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Paper 4

Payments for Ecosystem Services

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Chief Economist's Foreword

Payment for Ecosystem Services: an innovative mechanism for capturing the value of the natural environment

In June 2011, the UK National Ecosystem Assessment (NEA) was published. It is a groundbreaking initiative, and the first time a country has undertaken a complete assessment of the services which nature provides, how these have changed over the past, the prospects for the future, and the value of these to society and continuing economic prosperity. A previous Defra Evidence and Analysis paper 'Economic Growth and the Environment' set out the importance of the natural environment in supporting economic activity and the need to manage natural assets efficiently and sustainably in order to secure long-term economic prosperity. The UK NEA reinforced these links to prosperity and to wider wellbeing.

The UK NEA has been followed by the publication of the Natural Environment White Paper, which recognises the opportunities for new and innovative approaches for reflecting the value of the natural environment in supporting economic growth and wellbeing. It commits the government to encouraging and facilitating greater use of payments for ecosystem services (PES) in the future, especially as part of a broader mix of policy instruments. Current fiscal and economic conditions create a further imperative for thinking imaginatively about delivering environmental outcomes most cost effectively. Approaches such as payments for ecosystem services offer the potential for improving environmental performance while also providing benefits for business and stimulating the development of creative solutions, so minimising any unnecessary burdens on the wider economy. This is part of a wider programme of work within Defra looking at available policy levers and the mix of instruments to deliver environmental outcomes more cost effectively.

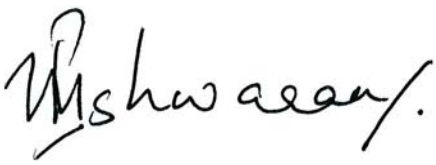
PES focuses on creating markets for ecosystem services, by bringing together the providers of these services and those that benefit from them. Such schemes are not new. For example, publicly financed agri-environment

schemes such as Environmental Stewardship – where farmers are paid for improved environmental outcomes – have been in operation in various forms for a while. But there is now increasing interest in how new business models for PES could emerge in the future. This is not just true in the UK but also internationally, where countries like the US, Australia, and France among others have been using and piloting these approaches.

Publicly funded payments for ecosystem services will remain important in the foreseeable future, but new opportunities lie in using PES to draw in additional sources of private investment. There are several examples of where it is more cost effective for businesses to invest in the natural environment than to deal with the risks to their ability to operate from the degradation or loss of natural capital (e.g. Vittel, France; and, closer to home, emerging evidence from initiatives such as SCaMP). These new opportunities for investment reflect the increasing understanding and awareness from business of the need to manage both risks and opportunities relating to the natural environment.

There is also significant potential for deploying publicly funded PES schemes in targeted ways which reduce the overall cost to the economy of delivering environmental outcomes (e.g. US Conservation Reserve Program, New York Catskills example and Australia Bush Tender).

By setting out the economic framework and key design principles, this paper sets out the fundamentals of an effective PES mechanism, and a robust analytical basis for taking forward this ambitious programme of work.



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Executive Summary

i. There is growing evidence about the significant potential for long-term growth in emerging markets for biodiversity and ecosystem services.

ii. Payments for ecosystem services (PES) can be essentially defined as payments to compensate for actions undertaken to increase the levels of desired ecosystem services. PES is a market-based approach linking those involved in 'supplying' ecosystem services more closely to the 'beneficiaries' of ecosystem services, potentially in cost effective ways and making use of new streams of finance.

iii. The overall aim of this paper is to explore in more depth how PES can be used to achieve environmental objectives by reviewing existing theory and analysis in this area and considering its application to the domestic context in England. This will help develop our thinking, identify key opportunities and challenges, and consider the role of government and other key stakeholders.

iv. In many ways, discussion about PES follows on from our thinking on valuing ecosystem services. Once you begin to understand better the value of different ecosystem services, including both the market and non-market values, then how to appropriate those values through different market and other decision-making mechanisms is a natural progression.

v. PES schemes, effectively, provide incentives to address market failure by altering the economic incentives faced by land managers or owners. In this sense, PES can be argued to fit within the broad category of market-based (economic) instruments which include taxes and charges, subsidies and direct market creation. Given the diversity of reasons for market failure and the challenges for the natural environment, appropriate action will depend on a mix of policy instruments including regulation, economic instruments and other approaches including voluntary, behavioural and information tools.

vi. Whereas taxes and tradable permits require the polluter to pay for the external costs of environmental degradation, PES focus on the user or

beneficiary paying for the ecosystem service enjoyed by the user. There is an important distinction between PES and subsidies by describing PES as a "contract for services".

vii. For this paper, the following principles are important for PES:

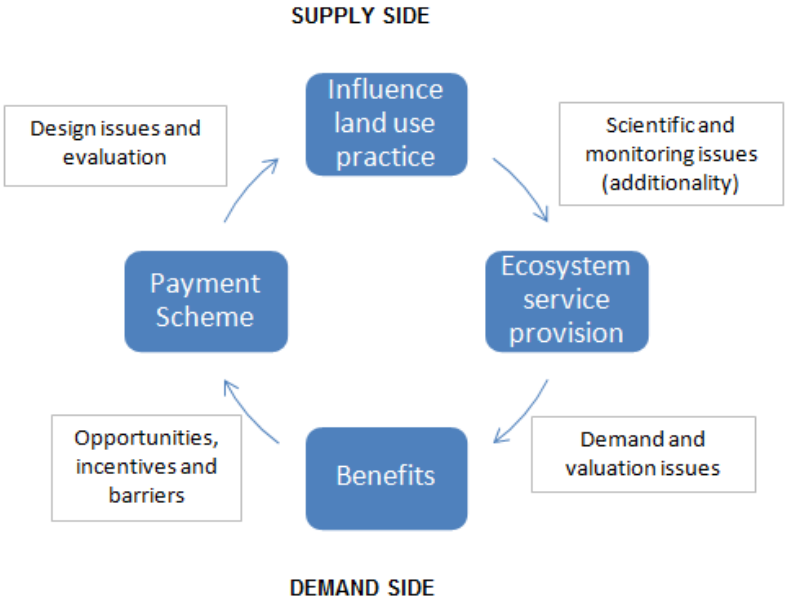
- ✓ There is a close link between the payment, land use practices and the delivery of ecosystem services: the "directness" of payment.
- ✓ There is a voluntary nature to the transaction, i.e. not because they are forced to trade by regulation or in order to meet a mandatory cap.
- ✓ PES should recognise only the "additional" benefits from ecosystem service delivery that arise, above and beyond land users meeting their statutory requirements.

viii. The paper recognises however that there are many "PES-like" schemes, i.e. those that fulfil most but not all criteria. It is important that a range of innovative approaches to financing environmental improvements are taken account of and so this paper also includes discussion of both PES and "PES-like" schemes.

ix. While the PES concept is relatively new, PES-type instruments have been in use in specific contexts for a considerable time. The most commonly-cited examples include agri-environment schemes, many of which have been operating since the 1940s. Other common examples of PES schemes found around the world relate to watershed protection, carbon sequestration, wildlife and habitat conservation and bio-prospecting.

x. The illustrative PES cycle presented below provides a high level overview of key aspects to be considered on both the demand and supply sides in designing PES; these aspects are covered in the main paper and summarised below.

Illustration PES Cycle



xi. The basic idea in PES schemes is that the users/beneficiaries of services provided compensate the providers. Payments for ecosystem service can be based on one specific service (e.g. carbon sequestration) or bundles of ecosystem services (e.g. carbon sequestration plus biodiversity enhancement). The financing of PES can be from government or financed voluntarily by private companies and individuals or incorporate private finance as key elements of the scheme.

xii. An important part of market failure is related to the 'public good' aspect of ecosystem services, recognising that distinctions in the exact nature of the public good for different ecosystem services could have implications for how PES schemes can be implemented. In some contexts, government financed PES may be the only option. For example, in the case of biodiversity, it is often difficult to identify all the users clearly, and users have a strong incentive to free ride. In other contexts, particularly where ecosystem services are private goods or club goods (many water services are examples here), it may be possible to identify the users and arrange for them to pay for service provision (private PES).

xiii. The table below provides a summary of key advantages of use of PES and where these approaches might work best as well as highlighting circumstances where they may not be suitable or be insufficient on its own.

Key potential advantages of PES	Circumstances where PES may not be appropriate or insufficient on own
✓ Work best where financial incentives can make provision of ecosystem services a more attractive option for a land manager; ✓ May offer more scope for private investment alongside public funding; ✓ PES instruments, because of their voluntary nature, offer less prescriptive and coercive approach and therefore may be a more feasible instrument in practice in some situations; ✓ Ability to target payments to land managers or owners who can affect the ecosystem services directly; ✓ Can seek out opportunities that provide for higher ecosystem service value, whereas regulation often needs to be applied to all land managers irrespective of benefit; and ✓ The greater the heterogeneity in the land managers' costs, the greater the potential for a PES scheme to be cost-effective compared to regulation.	✓ Where property rights are not well-defined, in which case financial incentives may not have any opportunity to influence behaviour; ✓ where there are information gaps in terms of ecosystem status and/or management; ✓ where PES is being considered to bring management practices up to the legal standard, in which case the principle of additionality is not being observed and this would also run contrary to the polluter pays principle; ✓ Where transactions costs associated with developing a PES may be very high.

xiv. The paper goes on to explore some of the key design issues for PES including:

Importance of spatial targeting: this relates both to the provision of ecosystem services, the beneficiaries or users and the costs to landowners of ecosystem service delivery.

Land use type and ecosystem service delivery: for a genuine PES there needs to be a clear relationship between the type of land use being promoted and the ecosystem services delivered which allows conditionality of payment to be based on the services provided.

Buyers: A useful distinction is between user financed and third party (or government) financed PES schemes. It can be argued that a user-financed PES scheme may have greater potential to be efficient because it can be better targeted and there are clear incentives on the part of the user for the mechanism to be working appropriately. Government-financed schemes may not have the full information but economies of scale in particular contexts may mean lower transaction costs than user-financed schemes.

Providers: The potential providers'/sellers' of ecosystem services are typically land managers whose management activities impact on specific ecosystem functions. Identifying the potential spatial scope and differentiation of provision and understanding the heterogeneity of providers in terms of cost are important in the design of payments schemes.

Payment and financing approaches: While an ideal approach might be to base payments on an output based (also known as payment by results) scheme, in practice this may be difficult and it is more usual for PES schemes to be input based (e.g. paying for adoption of particular land management activities). Payment design issues relate to degree of targeting and differentiation of payment, how they deal with the long term nature of the ecosystem service delivery and deal flexibly with changing circumstances and scientific understanding over time. There are more likely to be problems over "additionality" when

payments are low, undifferentiated and un-targeted but transaction costs are likely to increase with greater differentiation and targeting. The literature highlights a growing number of innovative financing approaches linked to PES schemes.

Measuring and monitoring: A crucial aspect of genuine PES schemes is to be able to measure and monitor the delivery of additional ecosystem services resulting from the payments. Monitoring costs can be significant so it is important these are taken account of in the PES design and payments.

Governance issues: Design of PES schemes need to take into account the institutional framework in which they will operate. These institutional, legal and social considerations can play an important role in defining the opportunities and challenges for PES. There may be a key role for government in enabling and removing barriers. The use of intermediaries can have an important role in improving coordination and reducing transaction costs.

xv. There are a number of key challenges that needs to be considered if we are to see scaling up of PES approaches in practice. These include:

Demand issues: Understanding what stakeholders want from ecosystems and associated demand for ecosystems services is a crucial first step in the development of PES. There is also a need to ensure that a wide range of stakeholders who benefit or who are impacted by environmental change understand these links. Otherwise demand for protection and enhancement of ecosystem services will be low because of this lack of awareness.

Improving scientific understanding: To scale up these approaches, we need improved understanding of how ecosystems provide services including the relationship between different services and trade-offs between services. We also need a better understanding of how land management can deliver the ecosystem services required.

Institutional and regulatory: These are likely to be key challenges in unlocking the potential for more widespread PES. While PES might be classified as an economic instrument, these incentives depend crucially on the institutional and regulatory context in which they must operate.

Reducing transaction costs: Evidence suggests that transaction costs can be potentially significant in developing and operating PES. While, in theory, PES is seen as a market solution to environmental problems, case study evidence suggests that the role of the state and/or community engagement remains a key factor in determining success. In particular, the evidence highlights the importance of trust-building and how this can reduce transaction costs. Many PES examples demonstrate the importance of an intermediary in this process.

