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Managing water through change and uncertainty: comparing lessons from the adaptive co-management literature to recent policy developments in England

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Water management is set to become increasingly variable and unpredictable, in particular because of climate change. This paper investigates the extent to which water policy in England provides an enabling environment for 'adaptive co-management', which its proponents claim can achieve the dual objective of ecosystem protection and livelihood sustainability under conditions of change and uncertainty. Five policy categories are derived from a literature review, and are used to conduct a directed content analysis of seven key water policy documents. The findings reveal that although, in part, English water policy serves as an enabling environment for adaptive co-management, there is a level of discrepancy between substantive aspects of the five policy categories and water policy in England. Addressing these discrepancies will be important if English water policy is to allow for the emergence of processes, like adaptive co-management, that are capable of coping with the challenges that lie ahead.

Keywords: adaptive co-management; policy; water governance; England

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1. Introduction

Widespread water quality issues, regional and localised periods of water scarcity, a growing population, and a more variable and uncertain future climate means that in the upcoming years water governance in England faces a stern test (Weatherhead and Howden 2009; Collins and Ison 2009; Barker and Turner 2011). Whilst we know that change will occur, it is not possible to accurately gauge the extent and precise nature of the challenges that lie ahead. As a result, enhancing the capacity of England's system of water governance to cope with future uncertainties becomes a crucial objective. This contrasts starkly with the rigid and bureaucratic approach that came to characterise water management in England during the last century, "founded on the assumption of a stable and certain operating environment in which discrete policy problems could be addressed rationally and objectively by neutral officials acting alone" (Watson and Treffny 2009, 450).

One approach that is receiving increasing attention as a way of achieving the dual objective of ecosystem protection and livelihood sustainability under conditions of change and uncertainty is adaptive co-management, a field of enquiry that combines the linkages dimension of co-management with the learning dimension of adaptive management

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(Olsson, Folke, and Berkes 2004; Armitage 2007; Armitage, Berkes, and Doubleday, 2007a; Armitage *et al*. 2009). Given the requirement to enhance the resilience of the system, here we propose that adaptive co-management is a particularly appropriate lens through which to interpret the direction water management is taking in England.

The establishment of adaptive co-management is seen to depend, in part, on a government that fosters the conditions to both encourage and sustain the process, in particular through the creation of an enabling policy environment (Pomeroy and Berkes 1997; Olsson, Folke, and Berkes 2004; Berkes, Armitage, and Doubleday 2007). As a result, in this paper, we attempt to assess the extent to which water policy in England provides a receptive context for the emergence of adaptive co-management going forward. While it is not explicitly stated in the documents examined that the UK Government is intentionally attempting to encourage adaptive co-management, we are interested in the coincidental relationship between government policy and the factors that appear to facilitate this process. It is notable that the need to adapt to issues such as climate change and a shrinking national budget has resulted in government objectives that could find fertile ground in a more direct consideration of adaptive co-management. To this end, the findings of this paper are of use to policy-makers in England.

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2. Method

Our overall approach entailed defining a set of policy categories that if operationalised would serve as an enabling environment for the emergence of adaptive co-management, where these categories were then used to analyse water policy in England from this perspective. The analysis began with a literature review, charting the development of adaptive co-management from its academic origins, as well as the major claims and contentions relating to the field. In doing this, we drew explicitly from three bodies of literature: work on the commons with a focus on the concept of co-management, resilience thinking and adaptive management, and the resulting merger of these two strands of enquiry, which, in more recent times, have given rise to the literature on adaptive co-management. In Section 3, we provide a condensed version of this literature review, which references many of the key sources from the broader review undertaken. Other important sources are referenced during our explication of the five policy categories in Section 4.

From the literature review, we distilled five policy conditions that appear important for providing a suitable enabling environment for the emergence of adaptive co-management. These categories were then compared to recent water policy developments in England. To do this, we employed a directed content analysis of key government water policy documents. After an initial assessment, seven key documents dating from 2008 onwards were selected (Table 1). Together these documents give a strong indication of government thinking and policy direction.

Our selection of the seven policy documents was decided upon according to four criteria. First, we aimed to include documents that related to the national (England) level, though in several instances the documents related not only to England but to the larger governing jurisdiction of England and Wales. Second, we aimed to include documents that laid out the government's broad, longer term vision for water governance in England. Typically, this was a vision for the time period up until the year 2030 or 2050. Third, we also sought to include documents that were specifically relevant to issues associated with adaptive co-management, such as those dealing with adaptation in the face of climate change, or with a decentralised or polycentric governance agenda (but

Table 1. Seven key English water policy documents.

