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ORIGINAL PAPER

Catchment management in England and Wales: the role of arguments for ecosystems and their services

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Abstract This study uses document analysis and interviews to explore how the use of arguments for biodiversity and ecosystem services has evolved in recent years in the water industry in England and Wales, with a focus on investments in catchment management programmes. Changes to land management practices within catchment areas can lead to improved water quality and lower treatment costs, and also ancillary benefits to the natural environment and various stakeholders. Our analysis reveals the increasing effectiveness of arguments associated with ecosystem service values in enabling the industry regulator (Ofwat) to support water industry investments in catchment-level conservation projects. Ofwat has adopted a much more flexible approach to regulation, moving from initial resistance to ecosystem service framings and a dominant focus on financial benefits to customers, to acceptance that customers have a legitimate interest in environmental quality and a willingness to accept some 'beneficiary pays' solutions. Companies are now required by Ofwat to include environmental impacts in cost-benefit analysis of investments, alongside assessment of customer preferences and support. This has facilitated investments in catchment management with positive results for water companies, customers, farmers and the natural environment. The shift in arguments in this industry matches a broader shift at European and UK levels towards greater use of economic evidence and payment instruments. The challenge now is to stabilise a secure regulatory environment in which companies are encouraged to pursue innovative methods to benefit the wider interest of customers and the natural environment, today and in the future. Arguments based on the

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value of water quality improvements and of the wider associated ecosystem services benefits have been, and remain, a key tool for achieving the environmental improvements and economic efficiency gains associated with successful catchment management initiatives.

Keywords Arguments for conservation · Water industry · Water quality · Catchment management · Ecosystem services

Introduction

In 1989, the 10 water and sewage authorities then owned by the government in England and Wales were privatised and became limited companies (Ofwat 2006). Following the privatisation, and in order to protect customers' interests as well as the environment, the functions associated with the regulation of the industry and the provision of water and sewerage services were separated into three distinct independent bodies, including the National Rivers Authority, which later became part of the environment agency (as the environmental regulator), the drinking water inspectorate (as the drinking water quality regulator), and Ofwat (as the economic regulator of the water and sewage industry) (Ofwat 2006).

Today, customers buy services from private water companies, which in turn supply them with water and/or sewerage services. In order to obtain good quality drinking water, water companies (and indirectly their customers, via their water bills) incur the costs of water treatment to remove pollutants from water. As part of a regulated industry, water companies in England and Wales must justify their expenditure and pricing plans to Ofwat. To grant approval, Ofwat needs to be persuaded of the validity, with respect to their remit, of investments. Ofwat's remit is essentially to protect consumers' interests and to ensure that the industry functions efficiently, competitively and in accordance with the rules.[1] In seeking to fulfil this role, Ofwat conducts an ongoing programme of five-yearly price reviews, which aim to set limits for the prices each water company can charge their customers over the following five-year period (Ofwat 2014b). The charges are set so that they represent the best value for customers and allow water companies to provide the required services in a sustainable way. Since investment programmes must be approved in the price review process, the reviews also establish the level of investments that may be made by water companies in environmental improvements.

Catchment management approaches offer potentially cost-effective solutions to water companies for ensuring better raw water quality, in terms of contaminants, suspended solids and colour. A water catchment is defined in Ofwat (2011a, p. 3) as "an area of land through which water from any form of precipitation (such as rain, melting snow or ice) drains into a body of water (such as a river, lake or reservoir, or even into underground water supplies—'groundwater')". The quality and quantity of water bodies within a particular catchment will be affected by both the land and water environment management activities taking place in that catchment and the state of the natural environment. This will influence the ecosystem service potential for provision of clean water/water quality, and catchment management can be used to reduce costs of water treatment, primarily through

[1] "Our main duties are to protect the interests of consumers, wherever appropriate by promoting effective competition, to enable efficient water and sewerage companies to carry out and finance their functions and secure that companies with water supply licences properly carry out their functions" (Ofwat 2007, p. 2).

delaying, or even removing altogether, the need for future capital investment in treatment facilities. In due course, this could benefit the customers through lower prices (and companies/shareholders, through higher profits and dividends). At the same time, catchment management activities will influence other ecosystem services. These changes may often be beneficial: for example, restoration of peat bogs will improve raw water quality and will also increase the environment's natural ability to store carbon, reduce fire risk, and enhance protection of biodiversity (Defra 2010). It should be recognised, however, that that managing catchments for specific ecosystem service provision (e.g. clean water) can also give rise to trade-offs in relation to other outcomes (e.g. reduction in habitat suitability for some species) (see e.g. Glaves et al. 2013).

