

Critical review of international literature relating to integrated and adaptive natural resource management, with particular reference to effective stakeholder engagement in catchment management

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Rationale

This review informs the evaluation of Knowledge Exchange (KE) activities which will take place in WP3 of this project, in which good practice guidelines will be developed through application and evaluation in Defra's three Demonstration Test Catchments (DTCs). Whilst the review focuses on catchment and watershed management, it also includes key papers relating to natural resource management (NRM) more generally, where issues of scale, stakeholders, resources and issues are comparable to those of catchments.

Knowledge exchange can be viewed as an evolution of knowledge transfer, which involves one way communication processes, often using either didactic or extractive methods. Instead, knowledge exchange is commonly conceived as two way flows of information between scientists and people who participate or have an interest in research findings which enhances mutual understanding of complex processes. Through such a process the stakeholder benefits from a greater understanding of science, and scientists have access to forms of knowledge derived from stakeholder experience. In this review we try to capture how stakeholder engagement might best be undertaken and what its limitations are in complex natural resource management processes. This review will help us shape good practice guidelines for KE in adaptive catchment management (with reference to diffuse pollution in the case of the DTCs) which the project will attempt to use, evaluate and refine.

Firstly we review the development of integrated and adaptive natural resource management and illustrate this with reference to different models and approaches that have been used across a range of issues, and time and spatial scales. Secondly we extract lessons for the engagement processes used in catchment management from the evidence available and explore in detail some of the challenges and opportunities that might be

associated with these. Finally we look at how lessons from other's experiences might benefit knowledge exchange practices within the Defra's Demonstration Test Catchments. Here we emphasise the need to monitor, evaluate and review KTE both during and at the end of the processes. The review of good practice in knowledge exchange was oriented within the wider context of NRM. Literature reviewed used keywords e.g.: NRM, engagement, integrated, adaptive, catchment, management, stakeholder, watershed, representation, environmental, evaluation, and focussed on:

- What does theory recommend and what knowledge has been gained?
- What does experience show us, and what evidence is there of effective practice (or otherwise) of stakeholder engagement?
- Previous reviews of KE related studies of NRM.

Introduction

This report summarises the key themes that have emerged in recent years from research on stakeholder engagement in natural resource management (NRM) and in particular adaptive catchment management (CM) processes. Stakeholder engagement is seen as a necessary ingredient in any integrated, collaborative and adaptive management process where responsibility for decisions and actions is distributed across a range of actors/ and interests, and is increasingly visible in political agendas aiming to encourage local decision making (RELU 2011). Before delving into the literature on the above topics it is necessary to define our key focus, that of who is a "stakeholder". Hemmati 2002 Ch2 (from Blackstock and Richards, 2007) provides a concise definition of stakeholder appropriate to this review. Stakeholders are:

"those who have an interest in a particular decision, either as individuals or representatives of a group. This includes people who influence a decision, or who can influence it, as well as those affected by it."

The management of natural resources has, over the past decades, become necessarily more complex, increasingly involving multiple interest groups with conflicting goals, differing

timelines and different approaches to planning, decision-making and actions. Much has been written about the potential benefits of, approaches for and challenges brought by the need to engage stakeholders in such processes, and existing reviews have synthesised elements of this learning (e.g. HarmoniCOP, 2005; Reed, 2008; Ison and Watson, 2004). Much of the literature reaches similar conclusions about the need for stakeholder engagement, methods for achieving it, and that geographical scale, governance, empowerment, timescale, resources and top-down versus stakeholder led processes may all impact on how effective the resulting NRM is. While Reed (2008) reasserts that there is evidence that stakeholder participation can lead to more sustainable decision-making, such evidence, and the reviews of papers upon which it is based, tends to stress the conditions and contexts of particular stakeholder engagements which underpin effectiveness. For example, Warner (2006) concluded from an international study of water management multi-stakeholder platforms that expectations of an engagement process should be both realistic and clear to all involved, and that effective engagement platforms depend on the a clear identification of the issues involved by the stakeholders present. Similar conclusions in relation to engagement are made in studies reviewing the efficacy of processes adopting adaptive management.