Bundling ecosystem services: For many ecosystems, bundling various services together has been highlighted as an objective of PES schemes and could help significantly to improve the cost-effectiveness of such schemes. However, in practice, the literature highlights there have been few multiple-buyer deals which is a challenge for further consideration.

xvi. The paper presents a preliminary assessment of opportunities for use of PES in a domestic context. Defra commissioned a research study on "Barriers and opportunities for the use of payments for ecosystems" that provides a more detailed assessment and is published alongside this paper[1]. Across the Defra network and more widely, there are many examples of where PES approaches are being tested and implemented. We need to ensure we take on board any lessons learnt from these initiatives in developing our evidence on PES.

[1] URS/Scott Wilson, "Barriers and opportunities to the use of payments for ecosystem services", report for Defra, September 2011.

1. Introduction

1.1 Objectives of the paper

There has been growing interest in mechanisms that can better 'capture' the value of ecosystem services in practice; payments for ecosystem services (PES) is one such innovative approach. PES can be essentially defined as payments to compensate for actions undertaken to increase the levels of desired ecosystem services. PES is a market-based approach linking those involved in 'supplying' ecosystem services more closely to the 'beneficiaries' of ecosystem services, potentially in cost effective ways and making use of new streams of finance.

The overall aim of this paper is to explore in more depth how PES can be used to achieve environmental objectives by reviewing existing theory and analysis in this area and considering its application to the domestic context in England. This will help develop our thinking, identify key opportunities and challenges, and consider the role of government and other key stakeholders.

There is a growing research literature on the use of payments for ecosystem services, and also an increasing number of case study examples of PES including domestic examples. This paper draws upon this growing experience.

1.2 Ecosystem services and valuation

In many ways, discussion about PES follows on from our thinking in Defra and elsewhere – now well established – on valuing ecosystem services. Once you begin to understand better the value of different ecosystem services, including both market and non-market values, then how to appropriate those values through different market and other decision-making mechanisms is a natural progression.

Ecosystem services are defined as services provided by the natural environment that benefit people. Some of these services are well known,

such as food and fuel provision and the benefits that arise through recreation and appreciation of nature. Other services are not so well known or reflected in practical decision-making processes, including climate regulation, purification of air and water, flood protection and nutrient cycling. With a broader focus on the benefits provided by ecosystems, we can not only avert unintended harm to nature but also more easily demonstrate that investing in natural capital can make good economic sense.

There is growing evidence of the value of the natural environment and the diverse range of benefits that it delivers, including food, clean water, healthy soil and carbon storage. Over the last few years, considerable research has been undertaken to demonstrate these values more clearly and the implications of ecosystem loss for delivery of these key services. Internationally, the work of TEEB (The Economics of Ecosystems and Biodiversity) has been assessing the global economic benefits of ecosystems and biodiversity, and the economic case for investment in natural capital[2]. In the UK, the National Ecosystem Assessment (NEA) reported in June 2011[3] and provides crucial information on the state and trends of the UK's major habitat types and the projected consequences of change over the next 50 years. The UK NEA is the first analysis of the UK's natural environment in terms of the benefits it provides to society including economic prosperity.

In December 2007, Defra published "An Introductory Guide to Valuing Ecosystem Services"[4]. This guide was a first step towards the aim of embedding impacts on the natural environment more widely across decision-making. It provides a step-by-step guide to valuing ecosystem services which integrates scientific and economic evidence on how changes to ecosystems and their services impact the economy and society. This evidence, which is built up as part of the valuation process, is important for understanding mechanisms to capture those values. This includes their uptake into market-based instruments such as PES.

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[2] Its final synthesis of approach, conclusions and recommendations was launched at COP10 of the Convention on Biological Diversity in Nagoya, Japan in October 2010. See http://www.teebweb.org/

[3] http://uknea.unep-wcmc.org/

[4] http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-valuing.pdf

1.3 The potential for markets in biodiversity and ecosystem services

There is growing evidence about the significant potential for long-term growth in emerging markets for biodiversity and ecosystem services.

The TEEB report for business [July 2010][5] reported estimates for global market size from the Ecosystem Marketplace[6] across a range of biodiversity and ecosystem service market opportunities including payments for ecosystem services. It estimated that globally payments for ecosystem services mediated by government stood at $3 billion in 2008, but that this could rise to $15 billion by 2050. Likewise, government payments for watershed management of $5.2 billion in 2008 could rise to $20 billion by 2050, with voluntary payments for watershed management increasing from millions in 2008 to $10 billion by 2050. The TEEB report concluded that new markets for biodiversity and ecosystem services are emerging and, if scaled up, they could represent major business opportunities and a significant part of the solution to the ecosystem and biodiversity finance challenge.

Domestically, PES-like schemes include the publicly funded agri-environment scheme payments through Environmental Stewardship (funding of approximately £400 million per year, 2007-13)[7]. There are also a growing number of examples of private funding for watershed schemes[8]. We have also to recognise that PES is not a new approach; the OECD (2010)[9] estimate that there are some 300 schemes operating globally and addressing a range of markets including watershed protection, climate regulation, biodiversity conservation, forest protection and erosion control.

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[5] http://www.teebweb.org/ForBusiness/tabid/1021/Default.aspx

[6] http://www.ecosystemmarketplace.com/

[7] Environmental Stewardship is Defra's programme to support the provision of environmental public goods by farmers in England. ES supports and secures existing good practice, as well as incentivising additional provision of public goods.

[8] Examples include the Mires on the Moor project involving SW Water with funding of £4m, additional investment by SW Water under the 'Thinking Upstream' programme of £9.1m in total up to 2015, and the Sustainable Catchment Management Programme (SCaMP) with funding including £9m from United Utilities (SCaMP1).

[9] OECD, "Paying for biodiversity: enhancing the cost effectiveness of payments for ecosystem services (PES)", (2010)

1.4 Structure of this paper

The structure of the paper is set out as follows. Section 2 provides an overview of what is meant by PES, looking at the definition and scope and providing a simple illustrative example of a PES in operation. Section 3 goes on to explore the rationale for such mechanisms, considering how PES might fit into the wider policy instrument choice for management of the natural environment and provides an analytical framework that helps in understanding this payment mechanism in the context of both public and private funding. Section 4 highlights some of the key design issues for PES. Section 5 then provides a preliminary exploration of some of the key challenges and opportunities for applying PES in a domestic context, identifying issues where further work is required. Throughout the paper, we highlight case studies of PES schemes, both international and domestic, to help illustrate the key issues in a practical context.

This analytical paper is part of a longer term programme of work in this area as recently highlighted by new commitments by Defra in taking work forward on payments for ecosystem services in the Natural Environment White Paper published in June 2011. It is hoped that this paper will improve understanding of the use of such mechanisms and will help to promote consideration of their use across natural environment policy areas.

Any comments on this paper would be welcome and should be sent to: nee@defra.gsi.gov.uk

2. What is PES? – Definition and Scope

2.1 Definition of PES

Payments for ecosystem services (PES) can be essentially defined in terms of payments to land managers or owners to undertake actions that increase the levels of desired ecosystem services. A more formal definition is provided by Wunder (2005)[10]: ''A PES scheme, simply stated, is a voluntary, conditional agreement between at least one 'seller' and one 'buyer' over a well defined environmental service – or a land use presumed to produce that service."

PES schemes, effectively, provide incentives to address market failure by altering the economic incentives faced by land managers or owners. In this sense, PES can be argued to fit within the broad category of market-based (economic) instruments which include taxes and charges, subsidies and direct market creation[11]. Other policy options to address market failure include direct regulation, public spending and other approaches including voluntary, behavioural and information tools. The following section (section 3) reviews in what broad contexts PES may be an appropriate instrument choice.

Table 2.1: Various policy instruments used for implementing environmental policy

Economic instruments	Public spending	Voluntary approaches	Information tools	Regulation
• Tax • Market creation including trading schemes • Subsidies • **PES (private and public)**	**PES (public)**	• Industry agreements to reduce impacts on environment	• Eco labelling	• Industry compliance standards • Restrictions on use and access

[10] "Payments for environmental services: some nuts and bolts", Sven Wunder, Centre for International Forestry Research, 2005.

[11] In many ways, PES should not only be described in terms of government policy instruments because it can be taken forward by the private sector (independent market creation) and generating private investment in such schemes is often a key aspect

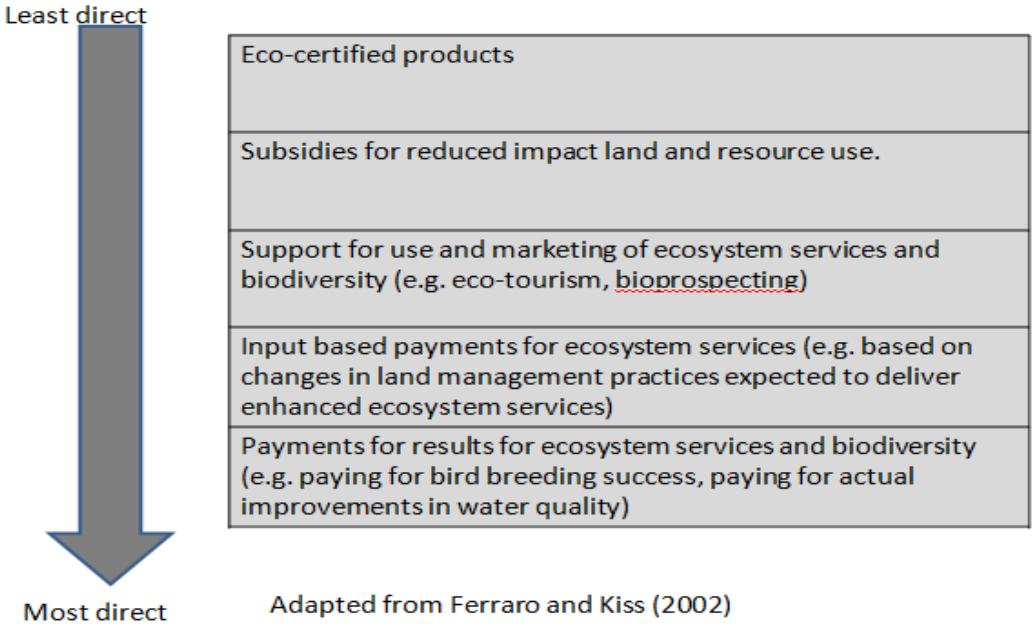
Whereas taxes and tradable permits require the polluter to pay for the external costs of environmental degradation, PES focus on the user or beneficiary paying for the ecosystem service enjoyed by the user. This is straightforward to understand in the context of positive externalities (e.g. if a payment could be made for pollination services that make a significant contribution to agricultural output). However, PES mechanisms are also applied to land management actions to reduce pollution and in these contexts there can sometimes be seen to be an overlap with subsidy-type instruments.

But there are some key distinguishing features between payments for ecosystem services and subsidies. In particular, they should not be confused with traditional farm subsidies, including direct area payments under Pillar 1 of the Common Agricultural Policy, which are poorly targeted at ecosystem services, despite basic requirements to keep land in "good agricultural and environmental condition".[12] Moreover, payments under a PES scheme are intended to reward services that go **beyond** what is legally required[13]. Payments for ecosystem services are financed directly or by third parties (such as government, NGOs, insurance companies or water utilities) on behalf of the beneficiaries of the ecosystem services to deliver specific ecosystem services ('contract for services'); this 'conditionality' is a particularly important feature. **This paper argues there is an important distinction between PES and subsidies by describing PES as a "contract for services".**

[12] "Direct payments to all farmers in the EU, granted on a per hectare basis, are a blunt instrument that is not capable of making efficient contributions to attaining specific objectives and to providing the public goods Europe's society expects from agriculture.", Stefan Tangermann, Direct Payments in the CAP post 2013, briefing note for the European Parliament, January 2011, p. 15.
www.europarl.europa.eu/activities/committees/studies/download.do?language=en&file=34680

[13] If a PES were used to get practice up to the legal standard then it would be described as a subsidy and would run contrary to the polluter pays principle.

Figure 2.1: Directness of payment for ecosystem services



We recognise that defining PES is not an exact science. PES is often used as a broad term for any market-based mechanism for delivering ecosystem services or conservation objectives, and we acknowledge that a wide range of economic instruments are important. Ferraro and Kiss [2002][14] make a useful distinction in highlighting that these incentives lie on a spectrum from indirect to direct with respect to their link to environmental objectives (see figure above). So on this spectrum, eco-certification on products might be classified as providing a fairly indirect incentive compared to a 'payment for results' scheme for watershed protection that provides compensation for delivering a well-defined ecosystem service.

For this paper, the following principles are important for PES:

- ✓ There is a close link between the payment and the delivery of ecosystem services: the "directness" of payment.
- ✓ There is a voluntary nature to the transaction, i.e. not because they are forced to trade by regulation or in order to meet a mandatory cap[15].

[14] "Direct payments to conserve biodiversity", Paul Ferraro and Agnes Kiss, November 2002, Science.

