Reviewing current understanding of catchment partnerships

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Executive summary

Catchment partnership working has long been seen as a key means to enable and improve water management. Recently, it has been seen as a key approach to delivering policies such as the European Water Framework Directive (WFD) and Floods Directive (FD). However, there are unresolved questions about whether this approach is always appropriate, and how best to plan and enable it. We therefore aim to carry out research that will explore whether and how working in catchment partnerships can help integrate or coordinate these different policy goals.

This briefing reviews the accumulating body of knowledge on why, when and how to enable catchment partnerships. We focus on those partnerships aiming to deliver more than one type objective, through the voluntary collaboration of multiple actors, which are often third sector but may also include public sector and private sector partners. There are limits in how far challenges of water quality and quantity can be addressed by statutory agencies alone: such partnerships offer a chance to identify and tackle the sources of problems. In England, this thinking has recently been reflected in formal policy support for catchment-based working in England.

Much existing understanding about how to implement and enable these partnerships builds on principles for collaboration. However, there are still questions about exactly when it is worthwhile to investment in these partnerships, linked to questions when and how to organise work at different levels. These reflect current questions in environmental governance, about the interplay of different interests across and between levels. Our research focus is therefore on the governance processes – i.e. decision-making – within catchment partnerships themselves, and within wider governance hierarchies or networks.

This briefing also scopes the diversity of catchment partnerships that currently exist in the UK, whose activities may offer useful insights for future work to develop or support catchment partnerships. These partnerships are often strongly focused on achieving different water quality and ecological objectives, but support flood risk management is becoming increasingly common. The knowledge compiled in this briefing will be used to plan the next steps of work, leading to new empirical study of catchment partnerships, with interim results due in March 2020, and discussions about implications by March 2021.

Acknowledgments

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Reviewing current understanding of catchment partnerships

Contents

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Reviewing current understanding of catchment partnerships

Background to this briefing

This briefing is the first output in a 2-year project to consider how and when catchment partnerships may enable multiple objectives for water management to be achieved. It briefly summarises what is already known about catchment partnership working, and considers some of the relevant theoretical frameworks that can be used to understand analyse them.

This project responds to interest from Scottish policy stakeholders in learning more about about when and how we can integrate different objectives for flood risk management and water quality. Beyond the water sector there is also an interest in understand if and how different goals for natural resource management can be reconciled. We build on our earlier work to examine examples and ideas for how to integrate different policy goals [49]. Both this work and other sources highlight that working at the catchment scale is often expected to help navigate this and other challenges for water management [e.g. 2; 18].

Introducing catchment partnerships

How do we define catchment partnerships?

Improving water management is often thought to depend on building collaborative partnerships to manage catchments (also called watersheds). Examples of catchment partnerships come from across the world, ranging from Australia [notably the Murray Darling Basin, 24] to Europe [such as the Danube, 22] and the USA [such as the watershed partnerships in Ohio, 25].

For the purposes of this research, we define catchment partnerships as;

- located within a biophysical freshwater (sub)catchment,
- involving multiple partners,
- working for multiple objectives including improvements to water quality & quantity.

Previous scholars have usefully identified different typologies of partnerships or collaborations [13; 39]. Partnerships vary in their duration, the degree of central steering by a statutory body, and the degree to which partnerships are formalised. Different types are associated with different contexts – e.g. Europe versus the US – and may be associated with different histories and outcomes [2]. We encompass partnerships that are both formally and informally constituted, in order to learn as much as possible about the implications of different collaborative arrangements.

Our definition excludes relatively short-duration closed-ended initiatives, which have limited potential to build new relationships and (re)consider challenges. We also exclude initiatives where most activity is carried out by lead statutory agency that only consults others, or only seeks to engage and persuade actors such as land-managers to carry out the agency's pre-existing objectives. We note however, that the boundaries of 'what counts' for inclusion are not always clear, especially when working with partial information.

As such, literature and principles on catchment-scale working, collaboration, and governing multiple objectives are all relevant to understanding catchment partnerships. There is also a vibrant empirical literature exploring experiences of collaborative catchment management in practice.

We note here that a focus on catchment partnerships is closely related but not necessarily exactly the same as a focus on Integrated Catchment Management (ICM) or Integrated Water Resources

Management (IWRM). These terms are used in a variety of ways, but usually emphasise the need to organise management based on natural hydrological system boundaries, and to address water management systemically rather than focusing on single issues or focusing on single parts of the water cycle. Often it is associated with considering and managing for more than one goal – i.e. for both quality and quantity, and also potentially the human dimensions that affect how water is managed. This approach aligns with our definition above (catchment scale, multiple objectives) but ICM and IWRM studies do not necessarily focus on the governance arrangements by which catchments are to be managed. As such, single agency projects attempting to manage the catchment system, can be labelled as IWRM, and indeed some understandings of IWRM have been critiqued for being technocratic [28]. Our focus on partnership draws attention to the governance arrangements by which these objectives might be delivered.

Why focus on catchment partnerships: what might they achieve?

Catchment partnerships have often evolved from a focus on specific aspects of water ecology, such as managing fish populations, to encompass several environmental and societal goals. This has reflected a general trend to move away from 'command-and-control' management of natural resource problems [13], often accompanied by a recognition that actors who have a stake in a problem must work together to tackle it, and that different goals are interconnected: for example, management for water quality and can affect water quantity and vice versa.