The development and practice of adaptive management

Effective stakeholder engagement is one of the key requirements for adaptive management in NRM. Adaptive management, sometimes paraphrased as learning by doing, of riparian systems has been discussed and used in various instances over the past 30 years in relation to modelling these biophysical systems (Walters, 1997). Much of this early discussion revolved around the integration of the hydrological and biological sciences, and the impact that 'emergent effects' arising from less well understood parts of the system had on the viability of what were termed management experiments. An earlier book by the same author explains why ecological resources should be managed in an adaptive way, with reference to sustainable harvesting models dating back to the 1950s (Walters, 1986). They conclude that testing policies and actively learning from them should form the basis of effective resource management and that experience of management itself is likely to be more beneficial than relying on development of models which repeatedly highlight uncertainty and information gaps, and are unable to predict the outcome of management

scenarios. However, not until more recently has adaptive management been used to refer to how processes might be applied to achieve wider stakeholder or policy goals (Gubbay, 2001, de Groot and Lenders, 2006). Indeed Walters (1986) reports that adaptive management in early cases from the USA was more effective in simple institutional settings where a few well defined goals are set by a small group of experts, whereas attempts by more complex groups of stakeholders generally fail. In another north American study McLain and Lee (1996) reported that projects attempting adaptive management had failed to recognise the value of non-scientific information, had a poor understanding of policy needs, and displayed a lack of awareness of the views of other stakeholders, leading for the authors to call for involvement of a broader range of knowledge and stakeholder types, more representative systems models and improved management and governance structures.

Gunderson (1999) asks if we can 'manage to learn', noting that institutions are more likely to be motivated to learn lessons because of actions perceived to be failures while there is no such response to a successful outcome: so while they might learn why something went wrong, lessons are rarely consolidated from what went well. Gunderson concludes that institutional capacity for learning should be a priority if adaptive management is to be practised effectively, a lesson also stated by Stankey et al (2005) in their extensive report for the USDA Forest Service which calls for rule based planning to be replaced with innovative practices that enable agencies, private bodies and the public to realign their activities in light of changing circumstances. Medema et al (2008) revisits the literature to try and explain why neither Integrated Water Resource Management (IWRM) nor adaptive management concepts have been reliably translated into effective resource management approaches. As they state, academic disciplines involved in developing systems theory have long acknowledged the complexity inherent in socio-ecological (and wider) systems. Management frameworks (such as IWRM and adaptive management) based on such understandings offer the possibility of translating this system thinking into worked examples. Crucially however, these management frameworks tend to be generated within academic circles, and not with or by those stakeholders responsible for their implementation. Hence the need for effective engagement and a focus on knowledge exchange to allow co-learning between stakeholders within resource management

scenarios (Allan et al, 2008). Indeed Allan and Gunderson (2011) bring us up to date and describe nine ‘pathologies’ associated with adaptive management (see Table 1), the first of which is ‘lack of stakeholder engagement’. One of the reasons they state for this is government agencies maintaining a unique position (e.g. statutory powers, technical expertise) amongst a group of stakeholders and being unable, unwilling, or having insufficient resources to put adaptive management into practice. Rather than beginning with engagement, deliberation and devolution of decision-making, they take responsibility for overseeing planning, monitoring and evaluation of the resource management process, thereby preventing the development of adaptive capacity.

Table 1: Pathologies in adaptive management (adapted from Allan and Gunderson 2011)

1	Lack of stakeholder engagement
2	Experiments are difficult
3	Surprises are suppressed
4	Prescriptions are followed
5	Action procrastination: learning and discussion remain the only ingredients
6	Learning is not used to modify policy and management
7	Avoiding hard truths: decision makers are risk averse
8	The process lacks leadership and direction
9	Focus on planning, not action

Other factors making adaptive management intractable are larger spatial scales and heterogeneity of views (economic, political or technical) across a range of stakeholders. Allan and Gunderson (2011) conclude that adaptive management is best suited to problems involving a high degree of scientific uncertainty where resources are available for several management approaches to be tried and compared, combined with a shared vision that brings even the most recalcitrant stakeholders on board.