[15] For these reasons, this paper does not focus on compliance driven markets (e.g. trading schemes). However, as later sections will discuss, a clear regulatory baseline is often an important underpinning driver of demand for PES to pay for ecosystem services delivered beyond the statutory requirements.

- ✓ PES should recognise only the "additional" benefits from ecosystem service delivery that arise, above and beyond land users meeting their statutory requirements.

The paper recognises however that there are many "PES-like" schemes, i.e. those that fulfil most but not all criteria. It is important that a range of innovative approaches to financing environmental improvements are taken account of and so this paper also includes discussion of both PES and PES-like schemes.

2.2 The scope of PES

While the PES concept is relatively new, PES-type instruments have been in use in specific contexts for a considerable time. The most commonly-cited examples include agri-environment schemes, many of which have been operating since the 1940s. Other common examples of PES schemes found around the world relate to watershed protection, carbon sequestration, wildlife and habitat conservation and bio-prospecting[16]. However, new innovative examples of PES are increasingly emerging or under suggestion, for example to address invasive non-native species or soil erosion in upstream watersheds, which often incurs dredging costs downstream. **Table 2.2** highlights a range of different types of PES and PES-like schemes highlighting specific international and UK examples[17].

[16] Bio-prospecting is the process of conducting scientific research into the useful application of genetic resources in various commercial markets extending to pharmaceutical, horticultural, cosmetic, botanical, or agricultural ends. The goal of bio-prospecting is to identify genetic resources that may be used to develop products of commercial value while providing enhanced incentives for biodiversity conservation.

[17] There is a case to include biodiversity offsets as an example of PES. It would fit in terms of paying the provider to deliver enhanced ecosystem services. However it is the polluter that pays rather than the beneficiary. In the context of this paper, therefore, we do not include within the definition of PES. For more information on this approach and recent developments, see http://www.defra.gov.uk/environment/natural/biodiversity/uk/offsetting/ . Recent analysis (see Impact Assessment published in June 2011) estimated the potential voluntary market (for a full rollout compared to current piloting) at just under £100m per annum.

Table 2.2: Examples of payments for ecosystem services schemes

Type of PES	Market driver?	International examples	UK examples
Voluntary carbon forestry	Voluntary, corporate responsibility, preparing for regulation	Chicago Climate exchange	Voluntary carbon payments enabled by Woodland Carbon Code[18]
Voluntary watershed management payments	Voluntary private PES	Vittel, France, Panama Canal	SCaMP (United Utilities/RSPB), SW WATER project, Angling Passport Schemes
Government mediated watershed payments	Government PES	Costa Rica, Pago por Servicios Ambientales (PSA), US Wetlands Reserve Program	Projects such as SCaMP include public agri-environment funding, Natural England pilots.
Government mediated biodiversity PES	Government PES	Australia Bush Tender, US Conservation Reserve Program	RDPE: Environmental Stewardship, England Woodland Grant Scheme (EWGS)
Recreation	Voluntary private PES	Yosemite Conservancy, US	Various "visitor payback" schemes (e.g. in national parks such as Nurture Lakeland, Lake District)
Genetic resources	Voluntary private PES	Costa Rica – INBio (National Biodiversity Institute) and Merck Pharmaceuticals	Marine biotechnology research activities in the UK could promote direct payments for bio-prospecting in future?

Source: material and examples drew upon Ecosystem Marketplace and URS/Scott Wilson, "Barriers and opportunities to the use of Payments for Ecosystem Services, report to Defra.

[18] The Woodland Carbon Code is an enabler which aims to simulate the market in forestry carbon sequestration. It is aiming to encourage a consistent approach to woodland carbon projects, and offer clarity and transparency to customers about the carbon savings that their contributions may realistically achieve. This has already been taken up by a number of companies.

The basic idea in PES schemes is that the users/beneficiaries of services provided compensate the providers. Payments for ecosystem services can be based on one specific service (e.g. carbon sequestration) or bundles of ecosystem services (e.g. carbon sequestration plus biodiversity enhancement). They can include many different types of buyer to seller arrangements. The financing of PES can come from government (government-financed PES) which may be effectively purchasing on behalf of a large number of beneficiaries (e.g. public benefits purchased through Environmental Stewardship relating to the public 'goods' of landscape and biodiversity on behalf of the English public). At the same time, however, a number of PES schemes are financed voluntarily by private companies and individuals (private PES) or incorporate private finance as key elements of the scheme. For example, see Case Study 1 below relating to the Vittel PES scheme.

Case Study 1: Private user-financed PES – Vittel Watershed Protection

Background

In the late 1980s, Vittel, one of the most commercially valuable bottled mineral water brands in the world, faced the threat of a substantial degradation of the aquifer in north eastern France. It was recognised that agricultural drivers were changing, including transition to more intensive farming practices. Projected increases in the nitrate concentration of groundwater posed a serious threat to Vittel's operations. The French accreditation system for spring water does not allow treatment, but stringent standards have to be met. This means that problems with catchments have to be addressed by 'upstream management'. In 1992, Agrivair was set up as a body to protect sources feeding Nestlé Waters interests in France. Through Agrivair, Vittel developed a PES scheme with local farmers. Nestlé Waters has used a similar approach with springs serving its Perrier and Contrex brands in France.

Details of Initiative

In an effort to avoid excessive nitrate enrichment of the watershed, Vittel pays local farmers to adopt less intensive farming techniques such as outdoor grazing, instead of fertiliser-intensive maize cultivation and feed lots, and the planting of trees to improve soil conditions and promote filtration services. The changes to the system meant that farmers had to

adopt various farm practice changes. Payments by Vittel provide sufficient incentives to compensate the farmers for these actions. The scheme was developed in collaboration with farmers and academics, and individual payments were negotiated with each of the targeted farms. This may mean that payments were not determined in a competitive process. However, the fact that both farmers and Vittel were able to come to agreements may point to an efficient outcome having been negotiated, given that participation was voluntary. Eventually, almost all of the largest farms in the area entered into contracts of between 18 to 30 years with Vittel. The scheme has been a documented success in terms of its impacts on water quality, farmer profitability and biodiversity.

Overall significance

The Vittel PES watershed protection scheme is one of the most clear-cut examples of a private sector user-financed PES scheme and demonstrates there is a strong business case for private sector participation in water-related PES. While economic incentives played a role in the success of the scheme, other factors such as trust building through the creation of an intermediary institution, were seen as equally if not more important. Another important aspect of this particular PES scheme was the commitment to undertake research to clearly identify the sources of pollution and identify where actions needed to be targeted. A detailed review by IIED (2006) concluded that "…the Vittel experience is most likely to be replicable in places where land cannot be purchased and set aside for conservation, and where the risk to business is high while the link between ecosystem health and farming practices is well understood and expected benefits are sufficiently high to justify the investment."

For a detailed assessment, see IIED/DFID, Daniele Perrot-Maitre, September 2007, The Vittel payments for ecosystem services: a "perfect" PES case?

2.3 Illustrative example of a PES

In this section, we introduce a simple example of a payment for ecosystem services scheme to illustrate some key principles of PES. We make use of this example in subsequent sections of this paper.

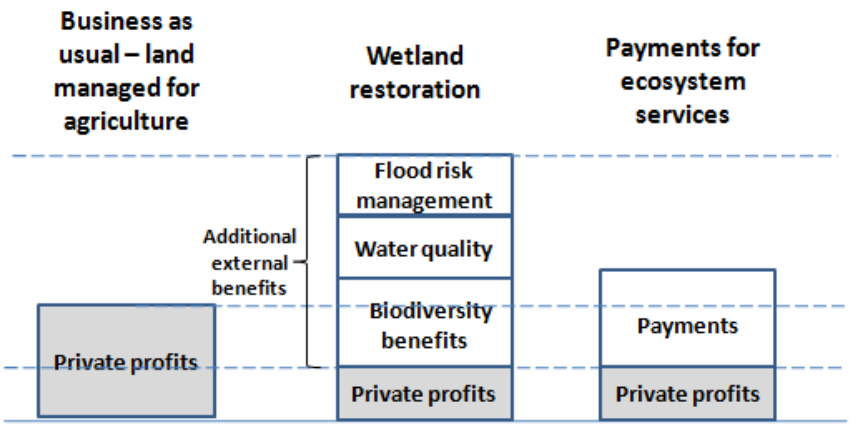
The illustrative example presented below relates to wetland restoration. Under 'business as usual', the land manager is focused on managing the land for agricultural purposes and deriving private profits solely from these activities (see the first column of Figure below); wider public benefits are not generally accounted for in the land management decision[19].

Different land management activities – in this case riparian and wetland restoration – could achieve an enhanced level of ecosystem services. For example, activities could include creating buffer zones along rivers for wildlife and re-flooding wetlands to improve water carrying capacity. This might lead to additional ecosystem service benefits in terms of biodiversity, improved water quality and flood risk management. However, these changes to land management activities could result in reducing private profits (see column 2 below). An incentive or compensation, to land managers is therefore required to encourage wetland restoration to be taken forward; this could take the form of a PES (column 3)[20].

[19] Note: The land still may deliver a range of ecosystem services but under the business as usual, the land manager may not take these into account in private decision making.

[20] This needs to take account of transaction costs in the PES design which can be significant – see discussion in Section 5.

Figure 2.2: A simple example of a PES



As highlighted earlier, a PES scheme is a voluntary agreement between sellers and buyers to deliver actions that increase or enhance ecosystem services delivery. In this example, the 'seller' or provider is the land manager who will undertake actions on their land leading to enhanced ecosystem service delivery. The 'buyer' is generally linked to beneficiaries, or users of ecosystem services that would be enhanced under PES, by this payment agreement. In this example, there are a number of different potential beneficiaries including:

- ✓ water companies – interested in improving water quality
- ✓ local residents – interested in reduced flooding
- ✓ insurance groups – interested in reduced flooding
- ✓ recreational users – interested in enhanced recreational opportunities
- ✓ conservation groups – interested in enhanced wetland habitat

If a PES scheme can be negotiated between the land manager and some or all of the beneficiaries, either directly or through an intermediary such as an NGO or government body, then an outcome which benefits all parties can be achieved. One of the best known examples of a PES scheme relates to paying for water services in the Catskills and Delaware Watersheds, which achieved considerable cost savings to New York State (see the case study 2 below).

Case study 2: Paying for water services in New York State

Background

New York City obtains 90% of its drinking water supplies from the Catskill and Delaware watershed system, situated 130 miles outside the city, which filters water through their waterways and wetlands. By the end of the 1980s, changing agricultural drivers and growing urbanisation in the Catskills were threatening water quality, which forced city officials to consider treatment of its water supply to ensure it continued to meet water quality standards. The estimated cost of a filtration facility was between US$8-10 billion. After careful assessment of alternatives, the City decided that investing in watershed protection measures was the most cost-effective option.

Details of the initiative

A range of measures were adopted, including land purchase of important areas and both educating and paying farmers to change their farm practices to minimise water pollution via a set of 'whole farm plans'. Measures were designed on a farm-by-farm basis to ensure both reductions in pollution but also integration with the farm business. Within five years, 93% of farmers in the watershed had chosen to participate. The cost of these measures is estimated at about $1.5 billion.

Overall significance

This is one of the best-known, and probably the largest, example of a payment for ecosystem services scheme. The decision amounted to investing in natural capital in place of man-made capital. The programme to conserve the Catskills and Delaware watersheds cost the City about US$1.5 billion, representing a considerable saving over the US$8-10 billion that a filtration plant would have cost. It has played a major role in stabilizing and reducing watershed pollution loads and in enabling the City to avoid having to filter its water supply.

Source: http://www.epa.gov/region2/water/nycshed/

3. An analytical framework for PES

3.1 Introduction

This section introduces an analytical framework for PES that helps in understanding this payment mechanism in the context of both public and private funding. The section reviews the underlying market failures that can relate to delivery of ecosystem services and may require government intervention and provide a specific rationale for government funding. However, it also provides a framework for understanding the private incentives for investment (the "win win" opportunities) and the role of government in enabling such mechanisms and private opportunities to be realised in practice.

From an economic perspective some of the key principles for consideration relate to:

- Market failures associated with ecosystem services and scope for PES;
- Tackling environmental issues at the appropriate level;
- Meeting environmental objectives;
- Demonstrating cost-effectiveness; and
- Ensuring acceptable distributional impacts.

3.2 Market failures associated with ecosystem services and scope for PES

Ecosystem services contribute to economic welfare through both the generation of income and wellbeing and prevention of damages that inflict costs on society. As the introductory section indicates, the developing evidence base is increasingly supportive of the substantial value and contribution of these services to economic growth and human wellbeing. However, while some of these ecosystem services are directly priced in the market (e.g. food and timber), many key ecosystem services are not accounted for at all and therefore risk being under-valued with resulting over use and degradation of these services.

