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HOLNICOTE PAYMENTS FOR ECOSYSTEM SERVICES (PES) PILOT RESEARCH PROJECT 2014-2015

FINAL REPORT TO DEFRA ON PROJECT NR0156
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EXECUTIVE SUMMARY

The Holnicote Payments for Ecosystem Services (PES) pilot research project is one of a number of initiatives funded by Defra to test the potential for a PES approach. The project was carried out at the National Trust owned Holnicote Estate located in West Somerset which covers some 50km² of pastoral farmland, semi-natural ancient woodland and heathland/blanket bog habitat on the fringes of Exmoor National Park. The Estate encompasses two river catchments, the Aller and the Horner which together cover 40km², and is the location of one of three Defra funded multi-objective flood demonstration projects. The 'From Source to Sea' flood project has piloted the delivery of natural flood management, taking a holistic, catchment wide approach which has sought to deliver multiple benefits for water quality, soil management and biodiversity alongside natural flood management. The Estate contains iconic upland and coastal landscapes and receives in the order of 1.2M visits from the public each year. Key environmental issues for the National Trust at the Holnicote Estate are soil erosion and management on the steeply sloping land, managing flood risk for the villages of Allerford and Bossington which lie at the foot of the river catchments and safeguarding the Estate's exceptional biodiversity and landscape quality.

Defra funding for the flood demonstration project came to an end in March 2015 and a new source of funding is needed to continue to explore and implement further natural flood solutions. Against this backdrop, the PES pilot research project aimed to identify potential markets for financial investment to allow for the long term continuation and expansion of the flood project. The project objectives were to:

- design a robust and realistic PES scheme which is strongly supported by relevant stakeholders;
- identify the most promising markets which are likely to generate sufficient funding to allow for continuation of the Flood Project and delivers multiple benefits such as water quality improvements, reduced risk of soil erosion, enhanced biodiversity and increased carbon storage and capture;
- fully engage with sellers, buyers and wider project partners;
- gain a detailed understanding of the mechanisms, barriers and constraints to delivery of 'real' market(s), and solutions to overcome these; and
- have a robust baseline and clear monitoring and evaluation strategy in place and to share the results of the project with others, build capacity and capture lessons learnt which can be applied to other PES projects.

An initial opportunities assessment was carried out to define the key ecosystem services provided by the Holnicote Estate and to identify a range of potential buyers, sellers and other stakeholders. Individuals and organisations including local businesses, the Parish Council, Flood Community Group, flood insurers, and statutory agencies were approached with targeted messages to gauge initial levels of interest in, and support for, the PES concept. Consultation was carried out using a variety of methods including presentations, face-to-face meetings, email and telephone consultations. Feedback from the consultation process was used to develop and refine thinking around the PES concept and how this might be applied at Holnicote.

Key lessons learnt from the pilot are summarised as follows:

- it is importance to have a coherent strategy which clearly sets out proposals for land management interventions. This is essential to engage stakeholders and provide a catalyst and focus for dialogue with potential buyers;

- credible data on the benefits of natural flood management are vital to demonstrate tangible evidence of results (in this case flood monitoring data were used to confirm a 10% reduction in peak flood during a severe winter storm event which would otherwise have flooded properties in Allerford and Bossington);
- incentivising the sellers of ecosystem services (in this case the National Trust tenant farmers) is critical to deliver the necessary land management change;
- the cost of implementing landscape scale change is significant (estimated £7M or £100K per annum to deliver the full suite of natural flood management measures at Holnicote) and it is unlikely that PES alone could achieve this; rather PES is likely to be part of a mix of novel and more traditional funding sources;
- the pilot has underlined the importance of agri-environment payments as a crucial source of funding for landscape scale land interventions;
- there has been growing belief in recent years that downstream beneficiaries of flood prevention are willing to invest in upstream flood risk management measures but this is not supported by the Holnicote pilot, most likely because of the unique pattern of property tenure (see below), low perceived risk of flooding, demographics and the relatively small number of residents/businesses involved;
- whilst potential buyers are supportive of the concept of natural flood management there is strong feeling that others should take responsibility for managing flood risk;
- property tenure on National Trust estates, where a high proportion of properties are tenanted, is likely to have a significant influence on attitudes towards flood risk management, compared with privately owned and insured residential dwellings and businesses;
- there is a perception amongst practitioners that the flood insurance industry should have an interest in investing in flood prevention measure. The pilot found that there is no clear mechanism for this at the current time;
- there is no major water quality driver for investment at Holnicote since the Aller and Horner are meeting their WFD targets and there is currently no public water supply which might otherwise act as an incentive for water company investment;
- biodiversity and water quality are perceived as being of high quality amongst local businesses so their is limited incentive for further investment in these benefits of natural flood management;
- development of a market around the issue of soil management is challenging - there are no obvious beneficiaries at Holnicote, other than the National Trust itself;
- it has proved difficult to engage effectively with potential buyers in the areas of health and well-being although these are perceived by the National Trust as being key ecosystem services provided by the Holnicote Estate;
- potential buyers are most likely to come from outside of the immediate project area and comprise visitors to the Estate, the public via agri-environment payments or investors in carbon code initiatives. The large number of visitors to Holnicote each year is considered to be a major untapped resource.



Conclusions

The pilot has highlighted how a PES approach, alongside other conventional funding sources, could generate funding for the continuation of the Holnicote Flood Project. These measures include:

- the development of a visitor hub at the Holnicote Estate to provide a focus to engage the public in this unique catchment wide demonstration of natural flood management. The development of a visitor hub has been embedded in the Holnicote Property Business Plan;
- continued use of opportunities to deliver land management change through agri-environment payments by on-going engagement with and support for tenant farmers; and
- investigation of the use of the Woodland Carbon Code and emerging Peatland Carbon Code to support new woodland creation and re-wetting of upland valley/blanket bog habitats, respectively.

The pilot has raised the profile of PES thinking within the National Trust and helped to inform its Land Choices strategy for Holnicote, ensuring that an ecosystems approach and the PES concept are at the heart of Land Choices. In practical terms Land Choices means understanding the current functions of all National Trust land and how these might be better balanced to achieve its aspirations in the future so that water, soils, carbon, wildlife, landscape and cultural significance and public enjoyment are as valid functions of farmland as productivity. Financial sustainability, including the investigation of funding sources, is necessary to support this approach.

In terms of wider transferability, from 2016 the National Trust and Environment Agency partnership Catchments in Trust programme will develop a catchment wide approach to natural flood management and delivery of other, multiple benefits across ten catchments in England, where the Trust is a major landowner. The lessons learnt through the Holnicote PES pilot research will feed through into this project, where one of the objectives is to jointly seek targeted funding.

In spite of these positive outcomes, the pilot has also demonstrated that it is not straightforward to identify and engage buyers in potential markets for landscape scale natural flood management. At the time of writing, it has not been possible to develop a real market for this ecosystem service at Holnicote, although the concept is widely supported by potential buyers. However, the project has provided a platform for the continuation of an ecosystem approach by the National Trust and it is anticipated that PES thinking will form a key part of future funding strategies at the Estate.

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1. INTRODUCTION

1.1 Background to Round 3 PES Pilots

Following a commitment in the 2011 Natural Environment White Paper *The Natural Choice: securing the value of nature* to an ecosystem services led approach to protecting and improving our natural environment, Defra set up a research fund to support pilot schemes and feasibility studies recognising that the development of Payments for Ecosystem Services (PES) may require significant capacity building and analytical support, particularly at the early stages of development. Between 2011 and 2013, Defra funded ten pilot projects (the Round 1 and 2 pilots) to test the potential for a PES approach. The pilots took place across a range of locations in urban and rural contexts. The aim of the Round 1 and 2 pilots was to provide lessons and momentum to take other PES projects forward to implementation stage.

In May 2013, Defra published an Action Plan: Development the potential for Payments for Ecosystem Services to draw together a high level review of the potential for incorporating PES into broad areas including water quality, flood risk management, linking agri-environment and PES, forestry, peatland and place-based partnerships. A particular emphasis was placed on ways of leveraging in new sources of funding.

The Action Plan highlighted that PES is an evolving area with further investment and engagement still required to fully realise its potential, providing a strong case for on-going support for PES pilots to help build capacity and spread good practice and other lessons learnt. This gave rise in 2014 to the Round 3 PES pilots with an emphasis on taking PES initiatives forward from research towards an implementation stage. This report describes one of the Round 3 pilot projects, the Holnicote PES Pilot.

The Holnicote PES Pilot has a strong focus on flood risk management, having evolved in parallel with one of the Defra funding Multi-Objective Flood Management Demonstration Projects (referred to in this report as the 'Flood Project') established in 2009. A series of ecosystem studies, with part funding from the National Trust, were completed alongside the Flood Project in 2011-2012, culminating in the development of proposals for the pilot in winter 2013 in response to the need to secure continued funding for the Flood Project.

The Defra funded Pilot has provided a spring board to develop the earlier ecosystem services work into the investigation and development of potential market. The National Trust will continue to develop a PES approach after the Round 3 funding comes to an end. This is part of the legacy of the project and this report captures the process and ideas to take forward, as well as reporting on progress to date.

1.2 Development of an Ecosystem Approach at Holnicote

An ecosystem services approach has been central to the evolution of the Flood Project. An initial ecosystem services assessment was produced as a thesis by Christopher Taylor as part of his MSc at Cranfield University (Taylor 2010). In this document the evaluation of potential environmental benefits (services) associated with land management change was based on an idealised array of land management change within the two Holnicote catchments. These proposals recommended landscape-scale changes that the Project consultancy team believed to be of an appropriate nature and scale to affect positive benefits to flood risk within the two catchments.

As the Project progressed it became apparent that for a variety of economic, social and environmental reasons many of the proposed land management changes could not be delivered either within the timeframe of the project or because of conflicting land use/land management aspirations and services currently held within the catchments. As deliverable land management changes evolved within the Project a second round of ecosystem services assessments was undertaken by the consultancy team in 2011 (PAA 2011).

This second ecosystem assessment attempted to make the best use of the data available to address the relative value of ecosystem goods and services resulting from the now altered range of proposed landscape-scale habitat modifications. It was recognised that these changes, although aimed at flood risk alleviation for those local to the Holnicote Estate, would engender a range of associated benefits including enhanced biodiversity, aesthetic improvements, and timber production. Following on from this second, habitat based ecosystem services assessment, a workshop was convened with the Ecosystems Knowledge Network and Valuing Nature Network in 2012 to form the basis of future ecosystems work for the Project (PAA 2012).

The next round of ecosystem services work for the Project was to focus on developing a further round of land management change proposals for both catchments on the Holnicote Estate which would take account of the current prospects and deliverability of change by the National Trust. These proposals would act as the future scenario against which services and benefits may be evaluated and a new evaluation would be made focussing on social and cultural services.

During 2013 there was, however, a growing interest in the concept of Payments for Ecosystem Services (PES) being driven by a series of Defra funded pilot projects. These pilots demonstrated a range of novel approaches to securing funding from beneficiaries of ecosystem services which delivered tangible outcomes for the environment.

The PES concept chimed with the aspirations of the Flood Project to secure continued funding for a suite of land management measures which would allow for:

- the Project to become self-financing;
- environmental and other benefits such as positive engagement with local and national stakeholders accrued through the Flood Project to be optimised and extended to deliver additional wider and multiple benefits;
- potential for additional land management changes to be implemented over a wider geographic scale within the project area; and
- the continued generation of long-term monitoring datasets to provide the evidence base for the demonstration of multiple benefits derived from catchment scale land management change.

In early 2014 the Project team successfully secured Defra funding to develop the PES concept at Holnicote as described above.