As such, partnerships may involve stakeholders from different domains (e.g. fisheries, tourism, land management) and also actors with different social roles and mandates (private, public and third or charitable sectors). They work together to develop and then implement plans that addressed shared needs and concerns. In some catchments, different stakeholders may have a history of dispute and conflict [as in the Danube, 37] and but skilled mediation has over time brought them together to plan and to manage the river. In other circumstances conflict may be less overt, but the complexity of problems may require the involvement of multiple actors and interests to build understanding and agree actions.

Overall, expectations for catchment partnerships can be high – various sources allude to them being capable of achieving more effective, efficient, sustainable, and/or participatory outcomes [e.g. 8; 17; 38]. Where national level policy specifies goals for water – such as in Europe, where the Water Framework Directive has been very influential [7] – these partnerships may additionally be expected to reconcile 'bottom-up' (local stakeholder based) objectives with top-down (statutory) objectives for catchment management. The hope that catchment working may help to connect and deliver different goals means it is also relevant wherever there is a desire for more holistic or joined-up approaches to water management. There is a desire to coordinate or integrate the delivery of top-down policies, such as the WFD and FD in Europe, and it is sometimes hoped that catchment partnerships can assist with this [18; 20; 47].

In practice many different goals and outcomes may be in tension with each other [3], and it is unclear the extent to which they can really be assimilated and reconciled by catchment partnerships. Therefore claims and assumptions about catchment partnerships must be appraised critically and checked empirically [2]. In the words of Molle [32] *"How interconnected and nested waterscapes can be managed by discontinuous nested political/administrative and social levels remains a fundamental question fuelling an endless search for elusive governance systems that would unite nature and society."* Catchment partnerships cannot offer a panacea to all of the

challenges facing contemporary water management: accepting this, the question is in what circumstances it might be worthwhile to focus on these, and how best to enable or support them.

Drivers for catchment partnerships

Catchment partnerships have tended to arise from the high expectations for what they can achieve, coupled with recognition of the limitations of pre-existing less collaborative ways of managing water. Partnership leaders and members have tended to be predominantly from the third sector, who voluntarily organised the partnerships in order to achieve new and additional goals over and above what statutory policy-led processes were delivering.

In England, since 2011, there has been explicit public sector support for catchment partnerships - the Catchment Based Approach (see Text box 1). This funding has been available to existing and new partnerships in England (and in catchments spanning the Welsh-English border) to collaborate to improve water management, with the aim of supporting delivery of the WFD. It is believed that the scheme has enabled partnerships to develop in parts of the country where previously there were none.

In other parts of the UK there is no scheme exactly comparable to CaBA, though there is interest in tackling challenges through catchment based or decentralised approaches. In Scotland Area Advisory Groups were set up by the Scottish Environment Protection Agency (SEPA) in the first cycle of planning under the WFD [5]. Since 2009 Local Advisory Groups have been set up across 14 planning districts to advise on Local Flood Risk Management Plans [40]. Both of these are policy-led statutory processes, and rarely map directly onto catchment management partnerships.

Text box 1 Details of England's 'Catchment Based Approach'

The 'Catchment Based Approach' (CaBA), was a scheme first piloted in 2011, and then extended in 2013. These partnerships are led by host organisations, often from the third sector, with the aim of promoting integrated water management. Funding to enable these partnerships is administered by the Environment Agency on behalf of Defra: in exchange the partnerships are expected to help deliver RBMP objectives [10], foster collaboration and "*deliver multiple benefits*" [11]. Each partnership receives relatively little money, typically £15,000 in a year, to fund collaboration and planning rather than implementation of actions.

CaBA partnerships are encouraged to produce a catchment plan and follow certain codes of practice [27] but have relatively little input from government agencies, and relative freedom to develop collaborations according to local circumstances [43]. Over 100 partnerships are now funded, with hosting organisations particularly likely to be Rivers Trusts or Wildlife Trusts [10].

Although support for these partnerships has emerged from efforts to deliver the WFD, Wingfield *et al.* [50] suggest that these partnerships are also an ideal means to enable Natural Flood Managament (NFM). They argue that CaBA pilots are already carrying out many NFM-relevant interventions motivated by objectives other than Flood Risk Management (FRM), and CaBA has "*always been intended to be a mechanism for better integration of FRM into integrated catchment management*" with this mentioned in Defra's 2013 policy paper [11; 29; 30; 47].

Reviewing current understanding of catchment partnerships

What catchment partnerships currently exist in the UK?

Catchment partnerships are not a new concept within or beyond the UK. This section briefly describes the range and diversity of catchment partnerships that are currently ongoing in the UK based on publicly available information.

Catchment Partnerships in England

We focus here on summarising the partnerships funded by CaBA, as we are not aware of pre-existing or new catchment partnerships which have not received CaBA funding. In 2017, there were 105 CaBA examples, of which 24 dealt with a subcatchment instead of a whole catchment. Recruitment of new cases since 2011 has purposively targeted regions with fewer partnerships: by 2017 each English county contained one or more CaBA partnerships[a].