Effective engagement in NRM

Stakeholder engagement is increasingly accepted by policy and decision-makers as a requirement of collaborative resource management. Engagement platforms have made use of tools developed for participatory rural appraisal, and have incorporated social learning

concepts in the design of engagement activities that has led to the development of more effective methods for knowledge transfer and exchange. Evaluating whether or not engagement is effective is partly about assessing the degree to which it leads to agreed collaborative outcomes being achieved. However, if a more objective conclusion is to be made of the effectiveness of engagement processes, evaluation criteria, based on agreed indicators, performance measures and baseline/monitoring data, need to be applied.

They make it clear that these elements need to work in combination, not isolation, if they are to provide a foundation for effective engagement in adaptive resource management. Agencies need to learn how to be flexible and responsive to stakeholders' ideas and critiques. In order to do this they need to scope out such processes before initiating them. Following a study of ten agencies in the USA where they uncovered a dearth of strategic thinking, Shindler and Aldred Cheek (1999) proposed five questions that should be agreed between stakeholders before embarking:

- 1) How will decisions be made?
- 2) What do we hope to accomplish with the public?
- 3) What does the public need to know to participate effectively?
- 4) Who is "the public" for this issue?
- 5) What special circumstances exist?

They conclude their paper with six good practice guidelines (Table 2) which enable engagement in NRM, but say little about the factors that may facilitate or inhibit their application:

Table 2: Six elements key to engaging the public in adaptive resource management

Shindler and Aldred Cheek (1999).

1	Open and inclusive public processes enjoy increased support
2	Skilled leadership and interactive forums contribute to long-term relationships among participants
3	Innovation and flexibility improve the quality of decisions
4	Early and continuous involvement improves public understanding of the issues and managers understanding of participant perspectives

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- 5 Efforts that result in tangible outcomes demonstrate accountability and build ownership among those involved
 - 6 Incorporating citizens ideas and experiences in decisions builds trust in natural resource institutions
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Broderick (2005) states that successful CRM approaches require the accommodation of differences within and between stakeholder groups, reinforcing findings from a detailed study in the USA by Selin et al. (2000). Such conclusions also emerge strongly from the research Fletcher (2003) carried out on democratic representation in UK coastal partnerships, where ad-hoc membership arrangements could jeopardise the meaningful involvement of the relevant stakeholders. Said et al (2006) stated that dependent on the context, public participation leading to acceptance of a process is required for such ICM to be feasible in the longer term whilst Keough and Blahna (2006) emphasise the need to include the full breadth of stakeholders in decision-making. Maarleveld and Dangbégnon (1999) state that it is not only the resource users who should participate in a forum, but those who are affected by its use as well, and to facilitate this institutional structures need to be developed to facilitate this broader engagement (SLIM 2004). However Warner (2006) warns against setting unrealistic goals for engagement and provides evidence showing the extent to which stakeholders may prefer to remain outside of a process when they feel that it will cost them more to participate than it will benefit them.

A common consideration in assessing effectiveness of stakeholder engagement is the degree to which lay, indigenous, experiential or local knowledge is incorporated into any dialogue, planning or decision-making process. This parallels Arnstein's ladder of participation (Arnstein, 1969) where the degree of stakeholder empowerment obtained from participation shifts from none at the bottom of the ladder (being dictated to), through increasing levels of participation, to devolved responsibility or power, which emerges from a shared understanding of a complex problem (even if solutions are still disputed), at the top of the ladder. Other approaches to assessing effectiveness of stakeholder engagement are based on the argument that increased information availability facilitates a greater level of common understanding between groups (social learning), as long as different parties are able to deliberate over their interpretations of the information (Collins and Ison, 2006). Several key elements are identified: the depth of engagement required for 'effectiveness' where depth is the degree to which power is transferred to stakeholders; what this means

for different types of stakeholder's engagement needs; and the ensuing balance of power, interest and legitimacy (Chevalier, 2001). During their study on principles of good practice for catchment management Marshall et al (2010) looked at the contextual factors that might impact on these (Table 3). One of their conclusions was that certain characteristics are outwith the control of projects and these will affect (positively or negatively) their ability to apply principles of good practice. Two of the six core principles identified were adaptive management and appropriate involvement strategies. Others included using appropriate decision making processes and defining roles and responsibilities.

