine Management Ltd.</p>	<p>Buyers: Annual levy payers - local residents Sellers: Wimbledon and Putney Commons Conservators (WPCC), a registered charity Intermediaries: The levy is collected by Kingston, Merton and Wandsworth Borough Councils</p>
<p>Ecosystem services provided: Biodiversity; flood control; recreation</p>	<p>Ecosystem services - biodiversity (Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC)); recreation; water quality</p>
<p>Habitats: Urban, open waters, wetlands and floodplains</p>	<p>Habitats – Urban, woodland, scrubland, heathland, wetland (bog, Beverley Brook, nine ponds)</p>
<p>Developer Permission Homes gained planning permission to build new homes at Portishead on the condition from North Somerset Council that ecological impacts were mitigated by creating a nature reserve between the site and the internationally designated Severn Estuary.</p> <p>Persimmon Homes paid for the set-up costs of the reserve, with responsibility for the management of the site given to Avon Wildlife Trust (AWT). An intermediary, Port Marine Management Ltd., charges an annual levy to each of the 2,550 property owners on the site. This funds ongoing reserve management, including two dedicated AWT staff.</p> <p>The reserve has delivered improved habitat for a variety of species, such as water voles and great-crested newts. It also acts as a sponge, absorbing run-off from the new development, filtering pollutants, and offering flood protection in the event of a sea wall breach. It also provides for recreation and education eg dog walking, school visits, and community involvement in conservation.</p>	<p>Wimbledon and Putney commons contain about one million trees and provide open green space to the local community. The Wimbledon and Putney Commons Act 1871 lays a duty on the Conservators to:</p> <p><i>“keep the Commons for ever open and un-enclosed and un-built on, and to protect the turf, gorse, timber and underwood thereon, and to preserve the same for public and local use, for the purposes of exercise and recreation.”</i></p> <p>To fulfil these duties the Conservators have access to a budget of around £1.3 million, two thirds of which comes from the Commons Levy, which is paid by council tax payers in the Levy area. The Levy can be considered a PES arrangement in the sense that those who choose to live within 3/4 of a mile of the commons and therefore benefit from their proximity to numerous recreational and cultural services, are willing to pay for their protection.</p>
<p>Sources: The Guardian (2010). Residents fund nature reserve in new housing development (online) available here. Personal communication from Steve Grainger at the Avon Wildlife Trust.</p>	<p>Sources: Wimbledon and Putney Commons web pages (online) available here.</p>

Establishing the baseline

The **baseline** equates to the likely future provision of the relevant ecosystem services in the absence of the PES scheme. Establishing the baseline will be critical since this will facilitate accurate monitoring which will, in turn, indicate the level of additionality being delivered, thus reassuring buyers that the requisite services are indeed being provided. What the baseline 'looks like' will vary considerably from scheme to scheme. In the case of the Woodland Carbon Code, for example, the baseline is a projection of the changes to the carbon stock on the site in question in the absence of woodland creation going ahead. In the case of a PES scheme for enhancing water quality, the baseline might comprise a snapshot of water quality obtained from monitoring points within the relevant catchment supplemented by an analysis of current farming practices within the catchment (on the basis that the scheme would likely be premised on payment for certain environmentally-sensitive farming practices rather than changes in water quality per se). In the case of a neighbourhood-scale PES scheme in which local residents paid for a warden to maintain the biodiversity value of a local green space, the baseline would simply be the anticipated state of the green space in the absence of the warden.

In establishing the baseline, scheme proponents will need to determine the level of ecosystem service provision that sellers would reasonably have been expected to provide in future in the absence of payment. At a minimum, sellers should be expected to comply with existing regulatory requirements (for example, farmers in receipt of payments under the Common Agricultural Policy are required to keep their land in Good Agricultural and Environmental Condition, GAEC). However, it is conceivable that in some cases, for example in catchments where good environmental stewardship is the norm, that prospective sellers could reasonably be expected to manage their land to environmental standards somewhat beyond regulatory requirements. If this were the case, the bar could be set higher with payments consequently focused on more far-reaching interventions with corresponding ecosystem service benefits.

For more complex schemes, when establishing the baseline proponents may need to determine not only current levels of ecosystem service provision but also anticipate how these might evolve in the absence of the PES scheme (the 'business-as-usual' scenario). Foreseeing how ecosystem service provision might change in the future can be challenging but scheme proponents should consider the impact of natural ecosystem changes as well as variables including government policy, the impacts of climate change and changing commodity prices. It will be critical to engage all the key actors in the scheme in discussing and agreeing what constitutes the baseline as this will provide the basis for determining the level of additionality secured through the scheme and therefore its success.

Issues of land ownership and property rights

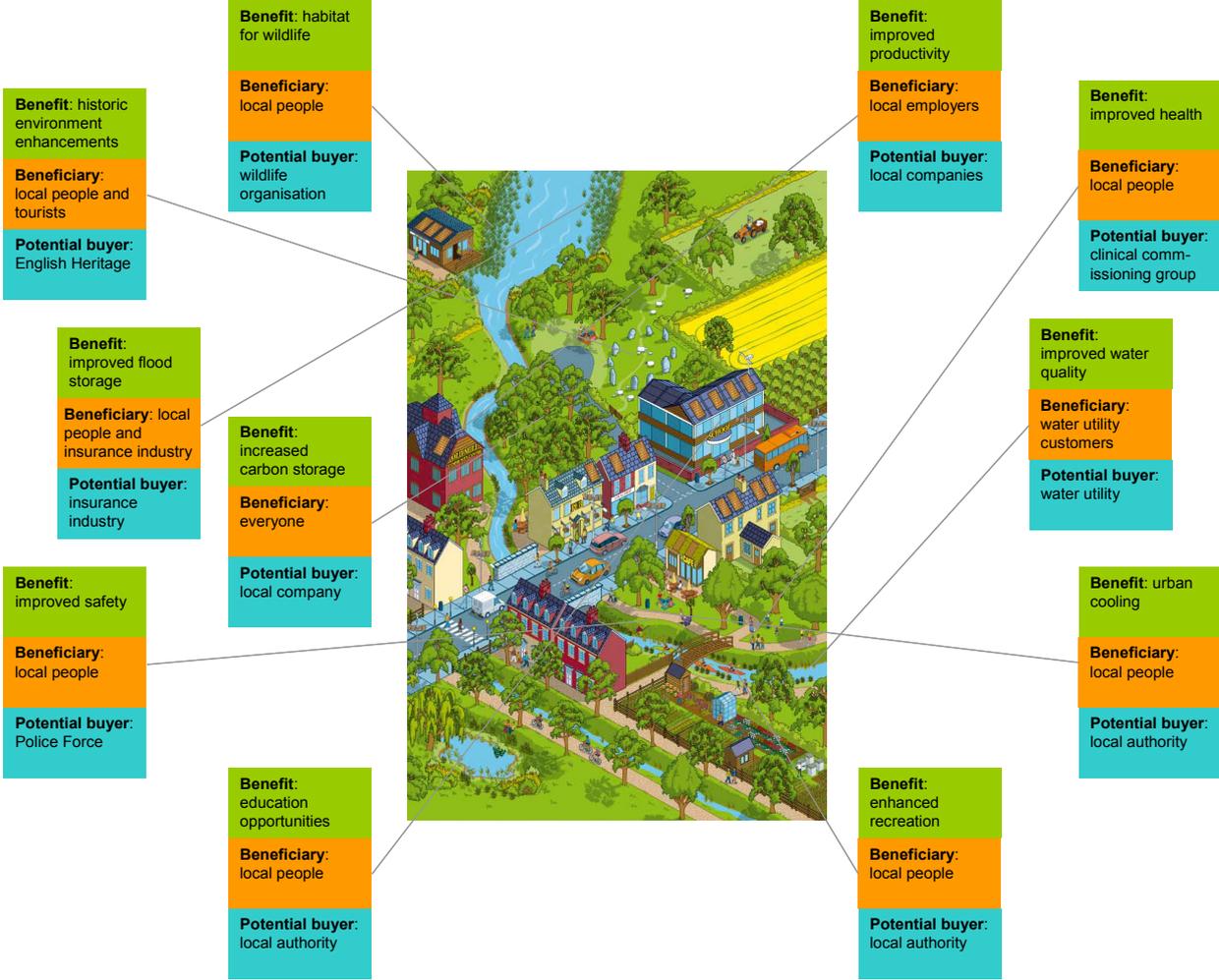
In seeking to establish a PES scheme several issues in relation to land ownership and property rights may arise. In some cases, several different parties may have interests in the same area of land and all may need to be engaged by scheme proponents. For example, a landlord may need to give consent for a tenant farmer to take part in a PES scheme and might seek to negotiate a share of the payment. Other parties affected may also include sporting tenants (in most agricultural leases sporting rights are reserved to the landlord and let separately²⁵). In some instances, it may be difficult to identify who owns certain areas of land considered important for delivering ecosystem services. The Land Registry, for example, is only able to provide details of owners of land or property if it is registered. Some land or resource managers may also be constrained in terms of the activities they can undertake. For example, tenant farmers may not be able to make particular changes under the conditions of their leases (for example, woodland creation). In some cases, complex and/or fragmented land ownership might present a significant challenge. In general, the greater the number of landowners that need to be aggregated, the greater the transaction costs and the more challenging it will be to reach an agreement.

Opportunities assessment

In designing a PES scheme, it might be helpful to undertake an **opportunities assessment**. This assessment could have at least three dimensions:

- A **review of relevant policies, plans, programmes, strategies and initiatives** to identify any wider environmental or sustainability objectives which the PES scheme might be designed to reflect and contribute to. These might include Regional Flood and Coastal Committees (RFCC) programmes for flood and coastal risk management projects, Marine Plans, River Basin Management Plans, Shoreline Management Plans, catchment plans prepared in accordance with the Catchment Based Approach, Higher Level Stewardship (HLS) activities in priority areas, Local Plans prepared by local authorities, Neighbourhood Plans, green infrastructure strategies and biodiversity offsetting schemes.
- A **beneficiary analysis** to identify all those who might benefit from the PES scheme. This analysis will help proponents ensure that all sources of potential funding have been explored and also reveal any opportunities to expand the scope of the scheme to deliver further benefits. Figure 12 illustrates the concept of a beneficiary analysis for a hypothetical PES scheme to fund and maintain the restoration of an urban river corridor. In practice, identified beneficiaries can be analysed according to their number; their reliance on the service in question; the extent of the benefits they might secure through the intervention; their engagement with the issues in question; their willingness to participate in a scheme; and their capacity to contribute financially (or possibly in-kind, for example through the provision of expertise).
- An analysis of available **funding streams** to identify potential sources of finance to bolster or extend the scheme. This reflects the Natural Environment white paper which argues that *“Landscape scale action requires partners to pool resources and get the best possible value from them”* and that *“partnerships often draw together funding from National Lottery distributors, and from environmental charities, business, local authorities and communities”*. Examples of potential funding streams include the Catchment Restoration Fund for England, the Catchment Sensitive Farming Capital Grant Scheme, the Community Infrastructure Levy, EU funding programmes such as the European Regional Development Fund and INTERREG, EWGS, Heritage Lottery Fund, HLS and Section 106 monies collected by local authorities from developers. PES schemes can also innovatively marry public and private money. For example, SCaMP has successfully combined money from United Utilities with agri-environment scheme funding. In the first phase of the project United Utilities paid £8m for capital improvement works (grip blocking, restoring moorland, livestock fencing etc) while the government contributed £2.5m through ongoing agri-environment support, mainly through HLS payments. Box 9 provides a further example of a scheme combining public and private funds. In the future it might be possible to envisage the creation of trust funds, for example at the catchment scale, through which a wide range of public and private beneficiaries funded numerous enhancement or restoration projects designed to yield multiple ecosystem service benefits.