Document name and publication date	Reference in text	Synopsis
Future Water (2008)	DOC1	A 96-page document outlining the government's overall strategy for water up to the year 2030. The focus is on the 'sustainable delivery of secure water supplies and an improved and protected water environment'
Water for People and the Environment (2009)	DOC2	A 77-page Environment Agency document outlining the water resources strategy for England and Wales up to the year 2050. The central premise of the document is the need to manage water in such a way that there is 'sustainable, reliable water supplies for people and businesses, whilst also protecting the environment'
Water for Life (2011)	DOC3	A government water white paper laying out a vision for future water management through measures to tackle water pollution using the catchment-based approach; water abstraction reform; increased competition in the water sector; and details on how the government will encourage and incentivize water efficiency measures
The Natural Choice (2011)	DOC4	A 77-page environment white paper setting out the government's intention to 'mainstream the value of nature' across society. It proposes to achieve this by developing local action for nature protection and improvement; creating a green economy; strengthening the connections between people and nature; and demonstrating leadership at EU and international levels. As a critical component of the environment, water and its management are an important topic in the document
The Catchment-Based Approach (2013)	DOC5	A 28-page document detailing a policy framework to encourage the wider adoption of an integrated catchment management approach for improving the quality of the water environment
Water for Life and Livelihoods: Challenges and Choices (2013)	DOC6	A 42-page document on the 'challenges and choices' relating to England's waters. The document is a summary of the results of a consultation on significant water management issues which are outlined from the perspective of the government, along with potential measures to address these issues
The National Adaptation Programme (2013)	DOC7	A 181-page, wide-ranging document concerned with 'making the country resilient to a changing climate'. The two cross-cutting issues that dominate the list of priorities (as identified in the Climate Change Risk Assessment) are flooding and pressure on water resources

where these documents also fulfilled the other criteria just mentioned). Finally, we attempted to include documents that covered both water resources and water quality management.

The documents selected were published from 2008 to 2013, though they were under preparation for some time prior to the publication dates. This covers the period when the implications of implementing the EU Water Framework Directive (WFD) began significantly impacting government water policy. The Directive required all inland and

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coastal waters to reach at least 'good status' by 2015. In contrast, previous strategy documents, e.g. EA (2001), did not address the WFD.

Hsieh and Shannon (2005) outline two strategies for undertaking a directed content analysis. We employed the second of these, which initially involved reading and re-reading the texts until we felt confident we had become suitably immersed in the data. We then began coding using the predetermined policy categories, as derived from the literature review. Different categories were coded using different colours.

Initially, coding entailed highlighting each section of text that corresponded with the different policy categories, based upon the nature of the content under consideration and the context in which it was written, rather than whether or not a particular key word or set of key words was mentioned. We then followed up the initial coding stage by also searching for a list of key words pertaining to each of the five categories, in order to improve the robustness of the analysis. However, almost without exception, the search for key words corresponded with the text that had already been identified during the first coding stage. We then assessed the extent to which each highlighted section appeared to relate, or failed to relate, to the conditions we attributed to the policy category in question. This assessment relied upon our own judgment and inference, and not upon a quantitative analysis of the data. We also attempted to identify any major changes in the nature of the coded policy statements as one moved from the earliest to the latest policy documents. In Section 6, we consider reasons for any changes observed.

3. Adaptive co-management: origins and developments

Broadly speaking, adaptive co-management is viewed as the merging of the field of co-management with adaptive management (Armitage, Berkes, and Doubleday 2007b). Co-management, as an academic concept, has its roots in commons theory, a body of scholarship that emerged in reaction to the famous 'Tragedy of the Commons' dilemma (Hardin 1968). According to that perspective, only intervention by the government or the market can stop users of a common resource from acting in their individual short-term self-interests and in so doing destroying the resource they collectively depend upon in the long run. However, researchers working in the commons tradition have instead reported on a large number of case studies, both past and present, that reveal how communities of resource users, acting without assistance or intervention by a larger government, have been able to collectively devise rules that enable them to sustainably manage natural resources, and the conditions that facilitate this outcome (Wade 1988; Ostrom 1990; Baland and Platteau 1996; Agrawal 2002).

Moving on from analyses based solely on community management, the earliest attempts at analysing co-management tended to focus on formal power-sharing arrangements between a community and the government (Berkes, George, and Preston 1991). Whilst the degree of power-sharing and joint decision-making varies considerably from case to case, researchers have found that in nearly all successful cases, co-management depends upon the crafting of new institutions that confer more advanced property rights at the local level and that are able to link the actors involved in the management of the environment or a natural resource across scales of organisation (Jentoft 1989; Pomeroy and Berkes 1997). They also depend upon adequate levels of trust between participants, and the development of social capital more generally (Pinkerton 1989b; Daniels and Walker 1996; Leach and Pelkey 2001; Plummer and Fitzgibbon 2006).

For its proponents, co-management has always been seen as a way of implementing a management process that more equitably includes the interests of the less powerful in decisions surrounding the use of natural resources (Pinkerton 1989b; Pomeroy and

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Berkes 1997; Borrini-Feyerabend *et al.* 2000). It has also been shown to improve the legitimacy and transparency of the process in some cases, as well as develop greater capacity at the local level through community empowerment (Borrini-Feyerabend *et al.* 2000, 2004; Plummer and Fitzgibbon 2004). Therefore, co-management "is not merely about resources; it is about managing relationships" (Berkes 2009, 1692). Other authors have pointed out the risks associated with co-management, and in particular the potential for local elites to dominate the situation in order to forward their own interests, or for the government to use the term as justification for their actions whilst continuing with a business-as-usual approach (Castro and Nielsen 2001; Conley and Moote 2003; Plummer and Armitage 2007a; Nayak and Berkes 2008).