Consequently, water companies have been interested in investing in catchment management schemes, but any such investments require approval from Ofwat. Seeking approval involves the use of arguments to demonstrate why a scheme should be considered beneficial from the perspective of Ofwat's remit. This paper examines the way the regulatory context and the roles of different stakeholders have shaped the arguments used, and how arguments and policy have co-evolved over the past 15 years. The analysis is based on one of 15 case studies carried out under the "Biodiversity and ecosystem services: arguments for our future environment" (BESAFE) project. BESAFE examined the ways arguments for conserving biodiversity are constructed and used, and explored the factors influencing how different arguments are effective in promoting conservation in different contexts, using a common framework for classifying arguments and assessing their effectiveness (Bugter et al., this issue; Tinch et al., this issue). "Introduction" section of this paper gives an overview of catchment based activities in England and Wales, and "Method and data collection" section describes the data collection and analysis methods used. The arguments about ecosystem service values identified in the context of the study, and their evolution over the past 15 years, are presented in "Results: arguments about ecosystem service changes via catchment management" section. "Discussion: the shift in the regulator's perspective" section highlights the shift in the economic regulator's perspective, and "Conclusions" section draws conclusions.

Method and data collection

To identify and assess the arguments used in the development of catchment management approaches in England and Wales, data were collected from a range of written sources, including:

- Ofwat's Price Reviews[2]
- Literature on catchment management schemes such as payment for ecosystem services with regard to famers/land managers affected by the catchment management approach (CSERGE and WRT 2013; Defra 2013a; OECD 2013; Westcountry rivers trust 2012)
- Results of surveys conducted with water companies' customers (Dialogue by design 2013; Lanz, Provins 2015)
- Literature on recreational users' willingness to pay (WTP) for ecosystem services (UKWIR 2012)
- Other studies related to the water industry in England and Wales

The arguments extracted from selected documents were analysed and recorded using the BESAFE database and framework (Tinch et al., this issue). The arguments we focus on are

[2] http://www.ofwat.gov.uk/pricereview/.

those relating to decisions about environmental management and biodiversity conservation. Generally, these arguments consist of four main components (though in some cases one or more of the components may be implicit rather than explicitly stated):

- The aspect of biodiversity the argument is addressing
- The beneficiaries (people, species, systems…) argued to benefit from protecting the biodiversity
- The form of benefits provided to the beneficiaries
- The value(s) attributed to these benefits

The structure of the database shows the detailed arguments within the perspective of the overall policy process. The database was used to generate a timeline of arguments used in the case, and the stakeholders who used them, to track changes over time in the ways arguments are used and expressed, and to assess various aspects of the effectiveness of arguments in the case. Across the BESAFE project, these data have been analysed to reveal which characteristics of arguments and contexts are associated with argument effectiveness (see Tinch et al., this issue).

To supplement and explore in more depth the issues revealed in the literature, expert stakeholders[3] were contacted in order to carry out anonymous interviews regarding their experience of the evolution of arguments in the context of the catchment management approach within the water industry. Qualitative data obtained from interviews were then combined with findings from the literature review and database analysis to draw overall conclusions regarding the use of biodiversity and ecosystem services arguments in the water industry in England and Wales, and the lessons for argumentation in other areas and sectors.

Results: arguments about ecosystem service changes via catchment management

The legal background and the rules that constrain different actors set the context within which arguments are used. The use and evolution of the arguments can only be understood in the light of this context. Important changes related to the implementation of the catchment management approach over the last fifteen years as well as a timeline of key publications and associated arguments (Fig. 1) are discussed below.

The dominant argument identified in the study, both through the literature and the interviews, focuses on the enhancement of water quality via changes to land management practices within catchment areas. Water quality improvement is widely seen as the most important outcome of catchment management, and the primary rationale for investing in these activities.

The economic side of this argument—i.e. that investing in catchment management could, at least in the medium to short term, lead to treatment cost reduction—was not made in a direct form (e.g. "Catchment management will cut costs", without further explanation) in any of the documents consulted. Rather, the improvement in raw water quality is presented as an end in itself. This may, or may not, be accompanied by noting possible implications for future costs, primarily in terms of postponing, or reducing the need for,

[3] Stakeholders contacted were from: Ofwat, the Environment Agency (EA), Natural England (NE), four major water companies (Anglian Water, South West Water, United Utilities, and Wessex Water), a policy adviser for the UK water industry, and a consultant specialised in the UK water industry.

Publication	PR04	SCaMP 1 (2005-10)	Govt. water strategy	PR09	Upstream Thinking	Catchment to customer	PR14	Ofwat's role on resilience
Stakeholder	Ofwat	UU	Defra	Ofwat	SW Water	Ofwat	Ofwat	Ofwat
Date	2004	2005	2008	2009	2009	2011	2014	2015
Water quality	■	■	■	■	■	■	■	■
Water storage					■			
Carbon storage		■	■		■	■	■	■
Health		■						
Heritage		■			■			
Recreation		■	■		■			
Natural environment		■	■			■	■	■
Wildlife					■			
Flood protection					■	■		
Resilience							■	■

■: Key argument associated with the publication.

Fig. 1 Timeline of publications related to the implementation of the catchment management approach, and associated arguments

future capital investment in treatment facilities. This form of the argument is represented in the BESAFE framework (outlined above) as various improvements in catchment environmental condition (biodiversity) leading to improved water quality (benefit) for customers and water companies (beneficiaries) in the form of avoided costs (value).