Nearly all CaBA partnerships are hosted or co-hosted by charitable or third sector organisations, of which many were pre-existing environmental organisations such as Wildlife Trusts and Rivers Trusts. Some, such as the Mersey Rivers Trust, host more than one CaBA initiative, but mostly each host coordinates only one partnership. A minority of co-hosts come from the non charitable-sector: National Park Authorities; Research Institutes, and several private-sector water companies. Looking beyond the hosts, a broader of spectrum of organisations participate in the partnerships, but they still tend to be dominated by the third sector. The projects vary in the extent to which they focus on working with organisations and interest groups already focused on aspects of water management, versus engaging with the wider public. For example, the host website for the Wey Landscape Partnership[b] notes a process and several projects that seek to engage the public. Many of these partnerships are not legally constituted in their own right.

We know that many of these catchment partnerships existed in some form prior to CaBA, and this probably accounts for the majority though it is unclear exactly what proportion. For example, there has been a long history of catchment management in the Eden, which has incorporated many ideas and initiatives over the years, and whose Rivers Trust now receives CaBA funding. Some partnerships, such as the River Thame Catchment Project, were initiated under the Environment Agency's Catchment Restoration Fund but now are now overseen by CaBA hosts. The historical evolution of the partnerships, combined with the mix of organisations in each partnership, means that multiple interests are represented in each case, albeit often clustered around aspects of ecology and environmental quality. Where we see hosts such as Wildlife Trusts – which traditionally do not focus on catchment management and water quality for its own sake - we can speculate that CaBA may have pushed some organisations to widen the scope of objectives that they consider. The CaBA website states that these partnerships are 'directly supporting achievement' of targets within the UK Government's 25 Year Environment Plan [9].

Catchment Partnerships in Scotland

There are handful of catchment partnerships in Scotland. We first note two well-known partnerships: the Dee Catchment Partnership[c] and the Tweed Forum[d]. Both of these long-running partnerships have their roots in the management of fish stocks, but whose partners, structure, and objectives have evolved over time. The Tweed Forum also encompasses and arises from the

[a] https://catchmentbasedapproach.org/get-involved/
[b] https://surreynaturepartnership.org.uk/surreys-catchment-partnerships/
[c] http://www.deepartnership.org/
[d] http://tweedforum.org/

challenge of cross-border working. Both are formally constituted partnerships with multiple objectives: improving aspects of aquatic ecology are still core concerns, but their objectives span everything from improving public access to supporting flood risk management via Natural Flood Management (NFM) measures.

Two other notable examples are the Spey Catchment Initiative[e] and River South Esk Catchment Partnership[f]. The Spey Catchment Initiative, initiated in 2010, shows a familiar evolution of its aims: it is still hosted by the Spey Fishery Board but its four priority themes demonstrate a range of goals: "*Planting/safeguarding riparian woodlands and enhancing wetlands", "Demonstrating natural flood management techniques", "Understanding how the river works – Catchment Management Process", "Education, awareness raising & getting people involved in the catchment*". The second example, the River South Esk, is a smaller catchment in Angus, encompassing a variety of land-uses and interests. Since 2008 it has had a project officer employed to develop and encourage implementation of a catchment management plan. It aims are couched in terms of supporting and balancing a variety of social and economic interests. Perhaps as a result, protecting and restoring environmental quality receives less emphasis than some other partnerships. Currently its six priority topics include: "*Quality of water", "Water resources", "Managing floods", "River engineering", "Habitats and species", "Socio-economics factors*".

Of course, there are also other activities affecting or contributing to catchment management across Scotland. However, we understand that these activites are either focused on a single issue or do not explicitly entail full partnership working. For example, SEPA has funded fourteen Priority Catchments[g] with a specific focus on tackling diffuse pollution, to help achieve WFD objectives. A second phase of Priority Catchments is being rolled out (2016-2019), involving a further 43 catchments[h], with SEPA catchment coordinators now targeting inspections on waterbodies designated as at risk or downgraded under the WFD. Engagement with farmers is supported by by Forestry Commission Scotland, the National Farmers Union for Scotland, and Scottish Land and Estates.

Some other initiatives also seem relevant, though it is not always clear whether they exactly meet our criteria for a catchment partnership, or would see themselves as doing so. An example near Edinburgh is the Water of Leith Conservation Trust[i]: although it encompasses a relatively small land area versus, say, the Tweed, this has produced a management plan that encompasses a mixture of goals and involves different types of partners so seems a relevant case to consider. Its origins were in 1988, set up by concerned Edinburgh residents, which differs from the NGO-led impetus of many partnerships. A young or nascent partnership is the Lunan Catchment Management Group: this was set up in 2016 in response to impetus from researchers at the James Hutton Institute. To date its activities have mainly consisted of meetings to discuss aspects of the research, which explores the potential acceptability of new interventions to manage water quality and flows.

[e] https://www.speyfisheryboard.com/the-spey-catchment-initiative-intro/
[f] http://theriversouthesk.org/
[g] https://www.sepa.org.uk/environment/water/river-basin-management-planning/actions-to-deliver-rbmp/priority-catchments/
[h] https://www.sepa.org.uk/media/330130/rural-diffuse-pollution-plan-for-scotland-2015-2021.pdf
[i] http://www.waterofleith.org.uk/management/

Lastly, we should note that some River Trusts, such as the Deveron, while not yet claiming to represent or host partnerships, are increasingly seeking to support a whole rivers approach whose interests and goals go beyond fish stock management, and are building relationships with land managers and other groups as they do so.