Although co-management has traditionally been seen as a relationship between the government and a community or group of resource users, others have broadened this conception to include market-based management (Rose 2002; Tietenbert 2002; Yandle 2003). From this perspective, "co-management is not envisioned as a replacement for central government, nor is it incompatible with existing market-based systems; it is a supplement to these decision-making processes" (Plummer and Fitzgibbon 2004, 63). Another important development has come with the realisation that many of the attributes that characterise co-management – such as power-sharing, trust, and institution-building – take time to develop and are ongoing (Gray 1989; McCay 2002; Borrini-Feyerabend *et al.* 2004). This understanding has turned attention towards the mechanisms via which the process of co-management evolves. Here, scholars have found fertile ground in merging the narratives of co-management with adaptive management. Adaptive management is a concept which treats policy decisions as hypotheses to be tested (Lee 1993) and which was originally derived from the work of the ecologist C.S. Holling (Holling 1978) and a field of enquiry that recasts the relationship between humans and the environment in the light of complex adaptive systems theory and resilience thinking (Levin 1999; Gunderson and Holling 2002).

Amongst other things, this synthesis has highlighted the importance of social learning if the participants in a system of co-management, who may have widely different perspectives and interests, are to jointly learn about and adapt to change (Armitage, Marschke, and Plummer 2008; Berkes 2009; Allen *et al.* 2011). Thus, co-management's attention to power-sharing and system linkages is complemented by adaptive management's concern with problem solving and learning-by-doing. The merger of these two fields, each with their own distinct disciplinary histories, has resulted in what has come to be called 'adaptive co-management' (Olsson, Folke, and Berkes 2004; Armitage, Berkes, and Doubleday. 2007a; Armitage *et al*. 2009).

The logic underlying adaptive co-management brings with it a conceptual shift away from thinking about 'humans *and* nature' to thinking about 'humans *in* nature' (Folke 2006). From this perspective, social and ecological systems are understood to be coupled, not separate. Furthermore, these 'social–ecological systems' comprised processes and interactions that are non-linear and characterised by an inherent degree of uncertainty, leading to shocks, surprises, and sometimes even to transformations in the basic structure and function of the system (Olsson, Folke, and Hahn 2004; Olsson *et al*. 2006; Moberg and Galaz 2005; Liu *et al.* 2007). As a result, it is argued that management practices must shift from traditional attempts to achieve optimal solutions to resource problems, to the need to account for change and uncertainty in a multi-level world (Gunderson and Holling 2002; Dietz, Ostrom, and Stern 2003). In many circumstances, this will require flexible institutions that operate within and across scales of organisation, represent the multiple interests associated with the management and use of a resource, and facilitate

adaptation through iterative cycles of problem solving and processes of dynamic learning (Folke *et al.* 2005; Pahl-Wostl, Craps *et al.* 2007; Armitage, Marschke, and Plummer 2008). Thus, in addition to the evaluative criteria traditionally attributed to co-management – namely appropriateness, equity, and efficiency (Pinkerton 1989a; Plummer and Fitzgibbon 2004) – the adaptive turn brings with it a strong focus on resilience (Folke 2006).

4. Key policy considerations for adaptive co-management

Here, we identify five key policy categories that have been distilled from our review of the literature. Although the categories represent general claims about conditions which are conducive to adaptive co-management, each of them is highly context-dependent. This realisation underscores the fact that there is no prescriptive recipe or blueprint that can be followed to instigate adaptive co-management. Instead, the policy categories are indicative of a process which is most likely dependent not solely on human design or on emergence, but on the interaction of the two (Berkes, Armitage, and Doubleday 2007). It is also necessary to acknowledge that several of these categories are interlinked, as will be made clear. The five categories are listed in Table 2 and then discussed in more detail below.

First, policy geared towards adaptive co-management must account for both the economic and non-economic value of water and the diversity of functions it performs in a catchment – including its role as a source of social – ecological resilience[1] – instead of viewing it purely as a resource for humans to draw upon (Folke 2003). This shift in thinking brings attention to the dynamic and complex nature of social–ecological systems, in turn allowing for broader, more inclusive management approaches that better account for the highly interdependent nature of hydrological, ecological, and social issues (Ruitenbeek and Cartier 2001; Folke 2003). It also promotes a wider appreciation for the water environment, and is consistent with adaptive co-management's emphasis on thinking about humans in nature, rather than humans and nature.

The second policy consideration involves a recognition that social – ecological systems are variable and prone to shocks and surprises (Olsson *et al.* 2006; Fabricius *et al.* 2007). To this extent, policies that uncompromisingly attempt to maximise yield,

Table 2. Five key policy categories for the adaptive co-management of water.

