



Summary for Policy-makers

Document prepared for:

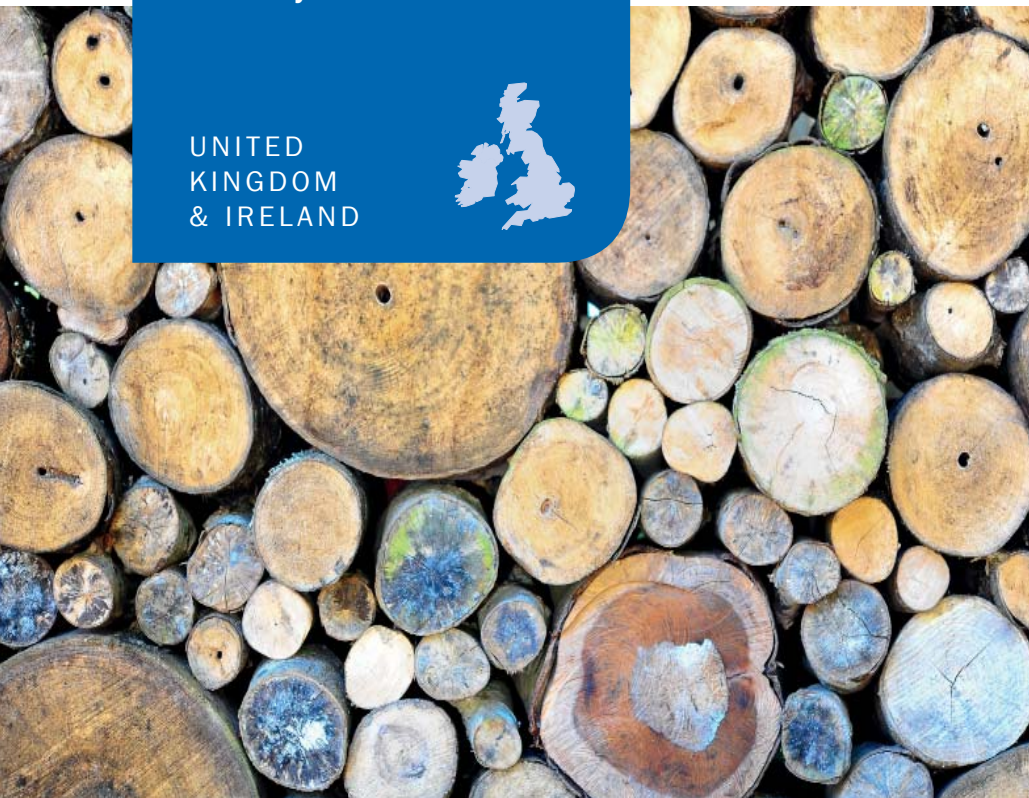
Defra

February 2015

UNITED
KINGDOM
& IRELAND



Payments for Ecosystem Services: Developing the Evidence Base on PES Beneficiaries in England



URS Infrastructure & Environment UK Limited
6-8 Greencoat Place
London
SW1P 1PL

Telephone: +44 (0)20 7798 5000

Fax: +44 (0)20 7798 5001

www.urs.com/uki/

Limitations

URS Infrastructure & Environment UK Limited (“URS”) has prepared this Report for the sole use of the Department for Environment, Food and Rural Affairs (“Client”) in accordance with the Agreement under which our services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by URS. This Report is confidential and may not be disclosed by the Client nor relied upon by any other party without the prior and express written agreement of URS.

The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by URS has not been independently verified by URS, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by URS in providing its services are outlined in this Report. The work described in this Report was undertaken between November 2013 and February 2015 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

URS disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to URS’ attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. URS specifically does not guarantee or warrant any estimate or projections contained in this Report.

Copyright

© This Report is the copyright of URS Infrastructure & Environment UK Limited. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

TABLE OF CONTENTS

Introduction.....	1
Further developing Payments for Ecosystem Services (PES).....	1
Research methodology	1
Scoping review of business sectors' PES readiness	2
Detailed profiling of business sectors' PES readiness.....	4
Selected manufacturing sectors: Business cases and PES action plans	5
Business case: Beverage manufacturing.....	6
Action plan: Beverage manufacturing	8
Business case: Food manufacturing	10
Action plan: Food manufacturing	12
Business case: Chemical / paper manufacturing	17
Action plan: Chemical / paper manufacturing	19
Potential role of Local Authorities in PES scheme development	23
Action plan: Local Authorities	23
Discussion – Targeting business beneficiaries	25
High-priority areas for action	25
Conclusions	27

Introduction

URS Infrastructure & Environment UK Limited – in partnership with Birmingham City University, Pundamilia Ltd and the Westcountry Rivers Trust – were commissioned by Defra to explore how wider participation in **Payment for Ecosystem Services (PES)** schemes might be encouraged, with a focus on two groups of beneficiaries:

- I. business sectors with dependencies on natural capital and ecosystem services; and
- II. local authorities who might be in a position to procure ecosystem services on behalf of local residents and businesses.

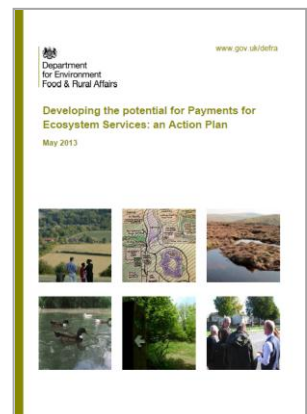
Further developing Payments for Ecosystem Services (PES)

PES schemes involve payments to the managers of land or other natural resources in exchange for the provision of specified ecosystem services (or actions anticipated to deliver these services) over-and-above what would otherwise be provided in the absence of payment. Payments are made by the beneficiaries of the services in question, for example, individuals, communities, businesses or governments acting on behalf of various s parties.¹

In May 2013, Defra published an Action Plan for further developing PES in England.² This highlighted some of the key challenges associated with developing PES, in particular understanding the level of demand from beneficiaries:

“While there are considerable and important efforts to understand the supply side for PES (e.g. how land managers can deliver ecosystem services on the ground), a key gap relates to better understanding demand from beneficiaries of ecosystem services, such as businesses, in order to identify future PES opportunities.”

Furthermore, in order to build capacity for developing PES, the Action Plan committed Defra to: *“fund new research on how wider beneficiary participation in PES schemes might be encouraged, with a focus on business sectors with dependencies on the natural environment”*. This report, which also includes a focus on local government as a potential buyer of ecosystem services, fulfils this commitment.



Research methodology

A three stage approach was taken to the **analysis of business sectors**:

1. an initial broad ranging sweep of the literature in order to scope the ‘PES readiness’ of all UK business sectors
2. a short list of sectors was then subject to further analysis through a more focused literature review and a final three sectors were chosen for detailed profiling; and
3. detailed literature reviews for each of the three sectors, and semi-structured interviews with representatives from these sectors.

This information was synthesised to produce sector-specific ‘proof of concept’ business cases and PES action plans.

¹ Smith, S., Rowcroft, P., Everard, M., Couldrick, L., Reed, M., Rogers, H., Quick, T., Eves, C. and White, C. (2013). *Payments for Ecosystem Services: A Best Practice Guide*. Defra, London.

² Defra (2013). *Developing the potential for Payments for Ecosystem Services: an Action Plan* [online] available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/200889/pb13918-pes-actionplan-20130522.pdf.

The **analysis of Local Authorities** focused on their role in securing ecosystem service provision, particularly through green infrastructure provision, flood risk management, sustainable energy provision, and measures to promote public health. To explore these drivers the project team:

1. Identified a 'long list' of potential public sector contacts from Local Authorities³ and other bodies
2. Developed a short list of LAs, considering factors such as directness of dependencies on the environment and awareness/engagement with such issues
3. Undertook semi-structured interviews with a range of LA representatives.

The information gathered was then synthesised to produce a PES action plan for Local Authorities.

Limitations

This research was subject to several limitations which should be borne in mind when considering its results. These were: sample size (it was only possible to obtain responses from a limited number of business and local authority representatives); selection bias (those who did respond to our requests for interviews are potentially more sustainability orientated than non-respondents); and self-reporting of information (with statements unable to be independently verified by the research team).

Scoping review of business sectors' PES readiness

Having undertaken a literature review examining the ecosystem services dependencies, awareness, drivers, and **potential PES roles of all UK SIC business sectors**⁴, a short list of business sectors was selected as having particular PES potential.⁵ These are detailed below:⁶

Sector	Rationale for selection
Fishing and aquaculture	<ul style="list-style-type: none"> Sector is highly and directly reliant on ecosystem services and only 25% of UK fisheries are sustainably harvested and at full reproductive capacity. Outside of nutrient removal there appears to have been little PES activity in the marine environment. Proposals are under development whereby investors fund reduced fishing effort and in return are allocated a share of the value of the future catch. Managed realignment schemes could be broadened to include a focus on fishery stock regeneration and other ecosystem services.
Mining and quarrying	<ul style="list-style-type: none"> Most types of mining have a high dependency on supplies of freshwater which are vital for mineral processing. Interest in tools to understand ecosystem service impacts and dependencies is increasing in the sector. Potential to play the role of both 'buyers' and 'sellers' in PES schemes: <ul style="list-style-type: none"> - Sellers as part of activities compensating for adverse environmental impacts. - Buyers in terms of freshwater supplies, protection of fixed assets from flood risk, and reducing net carbon emissions.