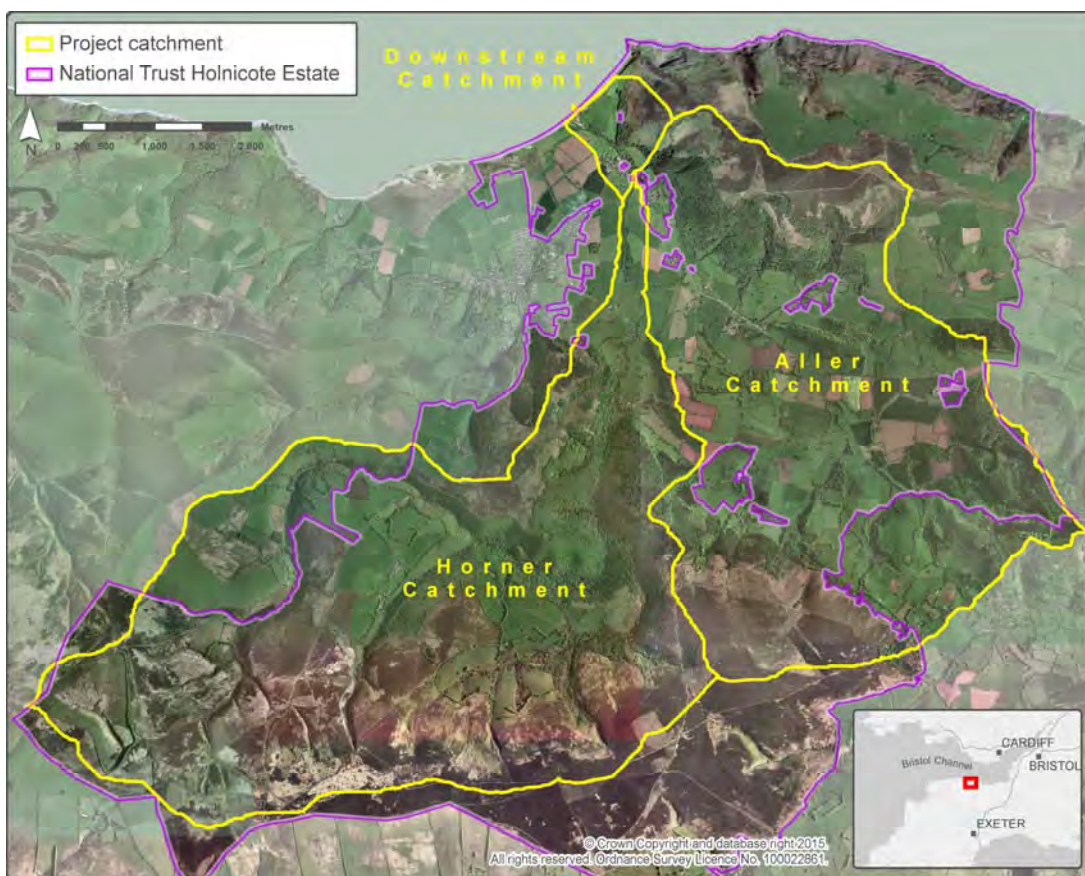
1.3 Links With the Holnicote Multi-Objective Flood Demonstration Project

The Holnicote PES Pilot has run in parallel with the later stages of the Flood Project with each Project capitalising on the knowledge and opportunities arising from the other. Whilst this report is a stand-alone

output from the Round 3 PES Pilot initiative, it also forms a part of the Database which has been collated for the Flood Project.

The area covered by the pilot is the same geographic area of the Flood Project located in West Somerset (see Figure 1) and comprising two river catchments, the Horner covering about 22km² and the Aller catchment covering about 18km².

Figure 1: Location of Holnicote Estate



1.4 Objectives of Holnicote PES Pilot

The Holnicote PES Pilot was conceived as a means of leveraging funding from a range of potential sources, using flood risk management as a focal point but drawing on the wide range of other ecosystem services provided by the National Trust Holnicote Estate including biodiversity, cultural, landscape, recreation, water quality, and health and wellbeing.

Any funds secured would be used to optimise the achievements of the Flood Project, to extend the scope and geographic scale for natural flood management interventions and allow for continued monitoring to provide a robust evidence base on the effectiveness of the Flood Project.



The Defra PES Pilot requirements were incorporated into the pilot such that the project would deliver both the National Trust objectives of continued funding for the Flood Project, but also meet Defra funding requirements. The specific objectives of the pilot were:

- to design a robust and realistic PES scheme which is strongly supported by relevant stakeholders;
- to identify the most promising markets which are likely to generate sufficient funding to allow for continuation of the Flood Project whilst delivering additional multiple benefits;
- to fully engage with sellers, buyers and wider project partners;
- to gain a detailed understanding of the mechanisms, barriers and constraints to delivery of a 'real' market(s), and solutions to overcome these; and
- to have a robust baseline and clear monitoring and evaluation strategy in place and to share the results of the project with others, build capacity and capture lessons learnt which can be applied to other PES projects.

In addition to these objectives, an underpinning theme of the pilot was to consider the transferability of the approaches and tools used and the scaling up of the benefits of a PES approach to other National Trust properties and/or catchments with similar issues across the UK.

During the course of the pilot, it became clear these objectives needed to be revised to take account of barriers and constraints to delivery of a real market at the present time and an additional objective was added which was to build a legacy for the National Trust and others.

2. METHODS

2.1 Identifying a Market for Ecosystem Services

The approach to the development of the Holnicote PES Pilot was shaped by the 2013 Defra *Best Practice Guidance for PES* and informed by previous ecosystem assessment work carried out by Penny Anderson Associates (PAA 2011; PAA 2012) which provided an initial assessment of the range of ecosystem services provided by the Holnicote Estate. The scheme evolution was also strongly influenced by the experiences and lessons arising from the Round 1 and 2 PES pilots (Defra 2014). The key tasks undertaken to identify a saleable ecosystem service were:

- Review of previous Ecosystem Services studies at Holnicote;
- Opportunities Assessment; and
- Consideration of three key questions forming the basis of any scheme, namely:
 - (i) are there specific land management actions that have the potential to secure an increase in supply of the service?
 - (ii) is there a clear demand for the service and is its provision financially valuable to one or more buyers?
 - (iii) is it clear whose actions have the capacity to increase supply of the service in question?

2.2 Identifying Potential Buyers and Sellers and other Actors

The project team convened a meeting to explore the range of potential PES stakeholders, identifying named individuals to target and establishing the appropriate mechanisms for engagement. A Communication Plan was developed to shape and refine the process of stakeholder engagement and as a living document to record and track progress.

2.3 Assessing the Prospects for Trade

The primary method of assessing prospects for development of a real market was stakeholder engagement. This aimed to build upon existing, long-established contacts and networks between the National Trust and other individuals and organisations and use these established points of contact to build trust and extend the stakeholder network.

A range of tools for stakeholder engagement were used including:

- 'ice-breaker' emails and letters;
- in-depth telephone and email consultation;
- face-to-face meetings; and
- site visits.

Opportunities were taken to use existing programmed meetings for example with the Local Nature Partnership, Somerset Water Management Partnership and Parish Council to introduce the PES concept, to start to engage support and interest and to lever access to potential funding sources.

The following points, adapted from the 2013 Defra *PES Best Practice Guidance*, and tailored to each individual/organisation, were incorporated into consultation material, e.g. letters, emails and woven into telephone discussions in order to provide a focus for discussion:

- what (if anything) you perceive as the benefits of ecosystem services for you/your business;
- how much, if anything, you might be willing to pay for ecosystem services;
- what you would expect in return for such payment;
- how much certainty you would expect in relation to delivery of ecosystem services;
- over what timescales you would expect the benefits to be delivered;
- for how long you might be willing to commit funding;
- how might such a payment work in practice;
- are there other ecosystem services that would benefit you/your business, such as biodiversity or sustainable tourism?

Working in partnership with the Allerford and Bossington Community Flood Group, consideration was given to the development of a structured questionnaire approach to gauge interest and support from local residents who directly benefit from the Flood Project. This idea was not subsequently progressed due to initial feedback from consultation with the local business community.

2.4 Opportunities for Development of PES

After a preliminary round of stakeholder engagement a synthesis of the opportunities and constraints associated with the development of real markets was carried out. Whilst the intention for the Holnicote PES Pilot was to focus on flood risk ecosystem services, it became apparent that, for reasons explored later in this report, there was not a potential for development of a real market for flood risk at the current time. The objective of the Pilot therefore shifted to consider legacy for the National Trust through a series of discussions with National Trust staff at local and national level and the consideration of PES opportunities associated with other ecosystem services that are provided as indirect consequences of the Flood Project, namely:

- soil management;
- carbon sequestration;
- biodiversity; and
- water quality.

The consideration of other potential markets comprised a literature review of other relevant PES initiatives, quantification of ecosystem services and the development of headline messages which could be used for future stakeholder engagement.

2.5 Resolving Technical Issues

In order for Defra and the National Trust to be able to utilise the evidence arising from the Holnicote PES Pilot, the final stage of the project focussed on resolving technical issues around:

- funding and modes of payment;
- identifying the right interventions i.e. changes in land management to increase delivery of ecosystem services ;
- scale and transferability;
- monitoring the delivery of interventions; and
- building trust.

This was achieved through consultation with the National Trust locally and nationally to explore current and potential funding mechanisms and integration of the PES concept within wider initiatives, in particular the National Trusts Land Choices programme and the National Trust and Environment Agency partnership Catchments in Trust programme.

3. IDENTIFYING A SALEABLE ECOSYSTEM SERVICE

3.1 Review of Previous Ecosystem Services Work

An ecosystem services approach has been central to the Flood Project from the outset and the PES pilot sought to capitalise on a suite of earlier ecosystem services studies (Taylor 2010; PAA 2011; PAA 2012).

An initial ecosystem services assessment was produced as a thesis by Christopher Taylor as part of his MSc at Cranfield University (Taylor 2010). This documented the evaluation of potential environmental benefits (services) associated with land management change was based on an idealised array of land management change within the two Holnicote catchments. These proposals recommended landscape-scale changes that the Project consultancy team believed to be of an appropriate nature and scale to affect positive benefits to flood risk within the two catchments.

In 2011 PAA completed a habitat based ecosystem assessment to provide an evaluation of the range of ecosystem goods and services provided by existing ecosystems across the Holnicote Estate, and those anticipated following the range of expected habitat modifications scheduled as part of the Flood Project. The evaluation was of relative change, rather than a proportion of capital expenditure in the project which was estimated at £7M for full implementation of all proposed interventions. The key findings of the assessment were that the greatest likely return on any investment, based on the greatest change in relative value, could be achieved for purification and erosion based services, that is clean air, clean water and erosion regulation. This would be realised through broadleaved woodland planting and storm management. Conversely, lower returns would be likely to result from stream buffers and field soil crop management. It was thought that the results of the study could be used to inform subsequent stakeholder engagement and prioritisation of interventions (PAA 2011).

Following this initial ecosystem assessment work a stakeholder workshop was convened (PAA 2012) to address three key questions:

- how did the cultural/economic and environmental landscape evolve to its current state and character;
- how do we define and evaluate the current services provided by this landscape; and
- what scenarios of future multi-objective land management change should be adopted for the Holnicote Project.

The key conclusions of the workshop were:

- the scale of change needed to be significant in order to deliver and register changes associated with flood risk and that there are other ecosystem services that may be enhanced or created within the Flood Project that are, in themselves, of a smaller scale;
- that a long timeframe was needed to be able to characterise the catchment hydrology and that funding for longer term monitoring was required to ensure that meaningful conclusions may be derived;

- there was a critical need to address opportunities for funding the ongoing implementation of land use change; and
- that it would be important to identify and characterise cultural and social ecosystem services.

These earlier studies provided the context within which with the Holnicote PES Pilot was subsequently developed.

3.2 Opportunities Assessment

The first stage in identifying opportunities for novel sources of income that might be delivered through a PES scheme was to systematically explore and document the full range of ecosystem services at the Holnicote Estate. The objective of this process was to identify those ecosystem services with the greatest potential for evolution into real markets (see Appendix 1).

At this stage, the identification of potential sources of income was not confined to the development of a market for flood risk, but explored all possible opportunities for income generation associated with provisioning, regulating, cultural and supporting services.

Key information for each ecosystem service was summarised and captured in a series of worksheets to provide a record for future reference. For each service the following data was recorded:

- what ecosystem service does (or could) the Estate provide;
- who are the potential suppliers;
- who are the potential beneficiaries;
- who are the other key players; and
- what baseline data is required and what do we already have, or need.

3.3 Identifying Saleable Ecosystem Services

The opportunities assessment work highlighted a number of key ecosystem services for which specific land management actions have the potential to secure an increase in supply of the service, for which there is a clear demand and which the National Trust could, either itself or via its tenants, increase the supply of the service in question, namely:

- the Estate produces a range of high quality food products including venison and rare breeds of cattle and sheep. Livestock productivity could potentially be improved through appropriate land interventions;
- the Flood Project itself provides improved flood protection for residents of villages and local businesses downstream. Land interventions have already provided tangible reductions in peak flood flow and it is anticipated that further interventions would result in further measurable reductions in peak flow;
- there are significant soil erosion issues in certain parts of the Estate, particularly on areas of the steeply sloping ground. Land interventions could improve soil management and reduce surface

water run-off protecting water quality, agricultural productivity and the condition of tracks and highways which act as conduit for transport and deposit of eroded soil;

- there are an estimated 1.2M visits to Holnicote per annum. Land interventions could safeguard local tourism and protect health and wellbeing through improved flood protection and enhance the visitor experience by providing an educational resource;
- the Estate already has a rich biodiversity resource and the Flood Project has increased the extent of wet woodland and wet grassland and associated species and has enhanced the quality of wet heath. Appropriate land interventions have potential to increase the range, extent and quality of habitats including broadleaved woodland, wet woodland, wet meadow, semi-natural grasslands, upland heath and blanket bog as well as associated species, particularly wetland birds and riverine invertebrates and wetland plants;
- the Estate supports approximately 2500ha of upland moorland and lowland heath (including 98ha of blanket and upland valley bog), 850ha of woodland (including c. 500ha broadleaved and wet woodland) and 1650ha of farmland which is predominantly semi-improved grassland which have the capacity to storage or sequester carbon. Appropriate land interventions have the potential to increase this significantly.