Category	Conditions conducive to adaptive co-management
Funtions of water	Conceive of water as performing a diversity of functions in a catchment, and not just as a resource for humans
Change and uncertainty	Recognise that change and uncertainty are inherent features of social–ecological systems, and adopt an attitude of learning to live with them
Resilience and adaptive capacity	Focus on enhancing the resilience and adaptive capacity of the system, paying attention to the social dimension
Participation and scale	Promote cross-scale, participatory approaches to water management that operate in accordance with the subsidiary principle. Here, support for local action is provided by higher level institutions
Process and learning	View water management as a long-term social process that proceeds through iterative cycles of joint learning

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control change, and reduce uncertainty appear misdirected (Holling and Meffet, 1996; Gunderson and Holling, 2002; Armitage *et al.*, 2009). Instead, policy-makers should embrace an attitude of learning to live with change and uncertainty (Folke *et al.* 2005; Plummer and Armitage 2007b).

Third, by acknowledging the place of change and uncertainty, the narrow goal of achieving efficiency – be it economic or organisational efficiency – must be broadened to encompass an intention to "manage the capacity of social–ecological systems to cope with, adapt to, and shape change" (Folke 2006, 254). Thus, policy should promote measures that enhance the resilience and adaptive capacity of the system, even at the expense of short-term efficiency gains (Pahl-Wostl, Sendzimir, *et al.* 2007). In the case of adaptive co-management, this must also entail a recognition of the importance of the social dimension for achieving this, rather than focusing solely on ecosystem resilience or on the ability of infrastructure to enhance capacity (Folke *et al.* 2005). As a result, the 'resilience and adaptive capacity' category is strongly linked to our remaining two categories discussed below, which relate to the social dimension of water management.

The fourth category, 'participation and scale', states that policy aligned with adaptive co-management theory must move away from centralised and bureaucratic forms of environmental and natural resource management. Such approaches tend to be rigid and reactionary, typically only seeking to inform, or at best consult, non-governmental agents about management actions and decisions (Holling and Meffet 1996; Glasbergen 1998). Instead, procedures should attempt to garner full participation of all key stakeholders in relevant decision-making processes and the co-production of knowledge, particularly resource users and those who directly affect the conditions of the water environment (Pinkerton 2003; Pahl-Wostl, Sendzimir *et al.* 2007; de Loe *et al.* 2009). This draws attention to the scale of activity. Here, the focus is both on developing pluralistic procedures at the local catchment and sub-catchment level, and on facilitating linkages within and across levels of organisation from the local to the national and international, but in accordance with the subsidiary principle[2] (Jentoft, McCay, and Wilson 1998; Plummer and Fitzgibbon 2004; Carlsson and Berkes 2005; Plummer 2006).

By doing this, and in moving beyond narrow, efficiency-oriented strategies, policy-makers should therefore conceive of water management as a long-term social process and not just a technical challenge (Allen *et al.* 2011). This fifth policy condition places much importance on the role of social learning as a key mechanism by which the process proceeds (Dale 1989; Pahl-Wostl, Craps *et al.* 2007; Plummer and Fitzgibbon 2007; Berkes 2009). Social learning allows the different participants in the management process to reflect upon their changing understandings and new ways of conceiving of the issues at stake, in response to both social and environmental signals (Keen, Brown, and Dyball 2005; Reed *et al.* 2010). Thus, the management system becomes better adapted to dealing with feedback. This feedback can be incorporated into policy by planning for iterative, multi-level management cycles designed to facilitate monitoring, learning, and adaptation (Pahl-Wostl, Craps *et al.* 2007).

5. Water policy in England

5.1. Water governance

Before discussing the findings of the analysis, it is useful here to provide a brief overview of the system that governs water management in England. Broadly speaking, at the national level, the Department for the Environment, Food, and Rural Affairs (DEFRA) is

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responsible for devising water policy and legislation, and for translating and enacting the various water directives emanating from the European Union (EU). The key DEFRA body charged with managing the water environment is the Environment Agency (EA), although other bodies such as Natural England also play important roles with respect to environmental protection and enhancement. Thus, there is an institutional 'split' between policy formulation (undertaken by DEFRA) and implementation (undertaken by the EA and others). European legislation has increasingly exerted power over water management in England; since the introduction of the Water Framework Directive (WFD) in 2000, the approach to managing water has changed radically. By focusing at the level of regional river basins and by encouraging greater stakeholder participation, the WFD attempts to raise all water bodies in the EU up to 'good status', according to a new and more stringent set of ecological and chemical standards. The WFD requirement is to develop management strategies at the river basin scale, but in recent years, England has also started to focus on the smaller catchment and sub-catchment scales, as a way of taking a more local and inclusive approach to water management.