³ Given limited resources for this part of the study it was agreed that the focus of the research should be solely on LAs rather than trying to capture LEPs, LNPs and BIDs as well (the one exception was an interview with a Local Nature Partnership which was encouraged through the interview process with LAs).

⁴ In order to ensure that all sectors with the potential to engage in PES were initially considered the UK Standard Industrial Classification of Economic Activities 2007 (UK SIC) was used as a framework for the long listing process – Office for National Statistics (2009) UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007): Structure and explanatory notes [online] available at: www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/standard-industrial-classification/index.html

⁵ NB. Whilst a large number of UK SIC sectors covered in the broad scoping review (see Section 3.2 in the main report) were not taken forward, there nonetheless remains strong PES potential in many of these business sectors. It is hoped that this exercise will provide a useful starting point for those wishing to explore these in more depth.

⁶ Full references for this table can be found in the main report – please see Section 3.5 in the main report

Sector	Rationale for selection
Major ‘manufacturing’ water users	<ul style="list-style-type: none"> • A number of ‘manufacturing’ sectors are disproportionate users of water. In England the top industrial abstractors of water are: ‘Manufacture of chemicals and chemical products’, ‘Manufacture of paper and paper products’ and ‘Manufacture of beverages’. • Demographic and social trends are placing more demand on water resources, with climate change likely to compound the UK situation. • There are examples of water dependent manufacturers acting as buyers in PES markets. • WRI’s work identifying potential PES beneficiaries in the Neuse River Watershed identified numerous manufacturers.
Transportation and storage	<ul style="list-style-type: none"> • Tend to have a reliance on fixed assets that may be vulnerable to weather and natural events, and so may be reliant on the climate and hazard regulating services of ecosystems. • The sector creates impacts which may affect its licence to operate – e.g. air, noise, and visual pollution. • There is some evidence that UK-based transport companies are using improvements in ecosystem service provision to offset impacts and improve CSR performance. • No current examples could be found of PES schemes being used to protect transport assets, although a PES scheme was proposed for protecting the Panama Canal from siltation.
Human health activities	<ul style="list-style-type: none"> • A growing evidence base suggests that contact with nature delivers a range of physical and mental health benefits to people. • The Mayesbrook Park restoration PES scheme sought to optimise park restoration design to provide health benefits for the local community. • The market for nature-based health services is considered to be a potentially large and growing as people live longer and seek a better quality of life.
Water supply and sewerage	<ul style="list-style-type: none"> • Highly dependent on ecosystems for cost-effective and sustainable operations, with water quantity and quality depending on the functioning of healthy aquatic ecosystems • The water industry also has a role to play in terms of protecting rivers, streams and lakes from pollution and unsustainable abstraction. • A total of 288 payments for watershed services and water quality trading programmes have been identified around the world, demonstrating the relatively high levels of uptake of water-orientated PES.
Food manufacturing	<ul style="list-style-type: none"> • Considered to be amongst those sectors most dependent on ecosystem services. • Thought to be highly sensitive to potential global supply disruptions from extreme weather events, water stress and other supply-related shocks. • There is particular potential for PES schemes to emerge in relation to businesses premised on locally sourced produce. <ul style="list-style-type: none"> - As an example, Yeo Valley Organic supports organic practices through its operations and farming enterprises, with a business model built on local sourcing

During the scoping exercise, **three key cross-cutting issues** were identified which apply to a diverse range of businesses. These are as follows:

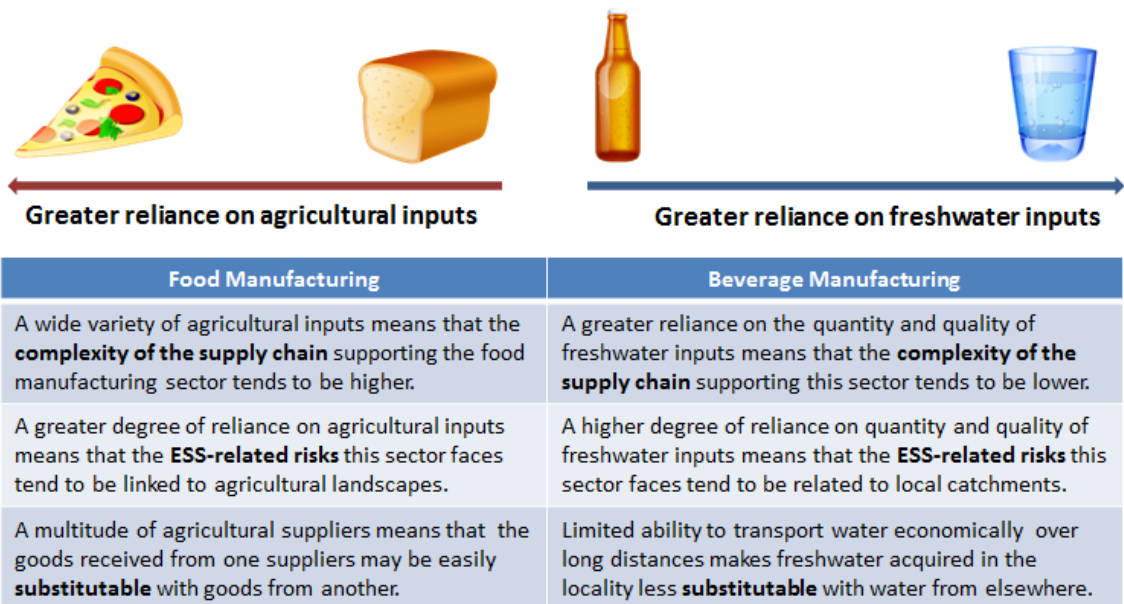
- Natural hazards and climate adaptation – across all sectors, there is the potential for facilities, infrastructure and supply chains to be threatened by natural hazards.
- Consumer and legislative pressure to reduce impacts – growing pressure on businesses to address impacts on the natural world; both through consumer preference and legislation.
- Market price – changes in flow of ecosystem services can affect market prices, whether directly or indirectly, so potentially opening up opportunities for PES.

Detailed profiling of business sectors’ PES readiness

Secondary research, internal meetings, and a steering group meeting were used to narrow the selection of sectors to a final three – **beverage manufacturers, food manufacturers, and heavy water users** in the form of the chemical and paper manufacturing sectors. The following is a summary of the findings of the additional research undertaken.

Food and beverage sectors: differing risk contexts

Major ecosystem service-related issues facing the food and beverage sectors include maintaining access to raw materials in light of rising and increasingly volatile food prices and climate change that affects agricultural stability and the availability of clean water.⁷ Despite these similarities, there are **important differences in the type and quantity of inputs** required for their respective manufacturing processes. These processes result in differing risk profiles (see below), and so led to separate detailed profiling of these sectors.



⁷ FAO (2012) Price volatility from a global perspective - Technical background document for the high-level event on: “Food price volatility and the role of speculation”, FAO headquarters, Rome [online] available at: http://www.fao.org/fileadmin/templates/est/meetings/price_volatility/Price_volatility_TechPaper_V3_clean.pdf

Targeting heavy water users

The manufacturing sector uses the highest proportion of abstracted freshwater in England. In addition, the manufacturing sector has been identified as the single largest non-household user of mains water.⁸ The top manufacturing abstractors of water for consumptive uses within the manufacturing sector in England are detailed on the following page:

Rank	Manufacturing Sector	Upper bound, ML ⁹ (2006)	Lower bound, ML (2006)
1	Chemicals and chemical products	277,666	163,782
2	Paper and paper products	51,356	51,356
3	Beverage	20,783	20,265
4	Coke and refined petroleum products	18,822	18,822
5	Food products	18,777	13,960

The **chemical industry** was considered of particular interest given its high usage of abstracted water, large size, and inclusion as an opportunity area within the Ecosystem Markets Taskforce Evidence Review Paper.^{10,11} The **paper and paper products manufacturing sector** was also considered to have relatively high PES potential due to a high dependency on abstracted water, high withdrawals, and relatively homogenous processes and dependencies when compared to the more diverse chemical sector (so potentially aiding roll out).

Selected manufacturing sectors: Business cases and PES action plans

This section summarises the business cases established 'for' and 'against' PES uptake in the beverage, food, chemical and paper manufacturing sectors, along with suggested actions for encouraging PES uptake.¹² These **business cases and action plans** were established on the basis of literature reviews and semistructured interviews with sector representatives exploring issues, actions and drivers relating to these sectors' dependencies and impacts on natural capital and ecosystem services.