Figure 12: Beneficiary analysis for a hypothetical PES scheme to fund the restoration and continued maintenance of an urban river corridor for multiple benefits



Box 9: Gowy Meadows, Cheshire

Gowy Meadows, Cheshire

Buyers: Essar Energy (previously Shell UK), Environment Agency and Natural England

Seller: Cheshire Wildlife Trust

Intermediary: Environment Agency

Ecosystem services provided: Biodiversity; flood risk management; recreation

Habitat: Freshwaters, lowland grazing marsh



Gowy Meadows site
(Source: Cheshire Wildlife Trust)

The Gowy Meadows site has a history of overgrazing and being heavily managed for drainage, and was no longer functioning as a flood plain for the River Gowy. An Environment Agency (EA) study highlighted the extra flood storage capacity that restoration of the site could provide. The Stanlow Oil Refinery is situated nearby on the flood plain and is at risk from both fluvial and tidal flooding. Following the EA study, a funding partnership was established between the landowners (then Shell UK now Essar Energy), the EA and Natural England to invest in the restoration of the site to lowland grazing marsh under the management of Cheshire Wildlife Trust (CWT).

The CWT leases the site from Essar Energy and works together with the EA to restore and manage Gowy Meadows as a nature reserve. The scheme delivers flood alleviation and water management benefits through the restoration of a network of drainage ditches to help manage the water table. Traditional grazing techniques deliver biodiversity benefits by creating ideal sward conditions for farmland and wetland birds and by controlling invasive species. 80ha of the site is designated as a Grade A Site of Biological Interest due to the rich flora and fauna that is now established in the ditches; for example 168 species of aquatic invertebrate were found in 2009.

Direct beneficiaries include Essar Energy and the public who benefit from reduced flood risk in the area and the CWT, who have had the opportunity to enhance the area's biodiversity, and visitors to site. School trips to the meadows also provide educational benefits. An EA report states that their strategy in the area is helping to encourage business and investment in Ellesmere Port, by providing a greener environment to live and work in.

Sources:

Natural Economy Northwest (2008). Case Study 2: Gowy Meadows Grazing project.

Defra and the Environment Agency (2005). The impact of flooding on urban and rural communities (online) available [here](#).

The Mersey Basin, Otters, Orchids and Oil (online) available [here](#).

Risk assessment

In designing a PES scheme, it is essential that proponents undertake a **risk assessment** to explore possible unintended consequences. Table 4 provides examples of questions that might be asked in a risk assessment as well examples of mitigation measures that could be reflected in scheme design.

Table 4: Risk factors and potential mitigation measures

Risk Factor	Potential mitigation measures
Is there a risk that increasing the provision of an ecosystem service in one area will lead to pressure on ecosystem services elsewhere (leakage)? (For example, is there a risk that farming on adjacent land might be intensified to compensate for reduced output in the area covered by the PES scheme?)	Ensure that arrangements for monitoring extend beyond the geographic boundaries of the PES scheme in order to assess the magnitude of any leakage and consider any potential conditions of contract that might be introduced to minimise leakage.
Is there a risk that land or resources will be managed to increase the level of a particular ecosystem service at the expenses of others (leading to trade-offs in service provision)?	The scheme should incorporate safeguards to minimise the risk of trade-offs. For example, new woodland certified under the Woodland Carbon Code must be managed in accordance with the UK Forestry Standard, including all the environmental and social aspects of this.
Is there a risk that the interventions will be too short-lived to deliver the necessary ecosystem service benefits (a lack of 'permanence')?	The scheme should incorporate safeguards to ensure the permanence of the interventions where possible. Under the Woodland Carbon Code, for example, the project land owner(s) must commit to a permanent land-use change to woodland and to maintain the project area as a permanent woodland carbon sink. Generally speaking, permanence can be encouraged through including 'no regrets' interventions within the PES scheme. These are measures which, from a seller's perspective, are 'worth doing anyway' (for example, to save on utility costs).
Is there a risk of creating perverse incentives (for example, creating a temptation on the part of land managers to plant non-native tree species which sequester carbon at a faster rate than indigenous species)?	The scheme should incorporate measures to minimise the risk of creating perverse incentives, for example guidelines on the way in which ecosystem service outcomes should be achieved and maintained.
Is there a risk that the land or resource management interventions proposed will fail to yield the anticipated ecosystem services leading to diminished confidence on the part of buyers?	If necessary, primary research should be undertaken to demonstrate the links between management interventions and ecosystem service outcomes ('cause-and-effect'). Ultimately, much will depend on the degree of uncertainty which buyers will tolerate. If the level of uncertainty is reasonably small, it may be possible to defer a more conclusive demonstration of cause-and-effect to the monitoring stage.
Is there a risk that changes in external factors (for example, rising commodity prices) might undermine the scheme?	Flexibility and the scope for adaptive management should be incorporated within PES schemes in order to accommodate external changes. Reasonably foreseeable external changes should be reflected in the baseline that will be used to gauge additionality.
Is there any risk of chance events such as fires or the arrival of invasive species which might undermine the agreed interventions?	If the risk of interventions being undermined is high, insurance should be considered as part of the scheme. Under the Woodland Carbon Code, for example, the project land owner(s) must demonstrate their commitment to permanence by replanting or undertaking compensatory planting should woodland area be lost due to wind, fire, pests, diseases or development.

<p>Is there a risk that payments might be targeted at the wrong land or resource managers because of shortcomings in the evidence base (for example, uncertainty as to whose land plays a critical role in water quality regulation)?</p>	<p>If necessary, primary research should be undertaken to identify whose actions have the capacity to increase supply of the service in question. If identification proves problematic it might be possible to aggregate clusters of sellers for payment (for example, sellers across a catchment).</p>
<p>Is there a risk of the PES scheme being perceived as unfair (for example, by directing payments towards land managers perceived to have inadequately stewarded their land in the past)?</p>	<p>In establishing the baseline it should be apparent if levels of existing land stewardship are markedly different and whether this has any implications for the distribution of payments to sellers. If there is a marked discrepancy, the bar may need to be set higher in terms of the interventions that qualify for payment. Alternatively, the scheme could encompass the offer of advice and assistance to those land or resource managers perceived to be 'lagging behind'.</p>

Identifying the right interventions

Identifying the right **interventions** is critical to the success of a PES scheme. First and foremost, there must therefore be a demonstrable link between the interventions proposed and the ecosystem service benefits of interest: *"Getting the science right is crucial and requires a clear understanding of the biophysical relationships between [land managers'] actions and their environmental consequences"*.²⁶ The strength of the relationship between intervention ('cause') and benefit ('effect') is key. In some cases, cause-and-effect may be reasonably well established. In the case of catchment management, for example, there is substantial literature detailing the effectiveness of measures for reducing diffuse water pollution (see Box 9). In other cases, there may be greater uncertainty. For example, the report of the Foresight Land Use Futures Project identified the need for better understanding of the relationship between land use and flood risk management: *"The extent to which changes in land management can 'mitigate' flooding at the catchment scale for extreme rainfall events remains unclear, although it is likely that rural land can contribute to flood alleviation by retaining and storing floodwaters in vulnerable catchments"*.²⁷ In cases where the relationship between cause-and-effect is subject to significant uncertainty, buyers may be reluctant to enter into a PES agreement. In these instances, primary research may enable scheme proponents to demonstrate a level of certainty sufficient to kick-start the scheme. In cases where the relationship is subject to a degree of uncertainty, buyers may nevertheless be content to enter into a PES contract if the weight of evidence suggests that a link exists or that the relationship can be later demonstrated through monitoring or further research. In these instances, buyers may be willing to commit to something of a leap of faith in the reasonable expectation of a return.

Box 10: Measures to control diffuse water pollution from agriculture

An Inventory of Methods to Control Diffuse Water Pollution from Agriculture – user manual (ADAS & IGER 2006)

This User Manual, published jointly by ADAS and IGER, describes 44 methods to control Diffuse Water Pollution from Agriculture (DWPA) through management of soil, fertiliser, livestock, manure and farm infrastructure. The 44 methods are appraised in terms of their effectiveness at reducing diffuse pollution and in terms of their cost. The document concentrates on three principal pollutants: nitrate; phosphorus (P); and faecal indicator organisms.

The 44 methods are presented in terms of:

- 1) description of the actions to be taken to implement the method;
- 2) broad reason for adopting the method as a means of reducing pollution;
- 3) detailed description of the processes involved and how the method may achieve a reduction in pollution;
- 4) assessment of the farming systems, regions, soils and crops to which the method is most applicable;
- 5) likely effectiveness of the method;
- 6) assessment of how easy the method is to adopt, how it may impact on other farming practices, problems with maximising effectiveness and possible resistance to uptake; and
- 7) estimates of how much it would cost to implement the method in terms of investment and operational costs.

Sources:

IGER & ADAS (2006) An Inventory of Methods to Control Diffuse Water Pollution from Agriculture (DWPA): User Manual (online) available [here](#).

In addition to delivering the ecosystem service of value to buyers, the selected intervention(s) must be cost-effective from the point of view of buyers (ie the payments for them must be less than those associated with any alternative means of securing the desired service); acceptable to sellers; and deliverable on the ground. Interventions must also be clearly visible and verifiable if payment is premised on the delivery of interventions rather than actual changes in ecosystem service provision (see below). It should be noted that some interventions, for example, tighter controls on pesticide use and storage, may represent 'win-win' solutions saving land managers money as well as alleviating pressure on ecosystems. As such, PES schemes could include targeted advice aimed at securing enhanced stewardship alongside payments for more significant interventions associated with clear opportunity costs.

Mode of payment

Once an appropriate intervention has been identified, proponents will need to determine whether the buyers pay the sellers for the actual ecosystem services provided (**output-based** payments) or for simply implementing the intervention (**input-based** payments). What is sold can therefore be a directly measureable service (eg additional tonnes of carbon sequestered through peatland restoration) or a land use or other resource management intervention likely to promote that service (eg peatland rewetting). The decision as to whether buyers should pay for the ecosystem service itself or a proxy management measure is an important design consideration. While output-based payments might apply in ideal world, in practice contracting for a prescribed level of service provision may be impractical or unacceptable, particularly to sellers. For example, a contract to plant and maintain a riparian buffer involves considerably less risk than a contract based on payments for ecosystem service benefits, ie improved water quality, which might be affected not only by changes in land management but also by factors such as drought or major rainfall that could wash soil and nutrients into watercourses. Input-based payments therefore present a perfectly acceptable alternative, assuming that the interventions in question are likely to yield the requisite increase

in service provision. Moreover, relying on a proxy management measure might represent a sensible, 'precautionary' strategy for dealing with uncertainty and incomplete information rather than a design drawback.²⁸ For a variety of reasons, including the cost of directly monitoring ecosystem service output, the influence of natural variations on supply and the difficulties in attributing changes in provision to individual sellers, most PES schemes rely on observable proxies. However, regardless of the approach taken – payment for direct ecosystem service outputs or observable proxies – some research will be required and, critically, consensus reached among PES actors.