Beyond this, the ancillary benefits to the natural environment and various stakeholders are increasingly recognised. Benefits used in arguments include carbon storage, flood protection, human health, cultural heritage, natural environment, pest control, recreation, resilience of services, water storage and wildlife. Table 1 summarises the generic arguments as identified in the case study, while Fig. 1 shows the occurrence of arguments in key publications over the period covered.

The specific term "ecosystem services" was not at all widely used—we found only two instances of the term in water companies' business plans submitted to Ofwat, for example. Rather, arguments refer to more specific expressions of the benefits of catchment management—for example the role of catchments in improving water quality, the benefits of reducing carbon footprint, the flood risk reductions associated with investments, and so on.

Coevolution of the arguments and context over time

The attention given to environmental improvement within price reviews has been gradually increasing over the years. The integration of environmental improvement within price reviews was initiated at the 1999 Price Review (Ofwat 1999). However the notion of catchment management was not referred to at this stage. It first appeared in U.K. policy in 2003,[4] with the water framework directive,[5] which became part of the UK law and introduced the notion of river basin management.

[4] http://jncc.defra.gov.uk/page-1375.

[5] http://ec.europa.eu/environment/water/water-framework/index_en.html.

Table 1 Types of arguments for conservation as identified in the case study

Benefit	Argument
Water quality	Contribution to improving raw (untreated) water quality through reduced diffuse pollution sources in catchments from the adoption of catchment management approaches (Ofwat 2011a)
Carbon storage	Contribution to combating climate change through reduced emissions from rewetting blanket bog (Defra 2008a)
Flood protection	Contribution to reducing the risk of flooding through slowing down the rate at which rainwater runs off land by restoring an area of upland moorland (Ofwat 2011a)
Human health	Contribution to improving human health through the creation of woods that are accessible (SCaMP website[a])
Heritage	Contribution to improving visitor's experience through large scale landscape works (e.g. moorland restoration) (Upstream Thinking Initiative website[a])
Natural environment	Contribution to enhancing and protecting the natural environment through the implementation of habitat restoration treatments (Ofwat 2011a)
Pest control	Contribution to reducing problems for stock through the decrease in the presence of pest from re-wetted areas (via mire ditch blocking) (Upstream Thinking Initiative website[b])
Recreation	Support to recreational activities, ecotourism, involving interactions with and appreciation of the natural environment (Defra 2008a)
Resilience of services	Contribution to increasing the resilience of catchment lands to periods of drought through blocking grips, managing stock levels and allowing the natural fauna to thrive (Ofwat 2015a)
Water storage	Contribution to increasing water storage in upland catchments through blocking up ditches in order to re-wet the peat and promote the bog grasses and mosses; this slows down the flow of water and increases the time it takes for the water to get to the river (Upstream Thinking Initiative website[b])
Wildlife	Contribution to improving wildlife from re-wetting mires (Upstream Thinking Initiative website[b])

[a] http://corporate.unitedutilities.com/cr-scamp.aspx

[b] http://upstreamthinking.org

The first Price Review to mention catchment management was in 2004. Ofwat, as part of the 2004 Review, agreed that United utilities (UU) could fund projects in two of their landholdings, following support expressed by customers for a catchment management project in their area (Ofwat 2004). The first United utilities "sustainable catchment management programme" (SCaMP)[6] subsequently began in 2005.[7] Since then, catchment based activities have increased dramatically, with 2 schemes proposed by two water companies for the fourth Asset Management Plan period (AMP4, 2005–2010),[8] over 100 schemes and investigations from seventeen companies under AMP5 (2010–2015; Ofwat 2009), and approximately 300 for the AMP6 period (2015–2020; Indepen 2014), proposed by 20 companies (see Table 2). Most of these proposals are for investigations into forms of

[6] http://corporate.unitedutilities.com/cr-scamp.aspx.

[7] http://corporate.unitedutilities.com/The%20SCaMP%20solution.aspx.

[8] Water companies are required by Ofwat to submit an Asset Management Plan (AMP) or Business Plan at each price review (Ofwat, Glossary of terms, http://www.ofwat.gov.uk/aboutofwat/gud_pro_ofwatglossary.pdf).

Table 2 Progress in the implementation of catchment management in England and Wales. *Source* adapted from Blueprint (2014)

Water company	Progress of catchment management plans		Catchment management schemes and investigation proposed by companies in their final business plans		
	Increase*	Static**	PR04	PR09	PR14
Affinity water	X		–	Catchment management programme started in October 2010	2 options for catchment management
Anglian water		X	–	Proposing catchment management solutions for 20 water sources (7 groundwaters and 13 surface waters)	Proposition of pilot study in a small number of catchments. [Previous catchment management solutions judged ineffective in the short to medium term
Bristol water	X		–	4 water sources	Plans to scale up their catchment management activities over the next five years
Cambridge water		X	–	Aquifer and catchment management model	Cambridge water and south staffs water merged in April 2013
Cholderton and district water	X		–	–	2 catchment management programmes
Dee valley water		X	–	–	Catchment management Studies to be carried out in the lower Dee area to tackle the problem of pesticide
Dŵr cymru/ welsh water		X	–	Proposition of catchment studies and controls	Plans to investment in catchment management over the next 5 years
Essex and suffolk water	X		–	Created a catchment partnership in 2009; undertake farm-scale investigations	Work within five catchments, and undertake farm-scale investigations
Northumbrian water	X		–	3 catchment management projects	Plan to increase catchment activities
Portsmouth water	X		–	Work with local farmers to improve the quality of raw water in a catchment	Plan to increase expenditure in catchment management activities
Sembcorp bournemouth water		X	–	–	Proposal rejected

