Building collaboration and learning in integrated catchment management: the importance of social process and multiple engagement approaches

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Abstract: This paper acknowledges that success at integrated catchment management (ICM) requires the ongoing participation of different groups of stakeholders in an adaptive management process. However, this can be difficult to achieve in practice because many initiatives fail to address the underlying social process aspects required for successful engagement. We introduce a 10-year ICM case study based in the Motueka River catchment, New Zealand, to illustrate how focussing on underlying social relationships can support multiple engagement approaches. We introduce the concept of 'community of practice', and suggest a framework for use in integrated programmes that recognizes the need for different

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engagement approaches to support the range of conversations required in such programmes. We illustrate this framework using a continuum of research approaches ranging from disciplinary through multi-, inter- and trans-disciplinary. Whatever the chosen level or style of engagement, the project needs a clear mandate and leadership to support the social and organizational processes required. Such efforts require time, including the need to build the capacity of participants—both in the community and in organisations. The importance of supporting both formal and informal conversations within engagement efforts is highlighted. The study also demonstrates a need for facilitation skills, particularly to manage the overall direction of such efforts.

Keywords: engagement; communities of practice; social learning, adaptive co-management, integrated catchment management, ICM

Introduction

Successful outcomes to environmental problems increasingly depend on the coordinated actions of decision-makers at different levels, from paddock (land managers) to enterprise (resource managers), region and nation (policy agents). In the management of any given catchment, agencies can anticipate multiple stakeholders will demand a voice in decision-making. In these situations, catchment management becomes not so much a matter of determining a solution, as about mediating a course between many possible perspectives, some political, at appropriate scales (Mollinga 2008)). Such a management process requires that many viewpoints and sources of information are shared among the different stakeholders concerned, and then integrated to find solutions that will guide the way forward (Allen & Kilvington 2005). Adaptive management approaches recognize that successful efforts will be ongoing as ecological and social systems change and co-evolve.

In response to these challenges current catchment arrangements are looking to move away from agency-centred, single-issue approaches to integrated approaches with emphasis on community involvement and whole-of-system approaches to land and water management (de Loë et al. 2009). As Fenemor et al. (2008) point out, engaging stakeholders in integrated catchment management (ICM) provides for a holistic approach to managing natural resources by actively involving the different stakeholders with an interest in the resource. It is inherently place-focussed, and should be seen as an ongoing process to help communities

learn and adapt. Putting people at the heart of the integrative process in this way does more than just provide a wider range of experience and perspectives from which resource managers can learn. It involves more people in the management; it takes people along on the ride and connects disparate issues. Dialogue provides the conversations, connections and combinations that bring new insights to virtually every kind of collective endeavour. When dialogue enables social learning, individuals, groups and organizations grow in their understanding of different perspectives, areas of agreement and disagreement, and (perhaps most importantly) their own values and those of others (Schusler et al. 2003). These all contribute to a shared understanding as a precursor to the development of innovative solutions that can support more enduring catchment management.

However, not all engagement initiatives are the same, and they differ in ease and purpose according to whether you are talking with your immediate colleagues or community or with groups having different perspectives and cultures. This is where the concept of 'communities of practice' is useful. The term generally refers to groups of people who share a concern for a common practice (or management activity), and who, through building relationships, learn from each other to improve their practice (Brown & Duguid 1991). In this sense communities of practice can be science disciplines, agency departments, or a farming community. As Allen and Apgar (2007) explain, in these groups learning is facilitated by interactions between people that build trust, binding its members together into a social entity that shares a repertoire of communal resources. Communities of practice tend to be self-organizing social structures, as they emerge by people with a common interest coming together to share (Brown & Duguid 1991). The trust embodied in communities of practice provides a safe environment in which people can learn by interacting. Thus they are useful for sharing tacit and cultural knowledge about practice. It is this characteristic of communities of practice that makes them good tools for building capacity across and between organizations. Effectively, communities of practice have potential to coalesce into a catchment community of practice.

Although collaborative and learning-based approaches to natural resource issues have been advocated for environmental management for many years (Plummer & Armitage 2007; de Loe et al. 2009), they are better seen as islands of success, rather than a new sweeping paradigm. There is a growing appreciation that the more immediate barriers are

organizational and social, rather than technical, given the multi-stakeholder nature of most environmental issues (Allen & Jacobson 2009). These barriers include a tendency to discount non-scientific forms of knowledge, institutional cultures within research and policy and decision-making that work against genuinely participatory approaches, and a failure to provide appropriate processes to promote the development of shared understandings among stakeholders belonging to diverse communities of practice (Allen & Jacobson 2009). Moreover, there is a need to replace the 'tool-kit' approach to participation, which emphasises selecting the relevant tools for the job, with an approach that views participation as a distinctly social process (Reed 2008). This implies a need to pay more attention to ensure that formal approaches to aspects of collaborative environmental problem-solving (read workshops and meetings) are recognised as being supported by related informal engagement activities (e.g. those smaller conversations in cabs on the way to airports, etc.) that support long-term relationship and trust building.

