

THE COLLABORATION LAB: THE TRANSFORMATIVE ROLE OF COLLABORATION IN MANAGING OUR LAND AND WATER

**Melissa Robson¹, Gabriele Bammer², Philip Barker³, Jeff Foote⁴, Suzie Greenhalgh⁵,
George Haremate⁶, Glen Lauder³, Graeme Nicholas⁴, Bruce Small⁷, Ra Smith⁸, Roger
Williams⁹ and Tina von Pein¹⁰**

*Landcare Research, Lincoln¹ and Auckland⁵; Australian National University, Canberra²;
Cultivate Partners, Wellington³; ESR, Christchurch⁴; AgResearch, Lincoln⁶ and Ruakura⁷;
Kahungunu ki Wairarapa, Masterton⁸; Plant & Food Research, Lincoln⁹; Development
Matters, Christchurch¹⁰;*

Email: robsonm@landcareresearch.co.nz

Abstract

The Collaboration Lab research programme is focused on the ‘Our’ part of Our Land and Water National Science Challenge. Adversarial processes have dominated allocation and consent applications, leading to stalemate and inaction (Small et al., 2013). Land and water regulations are based on a linear input of science into policy (OECD, 2009; Weible et al., 2004) while taking a ‘decide and defend’ approach to resource management planning (Robson, 2014). The magnitude and complexity of land and water challenges facing New Zealand require science and society to work together in new ways via New Zealand-appropriate models of engagement and science–society interaction.

The value of collaboration has begun to be recognised in New Zealand. Social science research over the past 20 years has emphasised the importance of collaboration for achieving successful outcomes in complex systems. However, there are still gaps in our understanding: there is insufficient long-term evaluation of collaborative approaches; there is a paucity of studies on how researchers undertake interdisciplinary research; translating concepts of collaboration into practice has proven very difficult; and there is a lack of important information about Māori participation in collaborative processes. The research in the Collaboration Lab programme will help to address these gaps. This paper describes the programme’s three research projects, which commenced in late 2016.

Project one will use practitioner insights on how the use of collaborative processes enables new practices, ways of organising and social relations in order to support improved decision-making and practice change. Project two will survey the participants of seven current limit-setting processes and the wider community. These surveys are designed to evaluate both the collaborative process and the outcomes of the collaboration. Project three will examine collaboration case studies using the Integration and Implementation Science (I2S) framework (Bammer, 2013) to understand if using the I2S framework could lead to improved outcomes in land and water management through improved researcher practice.

Together these projects will enhance understanding of collaborative practice, weaving together centuries of focused practice in Māori tikanga and the leading edge of current collaborative practice from multiple fields to form new mātauranga, or practical wisdom.

Introduction

Adversarial processes in New Zealand have dominated water allocation and permit application, leading to stalemate and inaction (Small et al., 2013). The phrase ‘over-allocated’ is increasingly being used to describe excessive nutrient loss or over-abstraction of water in an increasing number of catchments (Weber et al., 2011). This has triggered the need for local and national discussions on how resources are allocated, who owns water, property rights, and how we transition from the current situation to a future where operating within resource limits is the norm.

Land and water regulations have been characterised by linear science input into policy (OECD, 2009; Weible et al., 2004) followed by ‘decide and defend’ resource management planning (Robson, 2014). The magnitude and complexity of the challenges in New Zealand’s land and water sectors require science and society to work in completely new ways. Future choices and decisions about resource management use will need to consider the complex socio-ecological (social, regulatory, economic, ecological and cultural) systems in which New Zealanders live (Douthwaite and Gummert, 2010; Ekboir, 2003; Giller et al., 2008; Hall and Clark, 2010; Spielman et al., 2009). This will require New Zealand-appropriate models of engagement, and science–society interaction that moves beyond hypotheses that isolate parts of the socio-ecological system to those that incorporate complexity and address the adaptive nature of social systems (Koontz and Thomas, 2006; Newig, 2007; Patel et al., 2007; Reed, 2007). A move to a more inclusive model of engagement and science–society interaction can also help incorporate Māori enterprises into the socio-ecological systems (Kahui and Richards, 2014; MoRST, 2007).