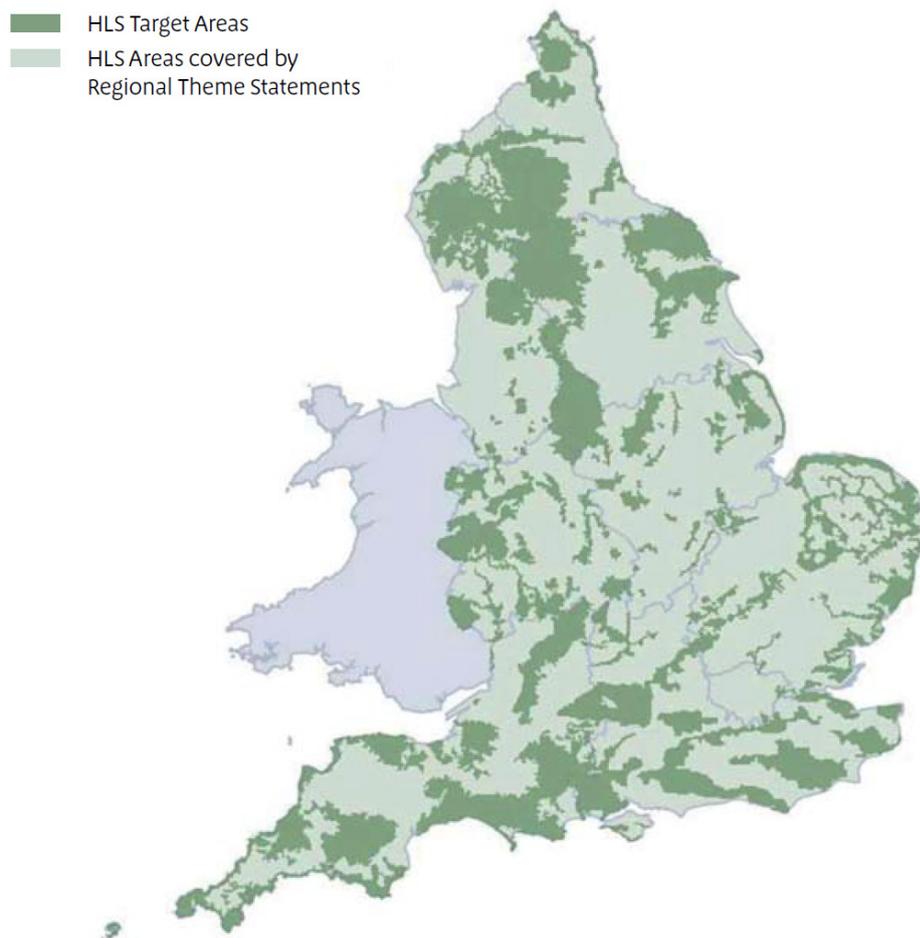
It is important to recognise that because most PES schemes base payments on observable proxies rather than quantitative changes in service provision, the incentive to innovate may be weakened.²⁹ Drawing on an example from the literature, consider a PES scheme based on payments to farmers for improved fertiliser management on farms rather than pollutant loads in nearby watercourses.³⁰ Such a scheme provides incentives to innovate relative to current practice but does not encourage farmers to adopt innovative approaches to reducing pollution, for example cooperating with neighbouring farmers to reduce fertiliser runoff at the landscape scale. If, however, payments were based on an overall reduction in pollution, this could encourage innovation but would be more costly and complicated to monitor and farmers would bear the risk that a given activity might not actually reduce pollution. The emphasis on input-based payments in PES schemes contrasts with the increasing emphasis on 'payments by results' (PbR) being pursued by government in a bid to increase efficiency and innovation (for example, in relation to health, crime and welfare-to-work).

Spatial targeting

Ecosystem service benefits are not spread uniformly across geographic areas. For example, some areas may be considered '**hotspots**' in terms of ecosystem service benefits, ie they provide highly valued benefits in relation to multiple services. This spatial variation in the provision of benefits can be an important consideration in designing PES schemes. Whereas some PES schemes may be open to all land managers and make payments on a per hectare basis regardless of an area's underlying capacity to provide services, other PES schemes may target payments at areas considered critical in terms of service provision. For example, Entry Level Environmental Stewardship is open to all farmers and land managers in England and disburses funding on a per hectare basis in return for the delivery of a certain level of general environmental management (eg hedgerow management, the management of field corners and the provision of skylark plots) over a five-year period. Higher Level Stewardship, in contrast, aims to deliver significant environmental benefits in target areas (or, outside of those areas, benefits based on target themes) (see Figure 13), and involves the development of a comprehensive agreement in cooperation with Natural England that achieves a wide range of environmental benefits over at least a ten-year period.

In light of the likely spatial variation in the provision of ecosystem services, scheme proponents should consider the extent to which payments might be targeted at hotspots. This could lead to the development of a scheme based on **differentiated payments** whereby sellers are paid different amounts based on, for example, the capacity of their land to supply particular services. This contrasts with a system of **uniform payments** whereby sellers are paid standard disbursements for service provision, for example on a per hectare basis. It should be noted that the larger a scheme in terms of geographic scale, the more costly it will be to administer a system of differentiated payments given the need to negotiate numerous bespoke agreements.

“Getting the science right is crucial and requires a clear understanding of the biophysical relationships between [land managers'] actions and their environmental consequences”

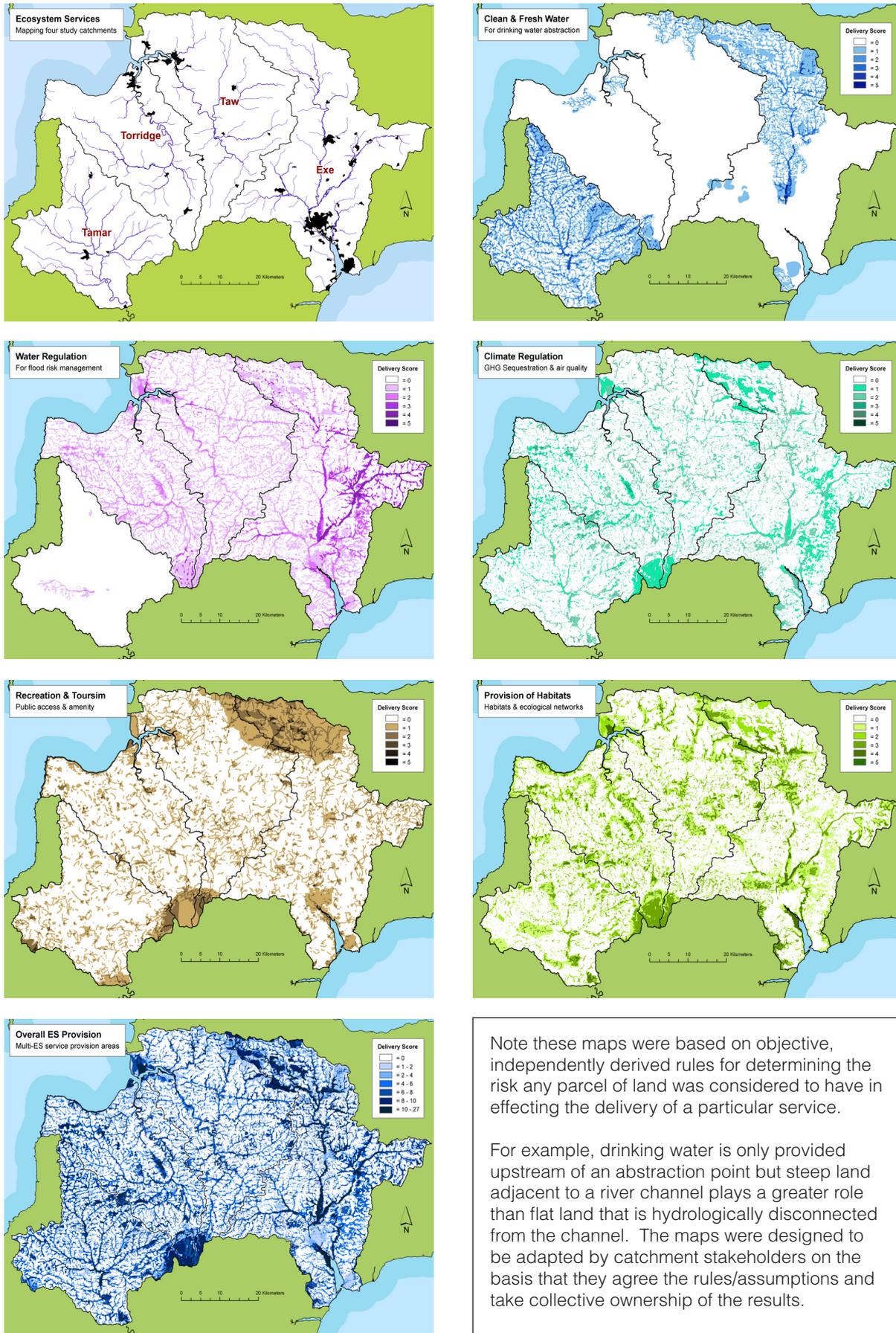
Figure 13: Higher Level Stewardship target areas³¹

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Various means can be employed to identify hotspots of service provision including research, mapping and environmental valuation. In relation to research, for example, for a catchment-based scheme, specialists might be commissioned to model the flow and behaviour of water through the catchment and characterise priority areas where tailored, location-specific interventions could benefit the provision of clean water. As the supply of ecosystem services is inherently linked to location, mapping ecosystem services represents a low cost means of targeting PES schemes.³² As an example, the Westcountry Rivers Trust has mapped the spatial distribution of key ecosystem services across four catchments in south west England (Tamar, Torridge, Taw and Exe) as an input to its PES-related work. The map of overall ecosystem service provision clearly reveals hotspots where action to safeguard, enhance and restore ecosystem services might be concentrated.

The value of particular services to beneficiaries can also be reflected in ecosystem service mapping. For example, environmental valuation studies might indicate that demand for particular services such as recreation and flood management is higher closer to centres of population and this evidence could be reflected in delivery scores. In addition to considering the spatial variation in ecosystem service benefits, scheme proponents could also consider any emerging threats to service provision on a spatial basis and target payments accordingly. For example, for an area such as a catchment, proponents could establish a threat index which assesses the level of threat to hotspots of service provision based on an analysis of surrounding land uses and changing conditions (for example, the impacts of growth in nearby populations

Figure 14: Ecosystem service mapping for four catchments in south west England



or the likely impacts of changing commodity prices). Increasingly sophisticated ecosystem service mapping applications could therefore reflect not only the geographical distribution of services but factors including the values attached to them and the level of threat they face.