Various types of market failure are associated with the natural environment which provides a strong rationale for government intervention. Market failures relating to ecosystems are linked to the 'public good' nature of many ecosystem services, the existence of externalities, and information and R&D failures.

Many ecosystem services have **public good** characteristics which account for their under-provision. For example, climate regulation and biodiversity can be described as pure public goods. These public good characteristics relate to being non-rival in consumption and non-excludable. For example, an upland area may provide ecosystem services to a population downstream in terms of water filtration and alleviation of flood risk. In this case, one individual benefiting from improved water quality and lower flood risk is not going to affect other individuals benefitting (non-rival) and no individual can be excluded from these benefits (non-excludable). These characteristics mean that, although there is value in these services, there are no incentives to pay to maintain these services (i.e. free riding). Government intervention is required to ensure these ecosystem services are maintained for the public benefit.

In practice, many ecosystem services may be quasi-public goods - in other words, may be in fact, either excludable or rival in consumption to some extent. For example, many water services (see example above) may be better described as **club goods** - an intermediate category between private and public goods - where the service can be consumed by many individuals (the members of the 'club') without affecting the consumption of others but whose consumption by non-members can be prevented. This has important implications for how PES can be implemented, as discussed in more detail below.

A key aspect of market failure relates to **externalities**, which arise where use of a resource by individuals and firms do not take into account the full social costs or benefits. Many ecosystem services fall into this category. For example, land-use conversion decisions from forest to agricultural land may not reflect the potential impact on carbon or on water regulation services and will not, without government intervention, be taken into account in the private decision on land-use conversion. This will lead to these costs being 'externalised', that is, imposed on society at local, regional and global levels

and results in under-provision of the ecosystem services concerned. The provision of ecosystem services can also be described in the context of positive externalities: for example, pollination services or a forest providing carbon storage benefits; both of these may relate to external benefits from the perspective of the land manager[21].

In the context of complexity in ecosystems and uncertainty in how ecosystems services are delivered or respond to different factors, **information failure** is likely to be playing a key role in the current losses in ecosystems and services. Information failures can occur when the information necessary for people or firms to make optimal decisions is incomplete or difficult/costly to acquire. As a result, existing opportunities to improve both economic and environmental outcomes may not be realised. The previous illustrative example of an upland area providing water and flood risk management services demonstrates this point In the past, there might have been limited understanding of what and how these services were being delivered downstream and the result might be the land is used for purposes that might decreases these services[22]. In particular, the private sector may not fully appreciate the ecosystem services they benefit from which can lead to inefficient outcomes. In the context of PES, there may be significant information gaps in how such approaches work in practice and there may be a role for information provision in terms of PES demonstration projects and capacity-building.

Finally, in environmental policy, a further source of market failure relates to **private under-investment in** environmental R&D- i.e. that the rate of return on investment in R&D is too low to support such investment when the benefits of this knowledge and improved management would accrue largely to the public rather than the private investor. While this is discussed generally in the context of environmental technologies (e.g. low carbon technologies), it can also become relevant in the context of innovations in approaches for managing land for delivery of ecosystem services and

[21] The provision of economic incentives in the form of a PES can help to internalise these externalities in private decision making. In terms of underlying economic theory, for this approach to deliver a welfare gain, the marginal social benefits (net value of the additional ecosystem services delivered) must be greater or equal to the marginal social costs (the full opportunity cost of delivery including transaction costs). An optimal provision of ecosystem services would be up to the point where the marginal social benefit is equal to the marginal social cost.

[22] Although this also needs to recognise that correcting for information failure may still leave other market failures where there are limited incentives for land managers to manage the land for these ecosystem services.

investment in natural environment infrastructure (e.g. managed realignment projects can be an alternative to 'hard' flood defences in specific contexts).

Given the diversity of reasons for market failure, it is likely that appropriate action will require a mix of policy instruments including PES but also regulation, other economic instruments and approaches including voluntary, behavioural and information tools. In particular, it is likely that PES approaches complement rather than substitute for other policy approaches.

PES-type instruments work best where financial incentives can make provision of ecosystem services a more attractive option for a land manager (effectively the payment is able to internalise the externality into the private decision-making of a land manager/owner). However, there are many circumstances where PES may not be appropriate or sufficient on its own. For example, if property rights are not well defined, financial incentives may not have the opportunity to influence behaviour. Another example would be where there are information gaps in terms of ecosystem management. In this case, a more effective response might be to provide information tools which may encourage private action in itself (especially where the private and social incentives align).

The previous section highlights that while some ecosystem services can be described as pure public goods there are many other ecosystem services that are in fact either excludable or rival in consumption and this has implications for scope for PES mechanisms. In particular, where ecosystem services are private goods or club goods (many water services are examples here), it may be possible to identify the users and arrange for them to pay for service provision (private PES). In this sense, many PES schemes are practical examples of the Coase Theorem[23] which argues that market failure can be removed through the assignment of property rights and the subsequent negotiation of the parties involved[24].

[23] Conditions for a Coasian solution include property rights clearly defined and enforced and transaction costs are low.

[24] Wunder [2008] argues that a frequent misunderstanding is that PES requires competitive markets to function. Many ecosystem services (such as watershed services) are too spatially specific to allow for true competition: the buyers need to work with the providers that occupy the land that can provide the 'targeted' ecosystem services. Wunder concludes that markets and competition are neither necessary nor sufficient preconditions for PES.

If PES benefits a small number of actors, the incentives to free ride and the transaction costs may be lower. In addition, if individual users have sufficiently large ecosystem service benefits accruing to them even when bearing all the costs then it becomes less likely they will free ride on the efforts of others and there will be incentives for these users to reach private agreement of a PES (for example, the case of a hydroelectric power producer benefitting from upstream management to maintain smooth stream flow).

Conversely, as the number of buyers of ecosystem services increases, transaction costs and the incentives for 'free riding' may also increase. In these contexts, government financed PES may be the only option. For example, in the case of biodiversity, it is often difficult to identify all the users clearly, and users have a strong incentive to free ride.

Table 3.1 below provides a summary of these different characteristics of public goods based on extent of rivalry and excludability and high level implications for scope for both public and private funded PES.

Table 3.1: Public Good Characteristics

	Non excludable	Excludable
Non rival	Pure public good – biodiversity and climate regulation ⇨ requires government intervention and scope for private led PES is limited.	Club good – some water services, private eco-tourism ⇨ Scope for PES including private financing opportunities.
Rival	Common property resource – fish stocks ⇨ create property rights at scale at which benefits accrue.	Market good – food provisioning ⇨existing markets

The implication is that not all PES instruments require specific government intervention. There are examples where voluntary private PES schemes have developed. However, these require particular circumstances and alignment of social and private incentives to work (see Case study 3 below relating the Panama Canal for an illustration), and they may also require prior government intervention (e.g. a clear regulatory background) to provide the incentives for such schemes to then come forward. Therefore, the role of

government in enabling and unlocking the barriers to development of PES may be quite varied. Section 5 explores some of these issues in more detail in the context of key challenges to developing PES.

Case study 3: Panama Canal watershed protection programme

Background

The 80km Panama Canal is a critically important waterway for global trade; it is the preferred shipping route between the Atlantic and Pacific Oceans. However, its operation was becoming increasingly affected by floods, erratic water supply (each ship going through a lock requires significant water supply to operate the locks) and heavy silting as a result of deforestation. Heavy silting requires regular and expensive dredging and the costs of maintaining the canal and the risks of canal closure had been increasing. Around 65% of the insurance premium of shipping companies using the Panama Canal is environment-related, such as covering for too little water or delays because of dredging.

Details of initiative

To deal with this issue, a reinsurance firm, ForestRE, established a watershed protection programme to reduce its liabilities due to dredging costs and canal closures. Insurance firms and major shipping companies are funding this 25-year project (through a 25 year bond) which will restore forest ecosystems, helping to trap sediment and nutrients as well as regulating the flow of fresh water to the canal. This in turn reduces insurance risk and means that shippers can enjoy lower premiums.

Overall significance

This is a good example of a privately-financed PES scheme which serves global beneficiaries. The case study demonstrates the application of PES to multiple ecosystem services derived from investment in reforestation, including reduced silting from sediment displacement, lower nutrient inputs and improvements in water regulation and supply. It is also a good demonstration of how the insurance and financial markets can play a role in the development of PES schemes.

Source: see Ecosystem Marketplace for more details.

3.3 Tackling environmental issue at appropriate level

Ideally, the policy instrument needs to be able to closely target the ecosystem service to be delivered. This is a potentially strong advantage in favour of PES mechanisms if they can target payments to land managers or owners that can affect the ecosystem services directly.

Spatial considerations for ecosystem service delivery are critical. These relate to both the appropriate scale over which an ecosystem service is managed as well as the spatial scale of beneficiaries. For example, in relation to water quality and flood risk management, the appropriate level for consideration of measures is likely to relate to the entire watershed or catchment level. In principle, PES measures can be flexible in consideration of the spatial scale for delivery (albeit there are some key challenges as elaborated in section 5). By contrast, instruments such a taxes might be much less suitable where effectiveness of the instrument requires detailed spatial aspects to be accounted for in the design.

As the previous sections have highlighted, ecosystem services can deliver benefits at a range of levels from local, regional and national to global. Clarity about beneficiaries/users is of key importance in designing effective PES schemes. A key advantage of using an ecosystem services framework is that it provides a systematic framework for consideration of the services provided and links to multiple beneficiaries/users, which can help in the identification of PES opportunities.

3.4 Environmental effectiveness

An important question on environmental effectiveness relates to the issue of 'additionality'. This consideration relates to the extent to which benefits are additional to business-as-usual and can also consider "threats" – that is, where without payments, there might be expectation that land-use change will occur which would reduce ecosystem service delivery.

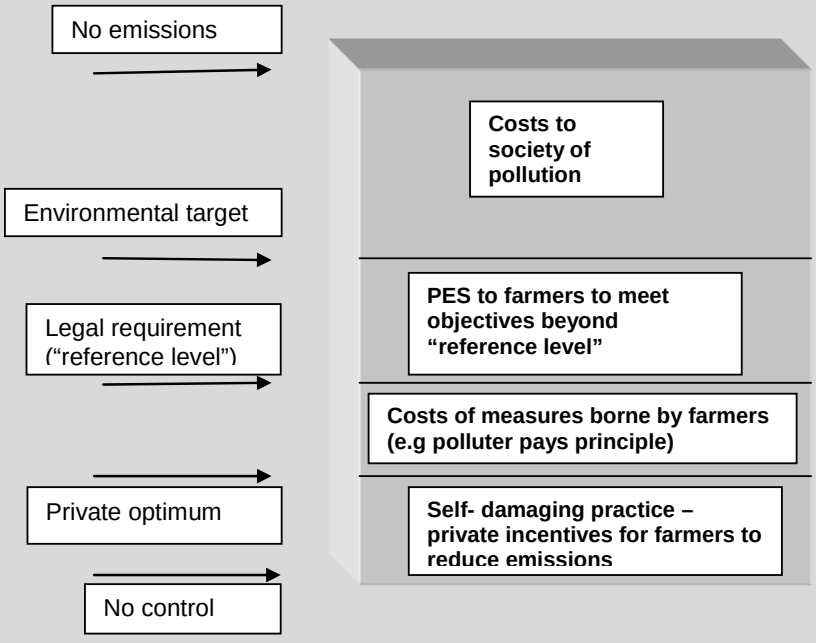
There are some key issues associated with achieving this in practice. As the previous section discussed, one important issue is to understand the policy and legislative context in which PES schemes operate. Where regulation

already exists, it is important to ensure that PES initiatives are delivering benefits beyond those already implicit in statutory requirements.

Box 3.1 below reviews these issues in the context of farming, highlighting some key issues in understanding the balance between private incentives and legal requirements.

Box 3.1: Illustrative example of PES and farming

This box shows how both private incentives and legal requirements for control of pollution from farming, the so-called 'reference level', reduces emissions from the 'no control' level. Costs of measures are borne by farmers to meet these reductions in line with the polluter pays principle. PES to farmers should then refer to the meeting of objectives beyond these legal requirements. In practice, determining the appropriate reference level can be complex and may change over time (for example: strengthening legal requirements to make the polluter pay).



Source: Adapted from TEEB for national and international policy makers report, 2010 (chapter 5).

In addition, there are some important issues to address if environmental benefits are to be realised in practice. What are the mechanisms to ensure

that ecosystem service delivery is maintained over the longer term? What are the mechanisms for ensuring that environmentally-damaging activities are simply not transferred to other areas/locations (known as 'leakage')?

