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An Assessment of Intermediary Roles in Payments for Ecosystem Services Schemes in the Context of Catchment Management: An Example from South West England

Hadrian Cook*

School of Geography, Geology and the Environment
Kingston University London
Kingston-upon Thames, Surrey KT1 2EE UK
hadrian@salisburywatermeadows.org.uk

Laurence Couldrick

Westcountry Rivers Trust, Rain Charm House
Kyl Cober Parc, Callington, Stoke Climsland, Cornwall PL17 8PH, UK
laurence@wrt.org.uk

Laurence Smith

School of Oriental and African Studies
University of London, London WC1H 0XG, UK
l.smith@soas.ac.uk

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Payments for Ecosystems Services (PES) schemes are an underdeveloped component of the policy mix for catchment management in many countries. The importance of intermediaries to such schemes is acknowledged in the literature but few studies go beyond theory to evaluate practice. This paper analyses generic intermediary functions for PES. It then evaluates an innovative example from southwest England that provides illustrations, and some lessons regarding necessary capabilities and characteristics for intermediaries, and understanding of their form, functions and modalities. The 'UpStream Thinking'

*Corresponding author.

project was co-developed by a private water company and an environmental charity. The former translated effective demand from shareholders and water customers for improved raw water quality into finance, whilst the latter had capabilities for catchment-scale on-farm delivery and trusted acceptance as an intermediary. While any sector can potentially provide a PES intermediary, the value driven, not-for-profit and politically neutral voluntary sector proves to be a good fit. Such 'boundary organisations' are also well placed for horizontal coordination of catchment management authorities and actions.

Keywords: Intermediary; catchment management; payment for ecosystem services; NGOs; transaction costs; social capital.

Introduction: Catchment Management Challenges and Payments for Ecosystem Services

Water pollution, over abstraction and flood risk are linked problems requiring coordinated solutions. As public policy challenges they evolve over time as both their outcomes and society's preferences are influenced by economic development and other social and environmental change. Solutions for these problems depend in large part on how land and urban infrastructure are used and managed. Cognisant of implications for habitats, biodiversity, local economy and human well-being, this forms the agenda for integrated catchment management (ICM).

In England, more than 15 years since enactment of the Water Framework Directive (WFD; CEC, 2000), there remains concern that less than 20% of rivers are judged to be in 'good health' in meeting the set objectives (BBC, 2015; Environment Agency, 2015). The WFD has been heralded as far-sighted, innovative, and a potential template for future environmental regulations (e.g. Voulvoulis *et al.*, 2017). However, the persistence of pollution and degraded ecology in many rivers and lakes, plus growing demand to mitigate worsening flood risk anticipated with climate change (EFRA, 2016), confirm that the challenges of ICM are both difficult and multi-dimensional. Hence, it can be argued that they are beyond the scope, remit and competency of any single agency or policy approach. Given its complexity and diverse legitimate stakeholder values, ICM can be characterised as a 'wicked problem' (Rittel and Webber, 1973) that exhibits both technical and societal uncertainty (Smith and Porter, 2010). This, and observation of successful ICM programmes, prompts assertion that analytic-deliberative, adaptive and collaborative strategies are required; i.e. those that engage partner agencies and stakeholders, and facilitate local deliberation of priorities and iterative actions, informed by evidence (Smith *et al.*, 2015). Within this context this paper focuses in particular on control of rural non-point source (diffuse) water pollution.

A combination of approaches well adapted to local conditions is needed to cost-effectively mitigate rural diffuse water pollution (Smith *et al.*, 2017). This includes

'baseline' regulation, advisory and education campaigns, economic incentives based on voluntary agreements and for exceptional cases direct land management strategies based on acquisition or prescribed change or restriction of use. Once such a policy framework is envisioned, adaptive strategies can follow. Building a collaborative approach based on partnership working between authorities, agencies and stakeholder representatives is an essential preliminary phase (USEPA, 2008; Smith *et al.*, 2015). Relevant to this collaborative, polycentric and adaptive management approach, this paper analyses and illustrates the role of intermediary actors.

Schemes characterisable as Payments for Ecosystems Services (PES) are relatively underdeveloped as a component of the policy mix as currently employed in England[1] and most other EU member states.[2] The cross-compliance and greening rules[3] of the Basic Payments Scheme (BPS) funded under the EU Common Agricultural Policy (CAP) do require measures for public, land, animal and environmental health, but only limited basic measures are specified to protect watercourses and groundwater against pollution, soil erosion and over abstraction. For such ICM objectives, payments offered in England by the 'Mid-Tier' of the Countryside Stewardship (CS) scheme[4] (funded under the rural development policy of the CAP) can incentivise measures to reduce water pollution through farmer selection of relevant management options and items eligible for capital grants.[5] However, the scope of measures and targeting for ICM are poorly developed to date (Smith *et al.*, 2017). First, because CS scheme regional priority statements[6] inadequately prioritise water quality protection as compared to landscape heritage and biodiversity conservation (Defra and The Rivers Trust, 2012). Second, because farmers have generally not considered the payments for water

[1] This paper primarily considers England rather than the UK because of increasing devolution of environmental policy and resulting differences in Scotland, Wales and N. Ireland (NB the UK referendum result of 23rd June 2016 prompts UK withdrawal from the EU).

[2] In contrast PES schemes in developing economies include those for forest environmental services, carbon sequestration, biodiversity, landscape protection and watershed services (Landell-Mills and Porras, 2002). These examples suggest both that PES can contribute to ICM and that catchments are appropriate units within which to link ES providers and beneficiaries, and develop markets for ES (Smith *et al.*, 2006).

[3] Since 2015, farmers with land above set thresholds have to meet 'greening' rules to receive a 'greening payment' of about 30% of their total BPS payment. There is little direct provision for water resources, although riparian buffer strips can qualify under a requirement for 'ecological focus areas' (RPA, 2016).

[4] Known as 'Environmental Stewardship' prior to January 2016.

[5] Although 'water quality grants' are only available in specified priority catchments (Smith *et al.*, 2017).

[6] As set out in regional statements of priorities (Gov.UK, 2016).

pollution mitigation measures sufficient to offset the income foregone, particularly for partial or full land parcel retirement[7] (Smith *et al.*, 2017).

Thus, subject to demand for ecosystem services (ES) and ability to pay, there is potential for greater use of PES for mitigation of rural diffuse water pollution and other ICM objectives. A very wide range[8] of candidate measures includes conversion of arable land to low input grassland or permanent woodland, in field and riparian buffer strips, artificial wetlands, winter cover crops, fencing of watercourses, ditch management, alleviation of soil compaction and temporary floodwater storage on farmland.