⁸ WRAP (2011) Freshwater availability and use in the UK [online] available at: <http://www.wrap.org.uk/sites/files/wrap/PAD101-201%20-%20Freshwater%20data%20report%20-%20FINAL%20APPROVED%20for%20publication%20vs2-%2005,04,12.pdf>

⁹ One Megalitre (ML) is equivalent to 1000m³ water, or 1,000,000 litres.

¹⁰ WRAP (2011) Freshwater use in the UK: manufacturing sector [online] available at: <http://www.wrap.org.uk/sites/files/wrap/PAD101-201%20-%20Manufacturing%20sector%20water%20report%20-%20FINAL%20APPROVED%20for%20publication%20-%2012,03,12.pdf>

¹¹ Duke, G., Conway, M., Dickie, I., Juniper, T., Quick, T., Rayment, M., Smith, S., (2013). EMTF Second Phase Research: Opportunities for UK Business that Protect and/or Value Nature. Final Report. ICF GHK, London [online] available at: <http://webarchive.nationalarchives.gov.uk/20130822084033/http://www.defra.gov.uk/ecosystem-markets/files/EMTF-2nd-Phase-Research-Final-Report.pdf>

¹² Business cases, action plans and supporting evidence can be found in full in the main report. Please see: Section 4.6 for the beverage manufacturing sector; Section 4.10 for the food manufacturing sector; and Section 4.14 for the chemical and paper manufacturing sectors.

Business case: Beverage manufacturing

Evidence that supports a business case for PES	Evidence suggesting a reduced business case for PES
<p>Securing resources is already delivering business value in some cases, with water seen as a particular opportunity area. Given that freshwater quality and quantity is critical to the industry in terms of securing agricultural inputs, for use in manufacturing and the operation of facilities, and as a product there may be the potential for PES scheme development. This is particularly the case given the predominance of water-based PES schemes in the literature.</p>	<p>Disconnection between suppliers and manufacturers. Where benefits accrue to other interests (e.g. due to the financial independence of suppliers) and/or where the complexity of global supply chains hide impacts and dependencies, there appears to be little incentive for voluntary payments to secure ecosystem services. Even with regional resources such as water, the link between a business's supply and an underlying ecosystem can be obscured.</p>
<p>Growing markets for ethical goods mean that beverage companies are increasingly looking to improve their environmental credentials, with growing pressure to demonstrate sustainably sourcing coming from the sector's corporate customers. This is driving some beverage manufacturers to self-disclose their product footprints and to consider novel methods for addressing identified impacts and dependencies, which could potentially include PES. Such steps appear to also deliver co-benefits in terms of risk management and cost-saving.</p>	<p>An overall lack of accountability for product footprints means that there is a reduced incentive for beverage manufacturers to explore their environmental impacts and so realise the risks and opportunities that are inherent in their supply chains. This is particularly the case given that beverage manufacturers are driven to lower costs as a result of market competition, and find that there is relatively little consumer demand for sustainably products.</p>
<p>The beverage sector's reliance on agricultural inputs means that there may be the potential for the development of PES schemes that help to secure critical supplies, for example by preventing the depletion of water supplies in areas where barley production occurs. Environmental stewardship by beverage manufacturers appears to be more likely where the means of primary production are directly owned and where suppliers are easily accessible. Supply chain 'ownership', be that literal ownership (e.g. orchards) or longer-term partnerships with wider suppliers, creates circumstances where voluntary markets for securing ecosystem services may operate.</p>	<p>Price is the primary driver for businesses in the beverage sector, but environmental impacts are often not reflected in resource prices given substitutable suppliers, a strong incentive to externalise impacts wherever possible, and a tendency for customers to buy on price primarily, and factor such as providence secondarily; this may limit appetite for environmental action and PES uptake. However, if the business case for PES can be made, this focus on cost may work to increase levels of uptake.</p>
<p>There are several examples of PES scheme development in the beverage sector when reviewing the international literature, particularly in terms of Payments for Watershed Services. Having a set of case studies developed around water to communicate the relevance of PES to the beverage industry may help to increase the interest such schemes</p>	<p>Awareness of PES appears to be rudimentary amongst many beverage manufacturers in England; limited understanding of environmental impacts and PES' potential role in addressing them, seems likely to limit scheme uptake. Although some linkages are made by those in the sector between ecosystem quality and commercial viability, CSR to currently appears to be behind much action on sustainability in the sector. This suggests that the economic benefits of action on ecosystem-risks are not often identified or realised by businesses in the sector, so presenting a barrier to PES.</p>

Evidence that supports a business case for PES	Evidence suggesting a reduced business case for PES
<p>A desire to stay ahead of emerging legislation has motivated some beverage sector action on environmental impacts. As such, clear policy signals on issues such as total product footprints may encourage awareness and action on ecosystem impacts, including the potential use of PES.</p>	<p>Short-termism in markets, particularly for goods that can be readily substituted, hinders the potential for investment in supply chain and ecosystem service security, so potentially limiting businesses' appetite for tools such as PES. In addition, businesses that do not own their facilities may have less ability to take action on site level dependencies and may have shorter investment time horizon, so limiting PES potential.</p>
<p>Beverage manufacturers are taking voluntary action to secure licence to operate and reputational gains and access to finance. Evolving requirements of insurance companies and financial institutions in relation to ecosystem services may also encourage action on environmental risks. NGO pressure is another key influence on beverage manufacturers and their corporate customers. This suggests that PES could also be promoted as a means of addressing environmental issues of interest to NGOs.</p>	<p>Legislation focused on the environment is often seen as being weak driver by beverage manufacturers, with the best practice of leading players in the sector considered to be far 'ahead of the curve' in this respect. As such, legislative pressure may need to be higher to drive environmental action on a broader, sector-wide basis, so leading to greater consideration of PES.</p>
<p>Potential for trade associations and cross-industry platforms to instigate action. Although the scale of a particular beverage company may limit its ability to influence supply chain impacts, there is the potential for trade associations and cross-industry platforms to provide a means of bringing together separate actors and disseminating information on PES. For example, communicating PES to larger organisations within a supply chain focus may heighten awareness of the tool amongst other organisations.</p>	

Action plan: Beverage manufacturing

Current state of play	Suggested actions	Priority level	Rationale
Low awareness of PES and PES opportunities within the beverage manufacturing sector	Provide information to the beverage sector on business relevant environmental risks and opportunities and how PES can be used in response. This is likely to be best achieved through the larger corporate customers of beverage manufacturers, NGOs, and trade associations. Messages could be drawn from the evidence gathered in this report, and through the further in depth research and piloting recommended below.	High	Such engagement could help beverage manufacturers to identify their environmental risks and opportunities, and so see PES as a means of addressing and realising these concerns. To be successful messages would need to be beverage sector-specific, have a clear focus on the cost savings possible through PES, and be delivered through trusted institutions.
There are some initial signs of PES-readiness amongst beverage manufacturers, but these need to be explored further	Identify beverage manufacturers with the highest potential for PES scheme uptake. Building on this research, commission in depth research into those beverage manufacturers who may have the greatest PES potential; for example those that have short supply chains, face water shortage or quality issues, or are under pressure from stakeholders such as their corporate customers and NGOs.	High	Further targeted research examining the environmental risk and opportunities facing the beverage sector would allow a fuller picture to be painted of the sectors PES potential, so potentially paving the way for PES pilots in future. This could include drawing together a list of priority companies, geographical areas (e.g. catchments), and ecosystem services.
This study did not identify any examples of PES scheme uptake by English beverage manufacturers	Support PES scheme pilots where key opportunities are identified. Following more in depth research into the key PES opportunities in the beverage sector, seek to pursue the most promising of these leads through PES pilots; at present Watershed Services appears to be an 'easy win' and further opportunities may be highlighted by future research.	High	Could support the wider uptake of PES by providing examples of beverage sector-relevant schemes 'in action'. This is likely to be particularly effective where a PES opportunity can be easily replicated by many other manufacturers. Classed as a high priority given the potential for such pilots to support business confidence.
Complex and global supply chains mean that identifying and responding to environmental risks can be difficult, with unclear benefits	Learn from larger corporate players on how to identify and respond to supply chains risks. Research, briefings, and wider engagement activities, such as learning workshops, could be used to increase the beverage sectors capacity to identify and react to the risks and opportunities inherent in their supply chains. This could include the establishment of bodies or trade association partnerships to increase leverage with suppliers.	Lower	The environmental impacts of beverage manufacturers tend to be in their extended supply chain. Improving the ability of these businesses to recognise and react to these concerns could encourage the use of PES. However, supply chains action is less likely to achieve wide PES uptake in the short term given the challenges involved. As such, it has been given a lower priority.