Spatial targeting can be undermined by the emergence of **'holdouts'**. Holdouts are providers who try to exploit their location or choose not to participate in a scheme but capture the benefits of actions undertaken by others.³³ The capacity for holdouts to undermine the effectiveness of a PES scheme depends on the extent to which supply of the ecosystem service in question requires coordinated action on the part of providers.³⁴ For example, a PES scheme premised on connecting fragmented habitats could be frustrated by land managers in possession of small yet critical parcels of land. A review of the Vittel PES scheme in France, cited evidence that the strategic location of the farmland – with each farm having the potential to impact water quality – led to opportunistic behaviour which increased transaction costs significantly.³⁵

A further factor relevant to scheme design can also vary spatially: the **opportunity costs** on the part of providers associated with additional ecosystem service provision. The opportunity cost of a land manager's decision to set aside a portion of land for wildlife habitat, for example, is the loss of that land for the next best alternative use, most likely agricultural production. PES schemes can be designed to reflect providers' opportunity costs through the use of differentiated payments to sellers, equivalent to the opportunity costs of ecosystem service supply. The use of differentiated payments can significantly enhance PES cost-effectiveness.³⁶ One means to establish a system of differentiated payments is to implement a reverse or inverse auction whereby land or resource managers provide sealed bids for the amount they are willing to accept for changes in land or resource use management. The Tasmanian Forest Conservation Fund is an example of a PES scheme, which has used both spatial targeting and reverse auctions – see Box 11. Further information on reverse auctions is provided below.

Overall, the OECD has argued that the degree to which ecosystem service payments are spatially targeted is the main determinant of the cost-effectiveness of PES schemes. In particular, *"the greater the spatial heterogeneity in costs and benefits of ecosystem service provision, the larger the gains that can be reaped by targeting and differentiating payments accordingly"*.³⁷

Reverse auctions

A **reverse (or inverse) auction** is a competitive bidding process whereby sellers nominate particular actions or services that they can provide and the price at which they are willing to sell them. The auction can therefore act as an effective mechanism for revealing information about the true cost of providing ecosystem services. Funding is allocated in the order of the bidders providing the greatest service provision at the lowest cost, with the selection of bidders continuing until the available funds run out. Reverse auctions may be well suited to situations in which there is one buyer and many sellers ('one to many' – see Figure 6), for example, where a water utility seeks to promote behavioural change on the part

Box 11: Tasmanian Forest Conservation Fund

Nearly 30% of Tasmania's forests are on private land and, as such, the Australian and Tasmanian Governments' conservation goals for forests cannot be achieved without the support of private landowners. The goal of the **Tasmanian Forest Conservation Fund (FCF)** was to protect up to 45,600 hectares of private forested land, including a minimum of 25,000 hectares of old growth forest, using market-based incentives.

In March 2007, the FCF Program implemented a **competitive tender process**, through which landowners could apply for funding to covenant their forested land. Over two different rounds, interested landowners were offered an assessment of their forested land and assistance with developing a draft tender. In addition, landowners were also engaged directly with **fixed price offers** for conservation covenants, particularly those with large landholdings with high proportions of old growth forest. Direct offers were based on a comparative analysis of the value of the successful tenders, which would have been more difficult without the knowledge gained through the competitive tender process. Conservation covenants were registered on the land titles of individual holdings or specific areas of holdings, under the Tasmanian Nature Conservation Act 2002. In consultation with each landowner, **Nature Conservation Plans** were also developed to provide guidelines for the maintenance of the covenanted land.

In terms of spatial targeting, a **Conservation Value Index (CVI)** was developed to calculate the conservation value of land holdings and allow for an objective comparison of proposals received through the tender process. Primarily, the CVI was developed to assess the significance of the proposal in contributing to the FCF Program's conservation objectives. The CVI also considered the conservation management of a particular proposal, as well as the security of the covenant (which was determined by the length of the covenant on the land, such as 12, 24 or 48 years or in perpetuity). When the program ended in June 2009, the FCF had secured, with the commitment of over 150 landowners, the protection of around 28,000 hectares of high quality forest, including about 11,000 hectares of old growth forest. According to a later evaluation of the Program, over 80% of the covenants secured were perpetual. This same report also concluded that while the targets were not fully achieved, this was largely due to budgetary constraints, rather than any major problems with the Program's design or implementation. However, the evaluation also indicated that while the reverse auction secured very cost-effective tenders in the earlier stages, proposal prices increased over the life of the Program as the most cost-effective proposals from early adopters were exhausted. The evaluation also indicated that the market-based approach adopted increased the conservation benefits significantly (potentially over 50%), when compared to simpler approaches such as funding eligible proposals in the order in which they are received.

A **Revolving Fund**, which is set to run until 2014, has also been established through which land of high conservation value is bought, covenanted for conservation purposes and then sold on to sympathetic landowners on the open market. Proceeds from land sales are returned to the fund, thus allowing for the purchase of additional properties. In this way, the fund 'revolves' and its value is largely retained. A later evaluation indicated that while the Revolving Fund has the potential to be the most cost-effective mechanism, property markets constraints (primarily lack of demand) for conservation properties and the limited speed at which they could be resold, impacts upon the ability of the Revolving Fund to secure multiple properties quickly for conservation purposes.

The Tasmanian Government provides ongoing monitoring and management support services to owners of properties covenanted under the FCF Program.

Sources:

The Australian government's web pages on the Tasmanian Forest Conservation Fund available [here](#).
Binney, J. and Whiteoak, K. (2010). The Tasmanian Forest Conservation Fund and associated programs: purpose, performance & lessons, a report prepared for the Department of the Environment, Water, Heritage and the Arts [online] available [here](#).

of multiple landowners within a catchment. A potential disadvantage of reverse auctions is the necessity for a large pool of bidders in order to induce competitive pressures and to reduce the risk of sellers colluding to influence prices.³⁸

The US Conservation Reserve Program (CRP) successfully employs reverse auctions in which potential ecosystem service sellers submit bids indicating the minimum payment they are willing to accept to provide an ecosystem service (see Box 12). Similarly, the BushTender scheme in Australia (Box 13) requires landowners to competitively tender for contracts by specifying activities to protect and restore native vegetation and their costs. Both the CRP and the BushTender scheme make use of an Environmental Benefit Index (EBI) which facilitates selection of the contracts offering the highest benefits for least cost (an example of spatial targeting).

The Westcountry Rivers Trust in partnership with the University of East Anglia and South West Water are piloting a scheme in which farmers bid for funding from South West Water in a 'river improvement auction'. Farmers were asked to submit bids indicating which farm improvements they would be willing to undertake and the grant they would like from South West Water to implement those improvements. Each bid was then assessed to evaluate the extent to which it would contribute to improvements in water quality. This evaluation enabled South West Water to award funding to the bids that offered the best value for money. Early indications are that the auction was a success with nearly half the eligible farmers in the catchment submitting a bid with the total sum requested more than double the amount made available by South West Water. Importantly, the farmers whose bids were successful have, on average, taken on over 40% of the cost of improvements themselves.³⁹

Box 12: US Conservation Reserve Program - using reverse auctions

In the 1970s soil erosion was a significant problem in the US with cropland soil erosion losses estimated at 2 to 6.8 billion tonnes. Blowing soil also reduced visibility and air quality, as well as making land susceptible to wind erosion and reducing agricultural productivity. In a bid to resolve this problem, the US government formally established the Conservation Reserve Program (CRP) in 1985.

The CRP is a nationwide land retirement programme in which the US government offers landholders incentives to change land use on highly erodible and environmentally-sensitive cropland and pasture in order to secure ecosystem services. The scheme was originally designed to reduce soil erosion and restore soil productivity. The aims have since been expanded to target wider ecosystem services such as surface and ground water quality improvements, air quality improvements, wildlife habitat creation and carbon storage.

The CRP uses a competitive bidding process whereby landowners submit bids for the ecosystem services they can provide and their cost. Bids are ranked by environmental benefits relative to cost, and the most cost-effective bids are selected. Successful landowners are offered contracts lasting for 10 to 15 years, providing annual payments based on the agriculture rental value of the land.

The CRP is the largest and longest-running PES programme utilising inverse auctions in the world. Since 1982, it is estimated that the CRP has: reduced soil erosion by 454 million tonnes per year; restored 2 million acres of wetlands; sequestered 48 million tonnes of carbon per year; established 3.2 million acres of wildlife habitat; improved water quality; reduced nitrogen and phosphorous use; increased wildlife populations; and reduced flood damage.

Further information on the CRP can be found in the accompanying annex of case studies.

Sources:

OECD (2010). Paying for biodiversity: enhancing the cost-effectiveness of payments for ecosystem services (online) available [here](#).

Henry, H (2005). The Conservation Security Program: A new conservation program that rewards historic land stewards who have applied and managed effective conservation systems. USDA Forest Services/UNL Faculty Publications (online) available [here](#).

Cowan, T (2008). Conservation Reserve Program: Status and Current Issues (online) available [here](#).

Box 13: BushTender, Australia - using reverse auctions

Australia's native vegetation provides a number of key ecosystem services such as biodiversity habitat, salinity control, water quality, soil protection, carbon storage, fire regulation and landscape preservation. In the state of Victoria, at least half of all native vegetation has been cleared. On private land, clearance is as high as 80%.

In order to protect and restore native vegetation on private land, the Victorian State Government trialled the BushTender scheme in 2001. The scheme pays landowners to undertake conservation activities through a reverse auction process. Landowners competitively tender for contracts by nominating conservation activities and their costs. Bids are ranked using a biodiversity benefits index and contracts are awarded to the projects which secure the greatest conservation benefits for the least cost. Successful landowners receive periodic payments for their management actions.



Source: Chris White, URS.

The scheme has been very successful at securing ecosystem services on a transparent and cost-effective basis. So far, around 26,000 hectares of native vegetation has been managed and protected, and the auction process has been estimated to be 700% more cost-effective than a fixed-rate scheme. This is because the competitive bidding process reveals landowner's costs, allowing buyers to select the most cost-effective projects and thereby eliminating the risk of overpayment for ecosystem services (which can occur in fixed-rate schemes). The auction approach also captures higher-value and higher-cost sites within budget because it pays less (ie just enough) for lower value and lower cost sites.

Questions have been raised over whether the scheme can maintain the improvements in cost-effectiveness over the long term since repeated auctions allow bidders to adjust their prices over time. When bidders are familiar with the average level paid for certain actions, there is a risk that they may raise the price of their bids above their cost leading to overpayment for ecosystem services. As this is a relatively new scheme, further evaluation will be needed in future to investigate this issue.

Further information on BushTender can be found in the accompanying annex of case studies.

Sources:

Department of Sustainability and Environment (2008). BushTender: Rethinking Investment for native vegetation outcomes. The application of auctions for securing private land management agreements (online) available [here](#). The Government of Victoria's web pages on Conservation and the Environment (online) available [here](#).

Monitoring the delivery of interventions

Having identified appropriate interventions and established the mode of payment for these, proponents should consider how best to monitor their delivery. Monitoring is a critical component of PES schemes since buyers need to be assured that benefits are being delivered in line with the agreement. Advice on monitoring can be found later in the Guide under phase 4: Monitor, evaluate and review implementation.

Building trust

Many of the challenges associated with establishing a PES scheme will be technical. However, proponents are also likely to encounter a range of cultural challenges. For example, a review of the Vittel (Nestlé Waters) PES scheme in north-eastern France (see case study annex) concluded that *"establishing PES is a very complex undertaking, one that requires the consideration of scientific but also social, economic, political, institutional, and power relationships"*⁴⁰. Overall, the review concluded that the primary reasons for the programme's success were not financial. Instead, *"Trust-building through the creation of an intermediary institution (locally based and led by a "champion" sympathetic to the farmers' cause); the development of a long-term participatory process to identify alternative practices and a mutually acceptable set of incentives; the ability to link incentives to land tenure and debt cycle issues and to substitute the old technical and social support networks with new ones, were all fundamental conditions of success"*⁴¹.