PES schemes need to align the interests of landowners and other groups in society that benefit from ecosystem service provision. They are based on voluntary transactions in which provision of a defined environmental (or ES), but most often a land use or management measure providing the service, is paid for by one or more ES buyer from one or more ES provider (adapted from Wunder, 2005). PES thus develops mechanisms to capture environmental externalities and develop market-based transactions to account for them. Such a voluntary 'provider is paid' mechanism can be complementary to, and synergistic with, 'polluter pays' (regulatory) and 'producer saves, (advice driven and voluntary) mechanisms (Smith *et al.*, 2017). For example, effective 'baseline' regulation facilitates identification of the 'additionality' of environmental improvement beyond expected 'good farming practice' that may merit PES payments, whilst advice provision can facilitate compliance with regulation and adoption of voluntary and incentivised measures.

Narrow definitions of PES concern periodic payments made to ES providers ideally matched to the opportunity cost of provision and conditional on delivery (Wunder, 2005; Engel *et al.*, 2008). However, few existing schemes match these conditions, and given the technical and operational demands aiming to do so may not make practical sense (Perrot-Maître, 2006). Many contemporary initiatives adopt a broader conception and scope (Salzman, 2009; Muradian *et al.*, 2010). For example, prior evidence-based determination of a causal relationship between land use practice and ecosystem enhancement is often lacking or uncertain, and few schemes demonstrate rigorous conditionality for payment based on monitored service delivery. In practice payments are often given for farm infrastructure improvements, and/or adoption of management practices, rather than for

[7] Typically, they have been able to qualify for the CS scheme by adopting lower opportunity cost measures for other environmental objectives (with marginal if any benefit to water protection).

[8] For example, Newell Price *et al.* (2011), provide an inventory of 83 diffuse pollution mitigation methods, ranging across change in land use, crop and livestock husbandry, field and farmyard infrastructure improvements, management of manures, and use of improved genetic resources in livestock.

Table 1. A typology of payments for ecosystem services schemes.

PES schemes can vary by:	Form taken:
Services provided	(1) One specific service **(2) Bundle of services**
Financing arrangements	(1) Payment to land managers administered by government with or without an intermediary and sourced from taxpayers (and/or development assistance in the case of less developed economies) (2) Payment to land managers administered by government with or without an intermediary and financed by beneficiaries of ecosystem services **(3) Payment to land managers by beneficiaries of ecosystem services usually via an intermediary**
Basis for payment and monitoring	(1) Output-based, payment by results **(2) Input-based, e.g. for a specified land use or management**

Source: The authors.

ecosystem service outputs, albeit based on some evidence that these will likely be produced. This broader and more flexible conception of PES is relevant to the challenges of ICM, and its acceptance is suggested by policy guidance and case studies published in England and elsewhere (e.g. URS-Scott Wilson, 2011; Smith *et al.*, 2013).

Typically, the form and provisions of a PES scheme vary according to what is being targeted (e.g. water quality, flood mitigation, carbon sequestration, habitat conservation) and the needs of stakeholders and beneficiaries. Table 1 summarises PES scheme terminology and variants. Of most relevance to this paper are input-based payments to land managers by beneficiaries via one or more intermediary for a bundle of ecosystem services; a combination in bold font in the table, and with reference to second column rows numbered as type 2–3–2. Schemes of this type are rare in Europe[9] (Perrot-Maître, 2006), as environmental pollution is usually controlled by a statutory agency. Similarly in the UK,[10] which has tended to rely on state agencies for monitoring and regulation of the water environment, whilst both Natural England and the Environment Agency (EA) have generally deferred from active establishment of PES schemes beyond the CS Scheme

[9] More examples occur in developing countries, although most commonly of type 2–1–2 (Table 1), with NGOs engaged in scheme design and as implementing intermediaries (Porras *et al.*, 2008).
[10] Also types 1–3–1 and 1–3–2 in Table 1.

(type 2–1–2). Hence, there are as yet few examples of mature type 2–3–2 schemes where specifically there is an intermediary acting between ES providers and buyers.[11] This begs the question: who is tasked with potential fulfilment of demand for ecosystem services from the private sector and civil society?

The importance of intermediaries to PES schemes is often mentioned but there are few published studies that go beyond theoretical considerations to detail their practice and functions, or evaluate their effectiveness (Huber-Stearns *et al.*, 2013; Pham *et al.*, 2010; Bosselmann and Lund, 2013). Also, most such studies are derived from examples in developing economies where scheme actors and operation may be affected by income, capacity and other developmental constraints and priorities. The contributions of this paper are a generic review and assessment of the intermediary functions needed for PES schemes (particularly those of type 2–3–2 in Table 1), and evaluation of a case study from southwest England against the resulting conceptual framework to identify necessary capabilities and characteristics for an effective intermediary organisation in this context. An evaluation of an innovative developed economy case can contribute to understanding of the emergence, form, functions and modalities of PES intermediaries, and of wider enabling factors in that context.

The methodology employed has comprised a literature review to synthesise lessons from existing examples and to form a conceptual framework for assessment of PES intermediary roles and functions. Evaluation of the case study in England was conducted through observation of the development and operation of the scheme over an extended period, including in-depth, semi-structured interviews with selected principals in the organisations involved. Employing a simple and small '*n*' form of stratified purposive sampling (Patton, 1990; Strauss and Corbin, 1998), respondents from four perspectives were interviewed: ES providers, intermediary, ES buyer, and relevant statutory agency personnel including observers, facilitators and regulators relevant to the scheme.[12] The remainder of the paper is structured as follows. Section 2 generically defines and conceptualises intermediaries and Sec. 3 identifies their specific roles and activities. Section 4

[11] Despite promotion by government (e.g. Dunn, 2011) the few contemporary examples that exist can be considered as 'work in progress'. Sixteen 'pilot' schemes were listed by the Ecosystems Knowledge Network, 2016. These included: water quality in the Fowey River in Cornwall, flood control and biodiversity and landscape enhancement for Kingston-upon-Hull, and harbour water quality for Poole Harbour in Dorset.

[12] Consisting respectively of: Six farm visits/interviews; repeated interviews (three occasions) with four intermediary personnel; repeated interviews (three occasions) with a senior manager from the ES buyer; and six interviews with statutory agency personnel.

describes the case study and Sec. 5 evaluates this and seeks to draw generalisable lessons and policy relevant conclusions.