Current state of play	Suggested actions	Priority level	Rationale
Corporate customer (e.g. supermarkets) and NGO pressure is encouraging beverage manufacturers to take ownership of their product footprints	Engage with the corporate customers of the beverage sector and NGOs with interest in their impacts. Such engagement could involve workshops, meetings, and briefing papers highlighting the potential role of PES in addressing the beverage sectors key environmental impacts. This could draw on the suggested further research into the beverage sectors key PES opportunities (see above) in order to ensure that engagement is targeted.	Lower	By engaging with these key influencers of the beverage sector, there is the opportunity to spread understanding of PES and so encourage its uptake. However, this has been given a lower priority given that many environmental impacts of interest to corporate customers and NGOs are likely to be in the supply chain, and so less likely to be easily targeted through PES.
Beverage companies perceive current legislation focused on the environment as not requiring them to do more, but are responsiveness to the threat of more stringent legislation	Setting out a 'direction of travel' promoting the reporting of total product footprint , for example in terms of carbon, water, and natural capital. This could set out a suggested trajectory for the evolution of product footprint reporting; potentially this could include Government support for best practice (e.g. supporting corporate studies, guidance of approaches, advice) and limited mandatory requirements in future to ensure a more level playing field.	Lower	Although this action is not PES or beverage sector specific, providing support to leading players in conjunction with the threat of eventual legislation to address those lagging behind may stimulate innovative responses, including potentially the voluntary uptake of PES. However, a lower priority has been given as this may only indirectly drive PES and could take a long time to take effect.

Business case: Food manufacturing

Evidence that supports a business case for PES	Evidence suggesting a reduced business case for PES
<p>Food manufacturers that have integrated agricultural production appear more likely to respond to environmental issues. Such companies may be able to benefit from PES through reduced costs and increased security of supply (e.g. paying to build reservoirs to protect against effects of drought). It appears that certain subsectors, such as vegetable and salad producers and processors, and dairy producers and manufacturers, have a particular tendency to have integrated farms in this manner and so may have higher PES potential.</p>	<p>Limited specific awareness of dependencies and impacts on the natural environment. The literature review indicated that the food manufacturing sector has major dependencies and impacts on the environment. Despite a broad awareness of these concerns, those interviewed appeared to have relatively limited awareness of specific issues related to the environment and the food sector. This may prove to be a barrier to PES scheme uptake unless the key environmental risks and opportunities facing the food manufacturing sector can be made clear to businesses, so providing a foundation for PES scheme development.</p>
<p>Some food manufacturers make use of dedicated and short supply chains for certain ingredients. These companies tend to rely on ingredients that are not readily transportable (e.g. that are heavy or bulky like milk or potatoes) or are not available elsewhere internationally (e.g. PDOs). There is a good business case for such food manufacturers to invest in PES schemes that improve security of supply and reduce costs given the potential for benefits to accrue to their business quite directly. An example of an existing PES scheme based on a dairy business' short supply chain was highlighted by the literature review (see full report).</p>	<p>Supply chains have a 'distancing effect' that restricts action on environmental issues. Although some companies were investing in their supply chains, this was typically to reduce reputational risks, rather than to secure sustainable supplies. This appears to be due to a perception that if inputs to the manufacturing process were to become unavailable from suppliers in a particular locality, it would normally be possible to switch to alternative suppliers in other parts of the world. This may present a barrier to PES scheme development where key environmental risks and opportunities are embedded in complex and global supply chains.</p>
<p>Some food manufacturers have high levels of water use. According to the literature, certain subsectors in the industry are particularly reliant on water supplies (e.g. meat processing and fruit/vegetable companies). Water shortages under climate change may reduce water availability and so increase its price. This may incentivise those that are particularly reliant on water to invest in PES, particularly in parts of the country at higher risk from shortages. For instances, concern was expressed about the effects of drought by some interviewees, with this leading to action by those with integrated farms. These factors suggest PES potential in some instances, although scope for action may be limited by the buffering effect of water companies and supply chains, plus an industry focus on onsite water efficiency measures.</p>	<p>Free-rider problem in water-based PES schemes (and potentially in other contexts). Concerns were expressed about free-riders, for instance in the context of catchment management or flood risk alleviation PES schemes, so presenting a barrier to their uptake. Bilateral partnerships could help to overcome this, although there are potential issues in terms of the distribution of risk¹³. However, an example of such a partnership was cited during the interviews (see full report) and so such barriers appear to be surmountable in some circumstances. There may also be the potential to bring multiple businesses together in a catchment, so reducing the potential for free riding (e.g. during negotiations associated with the Water framework Directive Programmes of Measures¹⁴).</p>

¹³ For successful bilateral partnerships to emerge, there would need to be a clear idea of likely benefits (e.g. reductions in water bills) as a result of investing in PES projects, ideally negotiated in advance of investment (e.g. with water companies). Although this would reduce risks and make PES more attractive to beneficiaries within the food manufacturing sector, these risks would be transferred to those with whom discounts were negotiated in advance (e.g. water companies), making the schemes less attractive to those parties .

¹⁴ Where changes in catchment management need to be re-negotiated in Programmes of Measures under the Water Framework Directive it may be possible to bring a larger number of downstream beneficiaries including major water users with substantial water bills to the table to consider cost-sharing PES schemes that include the majority of water users in a catchment.

Evidence that supports a business case for PES	Evidence suggesting a reduced business case for PES
<p>Access to ethical markets via corporate customers and reputational gains are key drivers behind action on the environment by the food sector. Both the literature and interviews highlighted that food manufacturers are increasingly seeking to prove their ethical credentials given corporate customer requirements and NGO campaigns. Such drivers may encourage consideration of environmental risks and opportunities, so increasing the likelihood of PES picked up as a tool, whilst PES schemes themselves may deliver reputational gains as a cobenefit (e.g. the public visibility of UK woodland carbon offsets was highlighted as a potential additional benefit).</p>	<p>Actions on the environment are primarily focused on improving manufacturing efficiency. The literature review and interviews reveal that food manufacturers are actively managing their direct operational carbon and water footprints and have established targets to further reduce their carbon and water usage. These activities were found to be primarily driven by cost savings linked to manufacturing efficiency, industry wide targets, legislation, and the demands of corporate customers. Whilst PES is based on the achievement of win-win outcomes, there was concern that the benefits available through PES may be outweighed by low hanging fruit of efficiency gains, through which benefits easily accrue.</p>
<p>Cost savings are a primary driver for beverage business. Interviews with food sector representatives revealed that cost was the primary concern for their businesses. This concern may provide a basis for PES scheme development, given the focus of this instrument on achieving win-win outcomes. Clear business cases for PES appear more likely to emerge in relation to the food sectors local and site level ecosystem service dependencies, given relative difficulties in securing benefits where suppliers are substitutable and distant.</p>	<p>PES concept and business case appears to be poorly understood. There appeared to be limited awareness and some confusion over the PES concept amongst those interviewed in the food manufacturing sector. This included doubts over the business case supporting PES scheme development, despite the focus of such schemes on achieving win-win outcomes. This failure to recognise the role of PES in delivering benefits to business may stem from a view that action on the environment outside of onsite efficiency gains is undertaken on CSR basis.</p>
	<p>Government regulation and policy tends to focus action on onsite environmental issues. Whilst government policy and regulation was seen as having a broad effect on food manufacturers (e.g. not only influencing leading players), it was seen to be primarily driving onsite actions (e.g. carbon and water efficiency). For instance, the majority of food manufacturers seem to view upstream solutions to flooding as the responsibility of Government and/or water companies and envision difficulties in making a business case for such action. As such, Government may have to send a clearer signal on the need for business to address wider natural capital and ecosystem service related issues.</p>
	<p>Scepticism about the use of sequestration as part of efforts to reduce carbon footprints. Whilst climate regulation was one of the most widely understood ecosystem service amongst interviewees, concerns were expressed over carbon sequestration schemes as a means of bringing addressing the carbon footprints that are such a major driver for environmental action within the sector. To support PES uptake it may be necessary to clearly communicate to food manufacturers the benefits of UK carbon-focused PES schemes, including their reliability and their local visibility. However, it should be noted that the sample of business interviewees was small and as such there is a need to further explore business attitudes towards carbon reductions via woodland sequestration.</p>

Action plan: Food manufacturing

Current state of play	Suggested actions	Priority level	Rationale
<p>Concern over the free rider problem may be barrier to the establishment of water-based PES in the food sector</p>	<p>Broadly speaking there may be two ways to overcome the disincentive of free-riders: i) get as many as possible of the companies who would benefit to contribute towards the PES scheme; or ii) water rate reductions are only offered to companies who invest in the PES scheme.</p> <p>Defra may be able to explore the potential for Government bodies to act as trusted intermediaries to broker partnerships between multiple food manufacturing buyers and water companies and administer payments to landowners (possibly by stacking private PES with public agri-environment payments) to improve catchment management in return for reduced water rates for investors¹⁵ or the ability to claim any wider benefits of investment¹⁶.</p> <p>Defra could also consider how Government bodies and policy initiatives such as Nature Improvement Areas and Water Framework Directive implementation could help to facilitate partnerships between multiple buyers and water companies and administer payments to landowners (possibly by stacking private PES with public agri-environment payments) to improve catchment management in return for reduced water rates for the companies that invest in the scheme.</p> <p>Given the large areas farmed by some companies that integrate agricultural production and manufacturing operations¹⁷, such organisations could be an initial key area of investigation in terms of water-focused multi-lateral PES scheme development.</p>	<p>High</p>	<p>Developing partnerships between ecosystem service buyers may provide a mechanism for reducing free-riding and sharing costs, for example through reduced water treatment costs associated with catchment management PES schemes. Given the high levels of water use by the manufacturing sector (and some particular sub-sectors in particular) there may be strong PES-potential where high water rates could be reduced through actions to improve the natural environment. As a result this area of action has been given a high priority.</p>

¹⁵ For example, where changes in catchment management need to be re-negotiated anyway in Programmes of Measures under the Water Framework Directive, it may be worth bringing downstream beneficiaries (including major water users with substantial water bills) to the table to consider cost-sharing PES schemes in which the costs of improving catchment management are shared by water users in return for future cost savings on utility bills.