The challenge then, for nurturing this more inclusive approach to research and management, is to facilitate processes by which this wider range of stakeholders can engage with complex problems on equal terms. This applies both to the design of multi-stakeholder engagement initiatives and the relationship- and trust-building needed at a more individual level. For those who commonly set the decision-making agenda—i.e. policymakers and scientists—this requires a change in position from expert to peer enquirer, walking alongside others looking to learn. For those more marginalized groups who are often left out of the decision-making arena – both formally and informally, this requires finding ways to confidently interact with decision-makers who are unfamiliar with their preferred language and style of communication (e.g. storytelling, hui).

Key to these richer engagement activities are intentionally designed social process and facilitation techniques that support different groups to come together and freely share their knowledge and experience, such as the *Watershed Talk* process described elsewhere in this issue (Kilvington et al. 2011b). At the same time we suggest that those proposing or catalysing engagement processes for any integrated environmental initiative must also appreciate that not all conversations are the same. At a holistic management level, different groupings need to agree on those goals and practices that will tackle the issue, while

acknowledging and respecting the different value systems of those communities of practice. At a more applied level, different communities of practice need to agree on how to link methods and ensure approaches to work are compatible. Thus, There is no one platform for dialogue and learning that can support the wide range of engagement contexts and purposes required in integrated environmental management, whether at catchment, regional or national scale.

In this paper we review emerging lessons around how to engage stakeholders in integrated management initiatives. We highlight the need to use multiple engagement approaches to address different constituent needs and opportunities, and to encourage the informal conversations that spring up around these. We focus on the experience of an ICM research programme based in the Motueka catchment in New Zealand and provide a simple framework for distinguishing a range of conversations across different communities of practice. We then illustrate the range of platforms for dialogue and learning that were used in the programme during 10 years of ICM research. Finally a number of lessons are described from across the programme to guide resource managers seeking to improve collaboration in other integrated science, management and policy initiatives.

Programme context and engagement framing

The Motueka catchment in New Zealand was chosen as a case study for researching ICM in New Zealand because of its rapid economic and population growth with corresponding environmental pressures and a diversity of landforms, land and water uses and issues. The catchment has a relatively unspoiled environment with land uses ranging from pristine national park to planted pine forest and intensive horticulture, nationally recognized trout rivers, and economically important coastal fish and shellfish resources (including a growing aquaculture industry) off the river mouth in Tasman Bay (Fenemor et al. this issue). With a focus on catchment-scale resource management issues, the research also includes catchment impacts on the adjacent coast in which the river plume extends more than 180 km^2, effectively extending the catchment area offshore (Gillespie et al. this issue).

The ICM research programme began in July 2000 after extensive consultation with end-users, stakeholders and input from two international experts (Bowden et al. 2004; Fenemor et al. 2008) and ran for 10 years. It was the product of a 2-year, multi-step design process (Bowden et al. 2004) involving public meetings, informal discussions, and interest group and agency

meetings. More details can be found throughout this special issue and on the programme website, http://icm.landcareresearch.co.nz.

As summarized in the introductory paper (Fenemor et al. this issue), and described by the research outcomes above, research in the ICM programme aimed to take a holistic approach to catchment-scale issues (Fig. 1). The research was focussed on a place-based approach using the Motueka catchment and Tasman Bay as a primary demonstration basin, but with some linked research initiatives also carried out in other parts of New Zealand including Gisborne, Waikato and Southland regions. Three biophysical elements are complemented by the social-learning element, which aims to provide a framework in which questions can be posed and addressed by research providers, resource managers and the stakeholder community working collaboratively (Bowden et al. 2004). Local Māori (tangata whenua) were key collaborators in this programme and as such particular attention was paid to ensure the ICM project worked closely with local Māori (the local indigenous people or tangata whenua) and associated groups, to learn how to make biophysical research more responsive to Māori needs, and for researchers and policymakers to better understand Māori values and issues.