Conversely, the systematic consideration of ecosystem services also identified those services which were considered unlikely to generate any financial income on the basis that they were unlikely to be influenced by land management interventions, there was no clear demand for the service or it was not clear whose actions had the capacity to increase supply of the service in question.

Full details of the opportunities assessment work are presented in Appendix 1.

The conclusion of this stage of the pilot was that there were six key, inter-related ecosystem services for which enhanced service delivery could be secured by the land management interventions proposed as part of the Flood Project. These were:

- provision of high quality food, including rare breeds
- flood regulation
- erosion regulation, including protection of water quality
- biodiversity
- carbon sequestration
- recreational value and health & wellbeing

Linking the benefits of these diverse services to the delivery of land management interventions through the Flood Project in a tangible way to potential buyers would prove to be a significant challenge for the pilot.

4. IDENTIFYING STAKEHOLDERS

4.1 Identifying Potential Buyers

A stakeholder analysis exercise was completed to identify individuals and organisations likely to benefit from the suite of inter-related ecosystem services that would form the basis of the PES pilot. The stakeholder analysis aimed to capitalise on existing contacts and networks developed by the National Trust Flood Project manager over a significant number of years. Additionally, it was considered that the existence of the Flood Project would be likely to act as a major catalyst for drawing in new potential buyers.

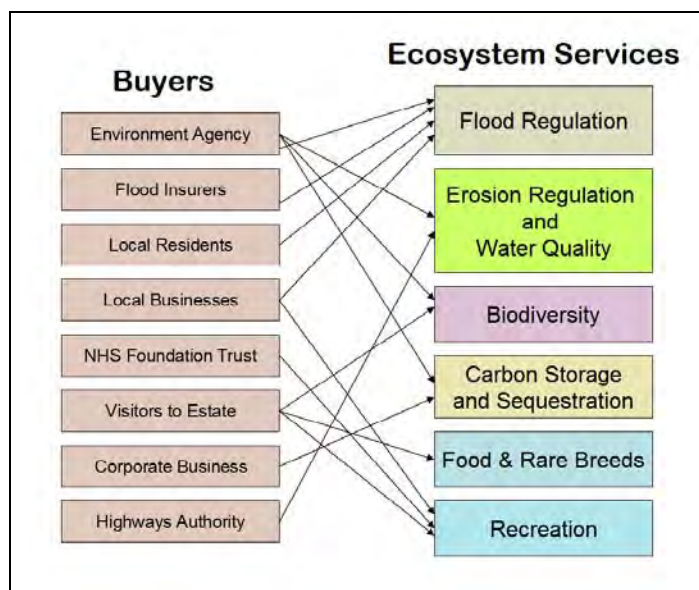
Buyers were defined as organisations or individuals who would benefit from the goods or services being sold and who might be willing to buy or invest financially in the Flood Project, or the inter-related ecosystem services which would be delivered as co-benefits of the Flood Project.

Where possible, named individuals within an organisation were identified along with contact details and other key information such as previous connections with the National Trust or other factors which might assist in securing interest in and support for a PES approach, e.g. organisations which had previously invested in the Flood Project.

Since one of the aims of the pilot was to identify novel markets, a suite of other potential buyers not currently connected with the Flood Project were also identified, such as large private business which might have an interest in investment from a Corporate Social Responsibility perspective.

Figure 2 illustrates the potential buyers and ecosystem services which it was assumed that they would benefit from. This assumption would be explored and tested by assessing the prospects for trade.

Figure 2: Potential Buyers and Beneficial Ecosystem Services



4.2 Identifying Sellers

Sellers were defined as the landowner or person with the appropriate institutional and legal freedom to 'sell' the identified goods or services into the market place. The primary seller of ecosystem services at the Holnicote Estate is the National Trust through management of the parts of the Estate which are currently 'in-hand' or by working in partnership with its agricultural tenants across the twelve tenanted farms on the Estate.

4.3 Identifying Other Stakeholders

A number of individuals and organisations who were considered likely to be supportive, willing and able to make and nurture connections between the National Trust and potential buyers and to share their local knowledge were identified as project intermediaries and knowledge providers. These comprised:

- Selworthy and Minehead Without Parish Council;
- the local Community Flood Group;
- the Local Nature Partnership;
- the Local Enterprise Partnership;
- Environment Agency;
- Wessex Water;
- Natural England;
- Exmoor National Park Authority;
- West Somerset Flood Group;
- Wessex Regional Flood and Coastal Committee;
- Somerset Water Management Partnership;
- Somerset County Council.

With this long list of potential buyers, intermediaries and knowledge providers in place the Holnicote PES Pilot sought to engage with the key players to gauge levels of interest in, and support for, local markets for ecosystem services. The next section presents the results of this initial engagement process which helped to shape the later stages of the pilot.

5. ASSESSING THE PROSPECTS FOR TRADE

5.1 Development of a PES Approach

The 2013 Defra *PES Best Practice Guide* identifies that there are a wide range of situations that might provide the impetus for trading to take place and a PES scheme to emerge. In the case of the Holnicote PES Pilot, the Flood Project provided just such an impetus by creating a focus for the National Trust increase the supply of a range of ecosystem services.

The emergence of PES thinking centred around the land management interventions already identified by the Flood Project. These land management interventions are presented in detail in the 2015 Defra Multi-Objective Flood Management Demonstration Project Final Report (PAA, JBA and National Trust 2015).

The Flood Project team met in June 2014 to develop a long term strategy for extending the scope and geographical scale of natural flood management measures at Holnicote on the assumption that additional funding streams to allow for the continuation of the project, including from a possible emerging PES scheme, would become available.

Alongside the benefits of work already implemented by the Flood Project, i.e. blocking of drainage features and pathways in the upper Horner catchment, creation of wet woodland, wet grassland and flood bunds in the lower Aller catchment and retention and creation of large woody debris dams in the Horner and Aller rivers, a package of additional measures was identified which, subject to further refinement in light of on-going monitoring and modelling work, would form the basis of the ecosystem service to be marketed to potential buyers. This would include:

- extending the drainage management measures in the upper part of the Horner catchment;
- changes in management of in-bye grasslands in the upper Horner catchment using the Pont Bren project^{1,2} as a template;
- engagement with changes to agricultural practices focused on soil and water conservation in the Aller catchment;
- extending woodland cover in the upper Horner catchment;
- larger scale *Molinia* (purple moor-grass) reversion in catchment headwater areas;
- additional floodplain management in the Aller catchment, i.e. an extension to the existing floodplain meadows (temporary flood storage areas); and
- addressing storm run-off associated with the road network.

Modelling work completed to date had identified that the existing land management interventions on the Aller could potentially reduce the flood peak by up to 25%, depending on the magnitude of the event

¹ Keenleyside C. (undated). *Pontbren Project: A farmer-led approach to sustainable land management in the uplands. The Woodland Trust*

² Wheeler et al. 2008. *Impacts of Upland Land Management on Flood Risk: Multi-Scale Modelling Methodology and Results from the Pontbren Experiment. FRMRC.*

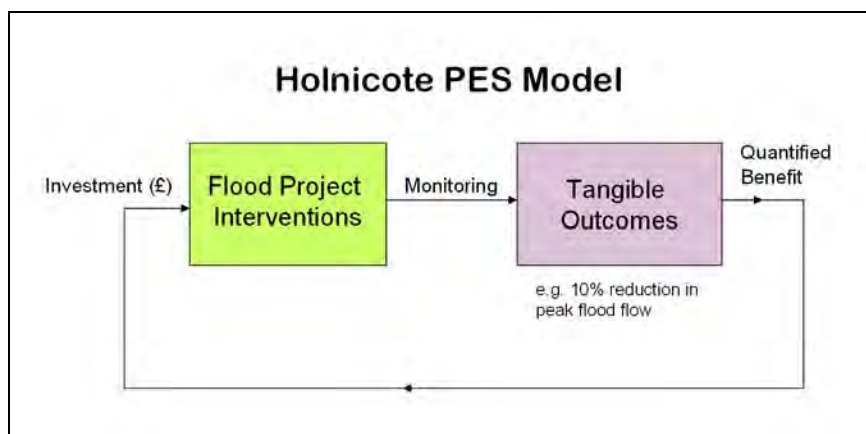
(PAA 2015). It was anticipated that further interventions would be capable of securing even greater reductions in peak flow, and the outcome of interventions would continue to be monitored to provide evidence for changes in the flood hydrograph.

Since it was possible to demonstrate tangible results in relation to flood risk, the emerging PES approach aimed to seek markets for the sale of the ecosystem services on a 'results' basis, i.e. buyers would be asked to invest in the project on the basis of the demonstrated reduction in peak flood flow.

This approach was strongly underpinned by initial feedback from stakeholder engagement which highlighted the importance of having tangible, meaningful results that could be readily interpreted and understood by the layman. For example, a common theme amongst potential buyers was the need to understand what a '10% reduction in flood flow' equated to in respect of properties flooding, or not (in relation to the magnitude of the severe Christmas Eve 2013 flood event). Being able to demonstrate clear, tangible outcomes was considered to be fundamental to securing investment by buyers.

Figure 3 illustrates the emerging PES model which shows how tangible, measurable results would be used to incentivise a potential buyer to invest in future Flood Project interventions.

Figure 3: Illustration of PES Model Based on Outcomes



5.2 Development of Key Messages / Ecosystem Services

5.2.1 Flood Regulation

The Flood Project was an important catalyst for engagement with stakeholders because the project is already well-known locally, and this facilitated dialogue around PES with the concept of PES and wider ecosystem services flowing naturally on from discussions about the Flood Project. Headline messages developed for the Flood Project as part of the Defra Multi-Objective Demonstration Project³ provided an important focus for discussion. The statements in Box 1 illustrates the type of headline statements used in stakeholder engagement in relation to flood regulation.

³ PAA, JBA and National Trust 2015 *From Source To Sea: Natural Flood Management The Holnicote Experience*. Final report to Defra.

Box 1. Headline Messages on Flood Regulation

- Land management interventions reduced the flood peak of a severe storm event in winter 2013 by 10% (anecdotally, this safeguarded properties in villages downstream that would otherwise have flooded);
- The insurance value of the National Trust properties at risk of flooding was estimated at £30M (in 2009).
- Capital costs of constructing the flood bunds were £163K, a small cost compared to the insurance value of the properties at risk of flooding.

The severe storm event in winter 2013 referred to in Box 1 was caused by a 50mm rainfall event falling in the Aller catchment in just 24 hours, which had been immediately preceded by 5 days when another 50mm of rainfall had already fallen on the catchment rendering it completely saturated and therefore fully primed for rapid runoff and flood generation. As expected, this event led to the generation of significant amounts of surface runoff and both the Aller and the Horner flooded out of bank onto their floodplains. A section of the A39 and some minor roads across the catchments were also flooded, especially in the vicinity of Piles Mill where the reduced capacity of the culvert under the A39 (due to misalignment of the culvert and bridge) acted to constrict the flow, forcing water to spill out of the channel here and pool upstream of the culvert.

The insurance value of £30M quoted in Box 1 was derived from the published Environment Agency Flood Zone Maps that were available at the commencement of the Flood Project.

Whilst the evidence base for reduced flood risk was well developed, having the benefit of a number of years of comprehensive hydrological monitoring data, equivalent evidence for the benefits of land management interventions for other ecosystem services was less well developed at the beginning of the project. The pilot sought to fill this gap by developing headline messages for other benefits of the Flood Project, particularly carbon, biodiversity, soil management and water quality since these ecosystem services were considered to be the most market-ready. These headline messages draw upon published data, including that generated by the Flood Project.

5.2.2 Carbon Storage and Sequestration

Land management interventions associated with the Flood Project have the potential to substantially increase carbon storage in soils and vegetation and carbon sequestration from the atmosphere, in particular:

- blocking of drainage features in the upper catchment to increase wetting and reduce losses of carbon from 95ha of upland valley bog, mires and flushes⁴ in the upper Horner catchment;
- increased tree cover through new woodland planting;
- improved soil management practices in arable and grassland systems; and
- arable reversion.

A study by the Lake District National Park Authority and University of Cumbria has estimated carbon stored in soil and vegetation (tonnes of carbon/hectare) as illustrated in Table 1. This was used to calculate potential carbon storage associated with land management interventions proposed as part of the Flood Project (Table 2). Example headline messages developed from this data are shown in Box 2.