Progressively building trust between the different partners in a PES scheme will be imperative, particularly if there is any uncertainty over the link between the proposed land or resource management interventions and the desired ecosystem service outcomes. This is one reason why the initial steps in developing a PES scheme are often exploratory and undertaken through research or pilot projects. Building trust on the part of sellers will be particularly important as new schemes may be met with scepticism. Clearly communicating the buyer's motives is vital to address this and working through a trusted intermediary familiar with the attitudes and motivations of sellers may help in building trust. Great care should be taken in the early stages of scheme development to address emerging concerns or misgivings and progressively build consensus between the parties. Developing PES schemes may take considerable time. In the case of the Vittel scheme, for example, it took ten years to complete the bargaining process.⁴² However, agreement may be reached much more quickly for simpler schemes. The Vittel scheme also illustrates the importance of continuing dialogue: *“even with all the scientific knowledge accumulated, the programme would not have been possible without the effort made to understand farmers, establish a permanent dialogue with them, and recognise their perspectives – not only in terms of farming practices but also in terms of life choices. The methodology used in this process was the key to success, not the funds injected into the programme”* (Director of Agrivair, the intermediary established by Nestlé Waters for negotiating and implementing the programme).⁴³

PHASE 3: Negotiate and implement agreements

The third phase in the process involves negotiating and implementing the PES agreement. Assuming that the appropriate interventions and the associated mode of payment for these (output- or input-based) have been established, the parties will need to negotiate and agree the nature, level and timing of payments and draw up the necessary contracts.

Negotiating PES agreements

Nature of payments

The impact of the proposed interventions on sellers may vary. For example, some interventions may provide benefits to both buyers and sellers. Installing fencing to prevent livestock from entering watercourses, for example, may benefit both buyers (through enhanced water quality) and sellers (through reducing the loss of lambs or the incidence of foot disease in cattle). In these instances, a match-funding approach may be appropriate with sellers co-funding the intervention. In other cases, interventions may have a clear adverse effect on outputs from the land or resource and payments will need to cover the full costs to the seller. In some instances, cash payments might be accompanied by in-kind payments such as the provision of capacity building, advice on best practice or help with accessing government grants. Importantly in layered PES schemes it may be necessary to tease out the relative contributions of the interventions to the delivery of different ecosystem service benefits to determine the contributions that each buyer should make. It should be noted that while PES is generally conceived of as a series of payments in exchange for the provision of ecosystem services, in practice PES schemes may also involve one-off payments, for example to cover the upfront costs of ecosystem restoration.

Level of payments

The price paid for an ecosystem service will be the result of a negotiation between the buyer(s) and seller(s), perhaps facilitated by a broker. Ultimately, the price will reflect what the buyer is willing to pay and what the seller is willing to accept in return for delivering the service. In the case of the Vittel scheme, the prolonged period of bargaining was partly due to the difficulty in reaching agreement on how to value the cost of the changes in land management and the extent of compensation. In particular, a key question was should the level of compensation be determined on the basis of the costs to the farmers involved or on the benefits derived by Vittel? If it was decided on the basis of farmers' opportunity costs, how should the differences between farms be taken into account?⁴⁴ The review of the Vittel scheme by Perrot-Maître (2006) provides details of the package of incentives ultimately agreed.⁴⁵

Negotiations to establish price can take into account:

- sellers' opportunity costs - impact on earnings from returns forgone (eg from agricultural production), both now and in the future (eg as commodity prices change);
- start-up and ongoing maintenance costs - to deliver agreed interventions, particularly for 'asset-building' schemes which focus on restoring an area's ecosystem services;
- transaction costs – to cover, for example, the costs of establishing the baseline, training, developing a monitoring framework and providing third party assurance;
- costs of alternatives – for example, for improved drinking water quality, comparing the cost of building a water treatment plant versus investing in natural ecosystem service-based filtration (see Box 14); and

- degree of competition in both supply and demand (buyers will tend to seek the lowest-cost suppliers of services).

Ultimately, the market will determine the price paid for an ecosystem service. It is therefore important to note that theoretical economic valuation does not determine the price paid for an ecosystem service. While valuation studies may help generate demand for a service, the values expressed in these studies should not be confused with the actual price of an ecosystem service.⁴⁶ It should also be noted that, given the complexity of ecosystem services and the spatial variation in terms of the benefits they provide as well as the level of demand they attract, the risk of their loss or degradation, the opportunities for enhancing them and the opportunity costs associated with supplying them, it is unlikely that universal prices for specific services will emerge. Furthermore, many ecosystem services are co-generated (for example, by multi-functional agriculture or sustainably managed woodlands) and are both delivered and utilised as 'bundles' of services rather than individually. As such, pricing individual components can be challenging.

Timing of payments

In order to ensure the successful delivery of the desired ecosystem service outcome, payments should ideally be conditional upon actual delivery of the ecosystem service(s) in question (a 'payments-by-results' approach). However, as discussed, a system of performance-based payments may not be appropriate, particularly given the potential up-front investment on the part of sellers and/or the time lag between the implementation of the relevant intervention and the provision of the ecosystem service, which could be decades in some cases. An alternative approach is to make payments on the basis of specified actions or the implementation of particular agreed measures (for example, woodland planting or the creation of buffer strips). Either way, a pragmatic approach which can be agreed to by both buyers and sellers will be necessary.

Box 14: Cost of alternatives: example from Payments for Watershed Services pilots, USA

Payments for Watershed Services (USA): grey-green analysis

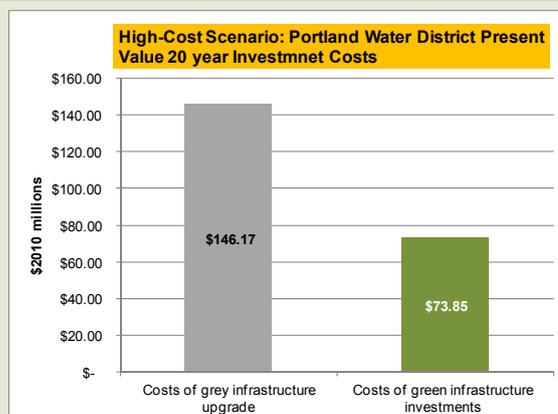
The World Resources Institute (WRI) is piloting three Payments for Watershed Services (PWS) initiatives within two major watersheds in Maine and North Carolina, USA. While the project is not yet a functioning PES scheme, the focus so far on building demand for watershed services provides relevant lessons learnt.

At the Sebago Lake Watershed pilot in Maine upstream development has impacted on the lake's water quality. As a result, investment in a new filtration plant may be required. The WRI examined the investment trade off between this 'grey' infrastructure, and an alternative 'green' infrastructure approach to improving water quality, which consisted of planting riparian forests and putting in place riparian buffers.

WRI looked at the green infrastructure options that had the greatest potential to reduce the levels of pollutants entering the waterway. Then, using a variety of data sources, they compared the cost effectiveness of investing in green versus grey infrastructure over a period of twenty years. This preliminary analysis found that investing in the green infrastructure options provided cost savings of between 51% and 76%. In addition to these financial savings, the non-market benefits of the green infrastructure were estimated to be worth an additional \$72-125 million.

Sources:

Talberth, J., Gray, E., Branosky, E and Todd, G (2012). Insights from the Field: Forests for Water (online) available [here](#).



Draw up agreements

In this step, the necessary legal agreements are drawn up and signed to formalise the scheme. An agreement could take the form of a simple contract between parties but in many cases the aim of long-term ecosystem service delivery will lead to the use of land conservation agreements (see below).

Agreements should be proportionate to the scale of the PES scheme in question and the risks associated with it. Generally speaking, agreements should cover:

- key start and end dates;
- details of the scheme area or footprint;
- who will pay the start-up and transaction costs as well as the ongoing management and monitoring costs;
- who will be responsible for what actions;
- what management inputs and/or ecosystem service outcomes are anticipated;
- what constitutes additionality;
- measures to minimise leakage;
- how results will be demonstrated and who will be responsible for monitoring, communicating, evaluating, verifying and potentially certifying them;
- payment terms including the nature, level and timing of payments;
- how risks and the burden of proof will be apportioned (for example, in the event that a seller fails to deliver the contracted service or agreed interventions);
- rules for modifying and adapting the contract; and
- accepted reasons for voiding the contract.⁴⁷

Land conservation agreements

Public, private or civil society interests may all seek to achieve ecosystem service delivery through the use of legal instruments to influence how land owners manage their land. Such instruments can generically be termed **land conservation agreements (LCAs)**, although other commonly used terms include 'conservation covenants, agreements, easements or servitudes'. All these terms refer to agreements between a landowner and another party which place long-term restrictions on the use or management of a parcel of land. Each agreement is a contract, usually attached to deeds, which specifies conditions for the use of the land and is intended to be binding upon current and future owners of the land. Such an agreement thus represents a voluntary partial transfer of property rights, or voluntary acceptance of limitations to the landowner's original 'bundle of rights'. An agreement may also require commitment to specified management actions and monitoring arrangements.⁴⁸

Examples of LCAs include conservation easements in the USA,^{49,50} conservation agreements in Canada⁵¹ and conservation covenants in Australia.⁵² Conservation easements in the USA are enforceable agreements under statutory law that limit the use of a parcel of land (usually in perpetuity) to achieve a conservation purpose. Such easements may contain a variety of conditions, but most common are restrictions on commercial activities, mineral extraction, topsoil removal, timber harvesting and housing development.⁵³

In Canada, the Nature Conservancy Canada uses conservation agreements to protect wetlands, forests, prairies and other habitats as well as rare plants and animals. Each agreement is tailored to fit the

landholding, the features to be protected and the landowner's interests, and is for perpetuity.⁵⁴

In Australia, a conservation covenant is a voluntary agreement between a landholder and an authorised 'covenant scheme provider' (usually a not-for-profit organisation, government agency or local council) to protect and enhance natural, cultural and scientific values.⁵⁵ Covenants are usually tailored to individual circumstances within the requirements of the administering institution and legislation.⁵⁶

LCAs have the following potential advantages:

- a means for conservation without change in land ownership, and thus compared to outright purchase a capital cost saving;
- land can be retained for some private uses and benefits, for example, sustainable felling under a forest conservation agreement;
- flexible agreements that can be well matched to the mutual objectives and circumstances of both parties;
- a capital payment for landowners in exchange for the rights foregone;
- for the landowner it may be possible in some jurisdictions to gain additional financial benefits via income, property or inheritance tax concessions⁵⁷ and this incentive may correspondingly reduce the payment needed from the 'buyer' of the LCA;
- facilitation of access to revenue streams from ecosystem service markets that require permanence such as carbon sequestration as well as support to the development of such markets by providing a stronger guarantee that supply of an ecosystem service will be sustained over the long-term; and
- it may be possible to value rights acquired as balance sheet assets for the purchaser.⁵⁸

Disadvantages or limitations of LCAs may include:

- higher transaction costs compared to ownership as both the 'purchaser' and landowner may exert time and money to specify, monitor and enforce divided ownership;
- monitoring and enforcement costs that may extend into perpetuity;
- abuses that may arise if financial incentives such as tax concessions become the overriding motivation for landowners;
- limited effectiveness for conservation purposes if the spatial implementation of LCAs is voluntary and ad hoc, and therefore not strategically targeted and coordinated;
- a risk of negative impacts on local economic activity and property-based tax revenues; and
- costly amendments at a later date if LCAs made today do not match the needs and preferences of society in future.⁵⁹

LCAs (known as 'conservation covenants') are already used in Scotland but do not currently exist in law in England, Wales or Northern Ireland. The Law Commission is examining whether there is a case for introducing conservation covenants into the law in England and Wales as well as the elements that a new statutory scheme may require, with a view to publishing proposals by the end of 2014.⁶⁰

In the absence of LCAs, some PES schemes have made use of **restrictive covenants**. For example, Upstream Thinking, the PES scheme implemented by South West Water and the Westcountry Rivers Trust requires the farmer to place a deed of covenant on his property (for 10-25 years) for conditional grants of

over £5,000. Typical restrictions imposed by these covenants include: limiting livestock numbers; planting cover crops after harvesting; refraining from planting maize in sensitive areas; and maintaining specified uses of manure stores or other infrastructure. Note that, generally speaking, restrictive covenants are established between adjoining properties whereas in this case they are being used in a different way. In contrast to restrictive covenants, LCAs may provide a stronger form of long-term protection, particularly if land is sold or inherited. They also make it easier to secure positive obligations; for example, requiring the maintenance of drainage or the mitigation of diffuse water pollution.