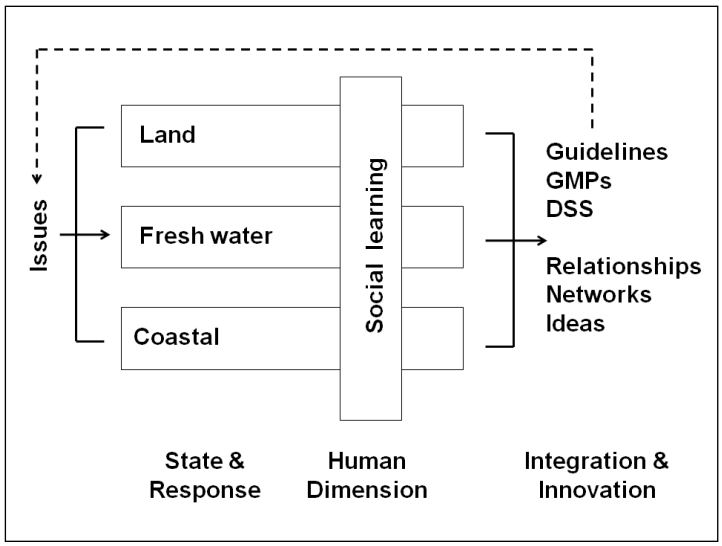

Fig. 1 Basic integration framework for the Motueka Integrated Catchment Management research programme (modified from Bowden et al. 2004). [GMP = Good Management Practice]

The addition of social learning to the research mix was to improve interactions between science providers and catchment stakeholders, and to maximize the uptake and use of new knowledge and tools developed from the research. In this way , the research is not only able to produce new outputs such as guidelines, good management practices, and models to help decision-makers, but through the act of collaboration the process helps build new or strengthened relationships and networks, which benefit uptake and research relevance (Kilvington & Allen 2009). As Fig. 1 illustrates, the addition of an evaluative feedback loop enables the development of new knowledge in an iterative process of collaborative adaptive management, or learning-by-doing. Here questions can be posed and addressed—with appropriate statistical rigour, as needed—in an environment in which research providers, resource managers and the wider catchment stakeholder community work collaboratively. This type of adaptive approach is applicable not just for research purposes but for any integrated environmental management initiative.

A framework for linking communities of practice

Taking a social learning approach to catchment management research requires researchers to broaden their approaches (Phillips et al. 2010). In particular, collaborative approaches need to be employed that help groups engage more closely with a wider range of perspectives, and that support dialogue. One way of looking at this is to acknowledge science disciplines as individual communities of practice. We can then recognize a continuum (Fig. 2) of engagement spaces depending on the other groups being interacted with. A useful way of thinking about the different conversations that need to occur in an integrated research programme includes the core spectrum of disciplinary, multi-, inter- and trans-disciplinary research (Jakobsen et al. 2004; Morse et al. 2007). Within this spectrum, inter- and trans-disciplinary research are primarily integration-based and characterized by the need for dialogue and learning among different social perspectives. This outline also serves to elaborate the theoretical grounding behind the different Social Spaces framework of the ICM Motueka research programme as described by Kilvington and colleagues (2011a) this edition.

Disciplinary science is characterized by the development of a deep understanding of a single problem, or aspect of a problem, within a well-defined specialization. Multi-disciplinary science is an additive approach that combines the efforts of more than one discipline within a

programme (Fig. 2). Each programme has a number of different disciplines represented, with each group working separately in their own way. Multi-disciplinary research may require cooperation among the different contributors. However, beyond that researchers will largely work and publish in their traditional disciplines.

In contrast, integrated research approaches commonly involve a process of coordinated and collaborative inquiry into a common problem with sharing, creation and synthesis of knowledge among disciplines, sectors and team members (Morse et al. 2007). Inter-disciplinary collaborations involve unified problem formulation, sharing of methods and data, and perhaps the development of new questions. Ideally, collaborators accept, understand, and sometimes apply one another's disciplinary methods and approaches (Eigenbrode et al. 2007).