Despite recent proposals within the EU Blueprint for Safeguarding Europe's Water Resources (EC 2012) to better address water resources issues under the WFD framework, in England, water quality and water quantity have historically been treated as two distinct policy domains. Whilst water quality management is now strongly governed by EU legislation, water resources have continued to be managed nationally by a licencing system that was introduced under the 1963 Water Act. Initially, water abstraction licences were granted in perpetuity and without due consideration of potential longer term environmental impacts. Since then, legislation has been brought in to time-limit all new licences, and powers have been introduced to amend or revoke licences which are causing significant environmental damage. The EA undertake management decisions concerning water resources based upon water availability statuses for the various 'resource management units' in each of England's roughly 100 designated catchments. These statuses are derived from a process called the Catchment Abstraction Management Strategy (CAMS). Substantial reforms to the licencing system are now being consulted on, whereby the government is looking to time-limit all existing water licences, to better link licences to water availability, and to instigate a more sophisticated system of water licence trading. Therefore, whilst legislation and policy concerning water quality is leaning towards greater stakeholder participation and co-operation, some of the recent water resources management actions instead emphasise the importance of water as an economic good and the role of competition and profit-making.

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5.2. Research findings

Here we discuss the findings of the directed content analysis, detailing the ways in which the five categories that were identified from our review of adaptive co-management compare to recent developments in English water policy. As discussed in Section 2, after an initial assessment, seven key documents were selected for a detailed analysis, where together these documents give a strong indication of government thinking and policy direction. A brief description of each of the seven policy documents, referred to in the text as DOC1−DOC7, is shown in Table 1.

5.2.1. Functions of water

Current English water policy adopts the ecosystem services approach to understanding how water functions within a catchment. In Future Water (DOC1), a healthy water

environment is explicitly linked to social, economic, and environmental resilience, where a 'joined-up approach' is advocated due to the interrelated nature of the different issues affecting the water environment. The range of ecosystems goods and services is outlined in the environment white paper, The Natural Choice (DOC4). Then, following the UK National Ecosystems Assessment (2011), the most recent policy documents detail a wide list of benefits that a healthy water environment provides for the different sections of society. These benefits relate to both economic outcomes and to human health and wellbeing, including resilience to droughts and short- and long-term resilience to "market changes and global changes, and climate change" (DOC6: 12). Beyond the services the water environment provides for human society, in several of the documents, mention is also given to the intrinsic value of a healthy water environment that conserves and enhances biodiversity, as well as the "strong moral responsibility to protect it" (DOC4: 7).

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5.2.2. Change and uncertainty

The documents reveal that the government recognises that a degree of change is inevitable when managing water, and that this is set to increase in the future. Whilst the challenges associated with climate change are regularly mentioned throughout all but one of the documents, other sources of change that are addressed relate to demography, lifestyle choices, and water demand. Natural variability is also recognised, where the water environment is viewed as "a dynamic system, constantly changing as a result of natural forces and human activity" (DOC6: 8). This understanding appears to have resulted in an appreciation that a new way of thinking about dealing with these challenges is required, one which adopts the notion of "preparing for and accommodating inevitable change" (DOC7: 76).

On the other hand, in most of the documents, uncertainty is discussed far less often than change is, and in some of them is not mentioned at all. Yet in Water for People and the Environment (DOC2) and The National Adaptation Programme (DOC7), it is better addressed. Here, there is a two-fold emphasis on both reducing uncertainty and managing for it, given that in the future there is likely to be "a far less stable operating environment with a higher degree of uncertainty and a greater potential for shocks" (DOC2: 62). Thus, policy should "encourage options resilient to climate change to be chosen in the face of uncertainty" (DOC2: 3).

5.2.3. Resilience and adaptive capacity

Throughout our analysis of the seven policy documents, we observed a focus on developing resilience and adaptive capacity, where in DOC7 (111) resilience is defined as "the ability of a social or ecological system to absorb disturbances while retaining the same basic ways of functioning, and a capacity to adapt to stress and change". However, despite the definition's recognition that the social system is an important feature of resilience – which is the focus of adaptive co-management – this dimension receives very little attention in the documents. Instead, they tend to focus on resilience and adaptive capacity, as they relate to ecosystems and the natural environment or to infrastructure and technology. This is most telling when considering DOC5, which never makes this connection despite promoting measures that, according to the adaptive co-management literature, are likely to enhance the resilience and adaptive capacity of the system. These measures include the devolution of management rights and the sharing of power with a wider range of stakeholders within the catchment. Only once, in DOC7, is

the link between the structure of the social system and overall system resilience clearly made. Here, the document states that the Catchment-Based Approach "is the sort of innovative approach that the regulatory framework can enable to help deliver long-term resilience, including to climate change" (DOC7: 73).

5.2.4. Participation and scale

With respect to participation and scale, there is a change in emphasis from the earlier documents in 2008 and 2009 to the documents that follow these. Although collaboration between different stakeholders is stated as being of importance in the earlier policy documents, this is typically framed more in terms of government consultation at the national or regional level, rather than joint decision-making and power-sharing in accordance with the subsidiary principle. Thus, although the catchment is discussed as a relevant scale in the earlier documents – for example, in terms of the CAMS process and government programmes such as 'catchment sensitive farming' – this typically does not then go on to discuss the merits of fuller stakeholder participation and co-operation at this level, nor how the catchment level is linked to levels below and above it.