One of the advantages that PES has over regulatory instruments is that they can potentially seek out opportunities that provide for higher ecosystem service value, whereas regulation often needs to be applied to all land managers irrespective of benefit. In practice, the extent to which PES can take advantage of this higher level of benefits will depend on scheme design. For example, some PES schemes use targeting to select sites based on benefit considerations as well as costs (e.g. the US Conservation Reserve Program (CRP) and BushTender programme in Victoria, Australia, as outlined in Box 4.3).

In addition, while instruments such as tax and regulation have had a key role to play in tackling industrial pollution, the arguments relating to property rights for land owners in terms of increasing the supply of ecosystem services on their own land are much less clear cut. PES instruments, because of their voluntary nature, offer a less prescriptive and coercive approach and therefore may be more feasible in practice.

A final but important point in terms of environmental effectiveness is that where PES schemes are focused on delivering a single ecosystem service, it is possible that these incentives will deliver this ecosystem service but possibly with negative impacts on other ecosystem services. This needs to be carefully assessed as part of the PES design. (See section 4 for more discussion).

3.5 Cost-effectiveness of instrument choice

PES schemes can have cost-effective properties similar to other economic instruments. In theory, PES can be designed to be efficient especially in comparison to regulatory approaches. For example, a PES with a fixed payment per hectare for a forest would induce those land managers or owners with lower marginal costs of conservation to conserve more land area than those with higher costs of conservation. As long as the payment per hectare under the PES is less than the benefits per hectare provided by the

additional ecosystem services delivered, then the net benefits of each hectare conserved will be positive. In contrast, regulatory approaches may require conservation on land irrespective of the costs of conservation. The greater the heterogeneity in costs, the greater the potential for a PES scheme to be cost effective compared to regulation.

In practice, PES design may be more complex than a fixed payment per hectare. A fixed payment assumes that ecosystem service benefits are constant for each hectare. Efficient PES design becomes more complex where benefits are non-uniform or where there are trade-offs with other ecosystem services or conservation that need to be taken into account. For example, many ecosystem services require a certain minimum land area to be delivered and therefore incentives per hectare may not adequately reflect these economies of scale. As the PES design reflects these aspects more closely, transaction costs associated with a PES scheme may increase significantly[25]. The trade-offs between better targeting of ecosystem service delivery and higher transaction costs need to be taken into account in the design of a PES. See section 4.6 for further discussion on these points.

3.6 Distributional impacts must be acceptable

An important advantage of taking an ecosystem services approach is that there is a clear focus on valuing ecosystem services and understanding who benefits/uses the service and who must bear the cost of delivery. Therefore, evidence on distributional impacts would be expected to be a key part of the assessment and PES design. In international contexts, particularly in developing countries, PES schemes are often designed to achieve both environmental and poverty reduction objectives. In a domestic context, given that potential providers of ecosystem services include farmers and land managers, PES have the potential to provide new mechanisms for income to flow to those who manage our natural assets.

[25] Norgaard [2010] argues that relationships between services and ecosystem states needs to be determined for each location to assure a realistic connection between payments, services and approaches to ecosystem management and conservation and this carries the implication that: "transaction costs of well designed and well maintained ecosystem service projects will be high".

3.7 Summary of PES as choice of policy instrument

This section introduces an analytical framework for PES that helps in understanding this payment mechanism in the context of both public and private funding. Various types of market failure are associated with the natural environment. The nature of the market failure and type of public good for different ecosystem services will determine the scope for both public and private led PES. Where market failures relate to pure public goods, government intervention may be required which could include government-financed PES. In other contexts, there may be greater incentives for the private sector and other tiers of society to invest so that these market opportunities begin to occur 'naturally', benefitting the users of these ecosystem services as well as the providers.

In all these contexts, there remains an important role for government and its agencies in facilitating and removing barriers to markets which can bring providers and beneficiaries together, building capacity for such approaches and helping to deal with the various information failures that can hold back such approaches. Further sections of this paper discuss this in more detail.

Table 3.2 below provides a summary of key advantages of use of PES and where these approaches might work best as well as highlighting circumstances where may not be suitable or be insufficient on its own.

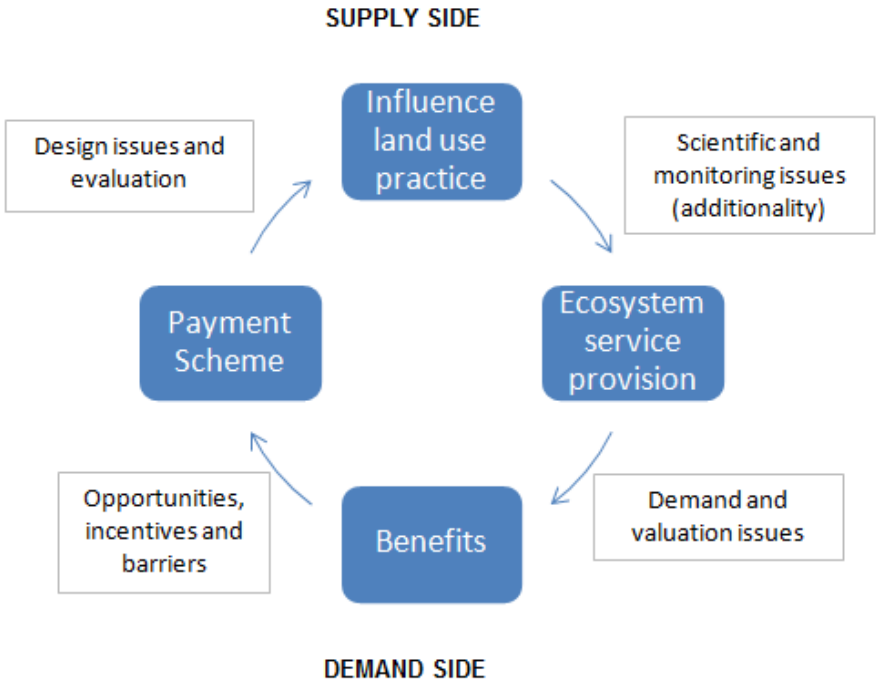
Table 3.2: Key potential advantages of PES and circumstances where appropriate

Key potential advantages of PES and where may work best:	PES may not be appropriate or insufficient on own:
✓ Ability to target payments to land managers or owners who can affect the ecosystem services directly; ✓ Work best where financial incentives can make provision of ecosystem services a more attractive option for a land manager; ✓ PES instruments, because of their voluntary nature, offer less prescriptive and coercive approach and therefore may be a more feasible instrument in practice in some situations; ✓ Seek out opportunities that provide for higher ecosystem service value, whereas regulation often needs to be applied to all land managers irrespective of benefit; and ✓ The greater the heterogeneity in the land managers' costs, the greater the potential for a PES scheme to be cost-effective compared to regulation. ✓ A focus on linking beneficiaries and providers can encourage both public and private financing;	✓ Where property rights are not well-defined, in which case financial incentives may not have any opportunity to influence behaviour; ✓ Where there are information gaps in terms of ecosystem status and/or management; ✓ Where PES is being considered to bring management practices up to the legal standard, in which case the principle of additionality is not being observed and this would also run contrary to the polluter pays principle; ✓ Where transactions costs associated with developing a PES may be very high.

4. Design issues for PES

The illustrative PES cycle presented below provides a high level overview of key aspects to be considered on both the demand and supply sides in designing PES. Many of these aspects are picked up in more detail in this section.

Figure 4.1: illustrative PES cycle



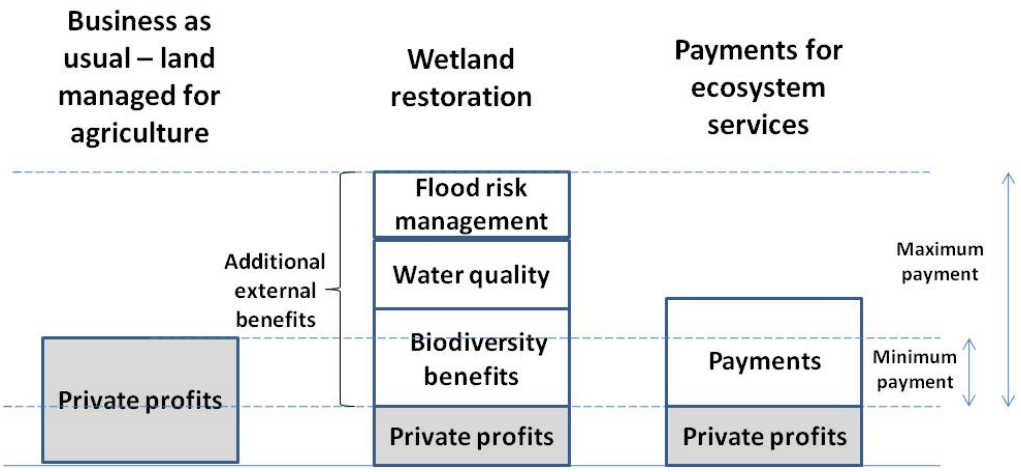
4.1 Illustrative example of PES

We use the same illustrative example of a simple PES as presented in Chapter 2 of this paper to follow through the key design issues for PES discussed below. As highlighted previously, a PES reflects a negotiated payment between the land manager (the 'seller' or provider) and beneficiaries (the 'buyers'or users) for delivery of enhanced ecosystem services. In the example of wetland restoration below, the payment negotiated is given in column 3. The payment needs to be at least at the minimum payment that will compensate the land manager for the reduction in private profits or opportunity cost for the wetland restoration actions. For the payment to deliver net benefits, the payment must not be greater than the value

delivered by the additional ecosystem services (flood risk management, water quality and biodiversity). If the payment agreed, lies between this minimum and maximum amount, then both the land manager (the seller or provider) and the various beneficiaries (buyers) can benefit from a PES agreement. Transaction costs associated with setting up the PES would reduce this zone of potential mutual benefit, so it is important that these are minimized.

From a buyer's perspective, a key issue is how the buyer can procure the maximum amount of services for a given budget. To achieve the most cost-effective approach on behalf of the buyer, the payment rates for a PES should be close to the opportunity cost for the land manager to deliver the required actions. Conversely, as the payment increases towards the maximum marginal social value (reflecting ecosystem services delivered), the less cost effective will be the PES.

Figure 4.2: A simple example of a PES



In the wetland PES example above, the payments relate to not just one ecosystem service but a bundle of services: flood risk management, water quality and biodiversity. This highlights that land management actions under PES will often deliver multiple benefits. In this case, if only one of the ecosystem services was targeted, the payment rate might not provide sufficient incentive to the provider. However, by accounting for multiple services, the scheme becomes cost effective and also avoids the need for multiple programmes, thus reducing overall transaction costs. This expands the opportunities but also the complexity from PES schemes. (See also the key challenges in Section 5).

Different approaches to packaging of ecosystem service benefits are illustrated in Box 4.1 below. In general, bundling is an adequate strategy only when the same buyer has several overlapping ecosystem service interests. Layering is sometimes also referred to as 'bundling,' but really has distinct marketing implications, because different buyer interests here need to be addressed. The piggy-backing approach attempts to integrate interests of conserving one ecosystem service into PES schemes providing other ecosystem services, but without explicitly or continuously paying for the component. An example of this would be biodiversity conservation piggy-backing on watershed protection. In these schemes, biodiversity beneficiaries could be entirely free riders, but it is more common that biodiversity conservation organisations help to cover the significant start-up costs of a PES scheme in return for not having to pay the recurrent future costs.

Box 4.1: Approaches to packaging of services into PES schemes

There may be various ways to consider how ecosystem services delivered are 'packaged' into a PES scheme. Possible approaches may include:

(1) **Bundling**: a package of services from the same area of land is paid for by a single buyer;

(2) **Layering**: a package of services from the same area of land is paid for by different buyers;

(3) **Piggy backing**: one service is sold as an umbrella service and other services 'free ride'

Source: Adapted from Wunder and Wertz-Kanounnikoff (2009)

Approaches to bundling of services tend to assume there is a high degree of synergy across many ecosystem services and in delivery of enhanced services. While in many cases this may be true, not all ecosystem services are complementary in their production. Where there are conflicts, there will be trade-offs, and in some cases these may be significant. PES schemes need to

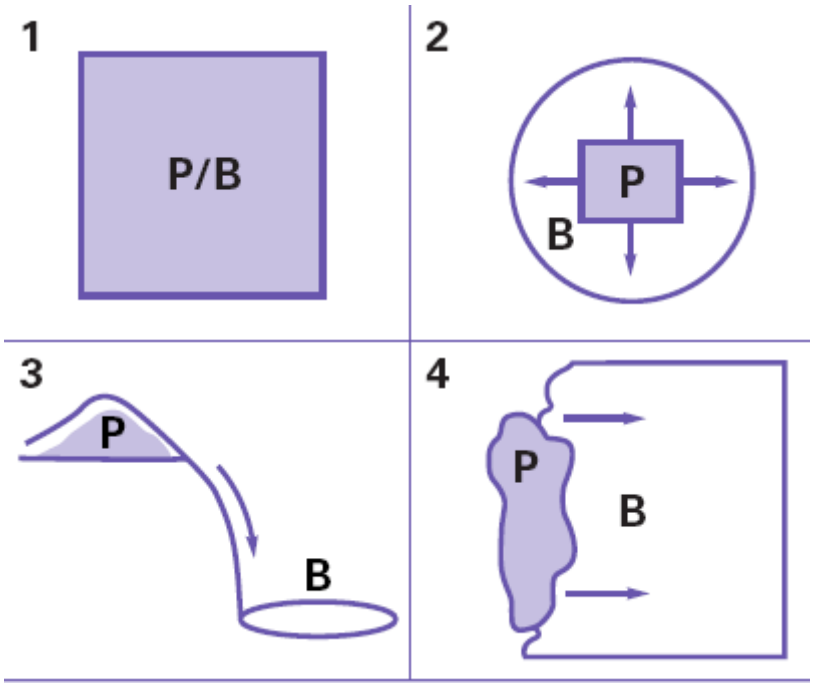
ensure this is considered in the design and any trade offs are made explicit[26].