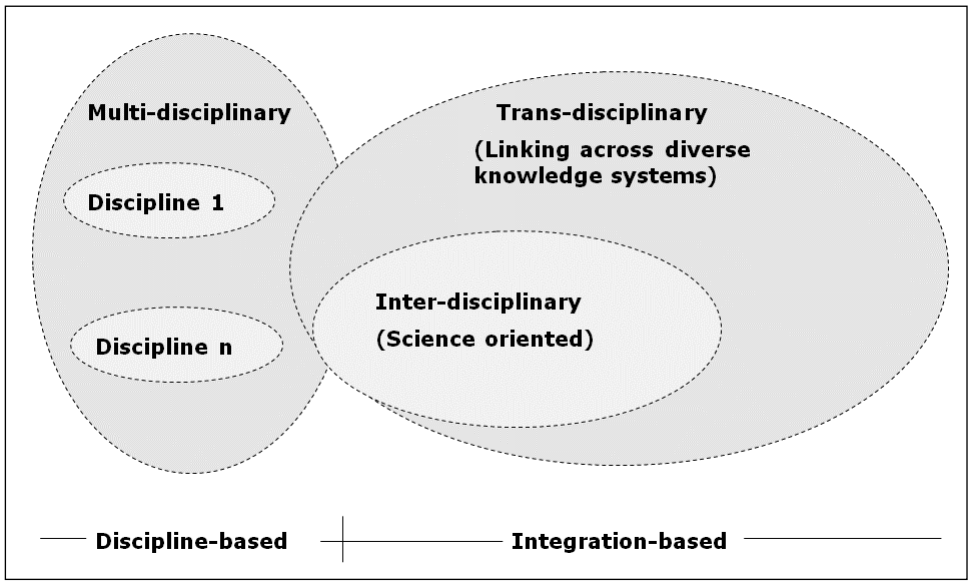

Fig. 2 Different types of science-driven engagement.

Trans-disciplinary collaborations go further in that they integrate the experience and worldviews of researchers and other stakeholder groups—land managers, planners, and policymakers, local communities, indigenous communities. Such collaborations commonly seek to establish priorities and then research common goals and create new knowledge and understanding. Collaborators may accept epistemological perspectives that are unique to the situation, and that may be foreign to the science disciplines involved (Eigenbrode et al. 2007; Miller et al. 2008). This issue is frequently exposed in dialogue with iwi, and with rural

communities. Science is usually seen as reductionist, whereas iwi and communities are more holistic and integrative in their approach. Recognition and, ultimately, accommodation of such perspectives is important for enduring outcomes. Trans-disciplinary collaborations have the potential to provide knowledge and understanding that is problem oriented, responsive and open to the needs of the different players, contextualized and systems-based, adaptable, consultative and socially robust (Nowotny et al. 2001). Thus the discussions can be broad-based, although problem-focussed. The talk is not so much of methodologies or technologies, as it is about areas and interests to inquire into, and people's values. Discussions also centre on issues of ethics and power such as who has the right to benefit from, decide or manage new technologies.

Although we have populated Fig. 2 as being science-driven, we suggest that the same framing could be used for dialogues driven from any communities of practice with a distinct knowledge culture. For example, for organizations and agencies it would be more appropriate to substitute 'department' for 'discipline'. The important point is that Fig. 2 highlights that difficult conversations across different communities of practice, each with their own work or knowledge cultures, are required to develop integrated approaches to sustainability issues.

It is clear that inter- and trans-group dialogue and collaborations are essential to deal with large-scale, long-term, complex and interlinked issues like ICM. The remainder of this paper describes and evaluates examples of such engagement approaches from the Motueka ICM programme. However, it must also be stressed that crossing practice areas—be they disciplinary, departmental or cultural—requires sound knowledge of one's own area, especially its own limitations (Munasinghe 2001). As Bracken and Oughton (2006) remind us, if there is to be any chance of success in developing common understandings, the first step is development of trust between different knowledge cultures. In this process we may be reminded of the limitations, and strengths, of our own knowledge systems, and they will become clear to others too. This is a positive—a return to basics—from which to build a more powerful approach to collaboration. Accordingly, in science-driven projects successful inter-disciplinary collaborations are still reliant on the quality and expertise of participants maintaining their own primary discipline skills. What does change is that members of the research team need to step out beyond their discipline and engage with a range of other

stakeholders and experts in the catchment if they are to successfully engage with a larger, more holistic set of questions.

Using multiple approaches to support programme engagement

In the next sections we provide examples of different engagement initiatives that underpinned projects seeking to link different stakeholders across a range of catchment communities of practice. It is important to appreciate that projects such as ICM need to engage people at a range of levels or hierarchies, each providing context to the other. Some initiatives here were based around high level policy questions, while others were locally based around dealing with a single issue in a particular stream or river reach. Over the course of the ICM programme these diverse conversations and forums continued and went beyond the normal meeting format to bridge gaps that are usually problematic, such as between science knowledge and management decisions, between agencies and communities, and even between science disciplines.