Understanding Intermediaries

Arguably an intermediary is not an essential requirement for a PES scheme in so far as it could simply involve a one-to-one transaction between two actors; for example, an upstream landowner and a downstream water user. In reality, this is unlikely to be feasible in practical terms or at acceptable cost for the downstream buyer as the number of upstream land users to be transacted with increases. Typically, the ES buyer will lack the knowledge and capabilities to be able to transact cost effectively at scale. Thus, in simple terms PES intermediaries can be defined as those actors performing functions that facilitate transactions between buyers and providers of ecosystem services. Such definition focuses on the roles that intermediaries perform and does not limit the type, characteristics or scale of the organisation concerned. Public, private, civil society and research organisations, collaborative groups and individuals can all potentially act as PES intermediaries, and may span scales from the local to regional, national and even transnational (Huber-Stearns *et al.*, 2013).

A generalised conception of the role of an intermediary can be drawn from principal-agent theory (Jensen and Meckling, 1976; Arrow, 1991). Accordingly, purchases of ecosystem services can be understood as delegations of authority from principals to agents established by contracts and rewarded by payments. Adverse selection, the challenge for the principal of selecting an appropriate agent, and moral hazard, the challenge for the principal of assuring the conduct of an agent, both stem from asymmetries in information regarding agents and their behaviour, and create uncertainty for the outcomes of contracting. Solutions require monitoring and potential use of penalties (withdrawn incentives). An intermediary acts as an agent serving principals on both sides of the PES transaction to address both challenges (Guston, 2001). Success for the intermediary depends on the behaviour of the principals on either side, both of whom rely on the intermediary for information. The intermediary will satisfy both parties to a contract by reducing the uncertainty of their outcomes and by remaining stable and resilient in the face of conflicts between principals and/or external shocks. Given that the intended outcomes of a PES scheme will generally be public benefits in the form of enhanced environmental goods and ecosystem services (and often socio-economic goals such as poverty reduction in a developing economy context), it can be assumed that the successful intermediary will be acting in the public good.

Within the wider context of a polycentric approach to ICM, policy solutions can be expected to emerge when actors agree and cooperate under a set of institutions governing collaboration that can similarly be considered as forms of contract (Sabatier *et al.*, 2005; Benson *et al.*, 2013). According to institutional rational choice theories collective action agreements emerge from the interaction of utility-maximising individuals (or organisations) that seek to minimise their costs (Ostrom, 1999; Benson *et al.*, 2013), and an intermediary can facilitate such interaction and cost minimisation. Researchers can seek to show how observed patterns of actor behaviour, interaction and outcomes are determined by the characteristics and constraints of the action arena and its actors (Ostrom, 1990, 1999). Recognition and analysis of the roles and importance of PES intermediaries can thus be attempted with reference to at least two established theoretical frameworks.

It is useful to supplement this with perspectives drawn from the recent literature on 'boundary organisations'. Studies of how science-policy interfaces can be enhanced have been prompted by observations that specialisation of personnel within public administration, allied to separations between policy makers, researchers and local knowledge, limit interaction and collaboration. Attention focuses on the individuals, organisations and mechanisms that can facilitate communication and interaction across boundaries, and counter undue risk aversion by policy makers and managers when faced with uncertainty (Agrawala *et al.*, 2001; Guston, 2001; Boissin, 2009; Lidskog, 2014). Like a PES intermediary between two principals, a boundary organisation is expected to facilitate information flows and interaction, whilst remaining accountable to both research and policy actors (Boissin, 2009).

The concept of 'boundary work' is increasingly being used in a broader sense with reference to boundaries arising for research, policy and practice in environmental management. For example, Mollinga (2013), emphasises that there is no scarcity of boundaries to cross in addressing the complex systemic challenges of water resource protection and management; whilst Cash (2001), reports that boundary work was instrumental for initiating, continuing and mediating relationships between science and policy for agricultural extension work addressing aquifer management in the USA. Such boundary work incorporates three key elements: concepts, objects and the setting within which to employ them (Mollinga, 2013; Cash *et al.*, 2003; Crona and Parker, 2012).

The development of 'boundary concepts' facilitates a shared vision, concepts, ways of thinking and approaches. For example, 'sustainable development' and 'integrated water resources management' are concepts that have served to unite varied constituencies in common purpose, and boundary organisations use such

concepts to define and communicate a problem and its scale, to negotiate boundaries and to mediate information flows (Cash, 2001).

'Boundary objects' are devices and methods that enable assessment, planning and action despite continued uncertainty, complexities and conflicts (Star and Griesemer, 1989). Examples include conceptual models, computer models, visualisations, classification systems and other representations and decision support tools that enable varied actors to interact and coordinate despite continuing divergent perceptions, interests or values. A boundary object needs to be sufficiently intelligible, flexible, robust and concerning of mutual interests that all actors can accept it as a common reference point (Lidskog, 2014). The best will be 'portable' in so far that they may be used in different social settings and by varied stakeholders for development of policies and plans that are both scientific evidence-based and context-sensitive. This requires information, processes and outcomes that are salient, i.e. relevant, timely and accurate for each stakeholder, and legitimate, i.e. having broad-based acceptance (Cash *et al.*, 2003); noting that people are more likely to trust what they co-produce rather than what is delivered solely by experts. Portable boundary objects can thus influence how a problem is understood, resources made available for its management, and the solutions adopted (Lidskog, 2014).

The 'boundary setting' concerns the organisational and institutional arrangements that enable boundary concepts and objects to be employed. For example, development and facilitation of fora in which stakeholders can meet for knowledge exchange and joint assessment and planning activities. Another important task for a boundary organisation may then be facilitation of data access via a shared repository for primary research, public and partner organisation data sets, and collective outputs. Such data compilation enabling analyses not possible from any one data set is an example of the potential synergies achievable from collaboration.

Despite the richness as points of reference of the theory and concepts summarised here, what appears to be less well considered, at least specifically in the PES literature, is the role of an intermediary as a co-innovator and initiator of change. Also, how over the time the intermediary may adaptively evolve both the innovation it is co-responsible for and its delivery, in order to best achieve the changes and outcomes desired.

Roles for PES Intermediaries

Table 2 presents a synthesis of overarching roles, associated aims and key functions or activities for PES scheme intermediaries. Five overarching roles are identified: (A) scoping and scheme design, (B) scheme administration,

Table 2. Overarching roles, aims and activities for payments for ecosystem services intermediaries.