Table 3: Diversity of characteristics of eight UK coastal or catchment projects (adapted from Marshall et al (2010)).

Characteristics	Relative spatial scale	Catchment / Basin / Estuary	Timescale	Number of management issues	Landuse type	Number of stakeholders (<10, >10)
Case study						
Solway Firth Partnership	Large	Estuary	1994 to date	Many, not just water	Rural / coastal	>10
The Ythan Project (Aberdeenshire)	Small	Catchment	2001 – 2005	<10	Rural	<10
Dee - Ken CMP (Dumfries and Galloway)	Small medium	Catchment	2000 (2002) to date	Water related and catchment biodiversity (link to LBAP)	rural	>10
Firth of Clyde Forum.	Large	Estuary	1995 (strategy published 2000) to date	Many, not just water	Diverse	>10
Tweed Forum (Borders)	Medium	Catchment	1991 (2001-03 planning phase) to date	>10	Rural	>10
West Country Rivers Trust (SW England)	Medium	Basin	1995 to date	River ecology and education focus	rural	>10
Mersey Basin Campaign	Large	Basin	1985 to date	> 10	Mixed urban rural industrial	> 10
Dee CP (Aberdeenshire)	Medium	Catchment	1999 (consultation) 2003 (planning) to date	35+	Rural, some urban	>10

The European Water Framework Directive (2000/60/EC) (WFD) recognises the need for stakeholder involvement in collaborative management of freshwater systems in order that

multiple, often interrelated, water quality and supply issues are to be addressed (Blomqvist, 2004). WFD guidelines build on lessons learned from existing catchment management projects, wider experience gained from collaborative natural resource management and previous EU commitments to stakeholder involvement in resource management (Environment Agency, 2003).

The Environment Agency (EA), the body with statutory responsibility for the implementation of the WFD in England, is seeking to reduce the impact of diffuse pollution on the freshwater environment. The EA increasingly recognises the need for improved stakeholder engagement methods to better enable collaborative learning and a more holistic understanding of catchments as integrated systems (Orr et al., 2007). One such approach advocates looking at a problem in different ways. A recent study (Toderi et al., 2007) looks at the opportunity to improve engagement of land managers by changing the way in which a technical problem (nitrate pollution) is framed. Such issues can be understood at local scales as interactions between land management practices (e.g. fertiliser timing, crop rotations) and natural processes (e.g. rainfall, erosion responses). This more tangible understanding was then used as a basis for dialogue between ecologists and land managers which led to co-development of mitigating practices that reinforced engagement and facilitated a more collaborative management approach. The EA is also endeavouring to learn from its experience of stakeholder engagement during the first round of the RBMP process in England (Orr et al., 2007). The EA distinguishes between four different, overlapping, categories of stakeholder (regulatory stakeholders; professional stakeholder organisations; local stakeholder organisations; and members of the public), and has adopted a more consistent approach to stakeholder engagement for the WFD process with key elements being:

- early engagement;
- providing clear information;
- transparency about what we are doing and how others can contribute;
- listening to others and understanding their needs and interests;
- providing opportunities for involvement that make efficient use of time and resources and
- allowing stakeholders to have effective input.

Other UK based projects such as 3Dee Vision in north-east Scotland also demonstrate how inter-agency working can be facilitated through early, effective engagement with locally pertinent issues (Walker and Langan, 2004).