To make these connections and conversations happen there are a variety of opportunities available (termed 'platform'; Kilvington et al. this issue a). An understanding of the frameworks that underpin social process issues can help understand where to use different platforms for learning and engagement (Kilvington et al. this issue a). In turn, as we have seen above, these platforms need to be underpinned by social processes that support relationships. In the Motueka ICM programme, platforms have included one-to-one meetings, annual general meetings, learning groups, computer-model facilitated workshops, online asynchronous groups, and an art–science initiative. Trans-disciplinaryinter-disciplinary; and multi-disciplinary examples are given below:

Trans-disciplinary collaborations

Trans-disciplinary collaborations reflect the principle of empowering and harnessing grass-roots action for ICM. Some sought better understanding of other groups' needs and worldviews to ensure responsiveness from the project, others were based on collaborations where tacit or anecdotal knowledge was likely to be useful, or where engagement was likely to assist understanding of research results or development of methodologies. Participants were involved in a number of ways. We provide examples below that cover the establishment

and operation of learning and online groups. We also use an example of an engagement process built around the development of ICM tools such as scenario modelling, and another around an art–science initiative to connect ICM thinking and underpinning science with the wider catchment community.

Learning groups

Participatory learning groups, when they work well, create trust and communication, which can flow through to support collaboration and innovation. They differ from traditional meeting or workshop processes in that they are designed as ongoing processes. Through cycles of reflection and discussion over the course of a number of facilitated meetings, learning group members explore experiences and ideas, building analyses, alliances and possibilities for action through participatory interaction. One example, the *Watershed Talk* community resilience project, is discussed elsewhere in this issue (Kilvington et al. this issue b).

The community reference group (CRG) was run over the 10 years of the ICM programme. This learning group comprised 8–10 residents from throughout the catchment selected initially by expressions of , plus up to four researchers and policymakers relevant to the discussion topic of each meeting. While some initial participants left, others joined. They represented a range of geographies, roles, cultures, gender and age and included farmers, orchard managers, recreational fishing, iwi and tourism perspectives. The CRG met three to six times a year between 2000 and 2010. Its role was to act as a sounding board to discuss the research being carried out and ways of applying the new knowledge gained to improve management of the catchment resources. Beyond these meetings participants were also invited to attend other research events—both social and work-related—which played an important role in building strong relationships. Each year, around the time of the AGM, a dinner was held for programme participants and CRG members and partners.

Several research initiatives developed out of CRG meetings. The Sherry River catchment group (Davies-Colley et al. 2004; NZ Landcare Trust 2010) emerged from a presentation to a CRG meeting about comparative water quality across the Motueka catchment (Young et al. 2005). Research on river discharge impacts on the Tasman Bay scallop fishery (Gillespie

et al. this issue) was hotly debated at another. An important research outcome involving CRG participation was their input into an influence matrix model for understanding the important factors influencing environmental outcomes at whole catchment scale (Cole et al. 2007). The trust built up among CRG members and researchers allowed the free flow of discussion, including direct challenges to the assumptions, structure and usefulness of the influence matrix model itself.

Another more time-bounded learning platform was the Collaborative Learning Group on Sediment —a group of parties who decided to focus their discussion on the sources and effects of fine sediment in the Motueka River. This issue-focussed dialogue ran between 2005 and 2006. The extent and nature of the sediment issue was debated by individuals from various stakeholder backgrounds, including a fishery manager, landowner, forestry manager, member of a local Māori tribe, and staff of government agencies. Side conversations were held through regular phone calls from the facilitator and smaller meetings between two or three participants.

Much of the benefit was derived from the process of assisting participants to learn of and see alternative perspectives on the same issue. As participants developed trust the group was able to explore issues in different ways. For example during one fieldtrip discussion revolved around breaking down myths around erosion. This discussion highlighted that forestry was not automatically the cause of more sediment loss than pastoral farming over a medium to longer time frame as is commonly believed(Young et al. 2005; Basher et al. this issue), highlighting the benefits of exploring topics that are taken for granted.

Online groups

Confluens is an online workspace for ICM staff and associated partner and other stakeholder groups. The site has around 70 members and was created because the project team was widely dispersed. Although the project site was in the Motueka catchment, team members were based in Nelson, Hamilton, Palmerston North, Wellington and Lincoln.