¹⁶ For example, partnerships may take the form of cost-sharing schemes between water companies and food manufacturers with manufacturers retaining the carbon benefits for corporate carbon reporting, CSR or carbon offsetting and trading purposes.

¹⁷ For example, Interviewee 3's company farm 4,000 hectares in the south of Spain

Current state of play	Suggested actions	Priority level	Rationale
Little evidence of NGO's and food sector partnerships with the potential for PES scheme development	<p>Facilitate partnerships between NGOs with experience working as PES intermediaries and food manufacturers interested in PES.</p> This could be encouraged in future research building on the Defra PES pilot scheme, possibly providing follow-on funding to NGOs and others with experience from previous funding rounds to form these partnerships. Such testing would help to build the evidence base on how partnerships between manufacturing businesses and NGOs can help to facilitate PES scheme development, so hopefully supporting wider uptake.	High	Whilst NGO pressure on businesses is important in encouraging sustainable practices by food manufacturers, there is little evidence of partnerships forming between PES-focused NGOs and such businesses (although these are emerging ¹⁸). Partnerships with NGOs have enabled companies to build capacity for sustainability projects elsewhere. ¹⁹ Given the potential for this action to be supported through a refocusing of PES pilot efforts, a high priority has been given.
Lack of awareness and understanding of the PES concept and business case in the food manufacturing sector	<p>Provide information to the food sector on relevant environmental risks and opportunities and how PES can be used in response.</p> There should be a particular emphasis on the win-win business case behind PES scheme development given that such activities were misconstrued as CSR exercises costing business money. It may also be beneficial to communicate drought risks due to climate change and the opportunities PES might present in terms of security of supply. Larger corporate customers of food manufacturers, NGOs, and trade associations may all be appropriate means of disseminating messages about PES. <p>Given the need to avoid complexity and make investment in PES as easy as possible, trusted intermediaries may play a major role in the promotion of PES schemes. Defra could commission research to explore the barriers facing private intermediaries and NGOs, learn lessons from successful intermediaries, and the potential for Government bodies to act as, or support, intermediaries; for instance by providing access to hard-to-reach land owners²⁰.</p>	High	Information about PES options needs to be more widely available, easily accessible and promoted to businesses in the food manufacturing sector given a widespread lack or misunderstanding of the concept and the business case behind it. Given that a thorough understanding of the PES concept will be required to provide a basis for scheme uptake, this area of action has been given a high priority.

¹⁸ For instance, WWF-UK, The Rivers Trust and the Westcountry Rivers Trust are currently engaged in the WaterLIFE project, an aim of which is to work with businesses to demonstrate the potential and the implementation of water stewardship in tow catchments. WWF has also worked with Coca-Cola on PES schemes in seven watersheds around the world that are critical to their business.

¹⁹ For example partnerships between WWF and Marks & Spencer (to develop their 100 point environmental strategy) and Carrefour (to trial sustainability tools with their suppliers)

²⁰ For example, reaching commoners via the Rural Development Programme (e.g. learning from the use of trusted, local, independent facilitators in Wales to build social capital and effectively communicate public PES opportunities via Glastir to farmers, providing them with assistance to access funds – Source: Wynne-Jones, S. (2013). Connecting payments for ecosystem services and agri-environment regulation: an analysis of the Welsh Glastir Scheme. Journal of rural studies, 31, 77-86.

Current state of play	Suggested actions	Priority level	Rationale
Concerns over carbon sequestrations schemes	<p>There is a need to better communicate to business the benefits of carbon sequestration through habitat planting and restoration activities in the UK. This could include an engagement strategy focused on those food manufacturing businesses with the highest levels of carbon emissions. Such a strategy could communicate key messages from research that reveals negative perceptions of carbon sequestration schemes may be misplaced; present the business case for such investments; discuss the wider social and environmental benefits that investments in the UK natural environment can bring; and highlight the relative strength of UK woodland carbon mechanisms²³.</p> <p>Funding for the work necessary to accredit PES mechanisms could be sought. Having schemes verified by UK Accreditation Service (UKAS) accredited certification bodies may help to address concerns that PES schemes will not deliver intended benefits. The Woodland Carbon Code is currently the only UKAS-accredited PES scheme in the UK and the cost of setting up accreditation presents a barrier to other current / future schemes becoming UKAS-accredited (such as the Peatland Carbon Code).</p>	High	<p>There is a need to reassure stakeholders that PES and PES-like schemes are capable of delivering any claimed benefits, particularly in the case of carbon offsets where concerns were expressed by the multiple stakeholders about the reliability of such schemes and the business case for investment. Given that carbon emissions are a cross cutting issue and important issues across many sectors, this issue is a high priority one. Developing a strategy to promote net carbon reductions via woodland sequestration amongst businesses in the food sector may be a useful step towards wider engagement on this issue.</p> <p>However, it should be noted that the sample of business interviewees was small and as such there is a need to further explore business attitudes towards carbon sequestration schemes before further action is taken.</p>

²³ For example, the Woodland Carbon Code was ranked No.3 in the world by the Environmental Finance Survey in the category 'Best Voluntary Carbon Standard'

Current state of play	Suggested actions	Priority level	Rationale
<p>CSR and access to ethical markets is the focus of much action on the environment in the food sector</p>	<p>Given the potential for PES schemes to raise the profile of a company's CSR portfolio and so provide access to ethical markets, it may be beneficial to focus on PES opportunities close to a company's customer base.²⁴ In the longer term, Defra could explore the possibility of co-ordinating a catalogue of PES opportunities nationally to provide buyers with a wider choice of geographical sites from which to choose projects. This is currently being undertaken in the context of the Peatland Code, and it may be possible to learn from that experience.</p>	<p>High</p>	<p>It is important that the benefits of PES are communicated with reference to the wider CSR gains that could be delivered for food manufacturers. It would however take time to identify and map PES opportunities of relevance to the food sector, and other priorities take precedence, particularly better communicating the PES concept and business case within the sector. This action could form part of an extended strategy for engaging the food sector and so has been given a medium priority.</p>
<p>There is a lack of case studies demonstrating how PES could be effectively used to address food sector risks and opportunities</p>	<p>Support the development of PES Pilots in key areas of opportunity. There are currently few case studies involving the development of PES schemes with food manufacturing companies in the UK. To bring the concept 'to life' amongst stakeholders in the sector it may be necessary to support the development of PES pilots involving food manufacturers.</p> <p>Such pilots should be strategically targeted to ensure that the support roll out in areas of the sector where there is particular PES potential, for instance where there are dedicated and short supply chains for certain ingredients; where farm businesses are integrated; and where there are high levels of water use.</p>	<p>High</p>	<p>It will be important to prove the PES concept and business case to food manufacturing stakeholders if support is to be won for independent PES scheme development. As such the development of PES pilots in key areas of the sector could form an important part of a sector engagement strategy. Classed as a high priority given the potential for such pilots to support business confidence.</p>

²⁴ Reed, M.S., et al. (2013) Peatland Code research project. Final Report. Defra, London. Available online at: <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=18642>

Current state of play	Suggested actions	Priority level	Rationale
Government regulation and policy tends to focus action on environmental action onsite	<p>Review Government regulation and policy to consider whether it supports PES development in the food manufacturing sector.</p> <p>The current policy and legislative framework that food manufacturing businesses operate in can be seen to focus environmental actions onsite, rather than encouraging the exploration of opportunities for environmental gains in the wider landscape.</p> <p>For example, the potential for the Water Act 2014²⁵ to influence PES uptake was raised. Whilst it was not established²⁶ whether the reforms of the Act would work for or against PES (or indeed be neutral), this case nonetheless serves to highlight how a review of new and emerging legislation through a PES 'lens' could help to establish the extent to which changes would be supportive of PES development in the food manufacturing and wider sectors.</p>	Lower	PES schemes do not operate in a policy and legislation vacuum and are subject to various incentives and disincentives as a result. Exploring the levers working for and against PES in the food and wider sectors would enable rational decisions to be made about the costs and benefits of amending policy and legislation to support greater PES scheme development. However, this has been afforded a lower priority in the context of this action plan given that it can take a long time to change policy and legislation and that the effects of any changes are less likely to be specific to the food manufacturing sector.