The need for wider inclusion beyond land managers and agencies is advocated by Broderick (2005), as well as the development of processes that can incorporate the views and different knowledge types of different stakeholder types. Awareness of the requirement for adaptive governance to enable adaptive management has led to key research into the role of social learning in such processes (e.g. Maarleveld and Dangbégnon, 1999). Stakeholder engagement under WFD has been studied in the Spey catchment (Scotland) by Blackstock and Richards (2007) who explored the impact of a range of stakeholders with issues often associated with alternative, and sometimes competing, knowledge types. While there are opportunities in such situations for knowledge exchange and social learning, it appears that gaining understanding, and mediating between differing views in relation to 'facts' has to be carefully resourced and managed in order that conflicts do not arise that may derail collaborative processes. A crucial point is made regarding the need to clarify the difference between engagement processes and processes that seek collaborative solutions. The former is based on ideals of empowerment, good governance and innovation, the latter on efficient and effective use of resources and provision of timely solutions. This builds on earlier work (Schusler et al., 2003) on deliberative planning involving a state agency and local communities and their development of common goals and working relationships. They describe eight elements that facilitated social learning: open communication, diverse participation, unrestrained thinking, constructive conflict, appropriate governance structures, multiple sources of knowledge, extended engagement, and facilitation. They also remind us that social learning is not the sole criteria for successful collaborative management and suggest consideration of organisational capacity, appropriate processes, appropriate structures, and supportive policies, as being necessary for collaboration.

Lubell (2004) looked at the involvement of grassroots stakeholders in collaborative watershed management. The results of a survey of farmers involved in the Suwannee River Partnership in Florida indicated that whereas economic factors were the primary influence on effective policy outcomes, effective participation and engagement in collaborative management was associated with high levels of perceived social capital. This is instructive in

showing that the methods used to achieve policy aims do not necessarily align with measures of a policy's success; a finding of relevance both to policy-makers and those responsible for policy implementation. This is reinforced in a more recent paper showing how farmers' voluntary engagement in environmental improvements is increased where management is carried out at the local level and social capital and reciprocity form an important component of decision-making (Marshall 2009).

Context specificity is a common theme, as is the conclusion that different types of engagement can, depending on the situation, result in similarly effective outcomes. Blumenthal and Janninck (2000) propose a framework incorporating participation, institutional analysis, natural resource issue definition, spatial scale, and process stages for comparing collaborative management. When applied to six approaches (soft systems analysis, adaptive management, ecosystem management, agroecosystem analysis, rapid rural appraisal and participatory rural appraisal) their framework illustrated how these processes differ in terms of stakeholder participation, institutional analysis, and formulation of resource issues, whereas all of the methods are applicable at the scale of a watershed and include elements of planning, monitoring and evaluation. While these six approaches enable increased understanding of natural processes, they are less instructive about the structure and evolution of social institutions and how these impact on processes. Another area requiring further refinement in order to make tools more accessible and relevant to practitioners is the question of whether they can be generalised across scales. A recent study suggests that while individual processes need to be appropriate to their location and stakeholder requirements, it is possible to identify regional similarities in organisational structure which might allow coordination across broader scales such as whole catchments or watersheds (Clark et al., 2005). However, it could be argued that this conclusion is restricted to this study's setting, where key elements outwith the process such as scale, governance structures or legislation are also constants.

Organizational principles and key characteristics of effective community-based environmental initiatives have recently been described (Gruber 2010), however these tend towards extensively detailed summaries of previous findings consisting of a mix of generic and accepted statements alongside some poorly defined pointers such as "optimum management system" and tautologies e.g. "Adaptive co-management and adaptive

leadership are dynamic and focused on processes rather than static structures". However this is beginning to be addressed, for example by Marshall et al (2010), in attempts to define good practice for catchment management while emphasising the types of influence that internal and external factors (limited ability to control context) have in defining how a process operates and the degree to which these enable or inhibit good practice guidelines to be implemented.