The space was created to enable interaction and conversations to occur within the project team and with a limited range of active stakeholders. While trialled early in the project, it was

initially abandoned, and then reintroduced a few years later when team relationships had developed to a point where participants felt comfortable about sharing their knowledge and asking 'dumb questions' of their colleagues (Phillips et al. 2010). A 2007 *Confluens* participants' survey (Smith & Horn 2007, unpubl.) found that while most thought the discussions interesting, some felt there were social barriers to responding including 'not wanting to appear dumb', 'not feeling qualified to express an opinion', or more commonly 'lack of time'. In this second phase it was noticeable that with the help of activefacilitation, e.g. posing provocative questions/opinions or timetabling topics in a structured manner, participation would surge. It also created a virtual space from which a number of new cross-disciplinary projects and ideas emerged that perhaps would not have occurred if that 'space' had not been created for this interaction to happen. Again, *Confluens* discussions were interspersed between smaller conversations, both virtual through email and face-to-face. These smaller interactions helped fill gaps in more formal discussions and played an important role in keeping people 'on the same page'.

Modelling with stakeholders

As well as the influence matrix model described above, other modelling initiatives were built on close engagement with stakeholders. For example the Motueka agent-based model (ABM) was aimed at answering 'what if' questions around land use change scenarios in the catchment (Montes de Oca Munguia et al. 2009). As part of this work the project engaged with researchers from local iwi/hapū (tribe/subtribes) to articulate and model cultural values and perceived land-use effects on cultural values and environmental health. Importantly this work, carried out towards the end of the programme, was based around strong relationships developed early on in the ICM programme and from other work strands. Local Māori researchers, many associated with a pan-tribal regional Māori resource management agency *Tiakina Te Taiao,* had been involved in building capacity through development of their own cultural knowledge systems (e.g. GIS) and cultural values mapping (Harmsworth et al. 2005), and through iwi/hapū-led projects on cultural monitoring approaches and cultural indicators of river and stream health (Harmsworth et al. this issue).

The Motueka ABM was developed with a social learning process to ensure the establishment of a meaningful context for its use (Montes de Oca Munguia et al. 2009). The process

involved workshops and hui (meetings) to provide the Māori research partners with background information on the development of the underlying spatial and temporal GIS layers, discussion of how cultural values could be modelled, and how the ABM could then be used by Māori for their own planning and policy purposes. Collaborative ABM products included spatial maps showing degrees of perceived land-use impact on Māori values, and Māori values expressed for forest-type classes and wetland ecosystems.

Art–science

While models are one way to foster discussion and help people think in new ways about sharing their different perspectives, another way of using different media in novel ways was explored by the Motueka ICM art-sci project 'Mountains- to-Sea' (Atkinson et al. 2004).

In 2002 Landcare Research hosted a workshop of artists and scientists to explore creative ideas that might emerge by bringing the two disciplines together. A collaborative art-sci proposal arose from this forum looking into new ways of understanding and conveying ideas about the environmental and social interactions that shape the Motueka catchment. A significant achievement of the project was the *Travelling River* exhibition, which gathered together over 250 community and science images and associated stories in an exhibition at the Suter Te Aratoi o Whakatu Art Gallery in Nelson in 2004 (Atkinson et al. 2004). Later that year the exhibition was installed at the Motueka Museum, and in 2005 at the Tapawera Show in the upper Motueka catchment.

The project aimed to build understanding about cultural and biophysical interconnections at a catchment scale. Creating opportunities for dialogue builds awareness of and commitment for improved environmental management. More than 3000 people attended the exhibitions. Many lively conversations were sparked between viewers as they wandered amongst the 24 braided-river-like curvilinear screens from which the images and stories were suspended. This dialogue and subsequent media coverage created a focus within the entire community on the whole-catchment concepts of connectivity from mountains to sea, and connectivity among community networks (Kilvington & Horn 2006).

Inter-disciplinary collaborations

In many applied integrated environmental projects such as ICM, inter-disciplinary collaborations differ from trans-disciplinary in that they more commonly focus their dialogue around issues of methodology, data sharing and scale. The aims and context of the research itself are set in the wider more inclusive discussions with stakeholders.

At the more straightforward end of the inter-disciplinary spectrum lie projects where the different disciplines involved are given equal weight in the project design, but at the same time their linkages provide ways for researchers to look at and show the catchment in a new light. Examples include the role of the river plume ecosystem in a mountains to the sea catchment approach (Cornelisen et al. this issue; Gillespie et al. this issue), and linking groundwater to fish behaviour (Olsen & Young 2009).

The development of IDEAS, a suite of models to explore catchment futures (Fenemor et al. 2008; Dymond et al. 2010), provides a good example of the range of challenges that characterizes inter-disciplinary engagement. Involving stakeholders in model development and implementation provides a number of challenges (Voinov & Bousquet 2010), and these cover both technical and process issues. To address these challenges IDEAS had both a social and technical stream of work associated with its development. The technical and social aspects together are called IDEAS—Integrated Dynamic Environmental Assessment System.