The value of collaboration in managing our land and water has been recognised by the Land and Water Forum (LAWF, 2012a, 2012b) and in proposed Resource Management Act reforms (Ministry for the Environment, 2013). It is also evident in a move in other countries away from linear scientific input into policy and towards collaborative policy making (Ekboir, 2003; Giller et al., 2008; Hall and Clark, 2010; OECD, 2009, 2010; Spielman et al., 2009; Weible et al., 2004). Over two decades the contributions of the social sciences to many fields, including post-normal science (Cash et al., 2003; Funtowicz and Ravetz, 1993), transition management (Kemp et al., 2007; Rotmans et al., 2001; Voss et al., 2009), integration science (Bammer, 2005, 2008, 2012, 2013; Bammer et al., 2005) and transdisciplinary science (Brandt et al., 2013; Pohl et al., 2010) have emphasised that optimising multiple outcomes in complex socio-ecological systems requires collaborative approaches that include the co-development of knowledge. This demands new ways of working for science, policy and society.

Programme development

The aims of the research programme from a user perspective were developed during eight discussions and co-design workshops over eight months, with a total of 18 collaboration practitioners (from national, regional, catchment, research-based and social collaborative initiatives), users and governors of collaborative processes, and scientists involved in collaborations across New Zealand. The research programme was developed in response to their articulated issues, including not only the content of the research, but also how it should be undertaken and with whom. In combination with reviewing the literature, four issues were identified that, if addressed, create opportunities to enhance the impact of collaboration in managing our land and water.

1. There is a lack of long-term evaluation of the contribution of collaborative approaches to multiple outcomes in socio-ecological systems (Godin, 2006; Kläy et al., 2015; Newig, 2007), with the consequence that evidence to decide if a collaborative approach is likely to be successful, or to support and justify the decision to use a collaborative approach, is lacking. This programme aims to provide information and evidence to support the decision on whether or not to use collaborative planning processes. The ongoing nature of this evaluation is reflected in a quote from the co-design workshops: “We need to collect ongoing evaluation otherwise things that were a big deal at the time become part of the wallpaper”.
2. There is a paucity of long-term studies of the practice of researchers supporting collaborations, with the consequence that the necessary practices for researchers are still underdeveloped. What has been achieved is poorly documented, and the research itself has had less impact (Bammer, 2013). The opportunity is there to provide information and evidence on the critical factors of integrative applied research for achieving outcomes in land and water management, as reflected in a quote from the co-design workshops: “We have already started a journey to change the role of science and scientists to support these complex limit-setting processes, but there is more we need to do in terms of integration, including other knowledge sources, and translation of information and, for the large part, we are not documenting how we are doing this interdisciplinary work, only the results of it”.
3. Translating the concepts of collaboration and collaborative management into practice has proven very difficult, and implementation challenges have been considered as simply barriers to progress instead of a major focus of research themselves (Beretan, 2014), with the consequence that it is difficult to critically assess the links between collaborative practice and future outcomes. In addition, the lack of attention to the importance of practice can lead to overly focusing on structural or procedural dimensions (Kaplan, 2002). More effective ways of capturing practitioners’ experiential knowledge are required to improve the practice of collaborative management (Beretan, 2014), as reflected in a quote from the co-design workshops: “There is so much knowledge in people’s heads at the leading edges of collaborative practice”. The opportunity is there to support, build and develop collaborative practice in New Zealand.
4. There is a lack of information about collaboration, specifically about Māori participation. A view of Māori contribution to collaboration will be a part of the process used by the programme to map the journey of Māori in this space and suggest a Māori role for the future. “Whakawhanaungatanga – collaboration brings us into relationship with each other”.

Research aims and hypothesis, and integration with Our Land and Water National Science Challenge

The Collaboration Lab has four aims: three research aims and a capacity-building aim. The research aims are:

- to understand how collaborative practice contributes to multiple outcomes
- to build evidence of whether collaboration is successful in delivering multiple outcomes
- to enhance understanding of critical factors that affect the impact of research in land and water.

The capacity-building aim is to build collaborative practice and capacity in New Zealand for both collaboration practitioners and researchers.

The Collaboration Lab will address two hypotheses (to 2019):

- collaboration yields successful outcomes for land and water management in New Zealand
- integrative applied research is better able to address issues of concern to communities in the management of land and water in New Zealand than single disciplinary and multidisciplinary research.

These research and capacity aims align with the Our Land and Water National Science Challenge short-term outcomes of: 1) increased awareness and use of new knowledge and tools by enterprise and catchment decision-makers to use the right tool, at the right time and generate the right outcome; and, 2) increased ability among target communities and Challenge partners to collaborate within and beyond the Challenge, and will contribute to the Challenge target of ‘a 20% increase in community confidence and ownership decisions in land and water decisions in 2025’ compared to 2016’.

Overarching research methodology

The overall research methodology can be described as collaborative and participatory research. Practitioners and end users have not only been involved in the development of the research as active participants, but the research team itself is made up of both practitioners and researchers. In addition, the research includes reflective steps and is focused on actionable research. These steps are aimed at embedding this methodology in the programme.