Implementing PES agreements

A key point in terms of implementation is the importance of including provisions for adaptive management within PES agreements, allowing lessons from practice to reorient the scheme and its associated land or resource management interventions to make progress towards agreed end-goals (or indeed revisit the original scheme rationale and objectives). It is important to recognise that PES remains in its infancy and all schemes will to some degree be experimental and something of a leap of faith on the part of all those involved. As the review of the Vittel PES scheme concluded, “*The entire programme was essentially a ‘learning-by-doing’ experiment*”.⁶¹

PHASE 4: Monitor, evaluate and review implementation

The fourth phase in the process involves monitoring, evaluating and reviewing the performance of the PES scheme in light of its original objectives.

The scheme should be monitored to ensure that:

- the contracted interventions or ecosystem service outcomes are being delivered;
- if payments are based on inputs, that interventions are in fact enhancing ecosystem services;
- adverse trade-offs are not taking place between valuable ecosystem services; and
- relevant regulatory requirements are being complied with.

Third-party verification and, potentially, certification may also be required to ensure the scheme is delivering on its goals and so provide buyers with the necessary assurance. In addition, the scheme should be periodically evaluated and subsequently reviewed to ensure that its objectives are met.

Monitoring

Effective monitoring should be: cost-effective; accurate, bias free; replicable; and timely. Importantly, the monitoring programme should also be designed to take into account effects on other ecosystem services not included within the scheme.

There are four key steps that can be taken to ensure effective monitoring:

1. Establish a baseline for the ecosystem service that is being marketed (see phase 2) and where possible any other key ecosystem services linked to it, using secondary (existing) data where possible, supplemented by primary data collection where necessary. This will enable demonstration of how the PES scheme has improved service provision compared with the business-as-usual scenario. Ideally scheme proponents should incorporate data from across the scheme area in order that the baseline isn't skewed by unusual conditions affecting only a limited number of monitoring points.
2. Choose and design monitoring and verification methods. Scheme proponents should decide whether direct measurement, modelling or indicators ('proxies' that can be used to infer the likely level of service provision) can most effectively meet the scheme's monitoring needs. Box 15 describes some of the circumstances under which direct measurements, models or indicators are likely to be the most appropriate choice for monitoring a PES scheme while Table 5 indicates how different ecosystem services might be measured in practice.
3. Monitor and verify. Regular measurements should be made of the relevant ecosystem services or the indicators that have been chosen to represent those services. Trends in the provision of the relevant services can then be compared against the baseline.
4. Review and adapt. Monitoring results should be reviewed on a regular basis to track trends and identify any deviations from the changes in provision anticipated. If deviations are detected, it will be necessary to determine whether or not they are attributable to external factors (eg adverse weather) or to shortcomings in scheme design which need to be rectified. Where buffers have been reflected in the PES agreement, ie a proportion of the additional ecosystem service provided remains unsold

to account for unforeseen circumstances that might compromise delivery, these may need to be increased if risks of under-provision cannot be adequately addressed.

Box 16 provides examples of monitoring in practice.

Box 15: Direct measurements, modelling or indicators ('proxies') for monitoring

Direct Measurement

- A high degree of accuracy is required by buyers, who are willing to pay to cover higher monitoring and verification costs
- Measurement infrastructure already exists (eg water quality monitoring systems are already in place)
- Changes in ecosystem services are relatively homogeneous across the area being monitored and/or changes in the provision of the service are likely to be relatively slow

Modelling

- Models exist for the system in which the PES scheme is intervening, which could be easily adjusted to incorporate the proposed interventions
- Sufficient data exists to create simple new models to describe the relationship between the proposed interventions and anticipated ecosystem service outcomes
- The market is large enough to justify an investment in innovation/modification and operation of models
- Greater accuracy is required than can be provided by indicators, but a full sampling programme of direct measurements is too costly

Indicators

- The costs of direct measurement or modelling are prohibitive or there are no established models, or expertise to develop or operate models, which are relevant to the ecosystem services covered by the PES scheme
- Indicators have already been established that can accurately and reliably represent changes in the ecosystem services covered by the PES scheme
- Secondary data, published evidence or expert opinion is available that can help identify, evaluate and select new indicators that can accurately and reliably represent changes in the ecosystem services being covered by the PES scheme
- Risks and/or market size are small, and approximations are sufficient to maintain confidence on the part of buyers in the delivery of the agreed services.

Table 5: Monitoring ecosystem service provision

Ecosystem service	Measurable parameter	Direct measurement	Modelling	Indicator ('proxy')
Water quality	Nitrate levels in water supply	✓		
	Buffer strips to slow run-off and intercept sediment			✓
	Ecological status of water bodies (eg abundance of indicator species)	✓	✓	
Flood risk regulation	Riparian tree planting			✓
	Synchronisation of water flows	✓	✓	
	Flow rates	✓	✓	
	Floodplain water storage capacity	✓	✓	
	Soil water storage capacity	✓	✓	
Climate regulation	Fluxes in atmospheric gases (CO ₂ , CH ₄ , etc.)	✓	✓	
	Tree planting			✓
	The Woodland Carbon Code carbon lookup tables		✓	
	Tree measurement	✓		
Habitat for wildlife	Wetland creation			✓
	Species richness and diversity	✓	✓	
Tourism and recreation	Visitor numbers	✓		✓
	Environment Agency rod licences	✓		✓
	Spending on nature-related tourism			✓

Box 16: Monitoring in practice

Direct measurement – Lysekil Nutrient Trading Scheme, Sweden

In order to mitigate the nitrogen discharge of its local waste water treatment plant, the Lysekil community set up a PES scheme to encourage farming of a mussel species that filters excess nutrients from water. In this case the ecosystem service – improved water quality due to reduced nitrate levels – was directly measurable. In order to monitor the level of nutrients removed, environmental officers analysed the nutrient (and in particular nitrogen) content of the harvested mussels.

Modelling – Slowing the Flow at Pickering, North Yorkshire

The Slowing the Flow project aims to protect Pickering from up to 1 in 25 year flooding events by funding a mixture of land management measures such as flood storage bunds, debris dams, and woodland creation. As the ecosystem service provided – lower frequency of future floods – can only be measured over the long-term, the approach to monitoring requires hydrological modelling. Hydrological models are used to estimate the impact of various actions on flood risk and to identify preferred sites for intervention. The Environment Agency's river gauging stations and several additional water level recorders installed as part of the project are then used to corroborate the model.

Indicators – English Woodland Grant Scheme (EWGS), England

The EWGS is a government-run PES scheme providing grants to English landowners to undertake actions to protect or restore woodland on their land. As the EWGS targets a number of ecosystem services which are difficult to measure directly such as improved soil quality and climate regulation, monitoring requires assessment of several habitat indicators. The process involves periodic surveys at 3-5 year intervals to assess changes in bird populations and habitat associated with management carried out under the grant. Woods in the grant scheme are paired with similar woods with no current plans for management to provide a comparison.

Sources:

Zanderson, M., Bråten, K., Lindhjem, H (2009). Payment for and management of ecosystem services: issues and options in the Nordic context (online) available [here](#).

Lindahl, O (2011). Mussel farming as a tool for re-eutrophication of coastal waters: experiences from Sweden (online) available [here](#).

Reports and papers on the 'Slowing the Flow at Pickering' project web pages of the Forestry Commission website (online) available [here](#).

Forestry Commission web pages on the English Woodland Grant Scheme (online) available [here](#).

Evaluation and review

It is important that PES schemes are periodically evaluated in light of the data collected through monitoring. In particular, formal evaluations can highlight any shortcomings in scheme design. For example, an evaluation of the first two years of the Payment for Hydrological Services Programme in Mexico showed that *"most of the payments had gone to protect forests outside of critical watersheds and were too fragmented in their distribution to provide a measurable improvement in water services. In addition, payments were made mainly for forests that were not at risk of being lost"*.⁶² Although the Tasmanian Forest Conservation Fund fell short of achieving its target to protect up to 45,600 ha of forested private land, the independent review of the scheme concluded that, *"The fact that the targets were not fully achieved is largely because of budget constraints for the program, not that there were any major problems with the design and implementation of the FCF"*.⁶³ There are relatively few formal evaluations of PES schemes available and, in order that future schemes can build on previous experience and lessons learnt, it will be important that any evaluations undertaken are communicated and disseminated as widely as possible.

The Magenta Book is HM Treasury guidance on evaluation and sets out the key issues to consider when designing and managing evaluations as well as the presentation and interpretation of evaluation results.⁶⁴ The Magenta Book emphasises that evaluation examines the actual implementation and impacts of an initiative to assess whether the anticipated effects, costs and benefits were in fact realised. In light of a formal evaluation, those responsible for a PES scheme will be in a position to review and adjust the scheme's design as appropriate.

PHASE 5: Consider opportunities for multiple-benefit PES

The final phase involves considering the opportunities for the PES scheme to incorporate multiple benefits. However, in some cases the inclusion of multiple benefits may have framed scheme design from the very outset while in others it may be immaterial if the scheme is clearly premised on a single service.

Although possibly simpler to establish, schemes involving payments for a single ecosystem service could potentially lead to resource management decisions that favour this service at the expense of others. This could potentially undermine the provision of other important services and lead to adverse environmental effects. As discussed, scheme proponents need to identify any potential trade-offs between services and mitigate any significant adverse effects on services not subject to payment.

Bundling, layering and piggy-backing

One means to avoid trade-offs is to sell the ecosystem services generated by the same parcel of land as a 'bundle'. **Bundling** involves a single buyer, or a consortium of buyers, paying for the full package of ecosystem services that arise from the same geographical area (see Figure 7). For example, carbon storage, water quality, biodiversity, visitor benefits and wildfire risk reduction could be bundled together in a single scheme involving payment for peatland restoration. Bundling services in this way has the benefit of promoting resource management that 'works with the grain of nature'.

An alternative means of 'packaging' ecosystem services involves '**layering**' (sometimes referred to as 'stacking'). In a layered PES scheme, multiple buyers pay for the separate ecosystem services that are supplied by a single parcel of land or body of water. For example, the same peatland restoration scheme could involve a private company paying for the carbon sequestration (climate regulation) benefits, a water utility paying for the water quality benefits, a wildlife NGO paying for the biodiversity benefits and visitors to the area paying for the cultural benefits through a visitor pay-back scheme. In a layered PES scheme, the ecosystem services generated by the same geographical area are essentially 'unbundled' and sold separately.