4.2 Spatial considerations

Section 3 highlighted that spatial considerations for ecosystem services delivery are critical in designing PES schemes. More specifically, spatial factors are important in accounting for:

- The provision (or risk of loss) of ecosystem services;
- How delivery of ecosystem services affects users/beneficiaries at different spatial scales; and
- The cost to landowners of providing the ecosystem services and participating in the PES.

Figure 4.3: The delivery of ecosystem services



Source: Fisher et al [2008] reproduced in RSPB "Naturally at your service: why it pays to invest in nature", 2009

[26] Payments for ecosystem services are typically developed to conserve one service or a particular bundle of services, rather than the full set of services in an ecosystem. The reason is that often, with a single service or a discrete bundle, the science is clearer. Where different policy areas are not fully integrated, this may encourage a focus on single ecosystem services. Business may also be focused on specific services (e.g. soil erosion increasing river sedimentation and adversely affecting hydropower). This does not, however, preclude the possibility that a land manager may be able to tap into several different payment streams for different ecosystem services.

Recent literature has made progress in characterising distinctions in the delivery of ecosystem services. PES design needs to take these aspects into account carefully and clearly. For example, Fisher et al [2008][27] highlight a number of distinct possible spatial relationships (see figure above) between service provision (P) and beneficiaries (B):
(1) service provision and benefit occur at same location (e.g. soil formation, provisioning services); (2) services provide benefits across wider landscape (e.g. carbon sequestration, pollination); (3) services provide benefits in very specific direction (e.g. upland areas deliver downstream benefits such as water quality) or (4) coastal wetlands provide flood risk management benefits to coastal population.

In the example above of wetland restoration, delivery of additional ecosystem services is likely to require spatial targeting as the additional environmental benefits from actions are unlikely to be constant spatially. Moreover, the spatial scale of users/beneficiaries will also vary potentially significantly, e.g. the beneficiaries of flood risk management may be very local while the beneficiaries of water quality improvements may be at catchment/regional level. There may also be significant heterogeneity in the costs of delivery of ecosystem services by different land managers. In theory, design of a PES needs to consider how to target all these aspects to maximise the net benefits from a scheme. The role of valuation is important for effective targeting. Box 4.2 below provides further detail.

Box 4.2: Role of valuation in developing PES

Valuation is an important underpinning of payments for ecosystem services. Valuation can help to identify beneficiaries of ecosystem services and provide evidence on the scale of these benefits. This evidence can be important in convincing decision-makers of the business case for investment in PES and assisting stakeholders in negotiations of a PES.

Decision makers, both public and private, have a range of available methodologies to help estimate monetary values of ecosystem services, many of which are non-market. For a brief summary, see http://www.defra.gov.uk/environment/policy/natural-

[27] Fisher, B, Turner, K, & Morling, P, 2009, "Defining and classifying ecosystem services for decision making", Ecological Economics, 68

environ/using/value.htm. However, it may not be possible to value some ecosystem services in monetary terms. For these non-market services, other non-economic and participatory approaches may be important.

The appropriate payment level for a PES needs to lie between the minimum payment required to provide incentives to the provider to alter behaviour, but must be lower than the maximum value of benefits delivered by the enhanced ecosystem services net of transaction costs. Valuation will help in both informing an appropriate payment level and in determining whether the PES scheme is worth implementing.

There are many uncertainties that need to be taken into account in valuation. If the overall willingness to pay is overestimated, the scheme will purchase too much of the service at too high a price. Conversely, an underestimate of value to the beneficiaries' will result in under-provision of the ecosystem services or may result in no PES being agreed. In order to value the benefits, evidence on quantified ecosystem services is required; it is not possible to value robustly if the underlying science is not robust.

4.3 Relationship between land use and ecosystem service delivery

One of the **necessary conditions** for the design of 'genuine' PES is a clear relationship between the type of land use being promoted and the provision of ecosystem services. The 'buyer' (beneficiaries/users) needs to establish the baseline level of ecosystem services in order to have a benchmark against which provision of the additional paid-for services can be assessed. Further, there should ideally be a clear understanding of the ecological functions which govern service quantity and quality and the associated land use and management practices which can affect those functions. An effective and ideal payment system requires that the linkages from inputs (actions by the provider) to outputs (ecosystem services required by the beneficiary) are reasonably understood by all parties. When this condition is met, it is possible for the beneficiary to contract for the specific services that are required and for the provider to undertake the appropriate, contracted actions to ensure the outputs are delivered (or at least that land use changes likely to enhance target services are undertaken). As Engel (2008) describes,

this enables 'conditionality' of payment to be based directly on the services provided.

For a PES to be effective there has to be 'additionality': the payment provides an incentive to increase or maintain the level of ecosystem services that would not have happened in its absence. Secondly, 'leakage' has to be monitored and minimised: leakage is the displacement of activities to areas that are not covered by the payment. This can be a direct movement of degrading activities or it could be indirectly (e.g. through higher prices encouraging increased activity). Finally, an effective PES needs to ensure that perverse incentives are avoided, for example, to degrade more before the introduction of a scheme to gain greater payments when it is introduced. This makes it important to have clarity about the statutory requirements land managers are required to meet so that payments are only made for the "additional" benefits from ecosystem service delivery beyond these requirements.

4.4 Distinctions in types of buyers

Identifying who will benefit from and pay for additional ecosystem services is a key issue. Engel et al. (2008) make a useful distinction between user financing and third party financing. This refers to an important distinction as to whether the buyers are the actual users of the ecosystem service (for example a water company) or are acting on behalf of the users (in this latter case the buyer is typically the government or an organisation such as a NGO). It can be argued that a user-financed PES scheme may have greater potential to be efficient because it can be better targeted and there are clear incentives on the part of the user for the mechanism to be working appropriately[28]. Government-financed schemes may not have the full information and generally will not observe the results directly. Moreover, there may be less incentive for such a scheme to be efficient compared to a user-financed scheme. However, this may not always be the case; economies of scale that can be realised by government-financed PES schemes may mean lower transaction costs than user-financed schemes. Government may also be in better position to make use of scientific research results to test

[28] This would most closely represent the negotiated solution that is set out by the Coase theory.

out different approaches to delivery. The table below provides a summary comparison.

Table 4.1: Comparison of user- and government-financed PES schemes

User-financed	Government-financed
Typically small scale	Often large scale schemes
Tend to focus on single ecosystem services/few buyers	Often multiple services/government acts as ES buyer on behalf of beneficiaries
Much more likely to be 'efficient' because more targeted?	Less likely to be efficient: often non-targeted, uniform payments, low additionality. However, could be administrative economies of scale.
More likely to be related to club goods (where there may be potential for different levels of exclusion)?	Based on public goods

Source: Based on Wunder (2008)

In the wetland restoration example, there could be a water company who benefits from ecosystem services delivered upstream and recognises that it can reduce its costs by incentivising changes to land management upstream in the catchment. The water company will be well-placed to value their own willingness to pay for improvements[29] and will also have a clear incentive to ensure that the benefits are delivered and effectively monitored. Where there are multiple beneficiaries, direct user-financing becomes more problematic. Coordination difficulties, conflicting objectives, transaction costs and free riding may militate against a PES scheme being effective.

4.5. Providers

The potential providers'/sellers' of ecosystem services are typically land managers whose management activities impact on specific ecosystem

[29] For example, the water company may be faced with a choice to achieve its water quality objectives through either investing in a new treatment plant or negotiating a PES scheme with upstream land managers. The value to the water company is then related to the expected avoided costs of having to invest in new plant capital.

functions. Identifying the potential spatial scope and differentiation of provision and understanding the heterogeneity of providers in terms of cost are important in the design of payments schemes.

It is important for the beneficiaries/users to be able to differentiate potential providers according to their expected costs in order to ensure the most cost-effective delivery of the ecosystem services. Applying a one-size-fits-all approach, for example by making undifferentiated per hectare payments, may reduce transaction costs but this will be offset by a loss of efficiency, the more so the greater the heterogeneity of costs. In practice, there are likely to be information asymmetries: the buyer is unlikely to know the (opportunity) cost to the provider of delivery of ecosystem services and hence there is the potential that payments will not be cost-effective. Some approaches can be taken that are helpful in revealing this information including reverse (or inverse) auctions.

4.6 Payment and financing approaches

As highlighted earlier, it is often the case that the causal pathways from actions to ecosystem services delivered are only partially understood and subject to significant uncertainty. For this reason, while an ideal goal might be to base PES payments directly on the delivery of ecosystem services, referred to as **output based** PES schemes or sometimes 'payments for results', this may be difficult in practice, especially where there is the natural variability of the environment to take into consideration. It is more usual to have input-based PES that pay for the adoption of land use or land management practices believed likely to result in improvements to ecosystem services. Monitoring of input-based PES tend to focus on, firstly, monitoring whether land managers are complying with their contracts in terms of specific practices and land uses and, secondly, monitoring whether the land is indeed delivering the desired ecosystem services. The additionality of any outputs may be unknown or only known after a number of years when sufficient evidence has been accumulated.

There is a range of different payment approaches, from simple undifferentiated payments per hectare to more targeted payments. There are more likely to be problems over additionality when payments are low, undifferentiated and un-targeted but transaction costs are likely to increase

as these factors are taken into account and therefore there will be trade-offs to consider. To target more cost-effective delivery of ecosystem services, payment approaches such as reverse auctions can be used. (See Box 4.3 for more detail including examples of this approach in practice). A key issue relates to how to ensure ecosystem services are delivered in the long run. Payment approaches such as covenants or easements are one way this is tackled. However, it could be argued that the PES is set up to deal with this; payments should be flexible to reflect changing incentives and scientific evidence over time.

Box 4.3: Use of reverse auctions to deliver cost-effective improvements

Background

Reverse auctions (also known as inverse auctions) normally have a single buyer – usually the government – seeking bids from a number of potential suppliers to deliver environmental gains (or reductions in environmental degradation). This approach can be particularly useful when there are a large number of potential suppliers or providers and the use of an auction can introduce greater competition into the process and improve value for money. Reverse auctions require the land manager or owner to submit bids specifying the minimum payment they are willing to accept as compensation for specified changes in land management practice. Bids providing the highest environmental benefits per unit costs are accepted until the budget is reached.

Details of initiatives

There are a number of examples of the use of reverse auctions. One of the best known examples is the **US Conservation Reserve Program (CRP)** which has been running since 1985 with over 80% of the land under the CRP enrolled using a competitive bidding process. It is an example of a large scale initiative: in 2010, it is estimated that approximately US$2 billion will be paid to secure retirement of 31 million acres of cropland. In Victoria, Australia, **BushTender** is an example of a reverse auction to conserve native vegetation. About one million hectares of Victoria's remaining native vegetation is on private land, of which approximately 60% is of threatened vegetation type. Under BushTender, landholders bid in a competitive tender and choose a range of actions to protect and enhance native vegetation.

Successful bids are those that offer the 'best value for money' in terms of native vegetation outcomes. The **Tasmanian Forest Conservation Fund** achieves voluntary conservation goals through market-led agreements. As part of the Fund, comprising around Aus$ 50 million, a reverse auction process aimed to establish an efficient market for forest conservation. Successful bids resulted in a contractual agreement of fund payments to the land owner, in return for applying various land management measures (covenants), granted for various time spans (from 12 years to in-perpetuity). To date, the fund has succeeded in protecting some high-value habitats, and a significant proportion of the area identified by the Government.