In contrast, documents from 2011 onwards reframe the issue so that "local businesses, citizens, and interest groups will play a significant part in determining and implementing the measures needed to achieve long-term improvements" at the scale of the catchment and local sub-catchment (DOC4: 30). Furthermore, these local scales are more coherently linked to the 'strategic' regional and national levels, in particular through the process of river basin management planning. Yet at the same time, the policy framework sets out to allow a degree of local autonomy for catchment-based groups as the government is "deliberately not trying to prescribe how and when local initiatives should work" but rather provide a "framework to support local action [where] much of what is described sets out the 'bridge' between local actions and the much larger scale actions described in the River Basin Management Plans" (DOC5: 2).

Whilst these policy developments concerning participation and scale apply largely to water quality management, water resources policy is also placing more of a focus on the decision-making of resource users within catchments. However, this is being achieved through the development of a system that more closely links water abstraction licences to real-time availability of water, as well as the trading of these licences. Both the farming and conservation sectors have observed that these market-based reforms have the potential to encourage greater co-operation between resource users (NFU 2013, unpublished report; ENDS 2013, unpublished report).

5.2.5. Process and learning

Again, a progression can be seen between the earlier and the most recent documents, this time in how English water policy relates to process. In particular, this can be observed by the way in which water management has come to be conceived of more as a long-term social process. Thus, in The Catchment-Based Approach (DOC5), the government states that their "level of ambition is not just for the short term. It is a long-term commitment" (DOC5: 14). Whilst this conception of water management as a long-term social process is not explicitly stated in many of the documents, the process of river basin management – including the participatory and cross-scale approach that is now being encouraged by the government, as discussed above – necessarily entails a social and process-oriented management approach. This represents a substantial change from the centralised,

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bureaucratic, and expert-dominated management strategy that preceded these developments (Parker and Sewell 1988; Watson and Treffny 2009).

Several of the documents discuss the importance of learning, but from a top-down perspective, where this usually refers to ways in which government bodies and different academic institutions can learn from "current research, pilot studies, and monitoring of existing and new mitigation and restoration activities" (DOC6: 39), or, as in the case of the Catchment-Based Approach, the importance of "starting to test and assess different ways of working, learning initial lessons around engagement, collaboration, and catchment planning first hand" (DOC5: 1). There is also reference to the adoption of adaptive management plans by the EA for managing water resources, which again suggests a place for learning in the thinking of policy-makers.

Yet, whilst there is clearly a recognition of the need to learn from experience, these policy documents do not explicitly frame learning as the mechanism by which processes like the Catchment-Based Approach evolve over time. Nonetheless, again the process of river basin management planning must be considered because of the way in which it requires participants at different scales to periodically develop management plans at six-year time intervals. As mentioned previously, this iterative and cyclical approach to water management encourages social learning when the different actors involved in the process are able to jointly learn from and devise actions in response to social and environmental feedback. Thus, whilst in these policy documents the government does not fully recognise the central role of joint learning in developing adaptive and resilient management strategies, to some extent, at least it is captured by the river basin management process, which is mandated for under the WFD.

6. Discussion

From our findings, it is clear that, in England, national water policy is increasingly adopting a position which, according to the five policy categories we detail above, provides a reasonably conducive policy environment for fostering adaptive co-management. Given the ways in which these more recent developments differ from water policy in the latter half of the twentieth century (see Section 1), this represents a notable shift. In particular, the key features of water policy in England that we identified as facilitating adaptive co-management are: (1) a recognition of the many economic and non-economic functions that water and the water environment perform, using the framework of the ecosystem services approach, (2) an acceptance that change is an inherent feature of water management that is only likely to become more prominent in the future, (3) a desire to enhance the resilience of the system, (4) the promotion of participatory and locally based management approaches that are linked across scales of organisation, (5) a growing awareness of water management as a long-term social process.

Yet despite this, it was also clear from our analysis that aspects of these categories were less well addressed. In particular, learning received relatively little attention, and in several of the documents was not mentioned at all. This is significant given that learning, and especially social learning, is one of the core principles of adaptive co-management because of the way in which it supports the development of collaborative processes and contributes to the sustainability of social–ecological systems (Keen, Brown, and Dyball 2005; Armitage, Marschke, and Plummer 2008). Indeed, from a governance perspective, many authors have drawn attention to the importance of social learning as a mechanism for transforming a system along a more sustainable trajectory (Geels 2004; Olsson, Folke, and Berkes 2004; Folke *et al.* 2005; Olsson *et al.* 2006;

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Pahl-Wostl *et al.* 2007; Loorbach 2010). Thus, Bos and Brown (2012, 1351), after examining a successful case of socio-technical transition in Australia's urban water sector, conclude that "governance experimentation in conventional, technocratic regimes has the ability to create and strengthen networks by which social learning is enhanced, leading to a transition in an existing governance structure". This strongly suggests the need for water policy in England to develop a stance that encourages experimentation and learning if more adaptive forms of management, such as adaptive co-management, are to emerge. This is especially true of a traditional water management system such as England's, which appears characteristically technocratic, efficiency-oriented, and hard-to-change (van der Brugge and Rotmans 2007).