Table 2 continued

Water company	Progress of catchment management plans		Catchment management schemes and investigation proposed by companies in their final business plans		
	Increase*	Static**	PR04	PR09	PR14
Severn trent water	X			Plan to carry out 47 investigations during 2010–2011 to inform their approach in the next investment period.	Plan to extend their catchment management approach—investigations in 50 catchments across their region
South East water	X			Develop a suitable catchment management strategy for specific areas	Undertaking 15 catchment management studies around five river systems
South staffs water	X		–	Investigations	Plans to further investigate the potential for catchment management with regard to nitrate and to implement catchment management in its two surface water catchments
South West water	X		–	7 projects	11 new projects
Southern water	X		–	–	Plan to work with local landowners at 1 site
Sutton and East surrey water		X	–	1 project/investigation	Plan to continue to work with farmers, Landowners at catchment level
Thames water		X	–	3 Catchment control projects	Plan to widen their catchment management activities
United utilities	X		SCaMP 1: projects across 27,000 ha of their water catchment areas in 2 areas[a]	SCaMP 2: new programmes across the remaining 30,000 ha of their water catchment areas in 2 areas	Plan to extend SCaMP type approaches to other catchment land they own and promote its use on other catchments that they do not own
Wessex water	X		Catchment management activities involved working in 8 source catchments	Continue work at the eight sources and work with farmers at 8 new sources	17 sites by 2020

Table 2 continued

Water company	Progress of catchment management plans		Catchment management schemes and investigation proposed by companies in their final business plans		
	Increase*	Static**	PR04	PR09	PR14
Yorkshire water	X			Catchment management pilot scheme	2 proposals for catchment management actions

Most of the information included in this table was collated from water company business plans; references for those plans as well as other references used to build this table are given in Supplementary Table 1)

[a] http://corporate.unitedutilities.com/scamp-index.aspx

* Increase: when the number of catchment management schemes or investigations proposed by a water company increases from a PR to the next

** Static: no new catchment management schemes or investigations proposed by a water company from a PR to the next

catchment management or source control, covering key areas including discolouration, microbiological contaminants, surface water management and protecting or increasing available capacity. Table 2 gives an overview of the implementation of schemes and investigation programmes proposed by water companies in their business plans carried out at price reviews.

SCaMP related activities were expected to prevent the worsening of raw water quality in the short term, and increase water quality in the long term, which could lead to substantial long term savings in terms of treatment costs over time: it was estimated that the restoration of peat bogs could deliver between £1.2 and £2.6 million of benefits per year, based on the cost of water treatment that could be avoided (Defra 2007) although these estimates were highly uncertain. Although at the time Ofwat rules demanded a focus on customer bills, United Utilities and others introduced arguments that changes to land management practices would improve water quality and also bring other benefits, such as an improved natural environment, biodiversity protection in SSSIs, stabilisation of farm incomes, and recreational benefits (Penny Anderson Associates 2011; Everard et al. 2004; Everard 2011). This demonstration project was widely viewed as a success by water industry regulators including Ofwat, the drinking water inspectorate (DWI), the environment agency and natural England[9] and additional schemes have been developed since SCaMP was first put into action (see Table 2).

The implementation of catchment management schemes has been supported by a growing evidence base, summarised by Westcountry rivers trust (2013). Examples include, for example, reduced water pollution through exclusion of livestock by fencing watercourses (Parkyn and Davies-Colley 2003) and poorly drained areas (Kurz et al. 2005), leading also to reduction in faecal coliforms (Line 2003), and reduction in suspended sediment through contour cultivation, minimum tillage, tramline modification and construction of beetle banks (Deasy et al. 2010). This evidence has been used to derive decision support models for assessing management options, such as the FARMSCOPER (FARM SCale Optimisation of Pollutant Emission Reductions) model (Gooday et al. 2015). Consequently, catchment management forms part of the Government's water strategy for England (2008), which outlines a "strategic and integrated approach to the sustainable management of our water resources, for the public water supply as well as for the provision of healthy ecosystems and the services they provide" (Defra 2008a). This is in part a result of SCaMP being seen as a success: the strategy refers to SCaMP as being "a good example of an alternative to end-of-pipe solutions". The strategic approach envisions that water will be treated less and at less expense (in particular if new treatment plants do not need to be built), and considers the importance of water resources in the wider ecosystem, calling for "an ecosystem approach action plan" where water companies are encouraged, "to work with farmers to tackle pollution at source" (Defra 2008a).