Roles	Associated aims	Key functions/activities (alone or in partnerships)
A. Scoping and scheme design	- environmental protection and conservation goals; - spatial targeting and coverage; - efficient or cost-effective budget allocation; - socio-economic development and poverty reduction in some locations.	1. stakeholder mapping; 2. activate stakeholder and partner consultation; 3. wider stakeholder and partner engagement and public awareness raising; 4. gather and analyse hydrological and other relevant data; 5. feasibility studies including identification and estimation of expected ecosystem service 'flows', and identification of measures required; 6. spatial planning and targeting, scenario modelling, technical appraisal and advice to scheme financiers (ES buyers); 7. draft scheme protocols including scope of transactions, budget allocation mechanisms, legal agreements and reporting/monitoring provisions; 8. if necessary, action to clarify or even establish property rights (e.g. land titles for smallholders or communities); 9. initial advice for ES providers; 10. facilitation of negotiations and resolution of conflicts and trade-offs; 11. design of programme standards and guidelines including payment mechanisms and contracts; 12. development of management plans and approaches for monitoring.

Table 2. (*Continued*)

Roles	Associated aims	Key functions/activities (alone or in partnerships)
B. Scheme administration	- deliver scheme objectives; - minimise transaction costs; - monitor and verify ES provision and reporting.	1. identify, recruit, organise and further advise ES providers; 2. pro-active assistance and support with scheme eligibility requirements and cost reduction; 3. support to ES providers to build the capacities needed for the interventions desired by ES buyers; 4. price setting, allocation of funds, contract administration and payments; 5. monitoring of ES provision (or required 'inputs') and enforcement of contracts; 6. negotiation of revised, replacement or new agreements; 7. maintaining communication; 8. building social capital and trust; 9. engagement and partnership working with other government agencies and civil society organisations; 10. continued data gathering, analysis and knowledge sharing; 11. exceptionally: acting as a 'wholesaler' of ES; 12. monitoring and evaluation of scheme outcomes and reporting.
C. Representation and mediation	- social equity; - scale for lower costs and impact; - dispute resolution; - wide scheme acceptance and support; - additional funding.	1. represent resource-poor ES providers; 2. promote inclusiveness and ES provider participation; 3. coordinate collective bargaining by ES providers; 4. assess seller compliance with regulation and agreements for ES buyers; 5. achieve scale-dependent advantages and coordinated impact; 6. public awareness raising and promotion of the scheme's worth to society; 7. leverage further and complementary sources of funding.

Table 2. (*Continued*)

Roles	Associated aims	Key functions/activities (alone or in partnerships)
D. Knowledge generation and exchange	- facilitate scheme operation; - reduce transaction costs; - influence policy.	1. generate and share information about and between ES providers and buyers; 2. local information hub; 3. public information dissemination; 4. demonstrating and communicating outcomes and practices; 5. feedback to policy cycle and wider ICM agenda; 6. lobbying of politicians and policy makers; 7. co-production of technologies and policy options.
E. Building social capital and trust	- facilitate scheme operation; - reduce transaction costs; - build local institutions.	1. build social capital: communications, networks, partnerships, knowledge exchange; 2. build trust between parties; 3. establish transparency and good governance; 4. maintaining broad-based acceptance that scheme operation and outcomes are fair and equitable.

Source: Synthesised from observation and from the literature on PES scheme intermediaries and other intermediaries and boundary organisations including Huber-Stearns *et al.* (2013); Porras *et al.* (2008); Asquith *et al.* (2008); Greiber (2009); Vatn (2010).

(C) representation and mediation, (D) knowledge generation and exchange, and (E) building social capital and trust; and from four to twelve functions for each role.

A PES scheme will establish transactions where none previously existed. Hence, the 'commodity to be traded', potential providers, potential buyers, details of the contract and the price must all be defined to set up the scheme and commence transactions.[13] The ability of the intermediary to act on behalf of the buyer(s) to find ES providers who are eligible, able and willing to participate is central. Capacities required may include technical capabilities for feasibility assessment and for spatial planning and targeting. In principle, the designers of a scheme should also seek to achieve budgetary allocative efficiency by matching payments to the opportunity cost of ES provision for each provider. This may prompt use of payment allocation mechanisms such as 'reverse auctions', although as noted below associated administrative complexity and transaction costs need to be managed. Hence, an intermediary's knowledge of the location, land use systems and farming population may substitute for this, and as noted above, payments in practice are often more simply determined. Further to this, in a wider context of ICM, and with the assumption that solutions can be best co-developed with local stakeholders, it becomes essential that diverse interest groups — for example, farmers, anglers, rural communities and local government — are engaged (Cook and Inman, 2012). As in other comparable public good and common property resource problems, the role of the intermediary is to facilitate and support technically the analytic-deliberative and adaptive process that may adopt a PES scheme as part of a package of solutions.

Continuing scheme administration will require the allocation of budget, making of payments, and oversight of contracts. For the latter, monitoring of agreed ES (or land use) provision and enforcement of contracts may pose challenges. Both internal scheme conditions and external influences will also change dynamically creating potential need to re-negotiate, implement and monitor revised or new agreements with ES providers. As noted with reference to theoretical frameworks above, a key aspect of both scheme design and operation is the need to minimise transaction costs. Considered generically, these are the costs incurred in defining, establishing, maintaining and transferring property rights (McCann *et al.*, 2005). Considered broadly, here they may include all the costs associated with scheme design, operation and associated activities (corresponding to the functions listed in Table 2), bar the actual payments for ES provision. Subject to bounded rationality,

[13] Exceptionally an intermediary could also act as a 'wholesaler', i.e. a purchaser of ES from providers and a seller to varied buyers (potentially pooling demand from local and international sources for single or bundled ES; NB: this will require capacity to accept significant financial risk).

if transaction costs exceed expected benefits, actors will not participate in the process. Conversely, where transaction costs are high, for example, because of asymmetries in information and a lack of trust between transacting parties, institutional rational choice theory predicts that partnerships provide the potential for lower cost solutions (Benson *et al.*, 2013). Intermediaries that facilitate both transactions between ES providers and buyers and wider partnership working, thus have a crucial financial role in relation to the aggregate costs of the management processes and delivery mechanisms of a scheme.

In a PES scheme, transaction costs will be influenced by the specificity of ecosystem services desired, the uncertainty of outcomes that ES buyers will accept, the frequency of transactions (Rørstad *et al.*, 2007), and intermediary and ES provider characteristics. ES specificity may affect costs for empirical verification of provision (and where necessary additionality). For example, verification that a parcel of land has been reforested should cost less than verification that a set of prescribed farming practices are adopted across the same area. Being willing to accept some uncertainty in such verification will also tend to reduce transaction costs for an intermediary and ES buyer, for example, by enabling use of a lower cost proxy measure or sampling strategy. Frequent transactions and automated payments may incur lower transaction costs per trade or unit of ES provision if standardisation of procedures and some economies of scale can be achieved (Kemkes *et al.*, 2010). A PES scheme for ICM objectives may require repeated transactions and hence familiarity between intermediary and ES providers may similarly reduce transaction costs. Gintis *et al.* (2003), also emphasise the 'self-policing force' and transaction cost reducing potential of mutually valued reciprocal relationships and trust, and that central to this is perception by land users that ES payments are a reward for a service valued by society rather than a 'bribe' to correct behaviour. The corresponding sense of worth may lower risk of moral hazard (breach of contract) and reduce costs of monitoring and enforcement. The ability of an intermediary to engage in partnerships again also becomes central as collaboration with 'competent authorities' responsible for regulation and environmental monitoring can reduce scheme costs. A locally well-established intermediary may also be able to reduce scheme development costs by 'piggy-backing' new PES agreements on existing engagement with land users (Bosselmann and Lund, 2013).