Much research to date does indeed provide good practice principles derived from studying existing processes, but these offer little in the way of guidance for new initiatives other than repeated calls to be aware of opportunities and constraints, and be as adaptive as possible in approach. Further applied research (Keough and Blahna 2006) has shown how the success of a process is influenced by the elements of good practice applied, although this study only looked at projects deemed successful (success in this case being defined as having met their original goals). Marshall et al (2010) note that catchment management processes in the UK depend on engaged stakeholders working within an institutional setting, and these are exposed to external factors including access to funding, availability of data, changing legislation and capacity to act. This is facilitated by co-developing clear objectives and processes for deciding them, the ability to turn plans into actions, which requires some form of investment in a coordinator, and the ability to withstand external factors such as funding or policy changes. This is reflected in other work which emphasises the need for governmental support for watershed groups in Australia and the USA (Curtis et al., 2002), however this can be a difficult role to play if the governmental partner also has a regulatory role (Blackstock pers. comm. 2010). Other research in the USA noted the decline of partnerships where government agencies withdrew support for coordination whilst those that maintained support were able to persist and develop their activities further (Genskow, 2009). This highlights the importance of stakeholders who are able to coordinate, facilitate and provide resources to a process. Indeed it could be argued that they are required if any form of success is to be attained because of this characteristic alone, regardless of their other rationales for engagement. Further, adaptive management is widely regarded as essential to future success in resource management (Grantham et al., 2010) and this requires a shift from 'prediction and control' approaches to the ability to learn from both successes and failures (Pahl-Wostl, 2007). To do this Pahl-Wostl advocates the view that

stakeholder participation should be sustained throughout a management process, and be integral to the monitoring, evaluation and adaptation phases.

Alternative conclusions derive from studies of volunteer group involvement and subsequent 'burnout' (Byron and Curtis, 2002) whereby expected gains are not realised and disenchantment ensues. This leads to the conclusion that collaborative processes need to set achievable goals at the outset, but the authors do not go on to refer to the potential for adaptive management approaches to be able to account for fluctuating circumstances and flexibility in decision making. Research in the Maitland Watershed Partnerships (Ontario) reveals that efforts to engage and involve in decision-making should extend beyond the planning period through implementation, monitoring and evaluation of a process (Ferreyra and Beard, 2007). This might enable clearer distinctions between outputs and outcomes to be agreed, and incorporating other benefits of engagement (Blackstock and Richards, 2007).

Ideas of tension in the participation - prescription relationship relate to Hisschemöller and Hoppe (2001) who explain that where problems are complex and there is uncertainty caused by a lack of knowledge or poor understanding of the available information, stakeholders may well have different understandings of the nature of the problem. In such a situation they need to enter into a dialogue if they are to form a shared definition of the problem and potential solutions (Koppenjan and Klijn, 2004). The process of problem definition should reduce ambiguity and uncertainty through the co-development of the stakeholders' understanding, generating what can be described as 'negotiated knowledge', that which is understood by all and required for the problem to be resolved (De Bruijn et al., 2002). Indeed elements, or stages of this, can be captured in a four dimensional matrix where it is possible to distinguish between a shared understanding of a problem; contested problems; shared understanding of the solution; and contested solutions. Other elements related to arriving at mutually agreed solutions include the need to increasing the stakeholders' understanding of tradeoffs inherent in complex systems if engagement is to be gained and maintained (Tompkins et al., 2008).

A recent review paper (Blackstock et al., 2010) details the ways in which different literatures might contribute to understanding how to engage land managers to mitigate diffuse pollution as part of catchment management processes. Key areas that emerged included the

questioning of scientific evidence by farmers; responding to further calls for collaborative planning and management; and when the value placed on information as a commodity increases. The review also makes the point that existing gaps in knowledge may well require co-learning activities in partnership with farmers and that future challenges, including climate change impacts, will necessitate development and use of adaptive co-management processes. In another study, 44 watershed (catchment) partnerships in California and Washington were evaluated over a period of time and importantly, sought to understand both substantive and process oriented criteria (Leach et al., 2002). Their findings relate to managing expectations with respect to time, with major issues taking on average 48 months to be resolved and have plans in place. However those involved believed that their partnerships were most useful when addressing these serious local problems rather than simpler issues, a positive finding tempered by the potential for partnerships to aggravate related issues (e.g. economic, regulatory and property rights).