Sometimes it is not possible to secure payments for all the ecosystem service benefits generated through a PES scheme. While one (or more) service(s) is sold as an 'umbrella' service, the benefits provided by other co-generated services accrue to users free of charge (ie the beneficiaries 'free ride'). This is often referred to as '**piggy-backing**'. For example, in the case of a peatland restoration scheme, identifying a buyer for the reduction in wildfire risk may be challenging and this service may 'free ride'.

Assessing the prospects for multiple-benefit PES

To assess the prospects for establishing a multiple-benefit PES scheme, proponents could follow the approach set out below.

- Identify the co-benefits associated with providing the 'core' ecosystem service that is being marketed. The NEA provides a checklist of the ecosystem services provided by eight broad habitats. At this point, identify all possible co-benefits, regardless of whether there is likely to be a market for them or not.
- Quantify the co-benefits where feasible and cost-effective. Where it is complex and/or costly to quantify co-benefits, consider whether it may be possible to estimate the co-benefits, for example

using proxies or indicators. A number of relatively straightforward and cost-effective indicators exist that can be used to estimate changes in the provision of certain ecosystem services. For example, changes the composition of vegetation growing on peat bogs may be an effective proxy for carbon sequestration rates.

- Assess whether co-benefits can be marketed via bundling or layering:
 - Bundling: assess the extent to which those buying the core ecosystem service are interested in the associated co-benefits and what premium they might be prepared to pay to secure them. If buyers are willing to pay a premium for the core service, then, helpfully, the transaction costs for establishing a market for the co-benefits are likely to be relatively small. If the co-benefits are clearly identifiable but difficult or costly to accurately quantify, bundling may be the best way of securing a sale and avoiding free-riding. Private sector buyers with strong Corporate Responsibility agendas may be particularly keen to secure co-benefits.
 - Layering: assuming that co-benefits can be quantified, assess whether these can be marketed in their own right to attract new buyers. If so, creating a new scheme that runs in parallel with the existing scheme (layering) may be a more effective way of securing payment for co-benefits than bundling.

As a conclusion to the Guide, Table 6 provides an indication of how three different PES schemes have tackled some of the key issues in scheme design and implementation.

Table 6: How key issues have been addressed in three different PES schemes

Issue	Woodland Carbon Code (Warcop): Carbon Sequestration	Slowing the Flow at Pickering: Flood Risk Regulation	Upstream Thinking: Water Quality
	 <p>Source: Forestry Commission</p>	 <p>Source: Forestry Commission</p>	 <p>Source: Westcountry Rivers Trust</p>
Background	Carbon sequestration through woodland creation has been identified as a cost-effective means of mitigating climate change.	The town of Pickering has a long history of flooding with four floods in the last eleven years. Drivers of flood risk were identified as: inappropriate cultivation of arable soils; overgrazing; excessive moorland and forestry drainage; and poor river management. The project is looking at how changes in land management and land use can help to reduce flood risk.	The Water Framework Directive provides a clear incentive to improve water quality as do the potential cost savings to water utilities. A number of drivers of poor water quality were identified in the catchments that supply South West Water, including degraded peatlands and diffuse pollution from agriculture. The project sought to improve water quality in these catchments.
Responding to the scale at which the ecosystem service(s) accrue	Due to the spatial insensitivity of carbon sequestration, the Woodland Carbon Code encourages woodland creation throughout the UK. In the Warcop Training Area there was an opportunity to convert 160ha of land grazed by sheep to woodland.	Unlike carbon sequestration, flood risk is spatially specific and varies depending on local factors such as topography, rainfall, and land use. The appropriate scale at which interventions should take place will depend on the area deemed 'at-risk'; in this case, the Pickering Beck catchment.	Similarly to flood risk, water quality is spatially specific. South West Water is seeking to improve upstream land management to improve water quality in particular. They are working with partners to implement measures across a number of catchments, including the Exe, Tamar and Fowey.
Establishing the baseline	The baseline was calculated by quantifying carbon sinks present within the site (tree biomass and deadwood, other biomass, and soil).	Durham University modelled the flow of water in the Pickering catchment. Baseline flows were modelled and data from historical flood events analysed.	South West Water investigated water quality throughout a series of catchments.
Land ownership and property rights	The Woodland Carbon Code requires proof of landownership. In this case the Ministry of Defence had clear land ownership rights.	In order to reduce flood risk, interventions were required on land across the catchment. Around half of the land was owned by the Forestry Commission, the North York Moors National Park Authority or by the Duchy of Lancaster Estates. The remaining land was privately owned and there was some resistance to implementing the measures proposed.	There are around 500 farmers in the Upper Tamar catchment. South West Water part-funded improvements to the infrastructure on a number of these farms.

Issue	Woodland Carbon Code (Warcop): Carbon Sequestration	Slowing the Flow at Pickering: Flood Risk Regulation	Upstream Thinking: Water Quality
Risk Assessment	Risk management is integrated into the Code. A comprehensive risk assessment is required which covers risk of natural disturbance, as well as social, legal and finance related risks. Conservative carbon sequestration rates and a 'buffer' are used to reduce risk.	The project has engaged with the local community, but ongoing difficulties in implementing measures on private land and with the community's desire to maintain an open landscape have hindered the project's goals. Risks remain that some measures could increase flood risk by synchronising flows.	South West Water understands that there are risks associated with farmers not complying with the conditions in the contract, but these are considered minimal. Working through 'trusted intermediaries' has helped mitigate this risk.
Identifying the right interventions	There is a strong cause-and-effect pathway between woodland creation and carbon sequestration. The Forestry Commission developed 'carbon lookup tables' which provide conservative estimates of carbon sequestration for different tree species and different management regimes.	A crucial element of the project is to understand how floods are generated in a catchment and how the way the land is used and managed affects the speed and volume of flood flows. The model produced by Durham University identified the parts of the river catchment where intervention would be most effective. Measures included planting riparian woods and constructing large woody debris (LWD) dams.	ADAS and IGER have analysed the effectiveness of a suite of measurements that can help to reduce diffuse pollution from agriculture. WRT identified suitable measures, including buffer strips and upgraded farm infrastructure.
Mode of payment	The Woodland Carbon Code is based on an 'outputs-based approach' as businesses pay for tonnes of carbon sequestered. The Code allows credits to be sold both 'ex-ante' and 'ex-post' helping to raise revenue associated with both capital and maintenance costs. The EWGS can also be used to help meet upfront costs associated with the project.	Slowing the Flow at Pickering is based on an 'inputs-based approach' with finance provided by a range of government agencies. The lead funder is Defra and supplementary partners include: Forestry Commission for woodland creation / forest measures; NYMNPAs for moorland measures; and the EA for developing flood storage bunds.	Upstream Thinking is an 'inputs-based approach' based on prescribed improvements to farm infrastructure that should reduce diffuse pollution to waterbodies. These are set out in an approved farm plan. The level of payment depends on the necessary measures to reduce diffuse pollution. South West Water funds the improvements through its capital works programme. The company has had catchment management plans approved by OFWAT to deliver preventative measures on land it does not own.
Spatial targeting	Carbon sequestration can vary depending on type of land afforested, tree species selected and management regime.	Spatial variability in the contribution of different land types to flood risk regulation was reflected in the modelling exercise.	South West Water recognised that spatial variability was key to managing water quality across the catchment and identified the need to work with farmers on different land types, including peatlands on Exmoor and enclosed farmland.
Building trust	The Forestry Commission hosts a registry of projects certified under the Code. This increases the Code's transparency and gives investors confidence that they are getting what they pay for.	A community engagement plan is in place and the local community has been kept informed through two Community Engagement days, via their representative, via the project website and through the local media. Good communication is considered essential to the success of the project.	The intermediary, the WRT has built a relationship with the farmers in the catchments over the past 15 years, through providing best practice advice and helping farmers to access grants. The trust between the intermediary and the sellers has been crucial to the success of the project.

Issue	Woodland Carbon Code (Warcop): Carbon Sequestration	Slowing the Flow at Pickering: Flood Risk Regulation	Upstream Thinking: Water Quality
Monitoring the delivery of interventions	Projects are independently validated to check they meet the required criteria, for example in relation to additionality. Projects are then verified every five years.	The Environment Agency's river gauging stations and seven additional water level recorders installed by Forest Research are used to distinguish the impact of the flood alleviation measures on the timing and velocity of flow rates.	Payment to farmers were made conditional on implementing an agreed farm plan and abiding by the contract.
Sources	Reports and information on the Woodland Carbon Code web pages of the Forestry Commission website (online) available here .	Reports and papers accessed on the 'Slowing the Flow at Pickering' webpages of the Forestry Commission website (online) available here .	Personal Communication from Laurence Couldrick at the Westcountry Rivers Trust.

Part 3 – Further Information and Resources

The table below provides links to useful sources of further information and advice.

In particular, the Ecosystems Knowledge Network has dedicated web pages on PES.

<http://ekn.defra.gov.uk/resources/tools-guidelines/pes/>

Resource	Link	Description of resource
Biodiversity & Ecosystem Service Sustainability (BESS)	http://www.nerc-bess.net/	BESS is a six-year (2011-2017) NERC research programme designed to answer fundamental questions about the functional role of biodiversity in key ecosystem processes and the delivery of ecosystem processes at the landscape scale.
Bonneville Environmental Foundation	www.b-e-f.org/	BEF is a non-profit provider of market-based solutions designed to help businesses and organisations balance their energy, carbon and water footprints through Renewable Energy Certificates, Carbon Offsets and Water Restoration Certificates.
BSR's Ecosystem Services Working Group	www.bsr.org/en/our-work/working-groups/ecosystem-services-tools-markets	BSR's Ecosystem Services Working Group focuses on emerging risks and opportunities associated with corporate reliance on, and impacts to, ecosystem services. The Group tracks the development of new environmental performance expectations associated with ecosystem services, as well as new decision-making aids and policy uptake.
Catchment Change Management Hub	http://ccmhub.net/	The Hub aims to provide a repository and guide to knowledge for planning catchment restoration and mitigation measures to achieve good ecological status in rivers and other water bodies for the benefit of local catchment managers, advisors and interested stakeholders – including local community groups and the general public.
Ecosystems Knowledge Network (EKN)	http://ekn.defra.gov.uk	EKN provides a resource for sharing knowledge or learning about the practical benefits of an ecosystems approach. In particular, the site provides examples of practical projects that have used the ecosystems approach and provides links to relevant initiatives and tools.
Ecosystem Market Task Force (EMTF)	http://www.defra.gov.uk/ecosystem-markets/	The business-led EMTF reviewed the opportunities available to UK business that could help them develop green goods, services, investment vehicles and markets which value and protect the environment.