As with learning, uncertainty is also a concept which does not always receive much attention in the policy documents we analysed, where in four of the documents it is not mentioned at all. Although at times there is a recognition of the need to develop strategies to effectively manage uncertainty, there is also a tendency to promote the idea that uncertainty is something to be eliminated or reduced. Whilst this is not in itself problematic, it is nonetheless suggestive of a mindset that tended to characterise the 'command-and-control' approach to managing water in the last century. Indeed, the still-dominant top-down and increasingly market-based governance paradigms in English water governance centre on discourses of economic rationalism and risk aversion, which tend to prioritise stability and efficiency (Elzen and Wieczorek 2005). Whilst traditionally there would appear to be good reasons underlying these positions, including concerns about control, public health, and fiscal prudence (Giddens 1999; Brown, Keath, and Wong 2008; Farrelly and Brown 2011), they nonetheless serve as a barrier to policies that would instead favour learning to live with uncertainty over simply attempting to eradicate it.

As we noted above, to a certain extent, the different policy categories are interlinked. From the findings of our analysis, it is apparent that although a new policy framework has been adopted for encouraging participatory approaches at catchment and sub-catchment levels, the ways in which this recent approach to 'participation and scale' ties in with the 'resilience and adaptive capacity' of the system, and its ability to deal with 'change and uncertainty', are not explicitly linked. This is a significant omission in the context of adaptive co-management. Thus, we find that whilst participation and scale as it relates to adaptive co-management is best addressed in the document The Catchment-Based Approach (DOC5), the same document makes no mention of uncertainty, resilience, or adaptive capacity. Furthermore, it only mentions change on three occasions, but where this relates to how the Catchment-Based Approach is expected to change over time, and not how it may be a valuable approach to managing water under changing circumstances. This omission suggests that government decision-makers do not yet fully appreciate the importance of the social dimension for reducing vulnerability, and thus enhancing the resilience, of complex social–ecological systems.

This difference in the way that resilience is conceptualised in the policy documents and in the adaptive co-management literature can be better understood by considering the emergence and development of the concept. Originally, the term resilience was applied to engineering, where it "has been technically used in a narrow sense to refer to the return rate to equilibrium upon perturbation" (Folke *et al.* 2010, 20). This notion of a single-equilibrium system also dominated the field of ecology in the 1970s. However, as noted in Section 3, it was in this decade that a new, non-equilibrium understanding of ecological systems was to emerge. Instead, these systems were characterised by multiple domains of attraction (Holling 1973). With this development, the definition of resilience also changed as it came to be conceptualised as "the capacity of a system to absorb

disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker *et al.* 2004, 10). As Davoudi (2012, 304) have noted, the thinking around social−ecological systems that developed from the 1970s onwards "has brought the role of institutions, leadership, social capital, and social learning into the scope of resilience". Smith (2014) notes that this is in contrast to how the term resilience is often used when referring to water management in England. Here, the idea of engineering resilience remains a seductive concept, perhaps in part because the business of public water supply entails large and costly forms of infrastructure which do not fit as easily into the more dynamic and flexible conception of resilience that followed from developments in social−ecological thinking.

For two of the policy categories in Section 5, we noted a change in the nature of the statements pertaining to them as one moved from the earliest to the latest policy documents. Here, we will consider reasons for these changes, which concerns statements addressing 'participation and scale', as well as those dealing with 'process'.

First, with respect to participation and scale, our analysis highlighted a difference between the first two policy documents, dating from 2008 and 2009, and the documents that followed, dating from 2011 to 2013. Here, there was a shift from framing participation as government consultation, largely at the national level, to a focus on the involvement of local and regional actors in decision-making, where action is linked across scales of organisation whilst also allowing for a degree of local autonomy. The event which appears to have triggered this shift in policy is the threat of a legal challenge in early 2011 from WWF-UK and the Angling Trust. Here, these organisations took the government to task over a perceived failure on its part to implement the Water Framework Directive (WFD) in accordance with its terms and conditions. It would appear that a key issue underlying the legal challenge was the nature of stakeholder participation in management decision-making and action at the catchment level. Following this, in March 2011, the government issued a position statement (DEFRA 2011c) in which it committed to developing the Catchment-Based Approach. Publications by DEFRA since this time, including the Catchment Based Management Approach (DOC5), suggest that the government now embraces a more pluralistic approach to managing England's water environment, with repeated references to the value of collaboration and partnership working on the ground, the importance of retaining the autonomy of local catchment groups, and the need for the government to relinquish absolute control over water management (DEFRA 2012, 2013a, 2013c, 2013d).