As a result, Ofwat became expected "to support companies who wish to adopt innovative approaches to improving water quality, including working with land managers to control diffuse water pollution at source, where this is to the benefit of water customers" (Defra 2008b). Defra's (2013a, b) strategic policy statement to Ofwat also stipulates that Ofwat should keep under review the impact of their regulatory framework on the implementation of new schemes, such as catchment management approaches, that offer best value to customers and potentially deliver multiple benefits. The improvement of raw water quality as part of catchment management schemes was then referred to in the 2009

[9] http://corporate.unitedutilities.com/2204.aspx.

Price Review, and Ofwat encouraged actions to improve the quality of raw water such as catchment management schemes for drinking water quality.

Shift to focus on 'outcomes'

Traditionally, delivery targets have been based on outputs—"specific things that the companies deliver to (help to) achieve outcomes"—or inputs—"the resources the companies use to deliver those outputs" (Ofwat 2011b, p. 7). For PR14, however, Ofwat introduced an different approach based on outcomes, defined in Ofwat (2011b, p. 7) as "the things that customers and society value". The stated aim is to deliver a wide range of benefits to customers and to society in general (Coppack et al. 2014). To achieve this, PR14 called on companies to focus on delivering what customers expressed as being important issues. These issues include both the delivery of safe drinking water and environmental quality (Ofwat 2014a).

The outcomes-based approach also means that Ofwat is moving away from setting industry-wide targets, allowing significantly more regional and company differentiation than in the past. Company-specific outcomes are supposed to "reflect the priorities of each company and its customers" (Coppack et al. 2014, p. 13) and are to be determined through the company's consumer research and engagement with its customer challenge group. This shift is meant to recognise that different locations, and different human populations, can prioritise different services and hold different values, facilitating the introduction of measures tailored to specific situations.

In terms of environmental valuation and cost benefit analysis, this also represents a shift away from a 'standard' approach using literature review and value transfer techniques to carry out desk-study towards a more case-specific approach that in effect calls for primary valuation studies—and water companies have in consequence carried out original stated preference work, in some cases several times—coupled with direct expressions of customer views about investment plans and their implications (UKWIR 2010, 2011; United utilities 2016). These requirements are not driven by catchment management: indeed the bulk of expenditure is for renewal and replacement of network and physical assets, driven by statutory obligations (drinking water standards, effluent standards/consents), and surveys focus mostly on core water and wastewater services and associated service failures (Lanz and Provins 2015). Overall, the scope for discretionary spend based on cost-benefit analysis (CBA) is somewhat limited, with the issues rather being the pace of the investment and spreading of investment costs over planning periods. Nevertheless, the valuation and assessment approach now being used has an important enabling role that facilitates the introduction of catchment management schemes.

Growing emphasis on customer views

A further evolution is reflected in the increasing acceptance that the views of customers or their representatives should be allowed to influence the decisions companies make with regard to the service they provide and the price they charge their customers. Ofwat announced in April 2011 that they considered customer engagement[10] as "essential to

[10] Customer engagement is defined in Littlechild (2011) as "understanding what customers want and responding to that in plans and ongoing delivery".

achieve the right outcomes at the right time and at the right price" (Ofwat 2011c).[11] To achieve this, Ofwat introduced further changes to its regulatory approach in a report entitled "From catchment to customer" (Ofwat 2011a), explaining its intention "to focus more on ensuring the companies deliver the broader outcomes that customers and society value". In practice, this means that Ofwat has implemented a framework for companies to investigate different options for delivering results, giving companies the freedom to select the best outputs to achieve outcomes (Ofwat 2011b).

The July 2013 methodology for periodic review 2014 (Ofwat 2013) gives a detailed explanation of the shift in the way customers are to be involved. Customers' views are gathered through:

- Direct local engagement with the water company—this concerns issues on local services and tariffs (Ofwat 2011c).
- Company customer challenge groups (CCGs)—these groups challenge the shape of their company's business plan to make sure they represent customers' views (Ofwat 2011c). Water companies were required to set up CCGs for PR14. The groups include customer representatives (e.g. Consumer council for water), the environmental and drinking water quality regulators (the environment agency, DWI), and also NGOs such as RSPB, Age Concern, wildlife trusts, river trusts, etc. Therefore, there is now a process of oversight by groups that include environmental, social and economic concerns and interests, all sitting down together.
- A sector-wide customer advisory panel—this panel made up from customer representatives, can inform and challenge Ofwat's decisions on issues such as the cost of capital, and provisions for pensions and energy (Ofwat 2011c).
- Surveys/consultations with customers initiated by water companies—for example, Anglian water conducted a consultation with its customers and stakeholders to gather their views on its longer-term strategy (Dialogue by design 2013).

Reducing bias towards capital expenditures

In addition to evidence on customer support, water companies are required to assess the costs and benefits of the schemes that are proposed within their business plans. For the most part companies have developed investment planning methodologies that incorporate CBA (UKWIR 2007, 2010), and approaches for dealing with risk and uncertainty in decision-making. For catchment management schemes, this has led to analyses quantifying and valuing a range of environmental, economic and social benefits in line with the outcomes set out in Table 1.