Table 1. Estimated Carbon Storage in Different Habitats⁵

Land Use	Carbon Storage (tonnes of carbon / ha)
Arable	44.0
Improved grassland	62.0
Neutral Grassland	63.4
Acid Grassland	83.3
Heathland	83.6
Woodland	123.3
Peat	261.0

Table 2. Summary of Potential Carbon Storage Associated with the Flood Project

Intervention	Area of land affected by intervention (ha)	Estimated Carbon Storage Potential (tonnes per ha)
Increased wetting of upland valley bog	95	25,578
New woodland planting	2.5	308.25
Arable reversion ⁶	24.5	475.3

The potential for carbon storage and sequestration associated with woodland creation and rewetting of peat are explored further in Section 6 which considers the potential for use of the Woodland Carbon Code and Peatland Carbon Code to generate at Holnicote.

⁴ 'True' blanket bog with peat depths greater than 0.5m is rare across the Holnicote Estate due to the relatively shallow peat layers.

⁵ Figures based on current best estimates in *Managing Land for Carbon - A Guide for Farmers Land Managers and Advisors*. Lake District National Park 2013

⁶ Figure is for the increase in carbon storage between arable and improved grassland

The cost of management interventions already completed to increase wetting of three targeted areas of the upper Horner catchment, including areas of upland valley bog habitats, is £70,000. This covered a total of 327ha, of which a small proportion is classified as upland valley bog. The primary purpose of this work was storm run-off impedance so data on areas of re-wetted peat were not specifically captured. It is therefore not possible to calculate a value for £/tonne of carbon stored.

On-going research to develop a Peatland Carbon Code will define metrics for carbon emissions for different categories of peat from pristine to actively eroding. In time, the Carbon Code metric could be used to estimate emission savings resulting from peat restoration, as well as carbon storage potential⁷.

There is currently no equivalent mechanism for capitalising on the carbon storage value of arable, grassland and heathland systems.

Box 2. Headline Messages on Carbon Storage & Sequestration

- Creation of 2.5 ha of new woodland for the Holnicote Flood Project has the potential to store 308 tonnes of carbon/ ha;
- Conversion of 24.5 ha of arable land to grassland for the Holnicote Flood Project has the potential to increase storage of carbon in the soil by 475 tonnes carbon/ ha.

5.2.3 Erosion Regulation and Water Quality

The catchment and soil characteristics at Holnicote Estate combine to produce soils which are, at certain locations, highly susceptible to erosion from surface water run-off or overland flow. The key factors influencing sensitivity to erosion are soil type, land cover, land management, slope, proximity to water courses and proximity to surface flow pathways. Currently 17% of the soils across the Estate are known to be in 'poor' condition, less than the national average of 25%⁸. The central part of the Aller catchment is a particularly erosion prone location due to a combination of arable land cover and steep slopes. The effect of soil erosion is loss of significant volumes of top soil which are washed onto highways and adjacent fields and into the Aller, impacting on water quality and releasing stored carbon. Current best estimates are that 61 tonnes of carbon per hectare are stored in the top 15cm of top soil.

A particular issue at Holnicote is the role of incised rural lanes as conduits for surface flow and soil washed from adjacent fields. A paper by Boardman *et al* (2013) recognises that these features can be an important element in the connectivity between hillslopes and valley bottoms. He cites Gruszowski *et al*. (2003) which showed that 30% of the sediment reaching a river was derived from, or transported via, roads. Runoff from fields reaches lanes via seepage, natural pipes and field drains and an important route is via field gates or openings. Boardman notes that in general, costs of clearance of mud from roads by local authorities in England are not recorded, though examples given in Evans (1996) include

⁷ Mark Reed, pers. comm.

⁸ Palmer, R.C., 2011. *Assessment of Soil Structure within the Holnicote Estate, Somerset during January 2011. National Trust.*

those from sunken lanes in Somerset at £53.7 km². It is reasonable to assume that costs associated with the clean up of Highways following a severe flood event could be significant.

A PhD thesis undertaken during the course of the Flood Project by Miriam Glendell, Exeter University, evaluated the effects of current and future land management changes in the intensively managed, agricultural Aller catchment (Glendell 2014a; Glendell 2014b). The research found that agricultural land use resulted in extensive alteration of soil physical and chemical properties, which is likely to have long-term implications for the restoration of ecosystem functioning and water quality management.

During an eight month period estimated suspended sediment (SS) yields from the agricultural catchment (26-116 t/km²) were higher than from the semi-natural catchment of the upper Horner catchment (22-58 t/km, km²). This corresponded with visual evidence of erosion episodes particularly in the Aller catchment.

From a PES perspective, these figures provide valuable evidence based on monitored data that change in land management which target conversion of arable land on steep slopes is likely to significantly reduce volumes of suspended sediment entering the Aller. However, whilst there are clear environmental benefits from improved soil management, currently, the PES pilot has been unable to identify an obvious financial beneficiary of reduced sediment inputs to the River Aller and it has provide difficult to engage with the local Highway Authority on the issue of drainage across the rural road network at Holnicote.

One key finding of the pilot is that in spite of these high levels of suspended sediment, water quality is not, in general, a significant driver for land management change at Holnicote because the Aller and Horner are already achieving good status under the Water Framework Directive and because there is currently no public water supply, with Nutscale Reservoir, Wessex Water's only asset on the Estate, out of action due to presence of geosmin⁹. It is therefore difficult to identify an obvious beneficiary of, or market for, clean water at Holnicote.

Box 3. Headline Messages on Soil Regulation

- **Research has demonstrated that estimated suspended sediment yields from intensively managed agricultural land can be twice as much as that from semi-natural habitats (Glendell 2014)**

5.2.4 Biodiversity

It is widely acknowledged that one of the key benefits of natural flood management is the potential to enhance wetland and riparian biodiversity, alongside other benefits of water quality and carbon sequestration (Frontier Economics 2013). Evidence presented by a study of Developing Place Based Approaches for PES for suggests that biodiversity, along with water quality, may provide the greatest revenue streams to landowners in place based schemes, with significant potential for revenue to be generated through voluntary payments (Quick *et al* 2013). Another study by Huberman (2008) suggests

⁹ Geosmin is an organic compound produced by bacteria with a distinctive earthy or muddy odour which is detectable at very low concentrations in drinking water, rendering it unsuitable for human consumption

that biodiversity is likely to be a key driver for PES in rural catchments where the biodiversity values of rural landscapes can be enjoyed by urban consumers.

The Holnicote Estate already supports a range of important habitats and species, primarily those associated with heathland, blanket bog and ancient woodland in the upper Horner catchment. The low reaches of the Horner and habitats in the Aller catchment are, by contrast, relatively depauperate or species-poor in biodiversity terms comprising more intensively managed agricultural landscapes with limited riparian and floodplain habitat interest. The Flood Project has the potential to extend and enhance a range of wetland and riparian habitats, and increase habitat availability and connectivity for species associated with diverse riparian corridors, particularly wetland bird species, wetland plants and aquatic invertebrates which utilise habitats such as floodplain grassland, coarse woody debris and riparian woodland.

Positive consequences for biodiversity associated with the Flood Project are:

- likely increase in diversity of aquatic invertebrates associated with retention and creation of in-stream coarse woody debris¹⁰; and
- enhanced diversity of wetland bird species associated with flood plain meadow and scrape creation, and;
- increased wetland plant diversity associated with more frequently flooded meadows.

The most recent surveys of the distribution of coarse woody debris in Horner Wood has demonstrated an striking increase in the number of active coarse woody debris dams which have the result of impounding water from 17 in 2010, to 81 in 2014 as a result of non-intervention management driven by the Flood Project (PAA 2015a).

There is currently relatively limited empirical data on the increase in wetland bird and plant species, but anecdotally the Flood Project is thought to have improved the population of dipper *Cinclus cinclus* in Horner Wood and increased the diversity of wetland plant species in the Aller flood plain.

It is likely that increased invertebrate populations in and around rivers, river corridors and over wet grassland and woodland will be providing increased or enhanced foraging areas for bat species, particularly Daubentons bat *Myotis daubentonii* which favours wetland habitats.

Vegetation changes in the flood plain meadows are likely to be subtle, rather than drastic (PAA 2015b). Soil sampling has shown that levels of phosphate (P) are low suggesting that with appropriate management, the vegetation composition may show and increase in plant species associated with wetter ground conditions such as meadow foxtail *Alopecurus pratensis* and tufted hair grass *Deschampsia cespitosa*.

The potential biodiversity benefits of drainage blocking of wet heath and blanket and upland valley bogs in the upper Horner catchment have not yet been fully quantified.

¹⁰ Current monitoring data shows no significant change but this likely due to short period of time over which monitoring has been undertaken to date (PAA 2015c)

Box 4. Headline Messages on Biodiversity

- The creation of flood bunds to reduce flood risk has resulted in creation of 11 ha of floodplain meadows, ponds and scrapes;
- The number of 'active' coarse woody debris dams in Horner wood has increased four-fold;
- Around 327 ha of blanket bog, upland valley bog and upland heath habitats have benefitted from drainage blocking in the upper Horner catchment;
- The Flood Project is likely to benefit wetland plants, birds and freshwater invertebrate habitats.

5.3 Testing Ideas in the Market Place

The concept of PES and its potential to generate income for continuation of the Flood Project and other associated benefits was tested with a number of potential buyers. The objective of testing the market was initially to break the ice with potential buyers and explore the concept of PES and, once it was established that there was some interest in the idea, to consider the merits of a business case. The thinking around PES was discussed with the following organisations and groups of people or, in the case of local residents, with the Community Flood Group:

- Environment Agency
- Flood Insurers
- Local Residents (via Community Flood Group)
- Local Businesses
- Corporate Businesses

It has not yet been possible to test the PES concept with all of the identified potential buyers. It is the intention of the National Trust to continue to explore the potential for markets focussed on health and wellbeing and erosion regulation with the NHS Foundation Trust and local Highway Authority, respectively, beyond the end of the pilot project from March 2015.

A potentially significant potential buyer is the large number of visitors to the Estate. However, the pilot has been unable to find an effective means of engaging directly with this group due to a lack of obvious focus points for visitor interaction e.g. a lack of visitor centre facilities. The National Trust is now investigating the development of such a facility which would, amongst other objectives, provide a mechanism for the development of a potential Visitor Giving PES.

5.4 Initial Feedback from Potential Buyers

5.4.1 Environment Agency

The Environment Agency has been a strong supporter of the Flood Project since its inception providing partnership funding for the creation of flood bunds and associated wet woodland and floodplain meadow. The key drivers for the Environment Agency to invest in the Flood Project have been its value as a demonstration of the effectiveness of natural flood management processes, gains in biodiversity and potential for the project to address soil management issues and associated water quality. The local Environment Agency representative has highlighted that the ability to demonstrate biodiversity gain is a critical factor in securing future funding from the Environment Agency.

There has also been considerable interest in the project from the Environment Agency Catchment Sensitive Farming team from the Somerset Levels following severe flooding of the Levels in winter 2013/14. The focus of interest has been on the potential to transfer land management interventions designed to reduce soil erosion and reduced flood risk to the upper catchments of the Parrett and Tone which drain into the Somerset Levels.

The Flood Project is frequently used by the Environment Agency at a national level as an example of best practice in integrated land management to provide multiple, with one of the most important aspects of the project being the availability of monitored, rather than modelled, data that provides evidence for a reduction in flood risk.

In spite of the value of the Flood Project as a demonstration site, there are no obvious mechanisms for trade in ecosystem services between the National Trust and the Environment Agency at the present time. Any future financial investment by the Environment Agency is likely to continue to be via grants or other one-off contributions for specific management interventions.

It was thought that the Wessex Regional Flood and Coastal Committee, one of whose roles is to encourage efficient, targeted and risk-based investment in flood and coastal erosion risk management that represents value for money and benefits local communities, would be interested in the multiple benefits arising from the Flood Project and be able to facilitate future investment in specific measures such as creation of additional flood bunds. The Flood and Coastal Committee raises revenue for flood defences through levies from local flood authorities to supplement national Flood Defence Grant-in-Aid funding. This is not a PES mechanism since the funding is not voluntary or additional, but could be an important component of future funding for the Flood Project.

The Flood Project has also been instrumental in forging a partnership between the National Trust and Environment Agency at a national level to form the Catchments in Trust programme which represents a significant investment by both organisations in the transfer of evidence from Holnicote to ten other catchments where the National Trust is a major landowner. An ecosystem services approach lies at the heart of Catchments in Trust and the lessons learnt from the Holnicote PES Pilot will be transferred as part of this.

5.4.2 Flood Insurers

The Holnicote PES pilot provided an opportunity to establish a dialogue with the flood insurance industry to investigate willingness to, and mechanisms for, interface with a PES approach.