With regard to other ES provider characteristics, many PES transaction costs may be independent of land holding scale whereas the payment for the ecosystem service itself is likely to be positively associated with the area concerned (particularly for input-based payments). Also, as small holdings are often intensively farmed, land management changes may incur higher opportunity costs. Thus,

compared to larger farms smallholders may require more incentive per unit area of land to participate in a scheme, whilst total transaction costs will rise with the number of holdings; more so if costs of verification of agreement compliance or ES provision are high. Thus, ES buyers and/or their intermediary may have incentive to focus a limited budget on low cost ES providers and exclude others. For example, by introducing scheme eligibility requirements that may disfavour smallholders such as minimum areas or formal land titles. Such scenarios challenge an intermediary if scheme objectives require high participation rates to achieve desired targeting and spatial coverage, or to meet social equity and development goals. An intermediary may then need to be pro-active in scheme design and operation to overcome barriers to participation and to reduce transaction costs per holding. This may require, for example, capacity to contract at multiple farm scales, design of interventions that sustain income generation from contracted areas, and substitution of other forms of security for formal land titles (Bosselmann and Lund, 2013). Such abilities will again be enhanced by in-depth knowledge of local conditions and trust between intermediary and ES providers.

Representation and mediation fall under scheme administration but merit detailed consideration. As noted above, PES scheme intermediaries serve as agents accountable to the interests of both ES providers and buyers. Often graced with the term 'honest broker' (also 'ethical broker'), the term makes a (positive) normative assumption about their operation.[14] Thus, in a developing country context in particular (though not exclusively) the intermediary may seek to actively represent the interests of disadvantaged and resource-poor ES providers in scheme development (Corbera and Brown, 2008; Pham *et al.*, 2010; Grieg-Gran *et al.*, 2005), and during operation support them (morally, legally and financially) in holding ES buyers to fulfil payment for services delivered. If there is potential for a PES buyer to exercise monopsony power then an intermediary could also help coordinate collective bargaining by ES providers to counter this (Smith, 2013).

An intermediary that achieves desired ES provider participation rates also serves ES buyers if scale-dependent cost advantages (Cash, 2001) and outcomes are gained. Coordinated participation by ES providers may be needed for the scheme to gain critical mass, and in most cases land management changes that are coherently targeted will achieve greater impact for water resource protection, or other environmental goals, than those that are scattered and *ad hoc*[15]

[14] The Compact Oxford Dictionary definition is: 'n. a mediator in international, industrial, etc. disputes', implying need for the role in response to an existing problem (Oxford Dictionaries, n.d.).
[15] Similar concerns arise in relation to the need to develop coherent environmental 'corridors' to conserve biodiversity and avoid scattered 'conservation sprawl'.

(Smith, 2013). An intermediary (preferable working in partnership with statutory agencies) also represents the interests of ES buyers by assessing compliance by ES providers with existing regulation so as to achieve 'additionality' in response to scheme payments, and with the terms of the PES agreement. This can mitigate concerns that payments may 'reward polluters' compared to land users already applying good practice, and reassure an ES buyer of value for money gained. Monitoring and regulation are difficult and costly in rural areas and regular engagement with farmers by a trusted intermediary can substitute (to a given extent) and be cost effective (Smith *et al.*, 2017). Finally, an intermediary may engage in representing the worth of a scheme to a wider public and to policy makers.

With regard to knowledge generation and exchange, it was noted above that information is central to problems of adverse selection and moral hazard, and hence to transaction costs and efficiency of outcomes. An intermediary must marshal information between ES providers, who may signal high opportunity costs to negotiate a higher price, and ES buyers who signal a low willingness to pay or seek to exert monopsony power. Information rents arising can be reduced by sharing information about both parties and through mechanisms such as auctions. Provision of interpreted information to ES providers and buyers reduces their exposure to risks and transaction costs, and develops the trust and local institutions needed for scheme development (Pham *et al.*, 2010). Poor access to information will adversely affect ES provider recruitment in particular, and an intermediary will likely serve as an important local information hub (Bosselmann and Lund, 2013). It may also exert influence to enhance the enabling political and policy environment for scheme development and operation. Boundary concepts and objects may be employed to assist all concerned actors to be able to differentiate normative opinions from fact and to clarify the scope, scale and severity of a problem and the merits of alternative solutions. Once more the intermediary role will clearly be enhanced by knowledge of local conditions and by experience of similar activities.

The 'social capital framework' asserts that trust, norms of reciprocity and horizontal networks can reinforce each other and together foster cooperation between stakeholders including officials (Sabatier *et al.*, 2005). An effective intermediary must build and hold the trust of all actors, defined in terms of confidence that people or organisations will keep their promises, treat others fairly, and show concern for others' welfare (Sabatier *et al.*, 2005). The functions and performance of a PES intermediary can be enhanced by social capital (Pham *et al.*, 2010; Perrot-Maître, 2006), and indeed, adoption of PES as an approach is more likely where civil society organisations and their associated social capital pre-exist and can facilitate trust between ES providers and buyers (Adhikari and Agrawal,

2013). However, PES intermediaries have also been criticised in some cases for their share of the costs of a scheme, contributing to distrust between ES providers, intermediaries and buyers, and hence they should seek to establish transparency over both their role and the benefits the scheme is generating for ES providers and buyers (Landell-Mills and Porras, 2002).