Overall significance

OECD (2010) recently highlighted that auctions are being increasingly used in both developed and developing countries. Reverse auctions require careful design but there is evidence that they can deliver potentially significant cost-effectiveness gains. The US CRP appears to be effective with net economic benefits delivered according to detailed evaluation of the auction programme. The reverse auction mechanism applied in the Tasmanian Forest Conservation Fund programme resulted in an estimated 52% cost-efficiency gain (compared to a first-come-first-served approach to allocating PES contracts). In the US, a local PES programme in the Conestoga watershed found that the use of inverse auctions resulted in a seven-fold increase in the reduction of phosphorus runoff per dollar spent compared to a fixed price approach. The success of Bush Tender in Victoria, Australia, has seen the development of the approach to secure other environmental outcomes such as reduced salinity and improved river health.

For a detailed account of the US CRP programme and other case studies relating to reverse auctions, see "Paying for Biodiversity: Enhancing the Cost-Effectiveness of Payments for Ecosystem Services (PES)", OECD 2010.

There is a potentially wide and innovative range of financing approaches; the literature on payments for ecosystem services identifies a diversity of different approaches. For example, financing approaches and instruments can include:

- Direct payments (including government, utility companies and private business);

- Voluntary contributions (e.g. to water bill, tourism taxes and charges);
- Endowment funds;
- Conservation easements;
- Watershed protection fees from industry;
- Hypothecated taxes/tax concessions;
- Conservation bonds; and
- Design and capacity building (e.g. World Bank, GEF).

New insights from behavioural economics suggests there is potential for involving final consumers more in financing, such as through facilitating voluntary contributions. See Box 4.4 for an example of some innovative recreational-based PES-like schemes in development.

Box 4.4: Potential for recreation based PES schemes

Significant benefits are provided in the form of tourism and recreation linked to visits to the countryside, but generally these benefits are provided free at point of delivery. PES schemes present a possibility for directing payments from beneficiaries (tourists, local business who derive their income from visitor spending) to landowners or managers, who could be compensated for maintaining these areas for recreation and wider conservation purpose.

One innovative approach relates to the potential to raise income through voluntary 'visitor payback schemes' drawing on the value which visitors associate with these places, with funding going directly to conservation projects. An example of this is the Nurture Lakeland[30] scheme in the Lake District. Drawing together over 1200 local businesses, it encourages visitors to donate to conservation projects in the area. Funds generated in this way do not go to landowners directly but go to local conservation projects, which may then pay farmers. While the project has raised over £1.7m in the last ten years, there is potential for far greater income generation when considering the 8 million visitors that come to the area each year.

[30] www.nurturelakeland.org

4.7 Measuring and monitoring

A key element of PES schemes is for the beneficiaries to be able to ensure that the services that they have paid for are delivered. Without this, there can be no conditionality of payment and the scheme is not a genuine PES (Engel, 2008). This requires a process of monitoring and enforcement. What exactly gets monitored will depend on the nature of the scheme, as discussed above, so any monitoring process will be specific to a given PES scheme. Where there is a clear chain of causality established, it may be possible for the beneficiary to monitor outcomes at the point of service delivery and make payments accordingly. More feasibly, the buyer will contract for certain land management practices or activities which it is hoped will deliver the ecosystem benefits and then monitor that the land management practices are indeed in place and pay on that basis. For example, this may involve ensuring that trees have been planted, fencing has been put in place or stocking levels have been reduced. Even where it is not the basis for payments, the beneficiary will still need to monitor and evaluate outcomes to be able to judge over the longer term whether the scheme in aggregate is delivering as expected and providing suitable value for money. The downstream water company, for example, would still need to be assured that they were indeed receiving a higher water quality than would be expected under baseline conditions. Monitoring costs can be significant, so it is important that these are properly accounted for in the negotiated payments.

4.8 Governance issues

Good governance is essential in the design of PES schemes. Principles of good governance include:

- ✓ Clear identification of property rights;
- ✓ A legal system to ensure PES can be properly implemented
- ✓ Enforcement of contract;
- ✓ Monitoring of PES including delivery of ecosystem services; and
- ✓ A functioning infrastructure for PES operation.

Design of PES schemes need to take into account the institutional framework in which they will operate. These institutional, legal and social considerations

can play an important role in defining the opportunities and challenges for PES. Key issues relate to property rights: in general the ecosystem service provider must have clearly defined and enforceable property rights. Institutional factors are likely to play a key role in transaction costs. There may be a key role for government in removing some of the barriers which lead to high transaction costs. The use of intermediaries (including NGOs) may also be one way to help deal with these issues, improve coordination and reduce transaction costs. (See Box 4.5 for the different roles that intermediaries may play). Motivations for the different participants in PES schemes are important to highlight. Economic incentives may 'crowd out' other motivations for environmental protection (for example, stewardship motivations) or may not be sufficient on their own. Therefore, it is important to better understand how PES schemes can be successfully formulated to take account of these different motivations. One of the potential advantages of PES mechanisms is that they have the ability to generate social learning (i.e. providers, buyers and intermediaries learning about an environmental problem together and developing a joint solution). This, in turn, has the potential to engender long-term behaviour change.

Box 4.5: Role of intermediaries in PES

The TEEB Report highlighted that intermediaries can play a number of different roles and various stages of the process of implementing a payment scheme:

- Represent beneficiaries (buyers such as NGOs, private businesses or government)
- Represent providers (the suppliers of the ecosystem services such as farmers)
- Serve as wholesale managers (acting as a financial intermediary that buys services and sells them to national and international buyers)
- Monitor the efficiency of the scheme for ecosystem service generation

Source: TEEB for business report, 2010

5. Challenges and Opportunities

5.1 Potential for scaling up payments for ecosystem services

The focus in this section is in understanding what opportunities might exist in a domestic context for increased use of such payment approaches for delivering enhanced ecosystem services and the scale of these opportunities. We also highlight some of the key challenges or barriers. Defra commissioned a research study on "Barriers and opportunities for the use of payments for ecosystems" that provides a more detailed assessment and is published alongside this paper[31].

5.2 Key Challenges

Demand issues: Understanding what stakeholders want from ecosystems and associated demand for ecosystems services is a crucial first step in the development of PES. The introduction to this analytical paper highlighted that, once you begin to understand better the value of different ecosystem services and who benefits from these services, mechanisms to capture these values can follow naturally. However, it is fair to say that there are still significant gaps in our evidence. The publication of the UK National Ecosystem Assessment (NEA) has been a significant step forward, but there will be an on-going need to continue to improve our understanding. There is also a need to ensure that a wide range of stakeholders who benefit or who are impacted by environmental change understand these links. Otherwise demand for protection and enhancement of ecosystem services will be low because of this lack of awareness. In other contexts, however, it is important to highlight that demand is often underpinned by regulation (for example, water quality regulation underpins the demand for better catchment management and hence associated payment schemes). Case study 4 is a good example of how the development of a payment scheme needs to involve a wide range of stakeholders in establishing the benefits being

[31] URS/Scott Wilson, "Barriers and opportunities to the use of payments for ecosystem services", report for Defra, September 2011.

provided from specific upland ecosystems and how different land management options could enhance these benefits. In some contexts there may be trade-offs between different ecosystem services and these need to be taken into account in any PES design. Finally, a key challenge also relates to how to accommodate the preferences and future demands for ecosystem services by future generations.

Case study 4: Delivering Nature's Services: Natural England's Pilot Projects in the English Uplands

Background

'Delivering Nature's Services' is a project testing the ecosystem approach in three upland pilots, with a significant emphasis upon consultation with users and providers of services. The project was initiated by Natural England to investigate, through practical implementation, how the ecosystem approach might work in real places. A significant aspect of each of the areas is that, in addition to Natural England's interest in developing a landscape-scale approach to its business, the local water companies have begun to look at catchment-scale management solutions to water quality problems rather than focusing upon 'end of pipe' treatment. By working closely with these catchment management projects and bringing in a range of other partners who represent ecosystem service providers, statutory regulators and beneficiaries, the range of ecosystem services being considered has been expanded beyond water. The three pilots are located in the Bassenthwaite lake catchment (Cumbrian Lake District), the South Pennines National Character Area and the south west uplands (Dartmoor and Exmoor).

Details of initiative

In each of the three areas, the project has sought to develop a consensus view on current and future ecosystem service provision. Through a series of workshops attended by people with a wide range of ecosystem service interests, a suite of location-specific, future land and water management options have been developed. These land management changes are predicted to enhance the provision of a wide range of ecosystem services (e.g. carbon storage, clean water provision, biodiversity, recreation and access). The land management changes will now be implemented through

existing initiatives, such as agri-environment schemes. New agri-environment agreements in each of the areas will be negotiated with land managers on the basis of these agreed priorities for ecosystem services, and some of this negotiation is already in place in the Bassenthwaite pilot area. It is hoped that these agreements will be complemented by other investments from other funding sources. In the Bassenthwaite area, there is also a trial initiative which is looking at how a voluntary tourist bed charge might be used to fund land management. The proposed options are being subjected to an economic valuation to determine the overall benefit.

Overall significance

The pilots have pioneered a collaborative approach to setting future land and water management objectives based on ecosystem service provision in the UK. They have taken a bottom-up approach to environmental management by talking to a range of representatives of both ecosystem service providers and beneficiaries. For example, in the Bassenthwaite pilot, people from over 30 organisations have had a chance to say what benefits they would like to see delivered and further work is planned to discuss this directly with farmers who manage the land. In Dartmoor and Exmoor, small groups of farmers have been consulted on how agri-environment agreements targeting ecosystem services might work in practice. The pilots are also unique in that they seek to deliver multiple ecosystem services from a given place and are actually changing land management in real places such as blocking moorland drains, planting trees and reducing livestock densities in erosion-prone areas.

The three pilots have tried to implement the ecosystem approach within the constraints of existing funding and institutional frameworks. They have sought to do this by supporting local planning and kick-starting longer-term activity within a relatively short period of time. Nevertheless, the experiences within the three areas have provided considerable insight into the opportunities and barriers to developing an ecosystem services-focused approach to local decision-making and management. The work with local partners and stakeholders should form a sound basis for future adaptive management as we learn more and respond to changing societal needs.

Source: Natural England

Improving scientific understanding: To scale up these approaches, we need improved understanding of how ecosystems provide services including the relationship between different services and trade-offs between services. We also need a better understanding of how land management can deliver the ecosystem services required. As highlighted in Section 4, one of the necessary conditions for the design of a 'genuine' PES is a clear relationship between the type of land use being promoted and the provision of ecosystem service. It could be argued that this relationship needs to be determined for each location to assure a realistic connection between payments, services and approaches to ecosystem management and conservation. However, gathering technical information for establishing and clarifying causal relationships between land use practices and the provision of environmental services can be costly. Case study 5 provides an illustration of some of these scientific challenges in the context of SCaMP (Sustainable Catchment Management Programme).

Case Study 5: Sustainable Catchment Management Programme (SCaMP1)

Background

The first phase of the Sustainable Catchment Management Programme (SCaMP1) aimed to tackle a combination of habitat and some water quality issues on United Utilities' (UU) landholdings in the uplands of the Forest of Bowland and the Peak District. SCaMP1 was funded primarily through the Water Pricing Review 04 (PR04), but relied on redirection of additional funds such as agri-environment payments. The project covered around 20,000 ha of UU owned catchment land, which help supply some of UU's 7 million customers with their water needs.

Details of Initiative

A partnership of UU, the Royal Society for the Protection of Birds (RSPB), local farmers and a wide range of other stakeholders was formed to steer and invest in conservation activities in 20,000ha of water catchment land in the North West of England, aiming to secure improvement in SSSI condition while coincidentally contributing to halting a progressive decline in water quality. The overall aim of SCaMP was to develop an integrated approach to catchment management incorporating sustainable upland farming which delivers: government targets for SSSIs (95% of SSSIs into favourable or

recovering condition by 2010); biodiversity plans for priority habitats and species under the UK Biodiversity Action Plan; stabilisation of raw water quality; and viable livelihoods for tenant farmers. In an initial programme running from 2005-2010 (SCaMP1), United Utilities worked to restore blanket bog and to establish woodland. Most SCaMP1 land was also targeted for a reduction in the number of grazing animals, especially cattle, and also stock exclusion at particular times of year and from seriously-degraded peatlands that have been restored. This is being achieved via long-term agreements with tenant farmers which define whole farm plans compatible with all of the above objectives. The costs of SCaMP1 activity are split between UU funds of £9m and public support via Higher Level Stewardship payments of £3.5m.

Overall significance

SCaMP1 is a good example of a project delivering multiple ecosystem service benefits: improving biodiversity; stabilisation of water quality; supporting rural communities; enhancing landscape; reducing carbon emissions from degrading peat; protecting carbon stores; and making fragile habitats more resilient to future climate change. It demonstrates an effective partnership approach with private, public and non-governmental organisations working together to change the way land is used.