Ofwat has adopted a risk-based approach, which consists in assessing companies' business plans, with a particular focus on issues that could have a major impact on customers, including:

- Outcomes—what the company proposes to deliver
- Costs—related to the delivery of the proposed outcomes
- Risks and rewards—the way companies' proposals balance risk
- Affordability and financeability—the impact of proposal on customers' bill

[11] Ofwat's regulatory approach for PR19 continues this theme, stating that, "At the heart of our regulatory framework for water and wastewater services is the desire to strengthen the approach to customer engagement and outcomes to ensure a continued focus on current and future customers" (Ofwat 2016, p. 4).

Ofwat (2014c) provides information on how water companies should address risk as part of their business plan submissions. Companies are required by Ofwat to provide information on their anticipated return on regulatory equity[12] for a particular scenario, drawing attention to the uncertainty attached to expected returns over the period 2015–2020.

In a further move to facilitate catchment management and related investments, at PR14, Ofwat focused on total expenditure rather than capital expenditure (Ofwat 2014b). This sought to reduce the potential bias to favour capital investments over projects that primarily require annual operating expenditure such as catchment management activities, with Ofwat stating the intention "to empower companies to focus on the resilience of services and resilience more widely, including the resilience of ecosystems" (Ofwat 2015a, p. 5). In the situation where the ongoing costs are ignored, the companies would have to face those costs, but would not be able to get them back through water bills; this acted to discriminate against such projects. These changes to the way in which companies assess costs represent an incentive for water companies to implement solutions that benefit current and future customers as well as the environment in the most efficient way possible. Nevertheless, it remains the case that traditional engineering assets appear on company balance sheets, whereas 'soft engineering' such as catchment management and discretionary/targeted payments to farmers do not, so financial markets may act as a *de facto* regulator inhibiting more rapid transition to systemic approaches.

Discussion: the shift in the regulator's perspective

In recent years, frameworks for representing the natural environment and the services it provides to human activities, in ways that inform policy agendas, decision-making and regulatory regimes and instruments, have developed rapidly, for example through the processes for the economics of ecosystems and biodiversity (TEEB)[13] and mapping and assessment of ecosystems and their services (MAES),[14] through the common international classification of ecosystem services (CICES)[15] and system of environmental-economic accounting (SEEA),[16] and through national initiatives such as the UK national ecosystem assessment[17] and natural capital committee.[18] For sectors closely linked to environmental goods and services, this presents both challenges and opportunities. In the water sector in England and Wales, there is recognition that interventions to enhance the network capacity for removing contaminants or containing flows are costly in financial and energy terms, and tend to lack robustness to extreme events, for example where surface run-off causes sewer overflows to waterbodies, contributing to impaired ecological status of water bodies and bathing waters. Traditional engineering approaches to water management in the UK face diminishing cost-effectiveness for water customers, increased uncertainty of outcomes and greater scrutiny of their wider environmental impacts, energy and resource

[12] This measure provides an indication of the return achieved by the company (Ofgem 2014).

[13] http://www.teebweb.org/.

[14] http://biodiversity.europa.eu/maes.

[15] http://cices.eu/.

[16] http://unstats.un.org/unsd/envaccounting/seea.asp.

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

[18] http://www.naturalcapitalcommittee.org/.

consumption. In response, there has been a shift since the early 2000 s towards management of water quality using integrated management approaches, with growing evidence to suggest that these can be cost-effective interventions.

Ofwat's initial views

As is often the case in policy change, the key underlying issue is one of distribution rather than efficiency. The primary issue related to catchment management schemes in England and Wales was not so much whether these schemes could be beneficial, but rather who should pay for their implementation. An important characteristic of catchment management schemes is that their costs are often up-front but the benefits will not be realised until later. In addition, the benefits are diverse, accruing in particular to farmers, water companies, customers, and recreational users of the area under management. Ofwat initially favoured strict implementation of the polluter pays principle (Ofwat 2011a).

Prior to PR04, therefore, there was a risk that Ofwat would take the view that water companies should not be allowed to source funds for investments in catchment management schemes via water bills, but instead should be reducing future bills to reflect the savings made if those schemes proved to be beneficial. In this context the incentives for water companies to invest in natural capital (e.g. investing in innovative solutions such as catchment management approaches) were much lower than the incentives for them to invest in built capital (e.g. building a new water treatment works), against which they could achieve a return (profit) over time (Ofwat 2011d).

Gradual shift in Ofwat position

Over the past decade, there has been a shift from a strict "polluter pays" philosophy to one in which some "beneficiary pays"/"stewards earn" element is accepted. The polluter pays argument has been that since farmers/upland managers were responsible for polluting or damaging the capacity of the uplands to provide clean water, customers should not be paying for any clean-up. However, it is also possible to argue that land managers have a historical right to farm their land, and if other people want to change the quality of the water that runs off their land, then it is reasonable to expect them to pay. Ofwat now considers that if customers receive benefits from catchment management schemes, then it is reasonable that they should contribute to those schemes: "water customers could legitimately expect to pay for those elements of catchment management that bring direct and measurable benefits to them, under the principle of paying for ecosystem services" (Ofwat 2011a, p. 21).