Vision Mātauranga is a significant influence on the overarching research methodology as well. The ranga or weaving of people is a pervasive value for Māori in their approach to society, and it is a concept that is central to the research programme, both in terms of the content of the research, and how it is undertaken and with whom: weaving people and knowledge to create new knowledge and capacity.

Project One – the participatory ‘lab’

Aim and impact

The aim of research project one is to improve understanding of how collaboration leads to improved environmental, social, cultural and economic outcomes. The research will improve and extend good practice for land and water decision-making and will be delivered through capability development at multiple levels.

Vision Mātauranga

Research project one will build an enhanced understanding of collaborative practice, weaving together centuries of focused practice in Māori tikanga and the leading edge of current collaborative practice from multiple fields to form new mātauranga, or practical wisdom. The research team includes a Māori researcher and a Māori collaboration practitioner, and so areas of interest to Māori can be woven into the research design from the beginning and reflected on during the process. The project will include Māori collaboration practitioners and Māori tikanga, and other practitioner knowledge will be treated with respect. The intended impact is enhanced understanding and capacity for Māori to be prepared for, and to participate in, land and water collaborations and to integrate Māori collaborative practices

into land and water policy and decision-making practices to create a culturally appropriate and uniquely New Zealand collaborative process.

Description

Translating the concepts of collaboration and collaborative management into practice has proven very difficult. Implementation challenges have been considered as simply barriers to progress instead of being a major focus of research themselves (Beretan, 2014), with the consequence that it is hard to critically assess the links between collaborative practice and future outcomes. More effective ways of capturing practitioners’ experiential knowledge are required to improve the practice of collaborative management (Beretan, 2014).

Methodology and participants

The project draws on collaborative sense-making, problem structuring, and practice theories and methodologies to develop a conceptual model of collaborative practice grounded in the perspectives of experienced collaboration practitioners (Hassan, 2014; Kurtz and Snowden, 2003; Rosenhead and Mingers, 2001). Joint sense-making with participants will identify ‘what is important’, including the systemic relationships between preconditions, enablers, behaviours, processes, situations and outcomes. Group enquiry methods will be based on dialogic practices (Isaacs, 1999). In this way, the conceptual model will be co-developed and tested with collaboration practitioners. The development of practical resources, learning opportunities and capability growth will be in large part an emergent product of the participants and their participation.

The conceptual model will be used to understand how the use of collaborative processes enables new practices, new ways of organising and social relations between stakeholders, at multiple levels. This is in order to enable improved decision-making and practices related to land and water? The process is represented in Figure 1. The participants in this research project will be collaboration practitioners from multiple fields – not just land and water. ‘Practitioner’ is seen to encompass a wide range of roles that have a depth of involvement: members of collaborative groups, conveners, design teams, sector and community participants, elected representatives, farmers, rūnanga members and non-government organisations.

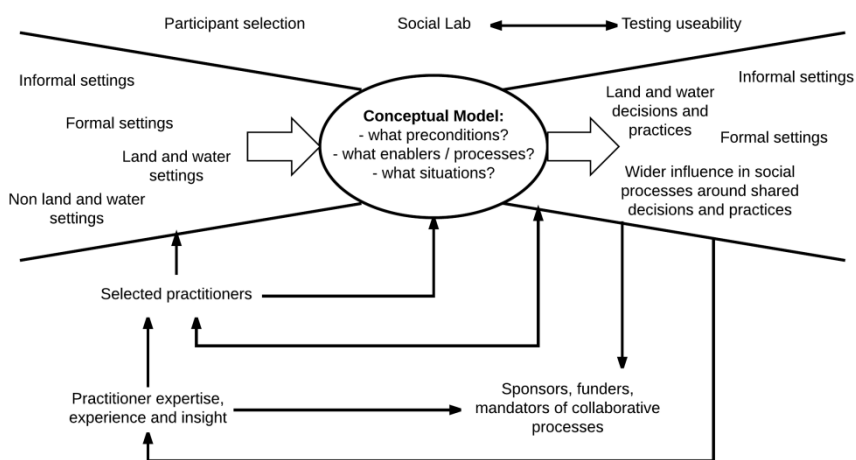


Figure 1. Proposed process for the co-development of a conceptual model of collaboration

Project two – Evaluation of collaborative processes

Aim and impact

The aim of research project two is to improve understanding of the effectiveness of collaboration in the implementation of freshwater limit-setting processes under the National Policy Statement for Freshwater Management (Ministry for the Environment, 2014). It looks at the dynamic nature of collaborative processes and explores how collaborative processes influence the wider community's perceptions of water management. The intended outcome is to identify how to better design and implement collaborative policy processes.