British Wildlife January 2014 reported a recent quote from the Guardian newspaper that one insurance company had calculated that it would be cheaper to buy and reforest Pumlumon the upland on which

both the Severn and the Wye rise, than to "keep paying out for carpets in Tewkesbury". On further investigation it was not possible to obtain details of the particular insurance company quoted. However, the concept of the flood insurance industry investing in reduced flood risk has long been of interest to practitioners in natural flood management (Worrall, *pers. comm*).

Two contacts within the flood insurance industry were approached, one in partnership with the Sheffield based *River Stewardship Company* which was established to develop an enterprise approach for improved waterway management and had existing contacts in the industry, and the other approach directly by the Holnicote pilot team.

A consultation document 'Securing the future availability and affordability of home insurance in areas of flood risk'¹¹ was published by Government in June 2013 outlining new approaches to flood insurance, including Flood Re and the Flood Insurance Obligation. The Flood Re approach will set an 'effective limit' on the amount that high-risk households would have to pay for the flood component of their home insurance based on property Council Tax band, with the level of excess in the event of a flood claim also controlled. It has been designed to provide cover for the properties at high risk of flooding that would find it difficult to find and secure insurance in an open market situation. Flood Re is scheduled to commence in summer 2015. It was suggested by the insurers consulted that the Government backed Flood Re initiative appeared to provide a vehicle through which the flood insurance industry could, in theory, invest in reducing flood risk, though it was thought that the current remit of Flood Re did not extend to investment in actual flood prevention schemes. This is echoed by a study which examined some of the challenges associated with implementing Flood Re in which it was clear that Flood Re relied upon continued commitment by Government to invest in flood prevention (Surminski and Eldridge 2014).

A number of significant issues which were likely to constrain the potential for Flood Re to invest in flood reduction schemes were identified in informal discussion with the insurers as follows:

- the idea of flood defences providing multiple benefits is interesting but there would have to be a strong business case and clear benefit for those providing funding;
- a precise mechanism for securing the flow of funding through Flood Re would need to be resolved;
- it was difficult to see a benefit for individual insurers with Flood Re pooling risks away from individual companies;
- the insurance industry would not necessarily be interested in the means of providing flood protection but it would need certainty of outcome;
- Flood Re is still taking shape and its role and remit are yet to be finalised;
- there are several players involved at a national level and it would be difficult to develop solutions locally;
- sustainability and flood resilience are key issues which need to be considered in the context of Flood Re;

¹¹ <https://consult.defra.gov.uk/flooding/floodinsurance>

- there may be some merit to investment where a discrete block of properties is protected by a specific scheme and all properties would be covered under Flood Re;
- for reasons of commercial confidentiality and anti-competition rules it would be difficult to explore opportunities with individual flood insurance companies.

The assistance of the *River Stewardship Company* in developing these initial links is gratefully acknowledged.

The conclusion from initial discussions with the flood insurance industry was that there appeared to be potential for the concept of investment by the industry in measures to reduce flood risk through investment in schemes on the ground, but that the most appropriate avenue for further discussion to take place would be at a national level between Government, the Association of British Insurers (ABI) and Flood Re. It was considered that Defra might have a role in facilitating or inputting to such discussions.

5.4.3 Local Residents

Some interesting observations in relation to the density and distribution of residential properties at risk of flooding in rural West Somerset were made in a report produced by the West Somerset Flood Group (2014). An extract is presented here to demonstrate some of the particular issues faced by these communities:

'This density and distribution pattern is associated with local factors that any approach to flood action needs to bear in mind

- *harder for Somerset County Council or Environment Agency to justify expensive flood schemes for such a low-density population*
- *properties often flood in very small groups*
- *significant impact on individual communities of just a small number of properties flooded*
- *roads important for travel to work, school and commercial centres*
- *roads carry high proportion of tourists*
- *civil contingencies planning has to take account of tourist population*
- *higher elderly population increases vulnerability*
- *response times for Fire and Rescue (and other services) are longer than in towns and cities*
- *potential for greater isolation*
- *potential for greater self-sufficiency*
- *small interventions can produce results with real benefits to groups of properties'.*

All the properties at risk of flooding across the Holnicote Estate have benefited from an increased level of flood attenuation as a direct result of the Flood Project.

Engagement with local residents was carried out indirectly through the Community Flood Group. This group has been actively involved with the PLP scheme and provides Flood Wardens to assist in early warning around flood events, as well as providing advice on flood resilience and preparation for flooding. It was considered likely that the Community Flood Group would provide a fair reflection of local opinions on flooding.

A number of options for engaging directly with local residents were considered including a leaflet drop, evening meeting and structured questionnaire approach. In view of initial feedback from local businesses (see below) it was concluded that the responses from local residents would be unlikely to be significantly different and so it was decided not to pursue the direct approach.

The key points of feedback arising from discussion with the Community Flood Group were as follows:

- the pool of potential buyers would be small as there are less than 100 properties at risk;
- the demographics of Allerford and Bossington are that many residents are elderly with limited ability to pay;
- the National Trust insures the properties which it owns against flooding, thereby reducing the incentive for residents to invest in flood prevention because they do not have to pay for their own flood insurance (this is different to private individual householders who need to secure building insurance in a free market economy) ;
- the Environment Agency and National Trust have paid for property level protection (PLP) in the form of flood boards, non-return valves on sewers, airbrick covers and electric pumps. The existence of the PLP and the Flood Project are perceived to have removed the risk of flooding and therefore removed the incentive for residents to invest in further land management interventions.

The latter comment suggested that management of expectations around flood risk needed to be clearly communicated to the local community since the Flood Project was not intended to completely remove the existing flood risk, nor could extreme flood events be eliminated.

In conclusion, there was no current potential for trade between the National Trust and the residents that benefit from reduced flood risk. The potential for transferability of the concept of trade between the National Trust and residents benefitting from reduced flood risk is explored further in Section 6.

5.4.4 Local Businesses

There are four businesses which operate on the Holnicote Estate. These are all are National Trust tenants and their businesses rely heavily on tourism for their income. Discussions with local businesses therefore touched on the potential for ecosystem services to minimise disruption to their businesses caused by flooding. The businesses were very willing to engage with the concept of PES and provided useful feedback as follows:

- there was a desire to better understand what a 10% reduction in peak flood flow meant in terms of the height of flood water (in relation to the severe Christmas Eve 2013 flood event), and whether or not this made the difference between their business flooding or not.
- there was general support for the concept of land management to reduce flood risk though it was not necessarily clear whether or not the measures completed to date had definitely benefitted the business or not;

- one business reported that the media coverage of flooding in Somerset in winter 2013/14 had a negative effect on their trade which relied on tourism and numbers of visitors coming to the area;
- there is only a limited history of flooding at two of the businesses involved, though it was felt that the recent installation of flood protection boards served as a useful reminder of flood risk;
- one respondent commented that 'it needed a flooding disaster' to occur to motivate action;
- the businesses were well prepared for flooding with, e.g. essential equipment and livestock positioned above flood level;
- as tenants of National Trust properties which are insured by the Trust against flooding and, it was cited that this further reducing worries about flooding;
- one business was willing to assist in any community based initiative to raise funding, though this is likely to take a long time and raise only small amounts of funding. They were unable to offer funding themselves but happy to provide 'in-kind' assistance, e.g. free labour for small capital items in return for positive publicity for their business;
- there was a strong sense of community working to address local environmental problems as they arise;
- the current high biodiversity value and (generally) good water quality in the Horner catchment in particular reduced the incentive for businesses to invest in multiple benefits;
- overall, there was a strong sense that funding of flood risk management should fall to Defra, the Environment Agency and the National Trust;
- it was considered that the National Trust, as a landlord, should have responsibility for investing in the continued long term maintenance of all its properties across the Estate.

In conclusion, whilst there appeared to be strong local business support for measures to reduce flood risk and a desire to acknowledge and respond to environmental issues, there was a clear message that any future investment in flood reduction measures should be the responsibility of Government and/or the businesses landlord to whom it pays rent. There appeared to be no opportunity for trade between local businesses and the National Trust in relation to either reduced flood risk or recreation and tourism.

5.4.5 Visitors

At the outset of the pilot a major potential source of PES funding was identified in the form of the large number of visitors which are drawn to the iconic Holnicote landscape each year. The most recent data for visitor numbers estimates 1.2M visits per annum¹². This equates to an average of approximately 3.28K visits per day. Whilst it is not possible to extrapolate the number of visitors from this figure, many of whom are presumably local people making regular visits, it is reasonable to assume that it equates to a large number of people overall and that this is a potentially large, untapped source of funding through some form of Visitor Giving.

¹² Source: Visitor survey undertaken by Bournemouth University circa 2003; results of vehicle counters placed in three locations at Holnicote in 2007



The concept of Visitor Giving is now well established and there are many schemes already in operation across the UK. This includes the CareMoor for Exmoor scheme¹³ administered by the Exmoor National Park Authority and the National Trust scheme at Wasdale Head¹⁴ in the Lake District. The pilot drew on work carried out by Mark Reed, Birmingham City University, and reported in the Defra funded research report 'Visitor Giving Payments for Ecosystem Services Pilot' (February 2014) to inform a potential Visitor Giving PES at Holnicote.

Reed *et al* (2013a) reports two key mechanisms for securing funding through Visitor Giving. One is remotely through use of mobile phone apps and other electronic payment mechanisms, the other is to physically gather contributions at key locations such as visitor centres and by working in partnership with local businesses such as bed and breakfasts.

Through discussion with local National Trust staff it was identified that there are few locations at Holnicote where the National Trust is able to physically interface with visitors. There are tea rooms at Selworthy and a few more formal car parks across the Estate. It was also pointed out that many visitors to Holnicote enter onto the Estate from other access points (e.g. via Exmoor National Park or the coastal path), so do not use the Estate car parks.

One of the key draws for some visitors is the lack of formal visitor facilities at the Estate, in fact it was noted that many visitors do not realise that it is a National Trust property although the Trust is trying to change the perception by targeting new signage and interpretation at specific locations, including Bossington, Selworthy, Horner and Webbers Post.

In part as a result of the pilot, but also driven by its Land Choices programme the National Trust has recognised that the Flood Project offers a unique opportunity for the Trust to promote its work in integrated catchment management to a wide audience, including its visitors, and is considering the development of a visitor hub at Holnicote. This would provide a spring board for the development of a Visitor Giving PES.

5.4.6 Corporate Business

It proved to be difficult to engage with businesses in the wider area, primarily because the project team had no existing contacts within organisations identified as potential buyers including Butlins, based in Minehead just outside of the Holnicote Estate, and EDF Energy and the minerals and aggregates industry further afield, in Somerset. Identifying and nurturing new contacts outside of established networks required a significant amount of time and it proved difficult to engage with businesses that were not already connected with the Flood Project or which identified with the concept of ecosystem services.

The Somerset Local Natural Partnership (LNP), of which the National Trust is a member, was considered a potential route into corporate businesses, including the Somerset Local Enterprise Partnership (LEP). However, whilst the LNP was supportive of the concept of PES at Holnicote it was not possible to facilitate fruitful links with businesses or the LEP via this route.

A meeting was arranged with the EDF Biodiversity Manager for Somerset which provided a platform to promote the concept of PES focussed around carbon sequestration as this was assumed to be the key ecosystem service of interest to EDF. Whilst the company was very supportive of the concept in principal, it reported that investment in environmental projects was tied to the local community within which its

¹³ <http://www.exmoor-nationalpark.gov.uk/visiting/donate-caremoor-for-exmoor>

¹⁴ <http://www.nationaltrust.org.uk/wasdale-eskdale-and-duddon/>



Hinkley Point power station is located on the Somerset coast. There was no mechanism by which EDF locally could invest in work at Holnicote which was too far outside of its geographic area.

It was concluded that there was no current potential for trade between the National Trust and businesses in the wider region. However, the potential for corporate businesses to invest in carbon sequestration through the Peatland Carbon Code or Woodland Carbon Code were identified as options to take forward.

6. OPPORTUNITIES FOR DEVELOPMENT OF PES

6.1 Refining the Scope of PES Opportunities

Synthesis of feedback from potential buyers indicated that there was not currently an obvious mechanism for trade in ecosystem services between the National Trust and potential buyers. Whilst there was widespread support amongst potential buyers for the concept of PES and recognition of the tangible benefits accrued by the Flood Project to date, there was insufficient demand amongst those consulted for ecosystem services supplied by land management interventions. This finding has important implications for other projects which are taking a catchment wide approach to natural flood management and looking to secure funding from novel sources. In short, there may not, at the current time, be an appetite for PES as a means of funding land management interventions to reduce flood risk, where there is not also a strong driver for improvements in water quality such as in the United Utilities SCaMP project and South West Water's Upstream Thinking.