This is really a normative issue associated with distribution of property rights—in terms of economic efficiency, the issue of who pays is largely irrelevant (Pezzey 1992). Catchment management can potentially offer economic efficiency gains, wherever it is cheaper to reduce pollution upstream and spend less on end-of-pipe treatment, and because of ancillary environmental and social benefits. The matter of who *pays* for the schemes, and who *benefits* from the longer term gains, is one of distribution, dependent on property rights, and not directly influencing the question of economic efficiency.[19]

The evolution in Ofwat's stance is therefore partly pragmatic, in that it is a recognition that strict adherence to a "polluter pays" philosophy would not be feasible within the wider

[19] With the exception of any differences in the transactions costs involved in different negotiated or imposed solutions.

social and economic context, and would effectively block catchment management initiatives. Since there is a need to act to take advantage of opportunities for catchment management investments as they arise, if the efficiency gains are to be realised, some flexibility is necessary. Many people will benefit from the services resulting from catchment management, and focusing too heavily on the distributional issue of who should pay threatens the delivery of overall efficiency.

The shift to accepting an element of 'beneficiary pays' is important in helping to ensure that these potential efficiency gains can be achieved in practice. This is especially the case where land ownership forms a barrier to catchment management investments. It is relatively easy to implement catchment management in areas where the land is owned by the water company, but when land is owned by third parties, and in particular multiple third parties, this poses not only organisational problems (high transactions costs) but often regulatory concerns. In 2009, for the first time, Ofwat allowed the water company South West Water to invest in improvements to land they did not own. Allowing investment on third-party land represented a major development, being "a departure from strict economic regulation" (OECD 2013), and another key step in the evolution of catchment management.

Without the shift to accepting 'beneficiary pays' solutions, water companies may still have been able to spend money on improvements and initiatives on land it owns. There is a clear chain of control and benefit to the company/customers. Even though in practice tenancy rights blur the boundary between owned and unowned land, expenditures that result in a transfer to the tenants can be viewed as part of normal commercial agreements between landlord and tenant. Indeed, earlier concerns were more about whether it was appropriate for water companies to own large tracts of land, and investing in catchment management schemes helped to justify land ownership. But the move to accepting beneficiary pays solutions is essential to allowing a company to spend (customers') money on improving land that it does not own.

Decline in paternalism

A second aspect of the shift in the regulator's perspective has been a move away from a somewhat paternalistic approach to defending customers' interests, rather narrowly focused on financial impacts for present day customers (Ofwat 2011c), to an approach that is intended to be more collaborative, consultative and customer-focused (Ofwat 2015b). One driver behind this approach is that customers can in effect stand for the interests of future generations and customers as well as present-day interests (Ofwat 2014b). The focus need not be narrowly financial, but can cover a wide range of present and future concerns, including expressions of environmental or social preferences.

Alongside this, there is increasing consideration of 'the environment' in a form of 'customer' role.[20] The environment has more traditionally been viewed as a 'supplier' (of water quantity and/or quality) and the Environment Agency has had to work hard to persuade people of the merits of the 'customer' metaphor. The Environment Agency and environmental regulators such as DWI can now contribute their views on companies' proposals and environmental obligations (Ofwat 2013). Ofwat disbanded their environmental team, leaving the environment agency to cover these aspects (Ofwat 2015b), but at the same time Ofwat now highlights environment quality and climate regulation in addition to water quality as arguments in support of catchment management approaches.

[20] Terminology used by an anonymous interviewee.

Part of the rationale for the change in approach lies with the Government's water strategy for England, which sets out and uses ecosystem services argumentation (Defra 2008). In general, the overall trend has been towards more catchment level management initiatives emphasised by Defra's promotion of the catchment based approach (CaBA) (Defra 2013b). CaBA establishes local partnerships that are expected to work with key stakeholders that have an interest in water and the wider environment within a particular catchment. As part of their role, local partnerships may "agree and deliver the strategic priorities for the catchment and support the environment agency in developing an appropriate river basin management plan" (Defra 2013b, p. 3), as part of the implementation of the water framework directive. In 2013, following a 2-year pilot phase, the CaBA was widely adopted across England with over 100 catchment partnerships formed in 93 catchments.

Overall, then, Ofwat's approach to these issues has changed substantially over the past 15 years. The notion of catchment management was referred to for the first time in the 2004 Price Review (PR04); in PR09, Ofwat started to show support towards water company plans to invest in catchment management initiatives and research programmes; and in PR14 Ofwat encouraged water companies to increase their investments in sustainable solutions, such as catchment management schemes, in the investment period 2015–2020. Water companies are now expected to take more responsibility for explaining their actions and what the costs and impacts are to their customers, with greater use of environmental arguments and valuations, and there is now a strong business case for water companies to increase investment in catchment management initiatives. One result is that environmental concerns are now fitting into business plans—for example, where previously a new treatment works may have been a default solution, there is now more potential that water companies will consider talking to land-users upstream and exploring alternative approaches. Ofwat (2012) discusses this in terms of a "risk-based approach" to regulation, identifying challenges (including climate change, rising environmental standards and rising customer expectations) that together increase uncertainty and call for a more flexible and adaptable approach to regulation based on prioritisation, risk assessment and continuous review. However, this also means that Ofwat exercises less direct control over what can and cannot be carried out. In this sense, there is a reduction in regulatory safeguards, but an increase in civil society oversight (anonymous interviewee).