Vision Mātauranga

Research project two does not have a specific Vision Mātauranga component, but aspects are captured as part of the survey process. Within the participant surveys, questions cover the changing knowledge of Māori values, participation and representation. Examples of such questions are:

- Are all other viewpoints represented in the process?
- Are the viewpoints represented in the process balanced?
- Is your participation making a difference to the outcome of the process?
- Has the process been effective for resolving different perspectives?
- Has your understanding of tangata whenua rights and interests changed?

Description

There is a lack of long-term evaluation of the contribution of collaborative approaches to multiple outcomes in socio-ecological systems (Godin, 2006; Kläy et al., 2015; Newig, 2007). As a result, evidence to decide if a collaborative approach is likely to be successful, or to support and justify the decision to use a collaborative approach, is lacking. To evaluate the effectiveness of collaboration it is critical to determine what process and resource factors are essential or desirable for collaborative, transdisciplinary practice and how these factors relate to the achievement of programme outcomes (Small et al., 2015). Collaborative approaches can be evaluated against the expected process and outcomes from social learning (Baird et al., 2014; Haug et al., 2010; Huitema et al., 2010; Munaretto and Huitema, 2012), which enables assessment of the elements of learning that are needed in collaborative limit-setting processes. Any evaluation approach must also recognise the need to assess multiple criteria related to both the collaborative *process* and the *outcomes* (Morton et al., 2012; Sabatier et al., 2005; Small et al., 2015).

Methodology and participants

This research will build on the research initiated within the MBIE Values, Monitoring and Outcomes Programme (VMO, 2017). Surveys will be used to evaluate the process and outcomes from the social learning of participants in collaborations. Our evaluation approach is consistent with other studies and uses stakeholder ratings to determine the extent to which the respective collaborative processes meet the success criteria (Cullen et al., 2010; Frame et al., 2004; Gunton et al., 2007; Morton et al., 2012; Robinson et al., 2011).

Participant surveys, either online or using tablet computers, will track the progress of processes (Small et al., 2013) and evaluate their dynamic nature. The aim of these evaluations is to determine the extent to which process criteria are being met and participants have

confidence that successful outcomes will be achieved. A survey at the end of the process is designed to elicit participants' perceptions of the outcomes of the process (e.g. the nature of the agreements, how agreements had been made). The survey questionnaire was adapted from the evaluation literature and the basic framework of Frame et al. (2004). The collaborative processes being evaluated include the TANK (Tūtaekuri, Ahuriri, Ngaruroro, and Karamu river catchments) collaborative process in Hawke's Bay, a process in Tasman and five Northland Waioira processes.

In addition, community-level surveys will be used to determine how the wider community perceives collaboration and the outcomes that collaboration achieves. The surveys, in the form of telephone interviews, will cover perceptions of how well the regional council manages freshwater, the perceived fairness of water management, perceptions of conflict vis-à-vis water management, and how well a person's interests and concerns are taken into account (Sinner et al., 2016). These surveys will be conducted in the Northland, Waikato and Hawke's Bay regions, and will include people from a sample of catchments with and without collaborative processes. In addition, any evaluations conducted as part of the Greater Wellington Whaitua process and the Waikato Healthy Rivers process will be drawn upon in an attempt to look at learning across different freshwater management contexts in New Zealand.

Project 3 – Improving transdisciplinary researcher practice

Aim and impact

The aim of research project three is to enhance understanding of the critical factors that affect the impact of research in land and water. The intended outcome is improved transdisciplinary research practice supporting land and water management and delivered through researcher capability development.

Vision Mātauranga

Research project three will build an enhanced understanding of the importance of, and practice of, integrating mātauranga Māori with multiple other knowledge sources. The research team includes a Māori researcher and a Māori collaboration practitioner, which means areas of interest to Māori can be woven into the research design from the beginning and reflected on in the process. The case studies will include Māori participants, and part of the critical evaluation of the I2S framework by the research team will be from a Māori perspective. The intended outcome is an enhanced contribution of interdisciplinary applied research that includes mātauranga Māori to address land and water problems in New Zealand.

Description

Integration and interdisciplinarity are not necessary for all research (Dovers, 2005), although in reality it is not usually a binary choice but a matter of degrees. However, for grand societal challenges (Mauser et al., 2013) interdisciplinary thinking is rapidly becoming an integral feature of research. This results from four powerful drivers: the inherent complexity of nature and society, the desire to explore problems that are not confined to a single discipline, the need to solve societal problems, and the power of new technologies (2004 US National Academy, cited in Bammer, 2013).