In conclusion, Table 2 provides a challenging list for any single agency, though as noted it is expected that an intermediary should be able to address many of these roles in partnership with other private, public and civil society actors, including ES buyers and other organisations representing ES providers. All of this requires conscious design and iterative implementation of arrangements and procedures. Complexity and locational specificity denies application of a 'one size fits all' template and PES implementation must be painstakingly constructed from experience elsewhere, the requirements of the PES buyer(s) and knowledge of local needs, conditions and actors. Intermediaries have critical roles to play in PES schemes and these must be well understood prior to developing a programme, preferably so as to align with and build from existing organisational capacities and a more or less enabling institutional and policy environment, and supporting actor landscape. Another uncertainty is the difficult question of who regulates the 'field' of the intermediary and the criteria to be used for selection of such an agency by a public or private scheme financier. A diversity of organisations, governmental and non-governmental, have facilitated development and operation of PES schemes (Porras *et al.*, 2008), but Trust Funds and local and international NGOs are observed to be the most common forms of intermediary. The private sector has not generally provided the intermediary function, though Davis *et al.* (2015), cite exceptions from northwest Montana, USA.

Further concerns in the literature relate to the quality of an intermediary's work including the extent of genuine and effective stakeholder engagement and participation, and political influences on their activities and hence neutral status (Pham *et al.*, 2010; Landell-Mills and Porras, 2002). This emphasises a need for economic and political neutrality and independence. There may also be dangers of local capture by elites or interest groups. This could extend to inclusion of only a sub-set of land users when 'piggy-backing' PES development on pre-existing activities. The original purpose for which a local institution was established together with the local polical economy may condition its portfolio of activities and networks, and therefore influence targeting of PES. Thus, choice of a local intermediary on grounds of cost efficiency could reinforce existing inequalities in access to resources rather than promote general inclusiveness (Bosselmann and Lund, 2013).

A Developed Economy Case Study: The Upstream Thinking Project in Southwest England

As noted above, the majority of PES intermediary case studies in the literature draw from developing economy examples. This section describes an innovative example from a developed economy that has had long standing policies for agri-environmental objectives. In this summary (and in the following concluding section), identifiable overarching roles and key functions performed by the case study intermediary are cross-referenced (with reference to the numbering in the table) to the generic categorisation provided in Table 2.

In southwest England intensive livestock and dairy farms can be a major source of diffuse water pollution in rural areas; the main pollutants being sediment, nutrients and faecal organisms. Developed to protect and improve raw water resources at source, the 'UpStream Thinking' project (UST) aims to use improved farm infrastructure and land management practices to enhance raw water quality and manage water flows before they reach water treatment works and supply to water users (Upstream Thinking, n.d.). The project was co-developed by a private water supply company, South West Water (SWW), and an environmental charity, the Westcountry Rivers Trust (WRT)[16] (Table 2, Role A, functions 1–12); an example of an intermediary acting as a co-innovator and initiator of change.

Until recently, the water industry in the UK has tended to rely solely on costly water treatment solutions to treat poor quality raw water. It is now well-recognised, however, that land use measures can help manage surface run-off and mitigate water pollution, and thus reduce the treatment costs required to meet safe drinking water standards. Reduced treatment implies reduced use of chemicals and energy, and reduced emissions. The associated reduction in costs could also help to limit future increases in water bills for water consumers. As part of integrated catchment management, measures taken may also enhance adaptation to climate change and the resilience of regional water resource management in terms of managing drought and flood risk (examples of public goods). In assessing its economic benefits, SWW predicted that UST could delay or even avoid the need for investment to upgrade water treatment works. This provided sufficient incentive for SWW to invest in the project but additional benefits potentially extend beyond regulatory compliance with drinking water standards and include

[16] WRT (Charity no. 1135007, Company no. 06545646) was established in 1995 with the aim of securing the preservation, protection, development and improvement of the rivers, streams, watercourses and water impoundments in the Westcountry and to advance the education of the public in the management of water (The Rivers Trust, 2017a).

improving habitat and biodiversity, contributing to EU Water Framework Directive compliance, improving carbon sequestration and at least partially mitigating flood risk (further public goods).

The project represents genuine innovation by the privatised water industry in partnership with an environmental charity. Such innovation first required the prevailing policy environment to become more enabling (of great importance as noted above). This occurred through a departure from strict economic regulation by the government's industry regulating body,[17] which from 2010 for the first time allowed capital investment by a water company on third-party land. UST has since achieved national recognition as a model to be potentially replicated and has gained several industry awards (Smith, 2013). In co-developing the project, SWW recognised the economic, ecological and regulatory benefit of improved raw water quality and was prepared to invest in provision of ecosystem services within the water catchments from which it abstracts, whilst WRT proactively engaged with SWW to develop an approach and fungible project (Table 2, Role A, functions 1–12). As an environmental charity with more than 15 years of experience working in the region, WRT could offer itself as an intermediary for the development and operationalisation of PES based on its knowledge of the catchment-wide actions that could be provided by farmers to improve water quality and of the farms and farmers located there (an example of the potential benefits of an intermediary's in-depth knowledge of local conditions as considered above).

In the scheme payments to farmers are based on action through investment in improved farm infrastructure and agricultural practice. Longevity of agreements and commitment by farmers are ensured through a 10 or 25 year contract (based on the economic life of farm infrastructure improvements) and attached restrictive covenants that specify conditions for improved farm infrastructure usage and specific land management practices (Table 2, Role A, function 7). There can be no guarantee under current legal provisions (Smith *et al.*, 2012) that environmental goods can be delivered permanently on small private farms, but SWW is enabled under the current regulatory regime to undertake investment appraisal over a 30 year horizon including a commitment to sustaining farming families. Farm infrastructure investments are co-financed by SWW and the farmer, usually on a 50/50 basis. Transaction costs are significant as each farm agreement is unique and time consuming to prepare (Table 2, Role A, functions 7, 10, 11). WRT also provides technical assistance with infrastructure improvement design and local

[17] The regulator is known as "Ofwat" or the Water Services Regulation Authority and is a non-ministerial government department established in 1989 when the water and sewerage industry in England and Wales was privatised.

planning applications as required (Table 2, Role A, function 9; Role B, functions 2 and 3).

WRT's strategy for the project depends upon a collaborative approach which sees landowners informed and assisted in the protection of river catchments as part of an integrated approach to good land management. Tailored one-to-one advice and farm plans that focus on both the environment and the objectives of the farm business are supported by the SWW financed capital grant scheme. These elements of the project delivered by WRT represent an investment of approximately GBP 2.75 million over five years across four target catchments in South West England.[18] There are also parallel initiatives funded by SWW and delivered with other partners that focus on the restoration of wetted peat moorlands in upland areas of the catchments concerned and restoration of floodplain wetlands. As an intermediary WRT seeks to 'mix and match' funding sources to achieve its mission (Table 2, Role C, function 7). Hence for example, the clean water objectives of UST can be complemented by biodiversity objectives achieved through supporting farmers in their access to the national CS scheme for measures that, for example, benefit bird habitats.