Catchment Partnerships in Wales

We are not aware of significant partnership on catchments within Wales, except for those cross-border catchments (on the rivers Wye, Severn etc.) that have been eligible for CaBA funding. For example, respondents to the draft River Basin Planning Guidance (2015)[12] for Wales did not include any named catchment partnerships. For catchments such as the Dyfi, Natural Resources Wales – the competent authority under the WFD – seeks to achieve management aims via specific projects, with little mention of integrated catchment management or catchment partnerships.

NRW is engaged in some projects related to catchments partnerships. It is engaged in an exploratory process in the Tawe Catchment[j] which the aim of engaging stakeholders in nine projects, to deliver multiple benefits for the environment, people and the local economy. In addition, Welsh Water – the supplier of drinking water and wastewater provision – leads a few collaborative catchment based projects to improve drinking-water quality under the title 'WaterSource'[k]. In addition to initiatives focused on specific problems such as pesticide disposal, WaterSource works in the Brecon Beacons 'megacatchment' and the Pendine Catchment. It is worth noting that NRW focuses producing 'Area Statements', an approach to spatial planning whereby different environmental sectors and concerns are considered together (e.g. forestry, agriculture, terrestrial biodiversity). This may explain why they are not always emphasising a catchment-based approach.

Catchment Partnerships in Northern Ireland

Northern Ireland Water (NIW) has established several multi-partner projects aimed at improving water quality[l]. However, these are generally single-issue projects – e.g. for riparian tree-planting and/or strongly led by NIW rather than reflecting the goals co-constructed by a partnership of a range of organisations or individuals. NIW have also driven the creation of 'The Water Catchment Partnership', with from representatives from NIW, Ulster Farmers Union, Northern Ireland Environment Agency and the College of Agriculture, Food and Rural Enterprise under the Department of Agriculture, Environment and Rural Affairs (DAERA). However this partnership's aim is to reduce pesticide pollution, and as far as we are aware it does not encompass other goals. Any other river related work appears to be confined to fisheries management, and activities led by statutory agencies that are focused either on implementing WFD or flood risk planning. In summary, we are not aware of any ongoing catchment partnerships for multiple goals in Northern Ireland.

What kinds of objectives are held by these catchment partnerships, and do these include flooding?

When seeking cases to describe, we always sought partnerships with multiple objectives. However, the number and type of objectives held varies between cases. All of the partnerships have aims to improve some aspect of ecological quality within rivers: some have specific aims to

[j] https://naturalresources.wales/about-us/what-we-do/how-we-work/natural-resource-management-in-the-tawe/?lang=en

[k] https://www.dwrcymru.com/en/WaterSource.aspx

[l] https://www.niwater.com/activities-within-catchments/

control invasive species or provide habitat for certain animals, whereas other partnerships keep their aims more general. A minority of the partnerships also include aims for access or recreation where competing activities need to be accommodated, or in more urbanised catchments with high user numbers.

Many catchment partnerships explicitly incorporate mention of flood risk management or NFM within their strategic plans. For example, flood management is one of seven strategic aims in the Tweed Forum's 2015-21 management plan [42], and the forum actively supports ongoing research on the topic [6]. Some partnerships refer to FRM and NRM as integral to, or natural extensions of, the work they already do in relation to goals to improve water quality or habitat provision. Long-running partnerships in Scotland were particularly likely to cite that their work supports or responds to flooding policy and plans, perhaps influenced by the explicit support for NFM within Scottish Policy [48]. Text box 2 illustrates how plans made by the Spey partnership cross-reference statutory plans and processes for FRM.

When carrying out this scoping study it was not always obvious whether some objectives predate others; or how each objective relates to others. A possible question for future work to explore is how different objectives – especially flooding – have (or have not) come to be layered, combined and incorporated, and the drivers for doing so.

Text box 2 Detail of how flooding is referenced by the Spey Catchment Partnership

The River Spey Catchment Management Plan [41] explicitly discusses the Flood Risk Management Scotland Act (2009), providing links to SEPA's Flood Risk Strategy and interactive flood maps. As one of the plan's eight, cross-linked, strategic aims, it addresses four elements: Sustainable Flood Management, NFM, Communication and Community Engagement, each with associated Actions, Partners and Objectives. The following section of the management plan, on Communities, also highlights objectives for Flood Resilience.

The plan states that *"a catchment wide strategic vision for flood management needs further development such that sustainable flood management is achieved wherever possible by the restoration of a more natural flooding regime… The challenge will be to find or develop funding mechanisms that recognise the downstream benefits – including to the Potentially Vulnerable Areas (PVAs) – that derive from appropriate up stream actions (outside the PVAs)".*

The introduction also states: "*The need to increase resilience to safeguard against the predicted impacts of climate change, particularly the more extreme flood events, has never been greater. Legislation such as the Water Framework Directive and Flood Risk Act should be seen as opportunities for positive action which can be achieved through cooperation, collaboration and partnership working*."