²⁵ For more information, see: <https://www.gov.uk/government/policies/reforming-the-water-industry-to-increase-competition-and-protect-the-environment/supporting-pages/reform-of-the-water-market-the-new-water-bill>

²⁶ Proposals to reform the water market under the Water Act 2014 would lead to the development of a national water supply network, making it easier for water companies to buy and sell water from each other. This may create flexibility for dealing with water supply issues, which could include catchment management options where these are cost effective. Alternatively, it could enable food manufacturers to switch water companies if they experience problems with water quality or supply, rather than investing in catchment management PES schemes to enhance local water quality and supply. At the same time, the Water Act 2014 may create a new market for water that could enable owners of small-scale water storage to sell excess water into the public supply as a form of PES. This is particularly relevant for food manufacturers with integrated agricultural production businesses, who have built reservoirs to buffer low flows during drought.

Business case: Chemical / paper manufacturing

Evidence that supports a business case for PES	Evidence suggesting a reduced business case for PES
<p>There is a strong reliance on water in both sectors with large quantities of water abstracted in addition to the use of mains water. Both sectors are abstracting water from catchments where supplies are already limited due to ecological thresholds, whilst climate change modelling suggest the UK's water resources may become more strained in future. Given likely increasing demands on water resources and changes in water availability, there may be the potential for catchment-level PES focused on security of water supply to develop in these sectors.</p> <p>External treatment of water can also be required in some circumstances (e.g. where mill effluent contains solids, nutrients, and organic substances). As a result, there may also be the potential for the use of natural solutions, such as constructed wetlands, to treat such wastewater at lower cost than other solutions.</p>	<p>Barriers exist to action by these sectors on water use. At present abstracted water is perceived as being low cost by the industry, whilst mains water is also seen as being cheap compared to the price of energy (where greater efficiency drives have taken place). Responsibility for supply of water was also seen to rest with water companies, who 'buffer' businesses from their dependencies on the natural environment. Larger companies can also move manufacturing when resources are under threat. The effect of low cost, buffering, and flexibility seems to be a relative lack of interest. For instance, there was an absence of chemical or paper responses to the recently released Defra abstraction consultation responses document²⁷. However, PES opportunities may still exist where the business case for action outweighs the cost of moving facilities. Interest may also increase in this resource as demand grows and the predicted effects of climate change start to emerge.</p>
<p>In addition to water, there are some further localised dependencies that provide a basis for PES. Protection against floods for sites that are located in flood-prone areas is highlighted in the literature as a typical dependency. There may be the potential for PES where chemical and paper manufacturing facilities are located in flood risk areas or where waste water treatment requires off site interventions. Examples exist of action to protect large scale infrastructure from flood risk through PES (e.g. Gowy Meadows). Other localised impacts and dependencies could drive PES scheme development, for example Dow's action on air quality through reforestation in the wider landscape.</p>	<p>The focus of industry is onsite efficiencies, despite growing threats from ecosystem service deterioration in the wider environment. The literature highlights that the risks²⁸ posed to the sector from biodiversity and ecosystem service decline are likely to become more acute, whilst global chemical sector profits are deemed to be at risk due to environmental factors. However, these risks were not cited in full by the interviewees, with the key drivers for change seen as being efficiencies and reducing raw material waste. Refocusing the paper and chemical sectors on their impacts outside of their 'factory gate' may be necessary if PES scheme development is to be considered by these businesses.</p>
<p>Understanding where there are simple supply chains with limited alternative suppliers may highlight PES opportunities. There is likely to be greater potential for the development of PES where links to natural resources are clear and simple (e.g. localised sources of agricultural or forestry products) and there are limited alternatives, so creating the basis of a business case for action. However, there is also the potential for businesses to buy up such resources where such supplies are critical.</p>	<p>Many of the resources used by both sectors are obtained through complex, international 'supply webs'. When the supply chain is more complex, and considered more like a 'supply web', the potential to secure supply is reduced significantly. Because the supply web interactions are complex and the potential for uncertainty and free riders is vast it reduces the potential for simple supply chain PES schemes (such as a water company investing in upstream management).</p>

²⁷ Defra (2014) Making the most of every drop consultation on reforming the water abstraction management system - Summary of consultation responses [online] available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/328442/abstraction-reform-sum-resp.pdf

²⁸ Natural resource depletion, increased protected area coverage, advances in the monitoring of natural resources, climate change, the rise of responsible finance, changing consumer preferences, and increasingly stringent environmental policy.

Evidence that supports a business case for PES	Evidence suggesting a reduced business case for PES
<p>Signals on natural capital and ecosystem services are starting to filter through to these industries. For example, Cefic has published guidance on biodiversity and ecosystem services given growing focus on this area, highlighting calls for ‘natural capital and ecosystem services will be properly valued and accounted for by public authorities and businesses’ by 2020²⁹. Paper and the chemical manufacturing sectors have trade bodies which could be a useful means of disseminating information on PES. Wider legislation and policy also appears to affect PES potential, with abstraction reform, for example, potentially helping the growth of catchment partnerships and awareness.</p>	<p>Short time horizons may reduce the desire of industry to take action on the natural environment. Some chemical manufacturers were seen as having shorter term investment horizons than others, with this resulting in a reduced tendency to consider transformative change. Such businesses may have less desire to use PES as a means of securing environmental gains, given the long timescales and upfront costs that can be associated with scheme development.</p>
<p>Both sectors face problems in bringing down GHG emissions, so raising the potential for investment in PES schemes focused on climate regulation. The paper and chemical manufacturing sectors have high levels of energy use, and despite large and effective energy efficiency drives, they are unlikely to decarbonise sufficiently without breakthrough technology. Given the requirements of the UK’s Climate Change Act, the use of PES schemes to offset carbon emissions through schemes such as the Woodland Carbon or Peatland Code may appeal to these sectors.</p>	<p>Whilst there was some general awareness of PES, the concept still needs to be communicated. In particular it appears that existing case studies need to be communicated and sector-specific examples developed, so demonstrating clearly the business case for PES scheme development.</p>
<p>Some chemical companies have taken up the use of green infrastructure including in the wider landscape. A number of large chemical manufacturers are engaged with the concept of GI and are using it in practice, both onsite and in the wider landscape. These cases demonstrate that there is the potential for investment in the natural environment where a business case can be made. Some larger manufacturers are thinking about impacts and dependencies beyond the ‘factory gate’ through lifecycle assessment. Such holistic thinking may also increase PES-potential.</p>	
<p>Both sectors place a high importance on improving public perceptions. The chemical industry has a poor reputation publically (e.g. due to fears of pollution from facilities), whilst the paper industry is under particular pressure to demonstrate sustainable sourcing of wood. As such the CSR co-benefits of PES scheme development may make such action more appealing to these sectors (e.g. woodland planted to offset carbon emissions and/or deliver air quality benefits could also deliver CSR gains in the form of community access).</p>	

²⁹ From ‘Roadmap to a Resource Efficient Europe’

Action plan: Chemical / paper manufacturing

Current state of play	Suggested actions	Priority level	Rationale
Lack of sector specific examples of PES	<p>Support the communication of existing and emerging case studies. These should highlight the way in which PES and similar actions could help to address dependencies and impacts on the natural environment. Messages should be couched in terms of the economic returns available to the businesses, so as to highlight the win-win nature of PES. They should also focus on examples of where PES can address water security and wider identified dependencies and impacts. Examples could include the use of existing Green Infrastructure case studies relating to the chemical sector. Trade associations may be a useful means of disseminating information.</p> <p>In addition to existing examples of best practice, it may be appropriate to support the development of PES pilots. These could be targeted at providing ‘proof of concept’ where the potential for wider roll out of PES appears highest (e.g. the development of catchment partnerships to deliver water supply). Further research into water security and wider PES opportunities suggested in the above actions may provide a basis for the development of such pilot projects.</p>	High	<p>Whilst there was general awareness of the PES concept amongst chemical and paper manufacturers, a need for sector-specific examples was highlighted. This suggests there is a need to communicate existing relevant work on PES in a way that is understandable to these particular business audiences.</p> <p>Given the relative ease of assembling and disseminating existing materials this has been given a high priority, plus the likely persuasive power of targeted sector-specific PES pilots, these actions have been given a high priority.</p>