WRT's active public dissemination,[19] communications to policy makers, and application of the 'Ecosystem Approach' (CBD, 2016) and a PES paradigm which places it as an 'ethical broker' between water company (and its customers) and farmers, provide examples of boundary concepts in practice (Table 2, Role A, functions 2 and 3; Role B, functions 1, 7–10; Role C, functions 2 and 6; Role D, functions 1, 3–6; Role E, functions 1, 3 and 4). A particular exemplar is provided in Fig. 1. This graphic depicts to the right of the river as viewed, a farmed landscape improved by adoption of best practice measures funded at least in part by PES schemes to produce food and other multiple ecosystem services, in sharp contrast to the unimproved conditions depicted to the left of the river. This 'good versus bad farm' image has become nationally well known in the relevant professional and policy communities and emblematic for the work of the rivers trusts movement (Table 2, Role C, function 6).

As examples of boundary objects, modelling and GIS-based tools are used to identify and target problem areas, for example, for soil loss and diffuse pollution, and areas most beneficial for ecological restoration (Table 2, Role A, functions 4–6).

[18] The Upper Tamar, Roadford Reservoir, Upper Fowey and Wimbleball. WRT was also instrumental in securing funds from both EU and UK sources to fund the WATER project, aimed at developing PES potential and guidance (WATER, 2015).

[19] In partnership with The Rivers Trust, a national 'umbrella' body for the UK's rivers trust movement.

Source: Westcountry Rivers Trust.

Fig. 1. 'Good farm versus bad farm', a depiction of feasible change and ecosystem service provision in a farmed landscape.

Holistic assessment and planning are used with the aim to ensure multiple benefits for stakeholders and the regional economy (Table 2, Role C, function 5). Planning is approached spatially, through the adoption of 'aspirational maps,' that display a range of land uses and land management scenarios. These might focus on water quality (for habitat and consumption purposes), on habitat conservation and enhancement, on carbon sequestration, or on recreation. Mapping involves the utilisation of environmental information in 'intelligent catchment design' using weighted GIS overlays (Cook *et al.*, 2014), comprising a clean and fresh water ecological layer, a clean and fresh drinking water layer, water regulation for flooding, water regulation for drought, a climate layer (greenhouse gas regulation and air quality) recreation and tourism and provision of habitat. Such spatial modelling indicates that approximately 6% of the catchment area comprises 'hotspots' where land use in intensive agriculture conflicts to the greatest extent with conservation. Instrumental measures may be targeted at wetlands and land in intensive grazing, at limiting flooding, attenuation of sedimentation, reduction of diffuse pollution, reduction of pathogen loading, improving carbon storage capacity, improving low biodiversity and increasing habitat provision (Table 2, Role A, function 5). The mix of approaches includes assisting farms to meet

regulatory requirements, benefit from time and cost-saving 'win-wins', and gain PES incentives in the form of capital grants for farm infrastructure improvements from the UST project, or when other funding won from the EU, UK government, other foundations or private sector permits (Table 2, Role A, function 9; Role B, functions 1 and 3; Role C, functions 2 and 5).

Examples of boundary work in reconciling the needs and priorities of the science, policy and practitioner communities are also provided by the UST example. For scheme design, this was addressed through a series of stakeholder meetings involving farmers, SWW and WRT as intermediary, supported by academic researchers (Table 2, Role A, functions 3 and 10; Role B, functions 1, 7–9; Role E, function 1). These meetings provided opportunities to identify knowledge gaps and uncertainties, recognise technical, policy and practical constraints, and collaboratively develop solutions and further research priorities. Facilitated deliberation and collaboration among stakeholders allowed decision makers to integrate science with local knowledge and benefit from processes of social learning (Table 2, Role D, function 7). For a wider public including SWW's customers and regional and national policy makers, both WRT and SWW have invested in communications and outreach activities through workshops with stakeholders, presentations at conferences and other fora, public outreach and a range of web-based and other communication media (Table 2, Role A, function 3; Role C, function 6; Role D, functions 3 to 6; Role E, functions 1 and 3).

Case Study Evaluation

The UST project provides an example of a PES scheme co-developed by a private water company and an environmental charity. SWW could translate the regulatory, economic and ecological benefits of improved raw water quality into assets for the company balance sheet, a modest increase in water customer bills and investment in ES provision. WRT had knowledge of the measures that could be taken by farmers to improve water quality, technical capabilities for catchment-scale assessment, planning and farm advice delivery, and trusted acceptance as an intermediary based on working relationships with the farming community established over 20 years (Table 2, Roles A, B and E). Despite the significant transaction costs of scheme operation and the costs of on-farm measures shared with farmers, the project is proving to be a cost-effective means for SWW to protect its raw water resources (CaBA, 2016). A benefit-cost ratio of 65:1 has been calculated for the project based on the benefits of deferred investment in water treatment plant upgrades alone (Smith, 2013). In addition, the scheme is expected to deliver savings in the operational expenditure of existing water treatment plants

(SWW, 2016). These financial benefits for South West Water and its customers could not be achieved without the intermediary functions performed by WRT,[20] (Ross, 2012, personal communication).

The vision of the scheme extends, however, beyond financial returns alone. The following summarises the views of Bright[21] (personal communication, 2012) who characterised PES as exemplified by the UST project as:

(i) 'Bioregional planning', a holistic approach to catchment management underpinned by sound economics;
(ii) community conservation, employing local leadership and support to achieve 'win-win' situations;
(iii) payment via a market mechanism, significant funding for ES provision from the beneficiaries of environmental gain (e.g. water consumers);
(iv) working to engage the public, through conservation and resource protection based in 'enlightened self-interest' such that stakeholders are incentivised and not just regulated.

As PES scheme development is to date very limited in the UK, with virtually no mature examples available for analysis of actor roles, the UST and work of WRT provide a valuable exception. While organisations from any sector can potentially perform the intermediary functions identified (Section: "Roles for PES intermediaries" above, and Table 2), the need for trust in and acceptance by both ES providers and buyers, for wider public and policy maker acceptance, and for independence and flexibility makes a case for the virtues of the value driven, not-for-profit and politically neutral voluntary sector (Couldrick,[22] 2012 personal communication). It can thus be argued that the UK's environmental charitable sector is potentially well 'equipped' for the PES intermediary role. This is reinforced by regulation by the Charity Commission[23] that ensures that a charity's foundation and operation are reported, accountable and for public benefit.[24] Charities are generally trusted by the public, seen as performing important roles and effective in bringing about change, and trusted to work independently (Ipsos MORI, 2014). Conservation voluntarism in the UK has a long tradition and we

[20] Mr. Martin Ross, former Environmental Manager, SWW and interview respondent.
[21] Dr. Dylan Bright (1972–2016), CEO of WRT (2008–2013), co-originator of the UST project and interview respondent.
[22] Dr. Laurence Couldrick, CEO of WRT, interview respondent.
[23] For England and Wales.
[24] A charity's purpose "must be beneficial" (and any detriment or harm that results from the purpose must not outweigh the benefit) and "benefit the public in general, or a sufficient section of the public" (Charity Commission, 2016).

observe that it is expanding in scope and functionality from advocacy and its own actions into partnership working and acceptance of delegated responsibilities within decentralised and polycentric governance. Participation of Rivers Trusts and other environmental charities in the national Catchment-Based Approach (Defra, 2013) provides a leading example of this. However, we also observe that formal status, mechanisms for local and higher accountability and relationships between conservation NGOs, elected bodies and designated 'competent authorities' can remain unclear. Gaps and uncertainties in financing, and competition in labour markets with agencies and private sector, are also issues that may affect continuity of delivery (Cook and Inman, 2012).