Reviewing current understanding of catchment partnerships

What do we already know about analysing catchment partnerships?

This section summarises selected sources from the governance and management literature. We focus firstly on the level of catchment partnerships. Secondly we highlight the need to understand the wider governance settings which shape those partnerships – i.e. the decisions and requirements made by actors at other levels, including but not only national policy actors.

Studies focused on governance within catchment partnerships

Although the term catchment management might imply that governance is something that happens separately at a higher level, we understand that governance processes are integral to partnerships themselves, and are critical to the evolution and ultimate consequences of those partnerships. The work to plan, coordinate, implement, reflect on activities 'on the ground', can all be understood as governance.

Nearly a decade ago Marshall et al. [31] summarised 13 principles of good practice for catchment management (see Table 1 below). These principles, derived from studies of catchment partnerships as well the views of participants in catchment management processes, still provide a good basis for both planning and appraising these partnerships. However, good practice is not fixed and definable, and this source suggests taking a flexible and pragmatic approach to definitions (and by extension, to evaluation processes).

Table 1 Definitions of principles of good practice, adapted from Marshall *et al*. 2010. For more information about these principles, consult this source, which includes a list of key sources for each of the points in this table.

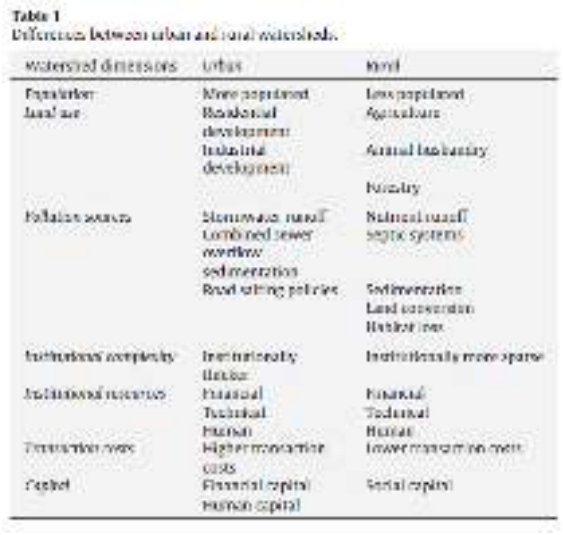
Good practice principles	**Definition**
Accommodate related issues	Identification and incorporation of relevant non-water related issues (e.g. agricultural policy, forest policy, climate change adaptation).
Acknowledge achievement	This may be reported as either internal recognition (awards, newsletter highlights etc.), or external recognition (academic reviews, national recognition etc) with the benefit of encouraging continued involvement.
Adaptive management	The ability to change plans in light of new information or considerations.
Appropriate decision-making process	Decision-making processes should be open, accountable, inclusive, clear and fair.
Appropriate involvement strategies	Strategies to accommodate differences within and between institutions: involvement of different knowledge types ('expert', experiential, local/contextual). Note: it may be easier to show number of groups and type of involvement attempted than to assess how effective the involvement was.
Communication & information flow	Effective reporting mechanisms: this applies within and between the core stakeholders, wider interested parties, and between stakeholder representatives and their organisations.
Conflict management	Identify and understand examples of where a process either provoked or was able to help resolve differences between stakeholders.
Effective use of existing forums	Existing social or stakeholder networks are used, thereby investing in existing trust, understanding, credibility etc. Note: this is dependent on the type of partnerships already acting.
Process efficiency	Available resources (funds, peoples' time, etc.) are used efficiently and effectively.
Process development	Learning through experience and improving practise: i.e. the process may start with problems (e.g. with involvement, planning, managing) or difficulties which if resolved will allow improvements to the process.
Roles & responsibilities clearly defined	Roles and responsibilities are established and clearly defined.
Spatial scale considerations	Identification of interactions between local and larger scale issues within a catchment and implications of these. This reflects the effect of physical scale on management planning, i.e. site, farm, catchment, basin, etc.
Timescale considerations	Separation of long-term objectives from short-term goals to help prioritise resources and define responsibilities. Issues relating to funding and long-term planning can be dependent on external factors, as well as the aims and objectives of a group, and envisaged project length.

Reviewing current understanding of catchment partnerships

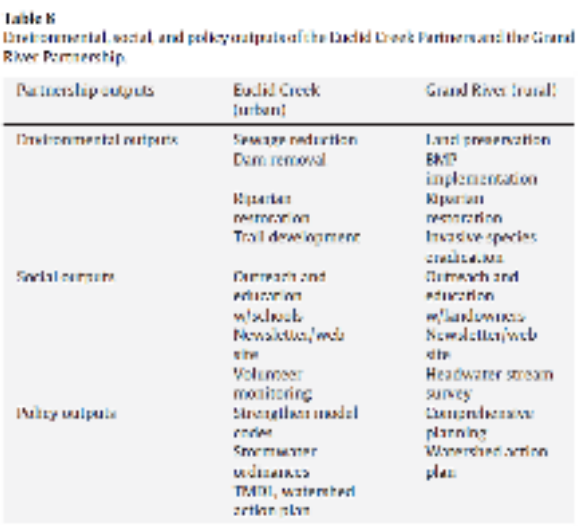
The last decade has seen a few authors differentiate styles or types of catchment partnership for [13; 39]. These suggest it can useful to differentiate the formalisation, centralisation, and timespan of partnerships. For example Diaz-Cope *et al*. (2015) differentiate 'inter-agency', 'cross sector' and 'grass roots' partnerships [13], which respectively represent partnerships between governmental organisations, between governmental, non-governmental and third sector organisations, and initiatives led by citizens and third sector organisations. They suggest that the latter grassroots initiatives are usually more suitable for small-scale problems, whereas inter-agency or cross-sector structures are needed for complex issues with large geographic scope and diverse stakeholders. That basic typology emphasises the degree of government involvement, but also highlights the need to understand (i) resource capacity (e.g. ability to draw on political, financial, technical, and human capitals), (ii) decision-making participants and styles (iii) 'institutional activities' (i.e. the type of decisions and work carried out by the partnership ranging from planning, to running social campaigns). Hardy *et al.* [23] also suggest it may be useful to focus on different sets of variables in urban and rural catchments, which tend to face different issues (Box 3).