Conclusions

The narrative outlined in this study reveals the increasing use and effectiveness of arguments associated with ecosystem service values in the context of enabling the industry regulator to support water industry investments in catchment-level conservation projects. The key arguments are based on the enhancement of water quality via changes to land management practices within catchment areas, and the ancillary benefits to the natural environment and various stakeholders. The expression of arguments has evolved over time, from initial resistance to use of ecosystem service framings, to a requirement to produce cost-benefit analysis evidence on their value. Land management measures addressing the issue of diffuse pollution are expected to be evaluated since they are now considered as a sustainable alternative to water treatment. The results generated by CBA of catchment management schemes will inform decisions about where and when to invest in those

schemes in the future. Arguments based on the value of ecosystem services therefore now play a central role in water policy in England and Wales.

The effectiveness of arguments has coevolved with a shift in regulator's perspective, with Ofwat adopting a more flexible approach to regulation. Ofwat's initial philosophy was very much based on protecting water customers and advocating on their behalf (for example, determining whether the quality standards were right, whether the payments and other arrangements were fair) and a strict polluter-pays approach. Now, however, Ofwat takes a less paternalistic approach, admits a much broader range of evidence, and is open to some use of beneficiary-pays solutions. Arguments based on ecosystem services (though not necessarily their framing as 'ecosystem services') have played a part in enabling and encouraging those regulatory changes. Encouraging companies to provide evidence of customer priorities, backed up with cost-benefit data (sometimes using an ecosystem services framework), has enabled Ofwat to reconcile its mission to protect customer interests with the increasingly-recognised need to achieve sustainable outcomes across society.

This study shows that ecosystem services arguments appear to have played a key role in supporting and enabling a shift in regulatory focus to a more open and democratic stance. The Ofwat position on catchment management has changed quite dramatically from one of reluctance to allow schemes that were not of clear financial benefit to current customers, to one of trying to create a regulatory environment in which companies can be encouraged/facilitated to introduce more innovative methods that will be of benefit to the wider interests of customers, both today and in the future. The shift in regulators' role offers a more effective and informed form of regulation in the utility sector, with a better way to identify and protect the interests of customers. Without the ability to use ecosystem services arguments to justify the benefits to customers of expenditures on catchment management, this shift would have been harder to implement, and would be harder to sustain.

The shift in arguments in catchment management in England and Wales is in keeping with the broader shift at European and UK levels towards greater use of economic evidence and payment instruments for conservation. Evidence of this is seen, for example, in the TEEB process, various national ecosystem assessments, the EU biodiversity strategy entitled "Our life insurance, our natural capital" and the second Aichi target calling for "biodiversity values" to be integrated into planning and strategies, and "incorporated into national accounting… and reporting systems." In the water industry, initial arguments were pushed by experts and pioneers keen to advance catchment management solutions. Through their persistence with these arguments, the success of early schemes, and the wider policy processes advancing ecosystem services and natural capital arguments, the arguments have entered the 'mainstream' of discourse in this regulated industry. More broadly, catchment management sits within a family of nature-based solutions seeking to restore ecosystem functioning for multiple benefits, including for example natural flood management and managed realignment solutions to flood and erosion control (Natural capital committee 2015).

In terms of the future prospects, at the level of the whole industry, catchment management remains quite cutting edge. Improvement in water quality and delivery of additional benefits (such as an increase in biodiversity and carbon sequestration, and a reduction in flood risks) have been associated with some existing schemes (e.g. Wessex water, United utilities via SCaMP (Ofwat 2011a) and South West water with the upstream thinking initiative). This suggests that catchment management schemes could potentially deliver better raw water quality and other benefits in other areas across England and Wales. There is uncertainty, however, as to whether water companies have cherry-picked the best

opportunities (which would suggest decreasing returns to further initiatives) or if they have implemented schemes as opportunities became available, at the relevant time (some schemes being more successful than others, leaving scope for additional valuable projects). Many schemes are under investigation in AMP6, and it will be important to study these and learn from them—both the positives and any mistakes—to develop best practice and wider understanding and skills. Although all the signs are good, the overall resilience of the catchment management approach could be considered to be quite low. Partly this is because there is a risk of failure or scandal associated with any one scheme, and a possible risk of contagion if that were to happen.

For further implementation of catchment management initiatives in England and Wales, both the customers and the experts will be needed—the latter to present the different options and the former to communicate their preference for green solutions. Although all the signs are good, the catchment management approach remains cutting edge; lots of new projects are being investigated, and it will be important to study these and learn from them—both the positives and any mistakes—to develop best practice and wider understanding and skills. Fundamentally, the further implementation of catchment management initiatives in England and Wales still depends on key individuals pushing it, and on a relatively small network of people involved in catchment management and ecosystem services assessment and valuation. Arguments based on the value of water quality improvements and of the wider associated ecosystem services benefits have been, and remain, a key tool for achieving the environmental improvements and economic efficiency gains associated with successful catchment management initiatives.

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