Nevertheless, it remains the intention of the National Trust to continue to seek investment in the continuation of the Flood Project because:

- there is scope for further reductions in flood risk at Allerford and Bossington beyond the 10% reduction in peak flow already achieved (for a severe flood event on Christmas Eve 2013);
- there have been significant additional environmental benefits of improved soil management, increased biodiversity, increased carbon storage and improved water quality which had yet to be achieved;
- the accumulation of further monitoring data would be invaluable in providing a long-term dataset of evidence for the effectiveness of land management interventions;
- there is significant scope for Holnicote to continue to be a key demonstration project for natural flood management techniques, not least in light of the extreme flood events in Somerset in winter 2013/14.

The pilot therefore considered the potential for development of future PES markets to generate sufficient income, alongside other more conventional sources of income such as grants and partnership contributions, to allow for continuation of the Flood Project and associated ecosystem services. In terms of how future funding would be used, the Defra pilot funding has allowed for initial capacity building within the National Trust and has commenced the task of collating suitable metrics to measure the change in supply of ecosystem services associated with the Flood Project. Additional funding would therefore be required to continue to develop sound working relationships with potential future buyers, put land management interventions in place, continue the collection of monitoring data and investigate and resolve technical issues to enable a PES scheme to come forward.

The cost of delivery of the land management interventions to date, including all associated staff and consultancy costs, research, baseline data collection, monitoring, survey, modelling and reporting completed is approximately £1.22M. Funding was provided by Defra (£721,000) the Environment Agency (£250,000) and the National Trust (£250,000) which included in-kind contributions from the Environment Agency and National Trust. Much of the existing cost has been associated with establishing a baseline. It has been estimated that the cost of implementing the full suite of land management measures set out in the Flood Project strategy is £7M (PAA 2012). The experience of the Flood Project to date is that the length of time to achieve the desired land management changes is very significant. Anticipated costs per

annum to implement the remaining tasks set out in the Flood Project strategy could be in the region of £40-£50K, or perhaps £100,000 for additional flood bunds (Hester, *pers. comm*).

Additional short term funding of approximately £60K for 2015/16 will be provided by the National Trust to allow for continuation of essential monitoring and modelling work. This work will ensure that there is a robust evidence base to underpin any future PES negotiations. Any future PES scheme would therefore need to be able to generate significant amounts of income. At the current time, the most promising markets by virtue of their scale and ability to generate the levels of income required are by integrating PES within some form of Visitor Giving Scheme (VGS) and use of agri-environment schemes including the new Countryside Stewardship Scheme (CSS). It is envisaged that these potential PES based funding sources would be supplemented or topped-up with conventional funding in the form of grants from external bodies and internal funding from the National Trust.

Consideration has also been given to the use of the Woodland Carbon Code and Peatland Carbon Code as potential PES based funding sources at Holnicote, linking with new woodland planting and re-wetting of blanket bog.

6.2 Integrating PES with a Visitor Giving Scheme

Public interest in flooding issues has been heightened, particularly in Somerset, by the severe flooding of the Somerset Levels & Moors in winter 2013/2014 (Hester, *pers. comm*). The Flood Project presents a unique opportunity to introduce the concept of natural flood management and other ecosystem benefits to the public, and this is recognised by the National Trust at a national level (National Trust Rural Enterprise Panel meeting, November 2014). The wider role of the Flood Project as a tool for raising awareness has been recognised by the National Trust in its Property Business Plan for Holnicote which was formally adopted in February 2015. This plan commits the Trust to investigate the development of a visitor hub to provide the necessary focal point to engage with the public and to capitalise on the unique opportunities that the Flood Project presents to engage people in natural flood management. It also enshrines the desire within the Trust to test and promote new economic models including use of PES as part of its Land Choices Programme.

One potential model is to incorporate PES into a Visitor Giving Scheme. This is a potentially significant un-tapped source of income which could be generated by engaging visitors with a unique example of a catchment wide demonstration of natural flood management, especially at the current time when flooding has a very high public profile. Reed (2013a) identifies that a typical donation is likely to be no more than £2, suggesting that around 50,000 people per annum would need to donate an average of £2 to generate the target revenue of £100K per annum for the Flood Project. In practice, the Flood Project is likely to be funded from a number of sources, including Visitor Giving, so it should be viewed as part of a package of funding measures.

The Reed (2013a) study identifies a number of good practice principles relating to the establishment and running of Visitor Giving Schemes generally, and the integration of PES options into these schemes. Of particular relevance to Holnicote are:

- the need to consider a range of potential payment mechanisms to suit the needs of different types of visitor, for example smart phone apps, donation boxes and opt-in levies on accommodation - discussions are now underway with National Trust staff to consider what the most appropriate mechanisms might be for Holnicote;
- targeting requests for donations clearly towards specific projects and demonstrating how donations will lead to specific, measurable (ecosystem service) benefits. The key messages

developed as part of this pilot will provide a useful starting point for this coupled with the use of Holnicote as a demonstration site which enables visitors to see the benefits of the Flood Project first hand;

- use of appropriate marketing strategies - the National Trust has well established and highly effective marketing expertise and reach across the regional and nationally so is well placed to develop a successful marketing campaign focussed around the Flood Project, indeed the project has already received significant local and national media attention;
- eliciting donations from regular visitors - many of the 1.2M visits per annum are likely to be repeat visits, consideration will need to be given to rotating the specific elements of the Flood Project requiring funding to ensure continued interest from the same group of people, or developing other ecosystem service incentives to attract funding outside of the Flood Project.

The National Trust already has an active Visitor Giving Scheme in place at Wasdale in the Lake District and therefore the necessary organisational structure in place to administer such a scheme which could be transferred, at least in principle, to Holnicote. Discussions between local and regional National Trust staff to consider how Visitor Giving could be taken forward at Holnicote are on-going.

6.3 Use of Agri-Environment Schemes

In the UK, the Environmental Stewardship Scheme is an example of a publicly funded PES (Defra 2014) whereby public monies are distributed to land managers in return for specified environmental improvements. At the outset of the Flood Project in 2009, it was envisaged that management changes and interventions could largely be implemented and funded through existing agri-environment schemes administered by Natural England and the Forestry Commission. A number of the agricultural tenants at Holnicote are already in Higher Level Stewardship (HLS) and, working in partnership with Natural England advisors, HLS payments been used to top-up funding for the Flood Project. On one farm this has been used to fund arable reversion and tree planting.

However, it soon became apparent that further opportunities to pursue this route would be at the onset of new schemes as the existing HLS schemes had no suitable land management options, particularly for the upper catchment changes required (PAA et al 2015). Indeed, HLS payments acted as a constraint to one of the Flood Project aspirations to increase tree cover in the upper Horner catchment where HLS encouraged clearance of scrub to maintain open grazing land (Hester, pers. comm.).

Nevertheless, agri-environment payments are considered to be one of the key mechanisms for funding on-going landscape scale change at Holnicote. The suite of measures which it is anticipated could be funded by agri-environment payments are:

- drainage blocking in blanket peat
- arable reversion
- new woodland creation
- in-field buffers strips

As part of the pilot project, Natural England has advised on the potential for the new CSS to fund land management for reduced flood risk. The so-called 'mid-tier' agreements were identified as an opportunity for appropriately targeted options to play a positive role in natural flood management with one of the

stated aspirations for water/flooding '*making water cleaner and reducing risk of flooding by supporting changes to farming practice (such as crop management), improving farm infrastructure and creating woodland*'¹⁵.

Since top priorities for the new CSS are delivery of biodiversity and water quality, these priorities bring significant elements of the Government's forestry and woodland policy within the scope of CSS. In particular, Government policy statement expresses an ambition to create 5000ha of new woodland a year with a commitment to support 2000ha of that annual woodland creation target. The detail of targeted opportunity maps for woodland creation is subject to on-going discussion but it is anticipated that it would include areas where woodland creation can either help reduce surface run-off and erosion through protecting soils and increasing infiltration or increase hydraulic roughness on floodplains when rivers are in flood.

Other key criteria, which are likely to be met at Holnicote, include biodiversity, water quality, historic environment, landscape and climate change. The mid-tier approach is also designed to offer greater opportunities for co-operation between clusters or groups of farmers to deliver landscape scale changes. Additionally, the use of public funds chimes with the National Trust aspiration for the work at Holnicote to be of public benefit. It would therefore seem that CSS offers a highly suitable route into funding for continuation and expansion of land management interventions at Holnicote. However, resources for the CSS are limited and competition for targeted funding is likely to be strong.

Additionally, at a practical level, a number of farm tenancies at Holnicote are already tied into HLS agreements for a 10 year period and it is unlikely that these could be entered into CSS in the near future. Some tenancies currently in Entry Level Stewardship (ELS) agreements, which end sooner than HLS, could potentially be targeted for payments under CSS.

A further potential barrier to widespread use of CSS at Holnicote in the longer term is the need to engage individual tenant farmers with the process. This is likely to occur on a farm by farm basis and even on a field by field basis, reflecting the significant timescales involved in implementing catchment wide change. The pilot project found that tenants attitudes towards willingness to engage were varied from very willing to not at all interested, and that external financial incentives and support were essential to secure buy-in.

The National Trust will therefore continue to capitalise on opportunities for the extant HLS agreements to contribute towards Flood Project objectives, and to work with Natural England to apply for targeted payments under CSS as the opportunities arises. Continued co-operation from its agricultural tenants will be crucial to achieving this.

6.4 Woodland Carbon Code

There is potential for the National Trust to generate additional income through the novel markets created by the sale of carbon via the Woodland Carbon Code developed by the Forestry Commission. Woodland Carbon Code guidance recognises that woodland in the right places can reduce flooding and improve water quality. The Woodland Carbon Code is open to individuals and organisations to purchase credits from registered and validated woodland projects, which must meet strict additionality criteria.

Woodland creation projects which sign up to the Woodland Carbon Code can continue to claim a woodland creation grant in England, Scotland and Wales and Northern Ireland, as long as the

¹⁵ *The new Common Agricultural Policy schemes in England: December 2014 update* (www.gov.uk - accessed April 2015)

additionality criteria are satisfied. In fact, evidence provided for grant applications can also be used to support an application for a woodland project to be certified as a carbon sequestration project under the Woodland Carbon Code.

The current price of carbon units sold under the Woodland Carbon Code is 6p per Woodland Carbon Unit, i.e. a tonne of carbon sequestered ($t/CO_2e/ha$)¹⁶ by a certified woodland. The scheme invites organisations and individuals to invest in future carbon sequestration, with Woodland Carbon Units issued only once the woodland has been verified. There are a growing number of projects across the UK.

The Code includes detailed look-up tables to calculate estimated tonnes of carbon sequestration per hectare based on species, density, yield, management and lifetime of the project.

It is anticipated that any new woodland planting which is secured as part of the Flood Project strategy would be eligible for registering with the Woodland Carbon Code and it is recommended that the Trust give consideration to pursuing this option as a source of future income.

6.5 Peatland Carbon Code

Unlike the Woodland Carbon Code which is an established scheme, already trading in carbon units, the Peatland Carbon Code is still in a trial phase which will continue through 2015. At the time of writing, work is on-going to develop a robust metric for a carbon emission factor associated with different categories of peat condition from pristine to actively eroding. The as yet unpublished data suggests that actively eroding peat has a high emission factor ($tCO_2eq/ha/yr$), and that projects to restore actively eroding peat offer the potential to produce immediate, and significant, savings in carbon emissions¹⁷.

The development of the Peatland Code has been supported by Defra in recognition that although there is a growing interest from the private sector in paying for some ecosystem services, there is a need to develop guidance and frameworks and monitoring to give sponsors the confidence to invest in peatland restoration on any significant scale (Reed *et al* 2013b).

The current trial phase is focussing on 'high calibre' peatland restoration projects and will test and further develop the Peatland Carbon Code on a small scale. Blanket bogs with a peat depth >50cm are eligible under the scheme with eligible activities including peatland restoration through re-wetting alone, or in combination with other management actions to re-establish peat forming species.

At Holnicote, there are relatively limited amounts of true blanket bog, with much of the upland areas comprising dry and wet heath over relatively shallow peat soils. Nevertheless there are approximately 95ha of blanket bog and upland valley bog where re-wetting through blocking of drainage features may benefit peat hydrology and biodiversity.

Importantly, the draft Peatland Code specifies that private sponsorship shall cover at least 15% of the restoration costs. Other additionality criteria specify that there must be no pre-existing legal order to restore the peatland, that without investment the peatland restoration project is not economically or financially viable and that existing barriers to implementation must be overcome.

A key aspiration of the Flood Project in future is to extend the drainage blocking measures already implemented in parts of the upper Horner catchment and it is recommended that the National Trust give

¹⁶ www.forestry.gov.uk/forestry (accessed - April 2015)

¹⁷ Mark Reed, *pers.comm.*



consideration to registering the project with the emerging Peatland Carbon Code to supplement funding in areas where this coincides with blanket and upland valley bog habitat.