The technical stream of IDEAS is a loosely linked set of biophysical and socio-economic models that may be applied at a range of scales, from local through to regional. However, it has particular strength at the catchment scale where biophysical processes have strong spatial interactions. For example, in the Motueka catchment, there is strong interaction between nutrient export from intensively farmed land and aquaculture productivity within the Motueka River plume in Tasman Bay (Gillespie et al. this issue). However, the integration of biophysical with socio-economic models is difficult to achieve in a dynamic sense because biophysical models at the catchment scale tend to be complex, requiring much input data and computer processing. Socio-economic models transcend catchment boundaries, operating best at regional to national scales. There are a number of issues of scale and data compatibility also involved in such endeavours. Accordingly the development of the initial

technical model and its integration has taken several years, and has involved a regular series of meetings between researchers from the different disciplines involved. More recently IDEAS also developed a social workstream that uses a participatory approach to ensure stakeholder knowledge is incorporated into the models, to set parameter thresholds and design scenarios, and to ensure users understand the inherent assumptions within the models used.

This scenario highlights the larger challenges of inter-disciplinary research for disciplines that do not directly appear to reinforce each other. All too often inter-disciplinary research ends up reinforcing a single discipline or epistemology, relegating others to a service role (Miller et al. 2008). This is most pronounced in collaborations where epistemologies differ widely, especially between constructivist-based social researchers and positivist biophysical researchers. Linking biophysical sciences (with their emphasis on looking for the right technical answer) and the more interpretive social sciences (looking to bring in and support different viewpoints) is not easy (Roughley & Salt 2005; MacMynowski 2007). As Phillips and colleagues (2010) recount, the Motueka ICM programme took about 2 years for researchers from biophysical disciplines to capitalize upon linkages across their projects and align these to programme goals. It took much longer to reach the same level of integration between biophysical and social scientists and this illustrates the differences in contrasting worldviews between biophysical and social researchers, each drawing on separate belief and knowledge systems, language and behaviour, and using very different methodologies and datasets.

Discussion

After 10 years of collaborative research it is noticeable that the wider Motueka ICM research team has developed a high degree of trust, respect and friendship, and that these have supported the quality of inter- and trans-disciplinary engagement efforts. The experience gained through the multiple engagement approaches used in this programme corresponds with a visible increase in the capacity of a range of key stakeholder groups (including the research team) to participate in integrative collaborative activities. Local iwi are now regularly represented in discussions around local resource management issues—they have grown their capacity and skills in Māori knowledge, cultural tools, and collaborative

engagement. A new pan-tribal (regional) iwi resource management committee was formed in 2008, and this provided coordination and a more proactive stance on regional and catchment resource management issues. Over the past decade the Tasman District Council has become more familiar with a range of facilitated social processes, and now targets the use of group and facilitated multi-stakeholder processes more deliberately. The research team has developed a range of skills that are necessary for integrated and collaborative endeavours (Phillips et al. 2010). These include skills in active listening and meeting participation, in addition to making full use of skilled facilitation and engagement processes. A number of the research team have gained the skills, confidence and connections to work collaboratively with iwi (Harmsworth 2005, Harmsworth et al. this issue).

Recognizing the need for multiple engagement initiatives has been an important plank in the success of the programme. This has allowed for creativity and spontaneity to emerge within the different initiatives, and caters for the different dialogue and learning needs of different participants. The concept of communities of practice has been useful, and when this has been combined with the multi-, inter-, and trans-disciplinary framework it has provided a useful guide to allowing for, and managing, a range of cross-group conversations. Looking across the different engagement experiences in the programme provides some clear guidance in three specific areas: the time needed to develop good working relationships; the need for programme leadership to provide a clear commitment to supporting the engagement processes in integrated programmes; and the need to include specialist engagement and facilitation skills in these types of integrated programmes. In summary some discourse on each of these areas follows.

An appropriate length of time to build trust and commitment among the different stakeholder groups is essential, and is reiterated in many reviews of such projects. By their very nature, integrative projects need appropriate time to allow for disciplines and other different knowledge cultures to come together and reach agreement on the goals of the work, and how it is going to be tackled. In many cases, as some of the examples in the Motueka ICM project illustrated, time is needed to build suitable relationships to have these discussions. If there are already some existing social relationships among the parties this process may be assisted and perhaps shortened, but still takes time. These additional time demands, particularly in the

early days of a project when research managers demand to see progress in the project, are not easily accounted for in project budgets and objective plans, and often accumulate to create pressures on participants (Phillips et al. 2010). With the benefit of the programme experience we would say that the amount of time to get started depends largely on the capacities for collaboration that the groups and key individuals possess.