SCaMP2, covering some additional United Utilities land holdings including some partnership working on land not owned by UU, is currently being undertaken. SCaMP2 aims to deliver interrelated biodiversity, raw water quality, soil carbon sequestration and landscape benefits through sustainable farming.

For a detailed overview, see Natural England, "Economic valuation of uplands ecosystem services", eftec, 2010.

PES demonstrator projects are important in helping build capacity. The availability of practical tools and improved access to scientific and socio-economic information is also likely to be important in scaling up such approaches. RSPB (2010) highlights that creating metrics to measure services, such as carbon sequestration resulting from land management

changes, is another key step to support private markets in ecosystem services[32].

How PES can work in the face of scientific uncertainties is also a key question. PES schemes that are output-based (payment by results) could be argued to have clearer incentives to deliver real outcomes compared with input-based schemes. However, in some contexts, this may make it difficult to take forward such schemes if providers perceive there are high risks that may not be in their control (e.g. external factors that affect ecosystem services). There may be a long lag phase before ecosystem services are enhanced, for example improved yield and quality of water or biodiversity resulting from measures undertaken to regenerate catchment vegetation. Monitoring is crucial as is the flexibility for a PES scheme to adapt as new evidence emerges.

Institutional and regulatory: These are likely to be key challenges in unlocking the potential for more widespread PES. While PES might be classified as an economic instrument, these incentives depend crucially on the institutional and regulatory context in which they must operate. The use of ecosystem services as the framework of analysis directs attention towards the multifunctional uses of land which then raises some key challenges in terms of requirements for an integrated land-use policy, including breaking down barriers between institutions with responsibilities for different elements of land-use policy. Spatial challenges, discussed in previous sections, also contribute to this, especially where the beneficiaries of ecosystem services may be distant from their provision (e.g. water supply and flood risk management) while the appropriate spatial level for the development of a PES scheme often does not coincide with the boundaries of administrative and planning units.

The nature of property rights is a key factor in the design of PES. Delivery of enhanced ecosystem services needs to be largely considered in the context of private ownership of land. Establishing PES requires clarity on who owns the relevant resources and extent to which owners of this land have the right to use the land in their desired manner taking account of existing regulatory requirements. In order to promote investment, investors need a level of

[32] "Financing nature in an age of austerity", RSPB, September 2010

certainty about the nature of these property rights over the longer term and have clear expectations that the institutional and regulatory background will be stable.

As increasingly more PES schemes are taken forward, important evidence is emerging on some key institutional challenges. For example, in the context of water-related PES, early schemes focused only on investment in land management activities on land that water companies owned. However, changes through the Water Industry Pricing Review (PR09) allowed water companies to invest in assets and land they do not own. Another issue raised in Natural England's pilot projects in the uplands (see Case study 4) is related to existing rules and regulatory constraints on 'stacking payments' to land managers. This is a significant obstacle where agri-environment payments are involved as these are currently calculated on the basis on income forgone. Payments from different sources for different services cannot easily be combined making any payment complex and/or insufficient. Existing payments through pillar 1 of the Common Agricultural Policy may also dampen incentives for land managers and farmers to restructure and seek new streams of income through PES.

Reducing transaction costs: Evidence suggests that transaction costs can be potentially significant in developing and operating PES. There are some key issues around how governance can impact on transactions costs, including the role of intermediaries in facilitating stakeholder involvement and participation. While, in theory, PES is seen as a market solution to environmental problems, case study evidence suggests that the role of the state and/or community engagement remains a key factor in determining success. In particular, the evidence highlights the importance of trust-building and how this can reduce transaction costs. In defining the group of sellers and buyers and creating mechanisms for trade, there is a need to build trust in the operation of such a scheme. Different parties need to reach views as to the values of the benefits from investing in such a payment scheme and this requires stakeholder participation in developing the evidence and building the trust to move forward. Many PES examples demonstrate the importance of an intermediary in bringing together these different buyers and sellers. For example, one of the success factors of the Vittel Watershed Protection Programme (see Case study 1) was seen to be

trust-building through the creation of an intermediary institution. In addition, many ecosystem service markets require a high level of cooperation rather than competition (e.g. watershed protection markets) so it is important to design PES schemes that strengthen cooperation rather than weaken it.

Bundling ecosystem services: For many ecosystems, bundling various services together has been highlighted as an objective of PES schemes and could help significantly to improve the cost-effectiveness of such schemes. However, in practice, the literature highlights there have been few multiple-buyer deals. Reasons for this appear to be quite numerous. The transaction costs of coordinating between several independent buyers are often high. Targeting a single service, such as watershed protection, as an umbrella service for other services may not necessarily work out because there may be more trade-offs in delivery than expected. There may also be an element where possible buyers may not have sufficient incentive to enter a PES scheme where other buyers are already paying. This raises the issue of incentives for free-riding and the question of whether additional payments would actually lead to additional services. In this context, Wunder [2008] highlights that successful multiple-buyer schemes may require clarity on the impact of different buyers' contributions. This brings us back to the importance of the need to understand the relationship between management activities and specific ecosystem services and the relationship of one ecosystem service to another.

5.3 Opportunities

This section presents a preliminary assessment of opportunities for use of PES in a domestic context. Key criteria that may inform our view of the opportunities include:

- Evidence on ecosystem services and the extent to which land management actions at different spatial scales can enhance these services;
- Understanding of beneficiaries (and the different spatial scales) and the extent to which they would be willing to pay for delivery of ecosystem services;

- The 'public good' nature of ecosystem services and the extent to which private financing could be encouraged; and
- Distinction between near-market opportunities and long-term opportunities.

The starting point is to understand what ecosystem services are delivered, the impacts (in terms of goods/benefits) delivered to economy/society, and the range of beneficiaries/users. Table 5.1 overleaf provides a preliminary assessment of the potential for PES for delivering specific ecosystem services across the NEA habitat types.

5.4 Concluding comments and next steps

The overall aim of this paper has been to explore in more depth how PES can be used to achieve environmental objectives as a complement to other environmental policy instruments by reviewing existing theory and analysis in this area and considering its application to the domestic context in England. A key objective is to help develop our thinking, identify key opportunities and challenges, and consider the role of government and other key stakeholders.

For a more detailed assessment see the URS/Scott Wilson study for Defra on "Barriers and opportunities for the use of payments for ecosystems". The study looks in more detail at the application of PES to a domestic context and considers actions to enable and facilitate greater use of such approaches where appropriate.

This analytical paper is part of a longer term programme of work in this area as recently highlighted by new commitments by Defra in taking work forward on payments for ecosystem services in the Natural Environment White Paper published in June 2011.

Across the Defra network and more widely, there are many examples of where PES approaches are being tested and implemented. These case study examples and pilots provide important 'ground truthing' for assessing the application of payment mechanisms and the issues, including barriers, being

faced. We need to ensure we take on board any lessons learnt from these initiatives in developing our evidence on PES.

Table 5.1: Preliminary assessment of opportunities for payments for ecosystem services by England broad habitats

Broad habitat (*)	Buyers/beneficiaries	Sellers	Overall opportunities including potential for private financing
Enclosed farmlands (52%)	Government (on behalf of public, local residents) Water companies (on behalf of consumers) Hydropower companies Insurance companies Conservation organisations (behalf of members, countryside visitors) Producer and certification organisations (on behalf of consumers)	Farmers/private land owners/managers	Represents significant land cover in England. Environmental Stewardship (ES) represents well known government funded PES. Possible scope for agri-environment schemes to deliver wider range of ecosystem services and improve cost effectiveness. Opportunities for private financing in PES likely to be related to watershed management (e.g. SCaMP, WATER). Could also be broader opportunities beyond direct PES relating to supplying biodiversity offsets?
Semi-natural grasslands (14%)	Government (on behalf of public) Public organisations such as National Parks (on behalf of public, visitors/tourists) Local authorities e.g. for flood control (on behalf of local residents) Conservation organisations (on behalf of members, countryside visitors) Private business (e.g. energy utilities)	Farmers/private land owners/managers Large estates, charities, public and crown holdings Private commercial land managers (e.g. energy producers)	National Parks all contain significant areas of this habitat. ES provides agri-environment funding including HLS relating to this habitat. Some examples of voluntary payment initiatives (e.g. visitor pay back schemes) relating to tourism in National Parks where there may be further potential. Other opportunities related to watershed management and interest by water companies. Pollination services highlighted of importance by the NEA – longer term opportunities may exist?
Woodlands (9%)	Government/ public agencies (on behalf of public) Local authorities Downstream beneficiaries – benefitting from flow regulation and soil retention provided by upland forests Private business/individuals to offset carbon through forest protection or afforestation, benefit from flow regulation services Conservation organisations (on behalf of members, countryside visitors) Tourism operators (on behalf of visitors)	Private and public woodland owners/managers (private business, conservationists, amenity owners)	Growing interest in use of payments for ecosystem services provided by woodlands. Key opportunities relate to forest carbon payments (linked to e.g. Woodland Carbon Code) and with watershed payment schemes including flood management services and woodland owners receiving payments for the multiple services provided by their woodlands. Potential scope for more targeted delivery of ecosystem services in English Woodland Grant Scheme.

Broad habitat (*)	Buyers/beneficiaries	Sellers	Overall opportunities including potential for private financing
Open waters (rivers and lakes), wetlands and flood plains	Government/public agencies (on behalf of public) Local authorities e.g. for flood control (on behalf of local residents) Private business – potable supply, energy and flood mitigation, water companies (on behalf of consumers) Conservation organisations (on behalf of members, visitors) Water recreation groups (e.g. recreational fishers)	Farmers/private land owners/managers who own riparian rights, wetlands	Opportunities for private financing in PES related to water quality (e.g. SCaMP, WATER). Payments by anglers for recreational fishing rights (e.g. Westcountry Rivers Trust Angling Passport Scheme). Potential opportunities for wetlands in water treatment and flood risk management (e.g. WPES). Payments for improved navigation.
Mountains, moorlands and heaths (5%)	Government (on behalf of public) Local authorities Water companies, hydropower companies (on behalf of consumers) Private companies (investing in corporate social responsibility/offsetting carbon) Local residents/Insurance groups – flood risk management Recreational users Conservation organisations (on behalf of members, visitors)	Farmers/private land owners/managers Non-governmental organisations including National Trust National Park Authorities	MMH make major contribution to certain ecosystem services (e.g. drinking water). Emerging opportunities for watershed payment schemes. Potential opportunities to expand the range of services targeted under upland agri-environment schemes and to elicit private sector support as well. Restoration of habitats has potential for multiple benefits – potential for packaging PES for water, carbon and biodiversity together. BRE (2009) estimates demand from companies and individuals to support land based carbon reduction projects on a voluntary basis. A number of companies willing to pay a premium for UK based projects. Growing number of "visitor payback" schemes.
Coastal margin habitats (including salt marsh)	Government (on behalf of public) Local authorities – flood defences (on behalf of public/ local residents) Private business e.g. water companies (on behalf of consumers), commercial fishing, insurers, port owners Conservation organisations (on behalf of members, visitors, bird watchers	Government/public agencies Private land owners/managers – lowland farmers/land in inter-tidal zones.	Private business potential gains through investing in protecting coastal habitats with multiple benefits (flood risk management, reduced siltation, fish nurseries) – port owners, private land owners, insurance industry Potential in relation to tourism, recreational visitors (e.g. through visitor pay back schemes). Strong case for habitat restoration for flood risk management objectives with multiple benefits.

Broad habitat (*)	Buyers/beneficiaries	Sellers	Overall opportunities including potential for private financing
Marine	Government (on behalf of public) Local authorities Fishing industry Private business e.g. pharmaceutical companies (bioprospecting), renewable energy producers Tourists/recreational users Conservation organisations (on behalf of members, visitors)	MMO Crown Estate Marine Planning Authorities Non-governmental organisations including RSPB/WildlifeTrusts. Tourism and leisure operators	Very few PES programmes implemented in marine environment. Uncertainties in the underlying science (e.g. in relation to regulating services) and open access nature of marine resources barrier to development of PES. Potential for direct user fees – (e.g. voluntary entry fees) for MPAs but would need to be carefully managed. Potential for direct payments related to bio-prospecting.
Urban	Local authorities (on behalf of local residents) Charitable organisations and community groups (on behalf of members, visitors) Private businesses (e.g. insurers)	Private land owners/managers Local authorities Authorities and charitable organisations	Potential related to green infrastructure, commercial development agreements, urban river corridor restoration, and green housing development.

Source: Using evidence from the report for Defra, "Barriers and opportunities to the use of Payments for Ecosystem Services", URS/Scott Wilson. September 2011 (*) Figures in brackets indicate the approximate % land cover in England

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