7. SUMMARY AND CONCLUSIONS

7.1 The Opportunities for PES

The pilot has highlighted how a PES approach, alongside other conventional funding sources, could generate funding for the continuation of the Holnicote Flood Project. These measures include:

- the development of a visitor hub at the Holnicote Estate to provide a focus to engage the public in this unique catchment wide demonstration of natural flood management. The development of a visitor hub has been embedded in the Holnicote Property Business Plan;
- continued use of opportunities to deliver land management change through agri-environment payments by on-going engagement with and support for its agricultural tenant farmers;
- investigation of the use of the Woodland Carbon Code and emerging Peatland Carbon Code to support new woodland creation and re-wetting of upland valley/blanket bog habitats, respectively.

The pilot has developed a series of headline messages about flood risk management, biodiversity, carbon and soil management which can be used to promote tangible benefits of a PES approach to potential future buyers.

In addition, the pilot has helped to cement an ecosystem led approach firmly within the National Trust thinking on its new Land Choices strategy and Catchments in Trust partnership with the Environment Agency which seeks to extend the lessons learnt at Holnicote to ten other catchments where the National Trust is a major landowner.

7.2 Proof of Concept and Potential Showstoppers

There has been a growing belief in recent years that downstream beneficiaries of flood prevention are willing to invest in upstream measures, but this is not supported by the pilot, at least not on the Holnicote Estate. This is likely to be due to:

- the relatively small number of properties affected and the perception amongst consulted residents and tenants that very little income could therefore be generated;
- many properties at Holnicote are owned by the National Trust and rented to private tenants, so there is limited incentive for tenants to seek to reduce their level of risk from flooding, i.e. it is perceived that the Trust would deal with flood insurance and any clean-up costs;
- the demographics of the villages affected, with many residents being elderly and with low incomes and therefore limited ability to pay;
- a perception that there is not a significant risk from flooding, particularly following the implementation of property level protection (PLP) and installation of flood bunds;
- a belief that Government, the Environment Agency or the National Trust itself should be responsible for providing and funding flood prevention.

A range of other potential buyers of ecosystem services consulted comprising the Environment Agency, flood insurance industry, local businesses and corporate business were supportive of the concept of

payments for ecosystem services although this did not result in the development of a market ready PES scheme for flood regulation and co-benefits at the current time. The underlying reasons include:

- Flood Defence Grant-in-Aid and levies administered by Regional Flood and Coastal Committees are widely accepted as the primary mechanisms for funding of flood schemes. Whilst this funding continues to be available, there is no incentive for other buyers to invest in flood prevention;
- water quality is not a major driver for PES thinking at Holnicote because, in spite of localised issues with soil erosion entering watercourses, the rivers are achieving 'Good' status under the Water Framework Directive and there are no public water supplies within the Estate, so no incentive for Water Company investment;
- biodiversity and water quality value is perceived as being relatively high, so there is limited support amongst local businesses which rely on tourism to invest in improvements in biodiversity or water quality;
- there are very few corporate businesses in the locality of Holnicote, making it difficult to identify potential corporate buyers.

The emerging PES approaches identified by the pilot are still at an early stage of development, so it is not possible to identify major showstoppers although possible limitations at Holnicote are:

- lack of funding within the National Trust to establish a visitor hub and future contributions through Visitor Giving;
- unable to secure sufficient income from Visitor Giving to sustain maintenance of the Flood Project;
- limited resources for funding of the new CSS and/or inability to secure take up amongst tenant farmers.

The pilot has demonstrated that it is not straightforward to identify and engage buyers or markets for landscape scale natural flood management, where there is not a clear incentive for buyers such as water quality as in the United Utilities SCaMP project.

It has proved to be difficult to engage effectively with potential buyers in the areas of health and well-being and erosion regulation, although these are perceived by the National Trust to be key ecosystem services provided by the Estate.

The pilot has therefore had to look to markets in flood regulation, carbon, biodiversity and soil management. Finding a sufficient number of buyers who are incentivised to pay for these ecosystem services in a rural environment has been a significant challenge. There are few potential buyers, with limited ability to pay and, at Holnicote, they are not sufficiently incentivised to invest due to a perceived lack of need for these services. There is also a feeling that the Government, Environment Agency and/or National Trust should be responsible for delivery of flood risk management measures, and perhaps this view will continue to persist whilst Flood Defence Grant-in-Aid (GiA) and other conventional funding sources are available.

To take PES thinking forward at Holnicote the pilot has identified that potential buyers will need to come from outside of the immediate project area.

The pilot has served as a reminder of the importance of agri-environment payments as a key mechanism for channelling public funds into natural flood management, but has also brought into sharp focus some of the practical and institutional barriers to widespread uptake. These include challenges in winning support amongst tenant farmers, lack of options within HLS to deliver the desired land management changes, the long timescales that HLS agreements are tied to meaning that land cannot be entered into CSS for many years in some cases, no guarantee that Holnicote would meet the eligibility criteria of so-called targeted 'mid-tier' agreements and a lack of resources available for delivery of CSS generally. In short, agri-environment payments are not a panacea for the type of landscape scale change envisaged by the Flood Project.

7.3 What Has Been Achieved Through the Pilot

The pilot has raised the profile of PES and an ecosystem approach within the National Trust at a local and national level. One of the key achievements has been to establish how PES could be used to generate funding as part of a package of potential funding sources including Flood Defence GiA and levies from the Wessex Regional Flood and Coastal Committee, as well as internal funding from the National Trust. It is unlikely that PES alone will be sufficient to support continuation of the Flood Project, which is likely to require in the order of £100K per annum to support capital investment, opportunity costs and on-going monitoring and evaluation.

The pilot has established that the most likely markets for ecosystem services will focus on flood regulation, biodiversity, carbon and soil management and that buyers will comprise visitors who come from outside of the local area or from Government, on behalf of the wider public, through agri-environment payments.

Visitors to the Estate have been identified as a major untapped source of funding and it is likely that a Visitor Giving Scheme could encourage donations, capitalising on public interest in natural flood management and biodiversity gains in particular. The pilot has been an influencing force in the recently adopted Holnicote Property Business Plan which includes a commitment to develop a visitor hub to act as a focus for engagement with the public.

7.4 Project Legacy

Whilst not a direct outcome of the pilot, the lessons learnt from the pilot study have helped to inform the National Trust Land Choices strategy for Holnicote, ensuring that an ecosystems approach and the PES concept are at the heart of Land Choices.

As a charity, the National Trust has a statutory obligation to conserve its land, wildlife, buildings, collections and archaeological sites in perpetuity for everyone to enjoy. The Flood Project has provided a unique opportunity for the NT to focus on one of its largest countryside estates in the context of improving water and soil management to reduce flood risk and to provide a range of other environmental gains, in addition to its existing conservation work programme.

This shift in approach to land management is based on recognising the pivotal role that water plays in linking components of the catchment at a landscape scale. Farmland in the floodplain is no longer seen as a separate entity to the high moorland or to the ancient sessile oak woods; the 'golden thread' of water has freed up our thinking to explore future management options at a much broader scale and with greater ambition.

This approach fits neatly with new strategic thinking within the NT, the "Land Choices" process, which seeks to understand the current functions of all its land and how they might be better balanced to achieve



its aspirations in the future. Traditionally, NT tenanted farmland has been viewed as primarily productive land which, through rental income, provides money to support its conservation work in the wider countryside. However, Land Choices demands a rethink so that water, soils, carbon, wildlife, landscape, cultural significance and public enjoyment are as valid functions of farmland as productivity. Currently, the wider functions of the land at Holnicote are being assessed and the Flood project has been and continues to be a major driver for this holistic approach to land management.

In early 2015, a new strategic partnership has been developed between the NT and the EA at a national level, "Catchments in Trust". This aims to enable a 6 year programme of 10 catchment scale projects which delivers within the NT Land, Outdoors and Nature strategy and intends to deliver more strategically for biodiversity, flood risk, land and water quality targets throughout England. The Flood Project is regarded as a key catalyst in securing this partnership, demonstrating collaborative working at a catchment scale to deliver multiple and quantifiable outputs. It provides further clear evidence that the catchment scale NFM approach demonstrated at Holnicote, the lessons learned and the key outputs of the project, are all being integrated into the fabric of NT policy and its future direction in England, Wales and Northern Ireland.

The lessons learnt from the investigation of a PES approach at Holnicote will be directly transferred to the Catchments in Trust programme via the National Trust.

7.5 Prospects for PES Going Forward

The pilot has attempted to capture all the potential sources of PES funding that could be exploited by the National Trust at Holnicote to act as a spring board for the development of future PES initiatives, both at Holnicote and elsewhere. Whilst it has not been possible to establish a market at the current time, there is a clear momentum for an ecosystem service led approach through Land Choices and Catchments in Trust at a strategic level, and via the Property Business Plan at a local level.

The National Trust is firmly committed to pursuing a new vision for management of its landholdings which goes beyond food production and is actively investigating new economic models to achieve its aspirations. Consideration of PES will continue to play a major part in this.

This report will form part of a suite of documents and other resources which will be made available to a wide audience interested in natural flood management as part of the Flood Project¹⁸.

In an economic climate where public funds face continued pressure, coupled with a predicted increase in extreme flood events and growing public interest in flooding issues, there is no doubt that PES as a concept will continue to be a key potential funding source. Indeed, the importance of PES approaches may increase as pressure on public spending grows, and Government and the Environment Agency look to private investment to supplement the cost of flood prevention.

7.6 Lessons Learnt from the Project

The pilot has encountered typical issues around bringing potential buyers to the table and the time and resources needed to engage and sustain positive relationships with stakeholders. However, in terms of 'lessons learnt' the following topics focus on those issues which are of broader relevance to the development of a PES approach in the context of a landscape scale natural flood management project:

¹⁸ Insert details of how to obtain Holnicote resource database

- **Existing strategy** - the existence of a strategy for delivery of land management interventions focussed around a key ecosystem service (in this case flood management) was essential as a catalyst for discussion with buyers since it provided a concise suite of tangible measures which required funding;
- **Tangible benefits** - the development of readily understood headline messages about the tangible benefits of land management interventions linked to natural flood management was crucial to engaging stakeholders in a credible way. Potential buyers wanted specific details on levels of flood protection provided by the project in terms they could easily visualise, e.g. a 10% reduction in peak flow (in relation to the Christmas Eve 2013 flood event) meant little to them, but how this translated to the height of water on the doorstep was critical to their understanding of the benefits;
- **Headline messages** - where there is not already a natural flood management vision or strategy for use of funding, it will be important to develop this along with headline messages on tangible outcomes, before engaging with potential buyers;
- **Scale of funding** - the land management interventions envisaged at Holnicote are likely to cost in the region of £40-£50K per annum (perhaps £100K for creation of further flood bunds). Large scale PES initiatives in the form of Visitor Giving and agri-environment payments are likely to be necessary to fund the scale of change required. Finding a sufficient number of buyers in a rural catchment with a small population and few businesses is challenging; the pilot had to look outside of the project area to visitors and the general public for potential funding sources;
- **Mix of funding sources** - PES is unlikely to generate sufficient funds on its own to sustain the Flood Project, but could be an important part of an overall package of funding for flood management alongside Flood Defence GiA, Regional Flood and Coastal Committee funding levies and internal funding from the National Trust;
- **Importance of water quality as a driver for PES** - the lack of real and perceived water quality issues at Holnicote means that water quality is not a key driver for change, and hence it there is no incentive for investment in this ecosystem service, This contrasts with other catchment scale PES schemes where water companies have been a key buyer, e.g. United Utilities SCaMP project and South West Water's Upstream Thinking;
- **Difficulty establishing a market for soil regulation** - the National Trust has a legal duty to conserve the whole environment, including soils. Its Land Choices programme encourages soil conservation as part of the wider farm environment, placing the health of the land on an equal level of importance to productivity. There are, therefore, legal and strategic drivers for the National Trust to invest in good soil management and conservation. However, although soil erosion is a key issue at Holnicote, there are no obvious buyers (other than the National Trust) or markets in, better soil management at a local level. Agri-environment payments on behalf of the public at large are likely to provide the only incentive for change;
- **Biodiversity as a key driver for PES** - biodiversity is likely to be a key driver for investment amongst public beneficiaries particularly through the CSS which has biodiversity and water as it's priorities, and because it is a tangible outcome that the public can relate to (it would be useful to test this assumption with visitors as part of the development of a Visitor Giving Scheme);

- **Responsibility for flood risk management** - there was a strong feeling amongst local businesses that Government and the Environment Agency should be responsible for flood risk management; this view is likely to persist as long as public monies remain available via Flood Defence GiA and levies collected by local flood authorities;
- **Pattern of property ownership/tenure** - Holnicote has an unusual pattern of property tenure with the majority of properties and businesses which benefit from flood protection owned and insured by the National Trust; this is likely to be a significant influence on attitudes amongst tenants who have voiced views that the National Trust should be responsible for flood management, and that they are less concerned about flooding because the Trust pays for buildings insurance and deals with clean up issues. This is likely to contrast with privately owned residents or businesses affected by flooding where the incentive to invest in flood prevention might be stronger;
- **Use of Countryside Stewardship payments in PES** - agri-environment payments are likely to be a key mechanism for channelling public funds into natural flood management projects, especially those with multiple benefits that are likely to benefit from targeting of the new 'mid-tier' agreements under Countryside Stewardship. However, resources for Countryside Stewardship will be limited and, for a variety of practical and institutional reasons, Countryside Stewardship is unlikely to be able to sustain the Flood Project on its own, without additional top-ups or partnership funding from other sources;
- **Use of Carbon Codes in PES** - the Woodland Carbon Code and emerging Peatland Carbon Code could play a role in securing funding for new woodland planting and re-wetting of blanket bog respectively, but the sums of money generated are likely to be small;
- **Role of Flood Insurance industry** - although there is perception that the flood insurance industry should have an interest in investment in flood prevention measures, preliminary findings from the pilot suggest that there is no clear mechanism for this and that Flood Re is unlikely to facilitate this at the current time;
- **Importance of incentives for land management interventions** - incentivising tenant farmers to deliver the necessary land management change is critical to delivering ecosystem services. However, voluntary uptake is rare, the level of uptake of financial incentives has been varied and relationships take a long time to develop and nurture. Full implementation of the Flood Project strategy is likely to take many decades and is estimated to cost c. £7M.