There are a number of activities and actions that greatly support both collaboration and, simultaneously, capacity building efforts. Identifying clear objectives for working in a participatory and integrated way provides the mandate and the incentive to make it work. Links between social and biophysical researchers were helped because the research framework (Fig. 1) provided a clear role for social researchers with specialist skills in engagement and learning processes—even if at the beginning of the programme most biophysical researchers were largely unsure of what these involved. Another area where the programme provided good practice was in supporting disciplines that are commonly marginalized (e.g. social sciences) in integrative programmes. Support for other disciplines is important for embracing and affirming other perspectives because it provides academic and personal support (Bracken & Oughton 2006), and helps work against the tendency for epistemological sovereignty (Miller 2007).

There is growing evidence that we need to replace recipe-based approaches—which emphasise selecting the relevant tools for the job—with an approach that emphasises participation as a process (Keen & Mahanty 2006; Reed 2008). The latter also implies the need to pay more attention to ensuring that processes are managed by those with well-developed skills in relationship-building, facilitation and conflict management. As Allen & Kilvington (2005) and Reed (2008) point out, highly skilled facilitation is particularly important for natural resource management given the high likelihood of debate and conflict. It can also be helpful to get the most out of the participants in the process and ensure ‘socialization’ of the research or other outcomes of such processes. To take up these challenges, inter-disciplinary science approaches need to include personnel with complementary skills in the management of participation and conflict, and the integration of biophysical and social aspects of collaborative learning.

There are other challenges in developing the necessary conversations among researchers, especially when these are broadened out in trans-disciplinary efforts that seek to involve community and sector stakeholders. Getting to know people and other knowledge systems is not just a matter of bringing people together for a meeting. It is about building a relationship of trust and respect, where the scientists and agency staff are no longer 'the experts' but members of a peer community of inquiry and action. This will require researchers, policymakers and agency managers to increasingly mix outside their 'comfort zone' and to engage within community-constructed spaces, e.g. community halls, schools, and indigenous meeting places such as marae. It requires us to look at dialogue of this nature as an ongoing and expanding social and learning process, rather than as a series of discrete one-off events.

Concluding comments

In the broadest sense, collaborative endeavours such as those described here are intended to improve efforts to manage our natural and built environment to achieve desired integrated and sustainable goals. The aim of bringing people together in a coordinated fashion to, articulate common aspirations, to share and understand underpinning knowledge systems, and find solutions to complex issues can be inherently difficult. The Motueka ICM research programme has provided a useful case study on which to assess and reflect the challenges of these types of complex integrative studies. A number of key lessons were derived. Most important is to build and maintain an underlying community fabric based on long-term relationships that help different stakeholders respect each other, communicate, and cooperate. While the formal platforms outlined in this paper are vital to establishing this community, it is important to acknowledge that many critical conversations will occur in the 'spaces in between' as a result of the relationships established and the spontaneous opportunities that arise. This is as much an outcome of the overall ICM community building process as the recognised meeting events but is inherently less easy to measure.

Our findings throughout the course of this project are similar to those articulated by other reviewers, and build on our earlier thinking in the project (Allen & Kilvington 2005; Phillips et al. 2010). Important factors for building collaboration included identifying stakeholders, selecting participants and leaders, identifying and agreeing on roles, determining common goals, and developing social and cultural frameworks and processes that support and enhance

collaboration. All this needs to happen in an atmosphere of trust and respect and may require careful facilitation.

From our experience in the programme several factors emerge that support good collaborative practice:

- Multi-engagement approaches and styles are required that support different stakeholders' needs and learning.
- Links and networks across communities of practice must be recognized, developed and nurtured.
- Organizational support and project leadership is needed that understands and encourages participatory approaches.
- It needs to be appreciated that people do not always learn easily and that listening and learning requires effort.
- Adequate time must be allowed for relationships and engagement to properly form.
- Technical dialogue and information need to be balanced with social and cultural aspects.
- We need to recognise that informal conversations are as much a part of the necessary social process, as the more formal and overt processes that support collaboration in workshops and meetings.

As we seek to institutionalize these challenges, integrated environmental initiatives need to include personnel with complementary skills in the management of participation and conflict and the integration of biophysical and social elements required for collaborative adaptive management.

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