When seeking to describe partnerships, it is important to understand underlying power relationships. For example, what is the true role and responsibilities of different actors in partnerships – what strength of influence do partners have on decision-making – do they have control or are they simply advisory? Power differentials may also help to explain why different types of partnerships may achieve different results – for example, why cross-agency partnerships may have the ability to tackle some issues that grassroots cannot.

Box 3 . Extracts from Hardy et al 2010, showing differences between urban and rural catchments, and in their outputs.



Watershed dimensions	Urban	Rural
Population	More populated	Less populated
Land use	Residential development	Agriculture
	Industrial development	Animal husbandry
		Forestry
Pollution sources	Stormwater runoff	Natural runoff
	Combined sewer overflow	Septic systems
	sedimentation	
	Road salting policies	Sedimentation
		Land conversion
		Habitat loss
Institutional complexity	Institutionally dense	Institutionally more sparse
	Elected	
Institutional resources	Financial	Financial
	Technical	Technical
	Human	Human
Transaction costs	Higher transaction costs	Lower transaction costs
Capital	Financial capital	Social capital
	Human capital	



Partnership outputs	Bodkin Creek (urban)	Grand River (rural)
Environmental outputs	Sewage reduction	Land preservation
	Dam removal	BMP implementation
	Riparian restoration	Riparian restoration
	Trail development	Invasive species eradication
Social outputs	Outreach and education w/handouts	Outreach and education w/handouts
	Newsletter/web site	Newsletter/web site
	Volunteer monitoring	Headwater stream survey
Policy outputs	Strengthen model codes	Comprehensive planning
	Stormwater ordinance	Watershed action plan
	TMDL watershed action plan	

In summary, to understand catchment partnerships, we must explore aspects of the partnerships themselves – in particular, strategies for collaboration, communication and conflict management; the set and number of partners involved – and also the remit of the partnerships – e.g. their geographical scope and scale of problems to be tackled, with attention to power. This suggests useful aspects to look out for, but we still have an incomplete understanding of what factors 'matter'. In what settings and for what challenges are partnerships particularly appropriate, and what are the critical factors to consider when developing interventions? In 2010 Marshall *et al.*

noted the need to better understand how partnerships play out in different settings, and to a large extent this challenge still remains.

Understanding of collaboration for other domains of natural resource management

Striving to understand and facilitate partnerships and collaboration is a theme common to other domains of natural resource management. As a result, many studies and recommendations that are not specific to catchment management nevertheless often identify sets of principles related to Marshall *et al*. For example, the importance of interpersonal and organisation collaboration was emphasised by a study of the progress made by several Ecosystem Approach cases [46].

Many such studies implicitly or explicitly build on the understanding of the 'commons' [e.g. 21] . This approach highlights understanding the characteristics of water that mean it is a common pool resource that benefits from collective management, since without enforceable governance arrangements it may suffer from 'free-riders' who exploit the resource without sanction. The so-called 'design principles' for common pool resource management provide a succinct list of key factors that help inform the design of interventions – as such, they may also help guide analysis of initiatives to improve natural resource management (see Table 2). These are relevant to consider as many aspects of water are thought to fit well with the idea of common pool resources [19]. For example, Hardy's exploration of rural versus urban catchment management [23] advocated the use of the Institutional Analysis and Design (IAD) Framework to help analyse and understand partnerships in both settings. The IAD is one expression of this perspective on the commons.

Table 2 The eight design principles of Elinor Ostrom, adapted and summarised from Ostrom, 1999.
CPR = Common Pool Resources

1.Clearly defined boundaries - individuals or households with rights to withdraw resource units from the CPR and the boundaries of the CPR itself are clearly defined.
2.Congruence between appropriation and provision rules and local conditions - use rules restricting time, place technology and/or quantity or resource units are related to local conditions and to provision rules requiring labour, materials and/or money.
3.Collective-choice arrangements - most individuals affected by operational rules can participate in modifying operational rules.
4.Monitoring - Monitors, who actively audit CPR conditions and user behaviour, are accountable to the users and/or are the users themselves
5.Graduated sanctions - Users who violate operational rules are likely to receive graduated sanctions.
6.Conflict resolution mechanisms - users and their officials have access to low-cost, local arenas to resolve conflict among users or between users and officials.
7. Minimal recognition of rights to organise - The rights of users to devise their own institutions are not challenged by external governmental authorities
And for larger more complex cases: 8. Nested Enterprises - Appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organised in multiple layers of nested enterprises.