Current state of play	Suggested actions	Priority level	Rationale
<p>Water is a crucial and at times locally limited resources, but barriers to action remain</p>	<p>Research exploring the barriers and opportunities associated with water-based, catchment-scale PES in the chemical and paper manufacturing sectors. Unlike complex multi-beneficiary supply webs river catchments offer a relatively simple movement of goods and services, namely water quantity, a service which is often being too large for any one business to purchase in its entirety. Given the potential inherent in this area, and barriers such a low water pricing, further research might look more deeply into how PES might be encouraged.</p> <p>For example, an assessment of the dependence of chemical and paper manufacturers on abstracted water could reveal acute cases where PES may be a useful solution. Conversations with the sector representatives reveal multiple factors³⁰ that such an assessment could investigate. A basic business survey would permit a GIS mapping exercise, with further investigation allowing for a risk/dependency rating for individual businesses to be developed. This rating could then be used to engage businesses.</p> <p>There could also be value in investigating how catchment-level partnerships might be formed in order to address water-related issues occurring at this scale. Abstractors within a catchment system often do not know who the other abstractors are, what their water quality and quantity requirements are, or have a way of engaging with them.</p> <p>The further development of the Catchment Based Approach, a Defra funded initiative, could provide a platform for chemical, paper and wider businesses to link with abstractors and other river catchment stakeholders either directly or through 'ethical brokers', as demonstrated through existing water company PES schemes. Interested Catchment Partnerships could seek to pilot PES, including engagement with abstractors in wider sectors.</p>	<p>High</p>	<p>Both the chemical and paper manufacturing sectors are highly dependent on water, but barriers exist to action by these sectors on water supply. Whilst this research has gone some way to highlighting these issues, there is a clear need for further work to identify clear opportunities for PES scheme development.</p> <p>For example, establishing a register of paper and chemical manufacturers at medium to high risk of water-related impacts on profit could provide a basis for engagement in terms of PES.</p> <p>Current levels of water use amongst paper and chemical manufacturers coupled with future trends towards greater water scarcity make this a high priority area for action.</p>

³⁰ Including: **1.** Businesses use of abstracted water; **2.** Businesses quality requirements; **3.** Businesses volume of abstracted water; **4.** Businesses potential to reuse water; **5.** Businesses potential to store water; **6.** Upstream catchment size from the location of the business; **7.** Catchment geology, land use and ability to hold water; **8.** Catchment abstractor competition volume abstracted and volume discharge; **9.** Current abstraction licencing status; **10.** Potential impacts in rainfall from climate change

Current state of play	Suggested actions	Priority level	Rationale
<p>Other dependences and impacts may also provide a basis for PES scheme development in these sectors</p>	<p>Investigate wider dependencies and impacts through further research. In addition to water availability, this study has highlighted additional local level dependencies and impacts of the paper and chemical industries that may provide a basis for PES scheme development. These include situations where:</p> <ul style="list-style-type: none"> • Fixed assets under threat of flood risk could be defended (e.g. flood plain restoration) • Water quality could be improved to reduce treatment costs (e.g. wetland filtration) • Levels of pollutants can be reduced (e.g. reforestation to improve levels of air quality) <p>In addition to local level dependencies, there are also wider concerns that may help to support PES scheme development. These include situations where:</p> <ul style="list-style-type: none"> • PES could also deliver reputational co-benefits (e.g. public access to woodland) • High carbon footprints could result in investment in PES schemes focused on climate regulation (e.g. woodland creation) <p>Further research could seek to identify which chemical and paper manufacturers are most liable to be subject to such issues. Such investigations may highlight particular subsectors most likely to face particular concerns, or could identify geographical hotspots. They could also seek to identify which manufacturers have long or short time horizons and why this is the case.</p>	<p>Medium</p>	<p>This study has identified multiple areas of opportunity associated with the environment beyond water supply. Further research may provide a basis for engagement in future focused on how PES schemes could help to deliver business benefits to chemical and paper manufacturers facing these issues.</p> <p>However, it is anticipated that these opportunities will be more 'piecemeal' in nature that those associated with water security, with less potential for eventual large scale roll out of PES and greater costs in identifying businesses. As a result, such research has been given a medium level priority.</p>

Current state of play	Suggested actions	Priority level	Rationale
Opportunities for action on the natural environment can be limited by the sectors' global supply chains	Investigate the supply chains of the chemical and paper manufacturing sectors. By working with businesses to understand which elements of their supply web are relatively simple and where environmental impacts dependencies could be addressed, opportunities for PES scheme development might be highlighted (e.g. ensuring supplies of agricultural or forestry products by protecting a particular watershed).	Lower	Where supply chains are relatively short and simple there may be the potential to address impacts and dependencies on the environment, including the possible use of PES. However, a large amount of the paper and chemical industries raw resources appear to be acquired through complex global supply chains and so unpicking these 'supply webs' to identify and act on concerns may be difficult. As such, a low priority has been given.
There is uncertainty about the effect abstraction reform will have on the chemical and paper manufacturing sectors	Examine the impacts of current and emerging policy and legislation on PES scheme potential. Both the paper and chemical manufacturing sectors are highly regulated, with this seen as being an important driver towards change by industry. Reviewing environmental legislation affecting these sectors with a view to establishing the extent to which supports PES may be worthwhile given relative uncertainty over how legislative changes, such as abstraction reform, may help or hinder PES scheme development.	Lower	Addressing uncertainty over the influence of wider policy and legislation on PES in the paper and chemical manufacturing sectors may help support the development of an environment more conducive to PES scheme development. However, it can be difficult and time consuming to adjust such levers, and any changes will be likely to have impacts on other sectors, and will have wider knocks on effects. As a result, this is given a low priority rating.

Potential role of Local Authorities in PES scheme development

The evidence assembled during this study tells us much about the potential role of local government and wider bodies (e.g. LEPS) in **procuring ecosystem services on behalf of local communities and business**. In summary:

- Local government plays a significant role in providing ecosystem services and there is a broad policy framework that supports action to maintain and enhance these services.
- LEPs are primarily focused on economic growth; however, there is some limited evidence that they are becoming aware of the links between environmental quality, investment and job creation.
- The importance of the multiple benefits provided by open spaces in urban areas was widely emphasised by LA interviewees, including socio-cultural and health and wellbeing benefits.
- Pressures to take action on natural capital come primarily from the public and central government, although these pressures do not relate to PES per se.
 - The threat of EU fines is driving local authority action on air quality; this could drive uptake of PES targeted at achieving air quality benefits.
- Local authorities highlighted a series of PES or PES type projects (see Box 2). In these examples LAs tend to act as the PES ‘intermediary’ or ‘seller’ rather than as the ‘buyer’.
- Flood risk management³¹ may be the most fertile area for engagement of LAs in PES given flood risk mitigation is a statutory function of local authorities.
- Public health is an additional opportunity for PES scheme development, with this coming through very strongly in the interviews. Local authorities also have a new public health role under the Health and Social Care Act 2012.³²
- Given the Government’s emphasis on increasing the supply of housing there is likely to be significant scope to secure funding for environmental mitigation action through planning obligations and/or the Community Infrastructure Levy³³.

Action plan: Local Authorities

The following table details suggested actions for **encouraging PES uptake in local government**. This was established through a literature review focused on the policy context supporting LA action on the natural environment and interviewees with Local Authority, Local Nature Partnership, and National Park Authority representatives.³⁴

³¹ Given that flood risk mitigation is a legal requirement, layered PES schemes could be developed whereby additional ecosystem services are secured on the back of flood risk alleviation measures.

³² See for example Department of Health (2012). The new public health role of local authorities [online] available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/213009/Public-health-role-of-local-authorities-factsheet.pdf

³³ Environmental work funded through CIL/s106 would arguably not constitute ‘true’ PES as it is not voluntary and in many cases the direct beneficiary is not paying; however it could be considered a PES-type measure

³⁴ Supporting evidence can be found in full in the main report (Section 5).

PES action plan: Local Authorities

Current state of play	Suggested actions	Priority level	Rationale
Few projects where local authorities are acting as PES 'buyers'	Investigate further the scope for local authorities to act as 'buyers' in the highest potential areas, namely flood risk mitigation and air quality improvements.	High	These appear to be the highest potential areas for LAs to act as buyers (the role Defra asked us to focus on), with these authorities otherwise seen more likely to operate as intermediaries / brokers.
Public health departments in LAs are starting to consider the links between health outcomes, health inequalities and wider determinants of health, including the environment	Engage with public health services within LAs, as well as the NHS and Public Health England, to strengthen the evidence base for links between health and environment, introduce PES thinking and explore the scope for their involvement in PES or PES-type projects	High	There appears to be scope for LA public health services to get involved in PES or PES-type projects given a growing focus on the wider determinants of health. This action is considered a high priority given the potential benefits of acting at an early stage in the development of LAs new public health role.
Local authorities are most likely to be engaged in PES or PES type projects as intermediaries/brokers or sellers	<p>Raise awareness amongst senior Local Authority staff about existing LA-focused PES and PES-type projects, and the potential benefits to local authorities (e.g. meeting statutory requirements, reducing costs) and their residents and businesses.</p> <p>This could include targeted workshops focused on key topics such as flood risk, air quality backed up by 'A Local Authority Guide to PES'.</p>	High	To drive wider engagement of local authorities in PES and PES type projects by focusing on communicating the most appropriate opportunities for them to get involved and the benefits that could result.
The extent to which local authorities reach internal agreements to 'buy' projects that deliver enhanced ecosystem services to deliver cost savings is unclear	Identify and disseminate examples of where a Council service has reached internal agreement with another service to 'buy' a project that delivers enhanced ecosystem services, so resulting in cost savings.	Lower	If this practice is not found to be widespread, disseminating examples of such practices might encourage other council's to identify similar cost saving opportunities.
LEPs are primarily focused on economic growth; however they are starting to become aware that quality of the links between the environment, investment and job creation	<p>Continue to engage with LEPs on the links between resilient growth and the environment, including highlighting LEP-funded PES pilot projects and their results.</p> <p>This could involve the production of guidance on PES targeted specifically at a LEP audience, with a focus on the win-win business case behind such schemes.</p>	Medium	To encourage LEPs to more actively engage with the links between ecosystem services and resilient growth