Resource	Link	Description of resource
Environmental Valuation Reference Inventory (EVRI)	www.environment.nsw.gov.au/publications/evri.htm	A storehouse of over 2,000 international studies providing values, methodologies, techniques and theories on environmental valuation. Free access is available to all citizens of member countries - Australia, Canada, France, New Zealand, UK and USA.
UNEP Guidance Manual for the Valuation of Regulating Services	http://hqweb.unep.org/pdf/Guidance_Manual_for_the_Regulating_Services.pdf	Identifies and evaluates different methodologies for valuing regulating services in economic terms; provides guidance on the main issues that need to be considered and addressed when using them; and demonstrates their application in valuing regulating services and the scope for incorporating these values into decision-making processes.
InVEST: Integrated Valuation of Environmental Services and Tradeoffs	http://www.naturalcapitalproject.org/InVEST.html	InVEST is a family of tools to map and value ecosystem goods and services developed by the Natural Capital Project (a partnership among Stanford University, The Nature Conservancy, the World Wildlife Fund, and the University of Minnesota).
Katoomba-CARE Payments for Ecosystem Services (PES) Contract Toolkit	http://www.katoombagroup.org/regions/international/legal_contracts.php	A collection of transactional resources for use by communities, project developers and lawyers interested in contracting for ecosystem services. Resources include template contracts, example clauses, and contract drafting and design information.
National Ecosystem Assessment (NEA)	http://uknea.unep-wcmc.org	The first analysis of the UK's natural environment in terms of the benefits it provides to society and continuing economic prosperity. The NEA follow-on phase is focused on further developing and promoting the arguments that the NEA put forward and making them applicable to decision- and policy-making at a range of spatial scales across the UK to a wide range of stakeholders.
Natural England – the Ecosystem Approach	www.naturalengland.org.uk/ourwork/research/ecosystemapproach.aspx	Details of Natural England's evidence programme on the ecosystem approach which is focused on identifying and mapping ecosystem services, understanding how they provide benefits and how they can be valued and considered in decisions about projects for, or affecting, the environment.
NutrientNet	www.nutrientnet.org/	NutrientNet, led by the World Resources Institute (WRI), is a suite of web-based tools used to facilitate market-based approaches to improving water quality.

Resource	Link	Description of resource
Quantifying the Benefits of Water Quality Catchment Management Initiatives	www.ukwir.org/ukwirlibrary/95165	A set of four volumes comprising: a Benefit Assessment Framework; an Overview Report; a Review of the Effectiveness of Catchment Management Initiatives; and Case Studies. In particular, Volume 1 provides a framework and supporting toolkit for assessing the benefits of catchment management schemes.
Rural Economy and Land Use Programme (Relu)	www.relu.ac.uk	An interdisciplinary research programme supporting projects under the theme of adapting rural living to environmental change.
Tasmanian Forest Conservation Fund (FCF) landowner information kit	www.environment.gov.au/land/publications/forestpolicy/fcflandowner-kit.html	Provided landowners with detailed information on the Program including factsheets on site assessments, tender applications and land sales.
The Economics of Ecosystems and Biodiversity (TEEB)	www.teebweb.org	TEEB is a global initiative which highlights the cost of biodiversity loss and ecosystem degradation and brings together expertise from ecology, economics and development to support the mainstreaming of biodiversity and ecosystem considerations into policy-making.
Valuing Nature Network (VNN)	www.valuing-nature.net	The VNN's mission is to support interdisciplinary partnerships to scope, develop and promote research capacity in the valuation of biodiversity, ecosystem services and natural resources and facilitate the integration of such approaches in policy and practice in the public and private sectors.
World Business Council for Sustainable Development (WBCSD) Focus Area on Ecosystems	www.wbcscd.org/work-program/ecosystems.aspx	The aims of the WBCSD's Focus Area on Ecosystems include developing and supporting the implementation of corporate decision support tools to identify and respond to ecosystem risks and opportunities, including a Guide to Corporate Ecosystem Valuation (CEV).

Glossary

Adaptive management	Using the lessons gained from putting a PES scheme, or any other management scheme, into practice to reorient the scheme and make progress towards agreed or improved end-goals.
Additionality	A concept used to distinguish the net benefits associated with an activity or project. In the case of PES, additionality is achieved through the implementation of actions over-and-above those which land or resource managers would generally be expected to undertake in the absence of a PES scheme (note that precisely what constitutes additionality varies from case-to-case but the actions paid for must at the very least go beyond regulatory compliance).
Baseline	The anticipated level of ecosystem service provision in the absence of a PES scheme. The baseline provides a yardstick against which any changes in the provision of ecosystem services resulting from a PES scheme can be gauged.
Beneficiary	Any individual or group who derives value from an ecosystem service.
'Beneficiary pays' principle	Where payments for an ecosystem service are made by the beneficiaries of the service, such as individuals, communities and businesses, or by governments acting on behalf of various parties.
Biodiversity	The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biodiversity offsetting	Conservation activities designed to deliver biodiversity benefits in compensation for losses in a measurable way.
Buffer	Where a proportion of the additional ecosystem service provided remains unsold to account for unforeseen circumstances that might compromise delivery.
Bundling	Where a single buyer, or consortium of buyers, pays for multiple ecosystem services that arise from the same parcel of land.
Buyers	Beneficiaries of ecosystem services, who are willing to pay for them to be safeguarded, enhanced or restored. See Primary buyers, Secondary buyers, and Tertiary buyers.
Carbon sequestration	The process of removing carbon from the atmosphere and depositing it in a reservoir (eg locking it up in biomass as trees grow).
Certification schemes	Schemes verified generally by independent accrediting agencies to confirm that management actions comply with published or otherwise accepted standards of practice, including, for example, eco-labels.
Co-benefits	Arise where a scheme or action provides multiple benefits in terms of ecosystem services provision. For example, restoring woodland can provide carbon sequestration, local climate control, tourism opportunities and habitat for wildlife.
Conditionality	Where payments are dependent on the delivery of ecosystem service benefits. In practice, payments are more often based on the implementation of management practices, which the contracting parties agree are likely to give rise to these benefits, rather than on measured changes in ecosystem service provision.
Differentiated payments	Whereby sellers are paid different amounts based on, for example, the capacity of their land to supply particular services or their opportunity costs.
Ecosystem	A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Ecosystem services	The benefits people obtain from ecosystems. Examples include the supply of food, water and timber (provisioning services); the regulation of climate, water quality and flood risk (regulating services); opportunities for recreation, tourism and education (cultural services); and essential underlying functions such as soil formation and nutrient cycling (supporting services).

Ecosystem valuation	The process of valuing the contribution of ecosystem services to human well-being through economic and non-economic analyses. Contemporary economic and participatory techniques requiring the use of both quantitative and qualitative methods allow the monetary and non-monetary values of a wide range of ecosystem services to be identified. Economic valuation attempts to elicit public preferences for changes in the provision of ecosystem services in monetary terms. Ecosystems and their associated services have economic value for society because people derive utility from their actual or potential use and also value services for reasons not connected with use such as altruistic, bequest and stewardship motivations.
Free-riding	When an individual or group benefits from the actions of others without paying or sharing the costs.
Frontloading	Where payments are primarily made up-front or in the early years of a PES contract to incentivise participants in the crucial stages when costs are high and benefits may not yet be realised. This is particularly important, for example, if new infrastructure is necessary.
Holdouts	Individuals who try to exploit their location or choose not to participate in a scheme but who capture the benefits of actions undertaken by others.
Indicator	Measurable variables that can be used to infer changes in the provision of an ecosystem service.
Input-based payments	Payments made based on an intervention (eg re-vegetating peatland) rather than a direct change in an ecosystem service (eg improved water quality).
Intermediaries	Actors linking buyers and sellers in a PES scheme who can help with scheme development and implementation.
Inverse auction	See <i>Reverse auction</i>
Knowledge providers	Resource management experts, scientists, valuation specialists, land use planners, economists, regulators, legal advisors and other experts who can provide knowledge essential to the development of a PES scheme.
Land conservation agreements	Generic term for legal instruments used to promote conservation on privately held land.
Layering	Where multiple buyers pay for separate ecosystem services that arise from the same parcel of land or body of water. Layering is sometimes referred to as 'stacking'.
Leakage	Where securing an ecosystem service in one location leads to the loss or degradation of ecosystem services elsewhere.
Market-based mechanisms	Instruments or regulations that encourage behaviour through market signals rather than through explicit directives.
National Character Area	National Character Areas (NCAs) divide England into 159 distinct natural areas. Each is defined by a unique combination of landscape, biodiversity, geodiversity and cultural and economic activity. Their boundaries follow natural lines in the landscape rather than administrative boundaries.
Opportunity cost	A measure of the benefit foregone by using a scarce resource for one purpose instead of for its next best alternative use (eg the income foregone if a parcel of agricultural land is taken out of production and set aside to provide habitat for biodiversity).
Output-based payments	A measure of the benefit foregone by using a scarce resource for one purpose instead of for its next best alternative use (eg the private return foregone if a parcel of agricultural land is taken out of production and set aside to provide habitat for biodiversity).
Packaging	In which a PES scheme focuses on the provision of multiple ecosystem services through <i>Bundling, Layering, or Piggy-backing</i> .
Payments for Ecosystem Services	Schemes in which the beneficiaries, or users ('buyers'), of ecosystem services provide payment to the stewards, or providers ('sellers'), of ecosystem services.

Perverse incentives	A policy or practice that encourages, either directly or indirectly, resource uses that lead to the degradation of ecosystem services, for example, subsidising fertiliser prices can encourage the over-application of fertilisers which in turn harms biodiversity.
Piggy-backing	Where not all of the ecosystem services generated from a single parcel of land or body of water are sold to buyers. Instead, a single service (or possibly several services), is sold as an umbrella service, whilst the benefits provided by other services accrue to users free of charge (ie the beneficiaries 'free ride').
'Polluter pays' principle	A principle according to which polluters bear the costs of measures to reduce pollution according to the extent of either the damage done to society or the exceedence of an acceptable level (standard) of pollution.
Primary buyers	Actors, such as private organisations and individuals, who benefit directly from, and pay directly for, improved ecosystem service provision.
Private payment schemes	PES schemes in which in which beneficiaries of ecosystem services contract directly with service providers.
Proxies	See <i>Indicator</i>
Public payment schemes	PES schemes in which government pays land or resource managers to enhance ecosystem services on behalf of the wider public.
Public-private payment schemes	PES schemes that draw on both government and private funds to pay land or other resource managers for the delivery of ecosystem services.
Reverse auction	A competitive bidding process whereby sellers nominate particular actions or services and the price at which they are willing to sell them. Also known as inverse auctions.
Restrictive covenant	A covenant imposing a restriction on the use of land.
Secondary buyers	Actors who buy improved ecosystem service provision on behalf of sections of the general public such as water utilities and NGOs.
Sellers	Land or other resource managers whose actions can potentially secure provision of an ecosystem service.
Senior water rights	The laws defining water rights and the institutions involved in water resources allocation represent the framework for managing water resources in the United States. Senior water rights have an earlier priority date and claimants who hold them have a higher priority to divert water from a stream or water body than those with more junior rights.
Stacking	See <i>Layering</i>
Stakeholder engagement	The process by which people who are interested in or affected by a decision are included in the decision-making process.
Sustainable Intensification	Producing greater output from the same area of land while reducing negative environmental impacts and at the same time increasing contributions to natural capital and the flow of ecosystem services.
Tertiary buyers	Actors, typically government, who buy improved ecosystem service provision on behalf of the wider public.
Transaction costs	The costs of administering a scheme, including in this context the setting up and running of a PES scheme and ongoing monitoring and evaluation.
Umbrella	A service or set of services which form the basis of a PES scheme, the generation of which also yields a range of other co-benefits. See <i>Piggy-backing</i> .
Uniform payments	Whereby sellers are paid standard disbursements for service provision, for example on a per hectare basis.

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