7.7 Transferability to Other Parts of the Country

The lessons learnt from the pilot are likely to be highly transferable to other National Trust landholdings or privately owned Estates with multiple tenant farmers, especially those with the following characteristics;

- rural areas where the majority of properties and businesses are tenanted;
- rural areas with few buyers;
- land holdings which attract significant visitor numbers;

- projects with a focus on delivery of natural flood management with multiple benefits, especially biodiversity, carbon and soil management.

The Flood Project generally has generated interest from a range of players involved in the implementation of natural flood management in the Somerset Levels and Moors, and it is anticipated that this relationship will continue, and that there may be scope to share lessons learnt on funding including use of a PES approach.

The lessons learnt from development of PES thinking at Holnicote will be directly applicable to Catchments in Trust. The Catchments in Trust programme is a major partnership programme between the National Trust and Environment Agency and involves ten river catchments where the National Trust is proportionately a major landowner (the National Trust is a major landowner with 192,490ha of land managed in England and in some catchments the Trusts owns 20% of the land area). The programme is currently in its scoping and development stage and is seeking Heritage Lottery Funding to take the project forward. The development phase will be in 2016, with the main project commencing in 2017 for five years. One of the project objectives is to jointly seek targeted funding to enable work to proceed more rapidly and more effectively than it would through both partner organisations (the Environment Agency and National Trust) working independently. A PES approach will be a part of this mix.

The targeted catchments are those with similar issues and priorities to Holnicote including a desire to deliver multiple ecosystem service provision, alongside biodiversity and Water Framework Directive targets. More specifically to the National Trust, through its Land Choices strategy, the projects will also seek to deliver healthy soil and water, sustainable land use and environmental compliance in a way which is financially sustainable.

7.8 Actions for Government to Facilitate or Remove Barriers

The pilot has identified a number of areas where Government could facilitate or remove barriers to aid the development and adoption of PES the context of catchment wide natural flood management:

- continue to ensure that CAP reform targets public monies into appropriate land management that reduces not increases flood risk and delivers multiple benefits;
- soil degradation is estimated to cost UK economy £0.9 - £1.7B per annum (UK NEA 2014). Government to consider how much money could be saved for UK economy if agri-environment schemes effectively tackled root causes of this;
- recognition that rural areas with a low density of potential beneficiaries are unlikely to be willing or able to fund land management of the scale required to bring about significant reductions in flood risk i.e. PES alone unlikely to deliver flood regulation ecosystem services and Government will need to provide and/or supplement funding for natural flood management in rural areas;
- use influence to work with farming community at a strategic level to encourage uptake of land management interventions to benefit natural flood management;
- public campaigning to continue to raise awareness of natural flood management, and how the public can help to fund this, before next major flood event comes along - prevention better than cure approach.

7.9 Conclusions

In conclusion the experience of the Holnicote PES pilot suggests that a partnership approach will be required to deliver multiple ecosystem services at a landscape scale between the landowner and the farming community, Government, statutory agencies and the public. Funding is likely to be derived from a mix of sources but primarily from the public purse in the form of Grant-in-Aid, levies and agri-environment payments, supplemented with voluntary donations via initiatives like Visitor Giving. At the present time, novel sources of funding from corporate business or other sectors such as health and tourism are difficult to tap into and there is no incentive for water company investment at Holnicote as there is in many other water related PES schemes.

The pilot has provided a platform for the National Trust to implement a PES approach in future. The Trust is in a strong position to administer funding from a variety of sources and has the capability to deliver the necessary land management interventions within an existing framework of measures, embedded in its Property Business Plan at a local level and its Land Options strategy at a national level. Systems are in place to monitor and evaluate outcomes for flood regulation, biodiversity, carbon and soil regulation. Generating sufficient levels of funding to support the full implementation of the Flood Project remains challenging. It is hoped that the creation of a visitor hub at Holnicote might enable the Trust to capitalise on public interest in natural flood management and biodiversity. The lessons learnt from the Holnicote PES pilot will also be used to positive effect as part of the Catchments in Trust programme.

The consideration of a PES approach has identified mechanisms and processes that may be used to continue land management change for multiple benefits into the future and has become an integral component of the Holnicote Project legacy. The National Trust are continuing to fund the Flood Project for a further year in order to firmly establish a basis for future land management change and the acquisition of sustainable multiple benefits, and to continue the process of establishing Holnicote as a national demonstration project.

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APPENDIX I

Appendix 1. Summary of Opportunities Assessment Work

Ecosystem Service/Good	Baseline Description	Are there specific land management actions that have the potential to secure an increase in supply of the service? Is there a demand?	Potential for Market for PES?
Fresh Water	The Holnicote Estate falls within Wessex Water's catchment area but there are currently no public water supplies, Nutscale Reservoir having been taken out of commission due to an on-going issue with control of geosmin (an organic compound produced by a type of bacteria). There are a small number of private water supplies to agricultural tenants and National Trust tenanted properties.	No public water supply, only limited scope to level funding from beneficiaries of private supply due to small number of individuals and properties involved.	No
Food	Majority of livestock are reared for lamb and beef; there is no direct supply chain to retailers except one tenant who sells into local farmers market. Other major agricultural land use is arable, with 'high end' maize and wheat production. Historically Porlock Bay has been linked to production of high quality malting barley. 'Lower end' fodder crops also grown, and one tenant grows short rotation coppice for personal use. There is a significant market for and growing interest in Exmoor reared venison which is known for its large size and high quality.	Agriculture is a major land use on the Holnicote Estate and there is interest in Exmoor venison in particular, with income from sale re-invested in the Holnicote Estate. No obvious local retail outlets, however, there is scope to influence improved land use with interventions aimed at reducing flood risk which might also improve livestock and arable productivity via the use of agri-environment schemes and other incentives.	Yes
Fibre and fuel	There is a specialist market for wool from the Exmoor Horn sheep. Horner Wood (2000ha) is commercially managed by the National Trust, mainly for softwood and some hardwood. There is a small local market for fuel wood for heating.	Only small numbers of potential beneficiaries involved, unlikely to generate significant income.	No
Flood regulation	The Estate comprises two distinct catchment areas: the Horner and Aller. The upland fringes of the Horner are subject to accelerated drainage from a large number of man-made drainage features and (in some areas) over-grazing. In the lower-lying floodplain of the Aller catchment is scope for temporary flood storage and flood meadow creation and land management interventions to address flood risk and significant soil erosion issues.	The Flood Project has already demonstrated that land management interventions can reduce flood risk.	Yes
Erosion regulation	Steeply sloping ground and localised land management issues results in soil erosion impacting on farmland and highways, with significant clean up and landfill costs.	Potential to address loss of high quality topsoil and reduce clean up costs through use of agri-environment measures and other incentives. In spite of water quality issues, the Horner and Aller catchments are currently meeting their Water Framework Directive (WFD) targets so this cannot necessarily be used as a driver for interventions (although the most recent WFD Assessment in the	Yes

Ecosystem Service/Good	Baseline Description	Are there specific land management actions that have the potential to secure an increase in supply of the service? Is there a demand?	Potential for Market for PES?
		Horner catchment has identified some water quality issues).	
Clean water	The key water quality issue is suspended sediment; other potential contaminants, e.g. nutrients and pesticide use are reported not be an issue (on-going research by Exeter University ¹).	No major water quality issues (except suspended sediment linked to soil erosion). There are no significant fisheries interests, although biodiversity i.e. otter and dipper may be adversely affected by high levels of suspended sediment.	No
Pest regulation	The Estate suffers from <i>Chalara fraxinea</i> and <i>Phytophthora ramorum</i> which are being actively managed. Heather beetle is present in the upper Horner catchment. The management costs are significant. Invasive alien species, such as Japanese knotweed, Himalayan balsam and rhododendron are present.	There are no obvious mechanism for levering funding.	No
Cultural Value	There are a number of iconic attractions including the Exmoor pony and red deer and picturesque villages including thatched cottages in Allerford, Selworthy and Bossington.	An estimated £1.2M visitors per annum (based on visitor data from c. 2003) visit the Holnicote Estate providing a potentially significant source of income via a Visitor Giving scheme.	Yes
Recreational Value	A significant number of visitors visit the Holnicote Estate as part of trips to other nearby destinations including Porlock and Minehead. One of the key draws of the Holnicote Estate is its considerable size and ability for visitors to 'spread out' over a large area. There is a very dense footpath network extending over 160km and a coastal footpath. There are 5 National Trust owned Holiday Cottages. Riding and cycling are other key activities.	As above.	Yes
Landscape Value	The views from the Holnicote Estate consistently rate as the highest scoring criteria in visitor questionnaires - these include honey pot sites of Dunkery Beacon and Selworthy Church. A number of National Trust members are reported to come to this location because of the very high landscape value.	As above.	Yes
Health and Wellbeing	Visitor surveys show that visitors come to Holnicote for wellbeing reasons, i.e. simply being outdoors and looking at the view was cited as a benefit, with the 'sense of space' being a key draw.	The Somerset Local Nature Partnership (LNP) and National Trust recognise importance of health and wellbeing and are keen to promote wider use of the natural landscape linked to this.	Yes
Social Relations	There are a number of groups involved in the management of Holnicote including the Exmoor Society with a remit to safeguard the landscape of the Exmoor National Park	There is no clear beneficiary and only small numbers of individuals involved.	No

¹ Glendell M. Evaluating an ecosystem management approach for improving water quality on the Holnicote Estate, Exmoor. *Geography* — College of Life and Environmental Sciences. Exeter: University of Exeter; 2013

Ecosystem Service/Good	Baseline Description	Are there specific land management actions that have the potential to secure an increase in supply of the service? Is there a demand?	Potential for Market for PES?
	and commoners on common land in the upper Horner catchment.		
Education, employment and skills	The Estate employs 17 members of staff and runs an Academy Ranger course, including volunteers who work on other National Trust Estates. The course offers training in rural skills. Forest School offers pre-school aged children learning on the natural environment and encourages development of social skills. In a wider context, there is a strong element of young farmers coming through but wider issues in terms of farm viability are important considerations.	There are no obvious mechanisms for levering funding.	No
Biodiversity	The Holnicote Estate includes Horner Wood SSSI/SAC designated for oak wood habitats. The Estate supports a number of 'iconic' species including red deer, bats, heath fritillary butterfly, and rare lichens.	The National Trust has strategic objectives to engage its members with the 'outdoors' so there is an existing driver to safeguard and encourage engagement with nature. There are strong links with, and potential to lever funding from, the significant number of visitors to the Estate for whom biodiversity is a significant draw.	Yes
Rare Breeds	The Estate rears rare breed cattle and sheep, the Devon Red and Exmoor Horn, respectively. Exmoor ponies are also a rare breed which command a significant market value across the UK.	There is scope to influence improved land use with interventions aimed at reducing flood risk which might also improve livestock and arable productivity via use of agri-environment schemes and other incentives	Yes
Carbon sequestration	The upland areas comprise wet heath, not blanket bog, so moorland gripping is considered unlikely to be a major source of carbon loss. It is anticipated that the significant levels of soil erosion are likely to be a key source of loss of carbon.	Whilst there is unlikely to be scope for significant afforestation due to high levels of agri-environment payments received by tenants for grazing the National Trust is investigating potential for increased woodland in the upper catchment.	Yes
Pollinators	Not a significant issue for the Holnicote Estate, though there is a small market for honey production on the moorland in the upper Horner catchment.	No obvious mechanism for levering funding.	No

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