As with participation and scale, a change in policy discourse around the notion of process − as more of a long-term, social phenomenon − can be attributed to the mandates of the WFD, which has put in place River Basin Management planning in England. Already discussed in Section 5.2.5, this entails a cyclical and iterative management approach nested across several scales of organisation. However, even here this remains more of a structural change in England (Watson and Treffny 2009) and not one which on its own has affected how process is conceived of in the policy documents. Instead, here again we must consider the significance of the legal challenge just described, which in turn resulted in the Catchment-Based Approach in England. This is because it is in the policy document relating to this development (DOC5) that statements on how water management proceeds most closely align with the notion of process as conceived of from an adaptive co-management perspective.

This insight, if substantiated, would point to the changes we have observed in government policy as stemming from the mandates of the WFD, which in turn has given environmental interests in the UK the power to challenge the government's stance.

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Indeed, the analysis would suggest that the policy positions that most closely align with the categories emerge from supranational centres of decision-making. Thus, alongside the government's evolving policy stance on participation, scale, and process, which are all largely in keeping with an enabling policy environment for adaptive co-management, the other category that most closely aligns itself is 'functions of water'. Here it is clear that the government's position is directly tied to an ecosystem services approach. In particular, government policy on this matter has been strongly influenced by the United Nations' Millennium Ecosystem Assessment (MA 2005), as a DEFRA report has made clear (Haines-Young and Potschin 2008).

Finally, it is necessary to recognise a key limitation concerning the approach we have taken in this paper. That is, using a directed content analysis does not reveal the sorts of insights that a more critical understanding of water policy in England might provide, where there may be a significant difference between the discourses adopted in the policy documents and the reality of water management on the ground. For example, Cook *et al.* (2013, 755) have discussed when exploring the concept of participation in integrated catchment management as: "while statements *about* legislation promise symmetric engagements, the mechanics *of* legislation frame participation as asymmetric consultation". In contrast, by critically examining the various proposals and statements, we identified in the policy documents from a discourse analysis perspective, or by embedding these documents within the wider political economy of water governance in England, it would be possible to discover something about the ways in which power operates to constrain or facilitate the adoption and implementation of the stated policy objectives. Increasingly, these factors are being recognised by the adaptive co-management literature, which now pays attention to the importance of understanding how power shapes issues such as trust building, conflict resolution, and social learning (Nadasdy 2003, 2007; Doubleday 2007; Armitage *et al.* 2009; Whaley and Weatherhead 2014) which are vital for fostering the success of the process.

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7. Conclusion

In this paper, we have examined current water policy in England through the lens of adaptive co-management, an emerging approach to environmental and natural resource management that is claimed to enhance the resilience of complex social–ecological systems under conditions of change and uncertainty. Given the sorts of challenges that issues such as climate change and a growing population pose to water governance in England, encouraging the development of approaches like adaptive co-management becomes an important policy consideration. Our review of the literature revealed five key policy categories which were identified as being necessary for providing a suitable enabling environment for the emergence of adaptive co-management. We then used these criteria to conduct a directed content analysis of key English water policy documents from 2008 onwards. Our findings have revealed that, in a number of ways decision-makers have put in place policy objectives that are amenable to the emergence of adaptive co-management. The analysis also indicated that these particular policy objectives – namely 'participation and scale', 'process', and the 'functions of water' – depended in large part on decision-making in supranational arenas, and most clearly the EU.

At the same time, we also noted a level of discrepancy between key aspects of the five policy categories and water policy as laid out in the seven government documents. In

particular, we identified: (1) a failure on the part of policy-makers to adequately prioritise the place of social learning as a central mechanism by which water management in England can progress and adapt to changing circumstances, (2) only a weak focus on uncertainty and the need to live with it, instead of simply attempting to reduce or eliminate it, (3) a failure to link resilience and adaptive capacity to the social dimension of water management.

In order to facilitate the development of an enabling policy environment for the emergence of adaptive co-management, here we put forward two proposals that should be carried through in future policy documents. First, water policy should give special attention to the place of social learning within existing management processes such as river basin management planning and the Catchment-Based Approach. It should also promote new objectives especially designed to facilitate joint learning as a way of developing a more adaptive system of water management in England, and to recognise that this is necessary because of the inherent levels of uncertainty decision-makers face from a range of sources (Pahl-Wostl, Sendzimir *et al.* 2007). Second, policy that attempts to enhance the resilience and adaptive capacity of water management in England must explicitly link this objective to the social dimension. In the documents we analysed, although resilience and adaptive capacity were stated aims of the government, this typically related to the design of infrastructure and regulatory systems, or the healthy functioning of natural ecosystems. Whilst these are important considerations, from an adaptive co-management perspective, the participatory, multi-level, learning and process aspects of water governance are seen as key social attributes of a more resilient and adaptive system. Embracing these concepts so as to achieve this aim could prove vital in the coming years, if policy-makers are to allow for a system of governance that is able to cope with the challenges that lie ahead.

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Notes

1. The ability of coupled social and ecological systems to "absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker *et al.* 2004, 10).
2. The subsidiary principle "aims at determining the level of intervention that is most relevant" for particular actions or activities (EC 2010), and thus to ensure "that powers are exercised as close to the citizen as possible" (EP n.d.). Often this implies shifting the focus from higher to more local levels, although this need not be the case.

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