To date, experiences in trying to apply these design principles suggest that they are useful but cannot be used deterministically i.e. they cannot provide a definitive way to diagnose and 'solve' natural resource management challenges [33]. However, they do suggest useful insights from this work, even without fully applying the design principles. Firstly, the process and outcomes of partnerships may not just been relate to the quality of their collaboration alone, but also result from and reflect decisions about the scope of challenges to be addressed and the specific ways that should be tackled. Secondly, we should understand catchment partnerships as contingent and imperfect, hence requiring constant adaptation and learning, i.e. adaptive management. This entails a need for monitoring to enable repeated evaluation and learning (and this process itself to also be reflected on) [45]. Lastly, the ways in which catchments partnerships could or should play

out will be shaped by their socio-economic settings. This calls attention to the need to understand the context and settings of catchment partnerships [23; 30].

Catchment partnerships as part of wider governance systems

The above literature on the commons signals the need to understand – and intervene in – catchments as part of nested and overlapping complex governance systems. There is no such thing as an intervention that is completely unaffected by other initiatives and other levels of governance. For example Aubin et al. [1] carried out a Social Network Analysis of French local water management plans and revealed how IWRM under the WFD triggered a shift from a hierarchical towards a more local, network based governance system, with some delegation to local organisations.

This is quite clear in the example of the English catchment partnerships that receive national government support via CaBA. The influence of rules, norms and resources across governance levels can be more subtle than direct funding. Likewise, we know that those working to deliver partnerships often network with each other, e.g. at conferences[m], but in addition to this there may be other formal and informal links between partnerships, or potentially influence from other initiatives. For example, Surrey Nature Partnership[n] encompasses and connects Catchment partnerships, Local Sites partnerships, and the Natural Capital Approach. Therefore, it is relevant to understand the development of catchment partnerships in terms of the literature on multi-level governance [16] and polycentricity [26]. The former term, multi-level governance, emphasises the need to recognise the many actors interacting across governance levels – from international to national, regional and local – whilst the latter term, polycentricity, brings focus to how multiple actors may interact to make and enforce rules within a specific policy arena or location, in horizontal networks that do not necessarily have a central or top-down organiser. Nearly all partnerships can be understood in these terms, albeit to varying extents – for example, top-down policy drivers and actors are more influential in some catchments, than others.

The work of Pahl-Wostl has usefully interpreted these governance ideas for water management. Pahl-Wostl et al. [35] emphasises the need to work towards a paradigm shift that sees the role – and problems – of governance as key, without expecting simplistic solutions or 'panaceas' will result. To assist with this challenge, Pahl-Wostl has offered frameworks to guide the analysis of nested systems for water management and governance. In 2010 [35] she developed the 'Management and Transition Framework' to analyse different cases of water management and governance. This identified that polycentric governance structures with effective stakeholder participation tend to support increased adaptive capacity, versus more hierarchical or un-networked cases. However, the legacy of pre-existing arrangements tend to create 'sticking points' for new initiatives [46], for example by constraining policy actors from responding to insights from innovative governance approaches [34]. Furthermore, roles, accountability and responsibility are often ambiguous, highlighting tensions between being adaptive and having the authority and resources to act. This emphasises a need to study the interplay between formal and informal institutions, with a focus on roles, responsibilities and accountability.

In 2014, Pahl-Wostl and Knieper [36] showed that overly centralised governance systems do not exhibit adaptive capacity when confronted with rapid or unpredictable change, being limited by

[m] https://www.therrc.co.uk/conference

[n] https://surreynaturepartnership.org.uk/

poor coordination and distribution of responsibilities. However, enabling polycentric governance requires a fine-tuned and dynamic balance between top-down and bottom-up approaches, and the capacity of actors to self-organise. Furthermore, whilst systems are thought to be more adaptive when they are decentralised, this does not necessarily translate into effective implementation, i.e. delivering improvements to both water quality and flood management or multi-actor irrigation agreements [14]. Identifying the right 'balance' between top-down and bottom-up, and how to achieve this, is an unresolved question.

Pahl-Wostl's latest contribution [34] uses idealised modes of governance ('bureaucratic hierarchies', 'networks' and 'market') to study the role of 'meta-governance' i.e. the governance of governance. It is unlikely that any of empirical cases precisely match one of these 'modes', particularly as national governments may encourage more deliberative networked approaches, but typically retain authority and some aspects of responsibility [15]. However, they are a useful heuristic, and can be derived by describing seven characteristics or aspects (Table 3). These have some overlap with the factors that should be used to describe catchment partnerships themselves, but is derived from and usefully brings focus to the wider governance settings of those partnerships.

Table 3 How different different governance 'modes' may be described, according to Pahl-Wostl (2019).