Collaboratively derived decision support tools require effective partnerships between researchers and stakeholders. Hewett et al (2009) describe the development of a Phosphorus Export Risk Matrix (PERM) model with stakeholders (farmers in this case), taking iterations of it to a series of stakeholder workshops in order to collaboratively develop a decision support and education tool. The resulting interactive PERM contains relevant queries and potential mitigation strategies that incorporate both expert and local knowledge, with stakeholders having a reliable understanding of the model and the implications of its outputs. This provides some evidence to support claims that co-learning, novel visualisation and communication tools, and risk management models can be useful in communicating practical land management options to land managers. Similar findings are emerging from engagement approaches used recently on the Monitored Priority Catchment project on the Lunan Water (Scotland) (Blackstock *pers comm.* 2011), and work currently underway within NERC's Environmental Virtual Observatory explicitly includes evaluation of stakeholder engagement in its development of web-based tools for assimilating and disseminating information and different understandings of water related environmental issues.

Selman et al (2010) investigated co-learning using art related methods to involve participants and promote sharing of experiences. Creative writing workshops were held with

the theme of a 'recovering river' and those involved reported enjoying the experience and a raised awareness of catchment management issues relating to their river. The authors argue that this is equivalent to building local capacity for the sustainable management of a river and that this type of engagement could complement collaborative catchment management processes. However, without following the individuals involved through, is it possible to claim any more than raised social awareness and alternative definitions of catchment issues? It seems that we need to better understand how raised awareness might lead to active engagement in problem resolution, if at all, before we can draw firm conclusions regarding the increased sustainability of river management (Orr et al, 2007, Blackstock et al, 2010). Indeed, awareness raising and co-learning between practitioners of different NRM processes should and can be an active pursuit, such as the workshops convened by catchment and coastal management coordinators in Scotland in order to write and publish a handbook of good practice in catchment management (CATCH 2009).

Conclusions in relation to the Demonstration Test Catchments and beyond

It is clear from the research to date that there are many recommendations that are repeatedly made to argue for and guide engagement in collaborative NRM and catchment management. Practical good practice guidelines have been based on such research, and these have been reported to influence the outcomes of collaborative management processes. Studies to date have also shown the difficulties involved in predicting how a project's context will shift over time which highlights the need for adaptive management whereby the formation of a plan is not an end point for decision-making, rather a constructive start of an ongoing process of negotiation, priority setting, activity, monitoring, evaluation and redefinition of problems to be addressed. Evaluation studies can provide useful feedback to a process (e.g. Tweed Forum, Mersey Campaign) however, such evaluations may not always be timed appropriately, or be affordable, and may only focus on a certain aspect of a process (Fritsch and Newig, 2006). Indeed they should ideally be designed into management processes. All of this requires both good leadership and high levels of coordination, which in turn facilitates long term access to funds and continued engagement of stakeholders in the collaborative process. Perhaps more complex and serious issues demand engagement from stakeholders and risks associated with them

becoming demotivated and withdrawing from the group are tempered by the benefits to be gained from solving the problem.

This review demonstrates the importance of building on the academic learning of the past decades, and testing management in the field. Now that environmental policy is calling for collaborative and adaptive management, there is both a need and an opportunity for adaptive management to be put into practice. This must be based on the understanding that monitoring of progress, evaluation of process and revision of required actions is essential to this. However it will not always be possible or indeed appropriate to do this – for example projects with few issues, agreed problems and simple solutions. For improved management of more complex processes to be feasible it requires not only effective engagement with relevant stakeholders, but in some cases, institutional reform in order that the flexible governance structures required for adaptive management can be developed.

It might indeed be concluded that much has already been learnt about the situations in which stakeholder engagement is recommended and how this links with adaptive co-management of resources, and that a degree of consensus around what is required in order for it to be successful has been reached by those academics studying it. What this and future projects need to do then is use the DTCs and similar action research test-beds to improve tools for engaging stakeholders, and engage all in the process of adaptive management, thereby facilitating improvements in the ways in which we manage our environment.

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