As a functional example, we observe that the Rivers Trusts movement draws inspiration and purpose from both the national conservation ethos and regulatory provision for charities. Its adoption of the Ecosystems Approach is well matched with a strong ethic for holistic and inclusive catchment management, while its *modus operandi* is to seek multiple funding sources, partnerships and to fully engage with stakeholders (The Rivers Trust, 2017b). Government approval and encouragement is increasingly signalled in England, again not least via the leading role played by Rivers Trusts (and other environmental NGOs) in the hosting and development of Catchment Partnerships as part of the national Catchment-Based Approach (Defra, 2013).

We also observe that identifiable strengths in the UST case to date include: trust building through the employment of an intermediary organisation that is locally based and sympathetic to goals of local farm businesses; the development of a long-term participatory process to identify alternative water protection measures and a mutually acceptable set of incentives; and the ability to design and deliver incentives well-matched to land tenure and farm debt cycle issues. The WRT has been working in the region for 20 years and has the local knowledge and expertise necessary for this coordination and targeting, whilst its farm advisors have built up a high degree of trust and acceptance amongst the farming community (Westcountry Rivers Trust, 2017). We conclude that this trust and associated social capital has proved essential for the development and implementation of UST and in reducing the transaction costs of project implementation.

We acknowledge, however, that charities have to be self-promoting to function and arguably with this an element of self-criticism may be lost. As for other organisations their role as intermediaries will be conditioned by their values, and their original founding purpose and mission could influence their targeting approach, or bias them against alternatives. Hence, independent evaluation and the presence of statutory agencies including Ofwat and the national EA are important. Another potential weakness is that as small and independent NGOs their funding is

usually project-based, tending to suffer from 'boom and bust delivery' and so making it difficult to sustain delivery of all desired plans and activities (Couldrick, personal communication, 2016). In this context, UST is something of a 'double-edged sword' for WRT. Its financing enables them to pursue their mission through innovative and effective means, but WRT remains wary of becoming beholden to SWW as paymaster rather than partner, as the scale of the UST project has grown in relation to the charity's other financing and activities (Couldrick, personal communication, 2016). In England and Wales, we observe that a private water company is a prime consumer of ecosystem services, but through abstraction and wastewater discharges can also negatively impact the environment. This raises the question of whether the PES scheme partnership and funding arrangements can marginalise the water company's ability to be held to account *by that intermediary*. In this example, WRT reduce this risk by building consensus rather than exposure and lobbying, and by ensuring no one funder accounts for more than 50% of their active delivery activities (Couldrick, 2016, personal communication).

Final Conclusions

In generic terms, although management of transaction costs is central (Section: 'Roles for PES Intermediaries' above, and Table 2), intermediary performance should also be evaluated in the context of broader factors including the difficulty of the situation, multiple and possibly conflicting scheme goals, political and policy influence and the existing institutional and actor landscape (Bosselmann and Lund, 2013; Huber-Stearns *et al.*, 2013). It is important to consider the locations in which the organisation operates, the purpose for which it was established, the networks of farmers and other land users affiliated with the organisation, and pre-existing operations which may enable cost savings through overlay of a PES approach. Such factors should be identified and considered when a PES intermediary role is outsourced to an organisation (Bosselmann and Lund, 2013).

Multiple objectives are particularly challenging. The potential trade-off between efficiency of budget allocation and other objectives such as inclusion of the rural poor and poverty alleviation is highlighted in the literature (e.g. Mayrand and Paquin, 2004; Corbera and Brown, 2008). A successful intermediary must develop ways to mitigate this trade-off and secure desired environmental outcomes at affordable cost (Vatn, 2010; Bosselmann and Lund, 2013). In UK, priority may be given to environmental objectives, and for UST specifically to raw water quality, although WRT is committed to providing other environmental services whilst also sustaining the rural economy and local farming communities (The Rivers Trust, 2017a). High farmer participation rates in target areas are also necessary to reduce

risks of water contamination to acceptable levels commensurate with SWWs capabilities for monitoring, rapid response water treatment and if necessary water blending from different sources (Ross, 2012, personal communication).

As considered in the introduction to this paper, a PES scheme for water resources protection will be best established as part of a hierarchy of complementary policy approaches and as part of a holistic and adaptive approach to ICM. Collective action is thus required in the form of polycentric and multi-level collaborations between organisations (Smith *et al.*, 2015). Key factors to achieve this are a permissive and enabling policy and regulatory environment with delegation of authority for action from higher levels of government to regionally and locally based authorities and organisations (Smith *et al.*, 2015). From our synthesis of observation and lessons from the literature (Table 2), we conclude that a key role is also played by intermediaries or boundary organisations in achieving the necessary "vertical" integration and "horizontal" coordination of authorities and actions. In UST horizontal coordination is provided by the WRT and vertical integration is achieved by the assumption of responsibility for action to protect water quality in the environment beyond its own property boundaries by SWW, working in partnership with, and with the regulatory approval and support of Ofwat and the EA. We observe that in the relevant literature such governance arrangements are rarely adequately identified, or analysed in terms of the required institutions and reciprocity of actions and agreement for their functionality. Within the river catchments of southwest England, and particularly in the Tamar system which is heavily exploited by SWW for water supply, we conclude that WRT's operation as a PES intermediary has so far maintained neutrality, independence, flexibility and cost-effective capability for delivery of water quality focused PES and other ICM interventions. It can be concluded that WRT's organisational form, legal status and capabilities have enabled it to match the characteristics and functions required of an intermediary in this context. Indeed, it is noteworthy that its operation has been cited as an exemplar of 'good practice' in terms of non-hierarchical, inclusive governance (Inman, 2005; House of Lords, 2012).

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