Aspects	Hierarchical	Network	Market
Motive of subordinate actors	Fear of punishment	Belonging to group	Material benefit
Roles of government	Government rules society	Government is partner in a network society	Government delivers services to society
Choice of actors	Controlled by written rules	Free, ruled by trust and reciprocity	Free, ruled by price and negotiation
Power	Position in formal hierarchy	Centrality of role in network	Degree of wealth, market share
Steering	Authority	Trust	Price, economic incentives
Roles of knowledge	Expertise for effectiveness of ruling	Knowledge as shared good	Knowledge for competitive advantage
Dominant Actor Type	Government	Civil Society Organizations – NGOs	Business - Companies

Overall, Pahl-Wostl's work emphasises the need to understand – and potentially seek change – not only in specific catchment level initiatives, but also in the wider governance settings. In particular, there is a need for learning, evaluation and adaptation across and within all these levels. This insight is also made by other work on water governance that uses different analytic approaches. For example, Watson et al. [44] use 6 issues to analyse and describe catchment partnerships - scope, scale, responsibility, engagement, financing and review processes – and they also emphasise the importance of reflexivity and resilience, informed by strong review processes and cross-scale connections.

Moving between different governance modes is likely to be difficult, since it entails multiple shifts in organisational cultures, knowledges and interests, all of which may interact to resist change [46]. Therefore it is important to encourage learning and reflection about the different ways of working – at different levels – before rushing to endorse and enable any changes in these.

Reviewing current understanding of catchment partnerships

Summary

The last decades have seen growing enthusiasm for catchment partnerships. They are commonly expected to help promote collaborative joined-up thinking and action, and thereby help to deliver different policy goals for water quality and flooding concurrently. However, questions remain about whether they can reconcile and deliver all of the objectives and expectations with which they are sometimes associated. Catchment partnerships may help tackle some problems in some contexts, but are unlikely to provide perfect solutions for every challenge. This means that catchment partnerships warrant further empirical study.

To study these initiatives, the literatures on partnership and collaboration provide an obvious starting point, as do literatures about integrating or coordinating delivery of multiple obectives [e.g. 47], complemented by insights from existing empirical studies of catchment working. It is also important to understand catchment partnerships as initiatives within nested multi-level governance systems, potentially also displaying aspects of polycentricity. In other words, we expect that the progress and outcomes of catchment-level initiatives will be shaped by aspects of the wider governance setting, as much as by their own design and choices.

Many questions remain about if, how and when to coordinate between and across levels. Our future work cannot answer all these questions – indeed, it is likely that no perfect answers exist, so adaptive approaches to managing and governing must be promoted – but we aim to build understanding of these challenges, with a particular focus on when and how to integrate and coordinate delivery of different policy goals.

What are the planned next steps for our research?

In Spring 2019 we will specify a methodology. This will build on the literature reviewed here – aiming to build on rather than reiterate existing knowledge – in order to explore the potential of catchment partnerships to deliver on contemporary goals for water management. Although informed by the international literature and cases, the research design will ensure a focus on integrating delivery of the Water Framework Directive and Floods Directive, a challenge of particular interest to stakeholders in Scottish water management.

The choice of framing and case(s) will also be shaped in liaison with parallel linked research on the role of different actors and instruments in the delivery of multiple benefits (RD1.4.2.b.i in the RESAS Strategic Research Programme). This research has so far particularly highlighted the need to understand the role and interactions of private sector actors in partnership with other organisations [4]. Building such in depth understanding suggest a focus on one or a few cases. Where resources and opportunity allow, it may be useful to contrast different 'types' of partnership – for example, those which are more or less formally constituted, those with greater or less emphasis on private sector actors – using multiple sources of data to build a picture of their achievements and potential. In order to understand the evolution, process and expectations associated with partnerships, this will most likely involve interviews and discussions with those people who shape and are responsible for partnerships.

We will be informed by Pahl Wostl's work on water governance, particularly her framework of ideal types [34] and by existing typologies of watershed partnerships [13; 39], in order to identify key factors that will allow indepth understanding of catchment partnerships. We will ask if the blend of different governance modes and types affect the outcomes of catchment partnerships, primarily in terms of delivering multiple benefits but also other aspects that can be judged as

relevant to the success of partnerships to deliver multiple benefits. We will also consider if and how existing governance arrangements enable or limit the scope and styles of catchment partnerships.

We note that evaluating different aspects and outcomes of partnership working – from strategy, planning and implementation to monitoring review and revision – require different sorts of data, some of which may not always be available. In particular, the ultimate effects on the delivery of multiple benefits (for multiple goals) may be hard to assess, unless evidence of impacts 'on the ground' have already been collected by a long-standing partnership. This may limit our ability to appraise if and how particular types of catchment partnership, and/or in different governance modes represent improvements: however, we can appraise procedural aspects and expectations for what effects will be in terms of water quality and quantity. Longer-term work to connect process and outcomes is particularly important given that existing studies of adaptive planning suggest that it helps to reach decisions but successful implementation of these decisions is not a given.

After receiving any necessary ethical approvals and checks in summer 2019, we will then start to apply the methodology. We aim to complete data collection by December 2019, with interim results available by March 2020. We will use the report of our interim findings to liaise and discuss implications with stakeholders. These discussions, together with further analysis, will allow us to develop a preliminary picture of whether, where and when catchment partnerships can help deliver on goals for water management, especially integration between river basin and flood risk management measures. The final research report is due in September 2021, and dissemination of the findings (both academic and non-academic) to be completed by March 2021.

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