Discussion – Targeting business beneficiaries

An examination of the evidence and actions set out in these tables reveals a number of broad areas of action that cut across multiple business sectors. These are detailed below in order of their suggested priority:

High-priority areas for action

Increase awareness, understanding, and confidence in the PES concept

The interviews revealed a **generally low awareness of PES amongst businesses**. It is considered unlikely that PES will gain traction in the food, beverage, paper, and chemical sectors without decision makers having a clear understanding of their dependencies on ecosystem services and the risks and opportunities these present; that PES is available as means of securing or improving flows of ecosystem services; and how they can work with other stakeholders to bring a PES scheme into being.

In light of this, we suggest that:

- Trade associations could play a key role in promoting PES within these sectors
- Engagement with the larger corporate customers of beverage, food, paper, and chemical manufacturers (e.g. supermarkets) could be a useful means of sharing PES knowledge and encouraging action
- A knowledge exchange strategy for PES is required – e.g. making use of existing institutions such as the Ecosystems Knowledge Network to communicate the PES concept and business case to trade bodies and decision makers in the manufacturing sectors. Key messages from exiting research, such as the recent Defra PES Pilot Review³⁵ could also form part of an effective engagement strategy.
- A key to being able to communicate PES through such bodies will be choosing the right language, for instance emphasising the voluntary nature of PES, potential financial returns, and wider CSR co-benefits on offer. Such engagement would likely be part of wider engagement with business on the environment.
- It will be important to develop more sector-specific examples of PES in action

Further detailed research into specific businesses with high dependencies

The first step in creating a successful PES scheme is to identify a saleable ecosystem service and prospective buyers and sellers.³⁶ This research has shown that there are **very large variations in the degree of ecosystem dependency** between business sectors, and at times within sectors. As such, to achieve maximum effect with available resources, it will be necessary to target support for PES at particular potential beneficiaries.

Bringing together multiple PES buyers will often be required, for example when acting at the catchment scale to secure water supplies. As a result, it will be important to **establish who and where potential PES beneficiaries are within particular priority areas** (e.g. geographical areas or particular subsectors within the manufacturing industries). Such ‘beneficiary mapping’ exercises could target key dependencies identified in this study. For instance, given a heavy dependency on freshwater amongst food, beverage, chemical, and paper manufacturers, work could be undertaken to locate and contact relevant businesses in catchments that are at risk of water shortages in future

³⁵ Defra (2014) Defra Payments for Ecosystem Services (PES) Pilot Projects: Review of key findings of Rounds 1 and 2, 2011-2013 [online] available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/368126/pes-pilot-findings-141028.pdf

³⁶ Smith, S., Rowcroft, P., Everard, M., Couldrick, L., Reed, M., Rogers, H., Quick, T., Eves, C. and White, C. (2013) Payments for Ecosystem Services: A Best Practice Guide. Defra, London.

(e.g. using a Catchment-Based Approach involving partnership building and evidence gathering to identify dependent businesses). This could form an initial step in the wider trialling of PES, for instance through the establishment of PES pilots. Lessons and principles learnt from these initial mapping exercises could then be spread to others in order to inform independent mapping in future (e.g. by Catchment Partnerships).

Supporting businesses in **identifying their own ecosystem dependencies** is also likely to be important in driving uptake of PES, particularly given a tendency for manufacturers in the beverage, food, paper, and chemical sectors to focus on onsite efficiency measures. In particular, support should be concentrated on increasing businesses' understanding of:

- site level risks and opportunities (e.g. supporting onsite green infrastructure); and
- local level risks and opportunities (e.g. identifying water related risks within a catchment)

Establish PES pilots to support business confidence in PES

There is a need to develop more sector-specific examples of PES in action, and so increase **awareness, understanding and confidence in the PES concept**. In particular these should show how the key opportunities identified through this study and further detailed analysis and mapping could be realised by manufacturing businesses in the beverage, food, chemical and paper sectors.

In light of this we suggest that:

- Support is given to a series of PES pilots within the beverage, food, chemical, and paper manufacturing sectors. These pilots could be targeted at the key opportunities identified through this study and further detailed analysis and mapping.
- There is a need to support easier engagement of beneficiaries en masse by intermediaries.

Lower-priority areas for action

Examine the existing policy and legislative context

Existing and emerging policy and legislation can work for and against the uptake of PES by the beverage, food, chemical, and paper manufacturing sectors. Given this, it may be important for the Government to **consider this interplay** (e.g. exploring the implications of both the Water Act and Abstraction Reform could form part of such research). However it is acknowledged that considerable time may be required to make legislative and policy changes and that these changes could have a variety of consequences.

In light of this we suggest that:

- Research is undertaken examining PES relevant policies and legislation
- A clear 'direction of travel' is set out, where changes to policy and legislation are some way off, but are plausible and could drive PES uptake.

Investigate and support voluntary action on supply chain impacts

A great many of the beverage, chemical, and paper manufacturing sectors' materials are **obtained through global supply chains**, which insulate them against ecosystem service dependencies. PES schemes that can reduce production impacts and/or secure resource supplies against threats could be taken up by these industries. However, given greater complexity and difficulties in securing benefits through supply chains, we recommend that efforts are targeted at site and local level ecosystem services where there is comparatively more potential to attempt to make progress.

In light of this we suggest:

- Carrying out a 'supply chain mapping' exercise focused on the suppliers of the beverage, food, chemical, and paper manufacturing industries could identify key opportunities for action – for instance where supply chains are short and suppliers are not readily substitutable

Further analysis focused on additional sectors

This study may form the basis for **further analysis of potential PES beneficiaries** focused on additional sectors with high levels of ecosystem services dependency and PES potential. In addition, some of the broader actions identified in this discussion and in the action plans could be usefully applied to identify and promote PES uptake in other sectors.

We suggest, however, that efforts should be initially focused on the four sectors covered in this report given that: the initial evidence assembled through this study can provide a basis for more targeted action; and concentrating efforts at 'proving' the PES concept and business case in a limited set of sectors could help to drive up awareness in other sectors as uptake increases

In light of this we suggest that:

- Research on potential PES beneficiaries within other sectors is considered only after action has been taken to drive PES uptake in the beverage food, chemical, and paper manufacturing sectors.

Conclusions

This research has uncovered a variety of sectors with the potential to benefit from the uptake of PES. In particular, it has focused on beverage manufacturing, food manufacturing, and heavy water users in the form of chemical and paper manufacturing sectors as a result of their close dependencies on ecosystem services. The current readiness of these sectors to benefit from the application of PES appears however to be limited and the business case for them to engage still needs to be developed and demonstrated. No 'easy wins' akin to the major programmes already being taken by the water industry were identified. However, the research does reveal potential for specific businesses in these sectors to engage and there are a few emerging examples of sector engagement with PES schemes which highlight areas of potential future opportunity.

To improve this situation, we have identified three high priority areas for action. Firstly, it will be crucial to raise awareness of the PES concept amongst decision makers in these sectors. PES was often not clearly understood by businesses and without this understanding it is clear that PES scheme development is highly unlikely. Communicating the key successes and lessons learnt from PES schemes undertaken to date should form a part of a knowledge exchange strategy for PES that is designed to address this deficit. However, to clearly make the business case for PES it will be important to undertake a series of pilots that bring to life the concept and make clear its potential benefits. To support the development of these pilots and wider roll out of PES, it will also be vital to build on this study by establishing who and where potential PES beneficiaries are within particular priority areas, so allowing targeted engagement and partnership building.

In terms of the Local Authority focused element of this study, this research has revealed limited opportunities for formal PES schemes involving LAs at this time, particularly where LAs act as 'buyers'. Examples of LAs acting as intermediaries/brokers or sellers in PES or PES-type projects were identified, but no instances of LAs acting as PES buyers were recorded. To address this it will be important to investigate further the scope for LAs to act as buyers of ecosystem services in the highest potential areas (namely flood risk mitigation and air quality improvements). Another potential area of opportunity is the link between health and the environment, with a need identified to engage with public health services within LAs, as well as the NHS and Public Health England, on the potential for health-focused PES scheme development. Engagement with senior LA decision makers and LEPs will also be required to raise awareness of PES and how it can be used in practice.