Many researchers in New Zealand are already undertaking some forms of inter- or transdisciplinary or integrated research, in many cases with good success. However, the majority

of the effort is usually focused on the results of the integrative effort. Little research attention or documentation is focused on how the integration was undertaken. There is a paucity of long-term studies on the practice of researchers, which means the necessary practices for researchers are still underdeveloped and what has been achieved is poorly documented (Bammer, 2013).

This lack of a deliberate focus on the *how*, as well as a lack of documentation, leads to a failure to capture the wealth of experience in a way that allows it to be transmitted, analysed, evaluated and built upon. It also means that individual practice often remains unevaluated, not subjected to critical or peer review and often isolated. These are critical barriers to achieving an impact from the collaborative or transdisciplinary research (Bammer, 2013). They also represent a barrier to the delivery of the objectives of the Our Land and Water National Science Challenge.

The I2S framework (Bammer, 2013) has been developed to support inter- or transdisciplinary research in solving complex real-world problems. The framework is not designed to replace other frameworks (such as action research, systems thinking or transdisciplinarity), but instead to provide a conduit for communication across the various frameworks on the *how*, and a disciplinary underpinning of this field of research.

Methodology and participants

Research project 3 will test the I2S framework for integrative applied research using case studies across New Zealand, and will use the data collected to critically assess the framework itself. Nine initial collaboration case studies that used interdisciplinary research have been identified. For each case study, those involved in the research and knowledge provision are identified, and a small working group format will be used to capture all the relevant information for the I2S framework analysis, as well as researcher reflections on the framework. In addition, users of the information – such as iwi, policymakers and stakeholders – will be interviewed to get reflections on the process from different perspectives. These data will be used to assess the likely impact of the I2S framework on researcher practice and use by policymakers, iwi and stakeholders.

Conclusion

The Collaboration Lab research programme is focused on the ‘Our’ part of Our Land and Water National Science Challenge. The value of collaboration has begun to be recognised in New Zealand. Social science research over the past 20 years has emphasised the importance of collaboration for achieving successful outcomes in complex systems. However, there are still gaps in our understanding. The three research projects in the Collaboration Lab programme will help to address these gaps, in terms of enhancing understanding of if, when (i.e. under what circumstances) and how collaboration contributes to beneficial outcomes, and the critical factors that affect the impact of research in land and water. Together these projects weave people and knowledge together to create new knowledge and capacity.

References

- BAIRD, J., PLUMMER, R., HAUG, C. & HUITEMA, J. 2014. Learning effects of interactive decision-making processes for climate change adaptation. *Global Environmental Change*, 27, 51–63.

- BAMMER, G. 2005. Integration and implementation sciences: Building a new specialization. *Ecology and Society*, 10, 2, article 6.
- BAMMER, G. 2008. Enhancing research collaborations: Three key management challenges. *Research Policy*, 37, 875–887.
- BAMMER, G. 2013. *Disciplining interdisciplinarity: Integration and implementation sciences for researching complex real-world problems*, ANU E Press.
- BAMMER, G., O'CONNELL, D., ROUGHLEY, A. & SYME, G. 2005 (eds). Integration research for natural resource management in Australia: An introduction to new challenges for research practice. *Journal of Research Practice*, 1, 2.
- BERETAN, K. K. 2014. Summary: Addressing the interactional challenges of moving collaborative adaptive management from theory to practice. *Ecology and Society*, 19, 1, article 46.
- BRANDT, P., ERNST, A., GRALLA, F., LUEDERITZ, C., LANG, D. J., NEWIG, J., REINERT, F., ABSON, D. J. & VON WEHRDEN, H. 2013. A review of transdisciplinary research in sustainability science. *Ecological Economics*, 92, 1–15.
- CASH, D. W., CLARK, W. C., ALCOCK, F., DICKSON, N. M., ECKLEY, N., GUSTON, D. H., JÄGER, J. & MITCHELL, R. B. 2003. Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences of the United States of America*, 100, 8086–8091.
- CULLEN, D., MCGEE, G. J. A., GUNTON, T. I. & DAY, J. C. 2010. Collaborative planning in complex stakeholder environments: an evaluation of a two-tiered collaborative planning model. *Society & Natural Resources*, 23, 332–50
- DOUTHWAITE, B. & GUMMERT, M. 2010. Learning selection revisited: How can agricultural researchers make a difference? *Agricultural Systems*, 103, 245–255.
- DOVERS, S. 2005. Clarifying the imperative of integration research for sustainable environmental management. *Journal of Research Practice*, 1, 1–19.
- EKBOIR, J. 2003. Why impact analysis should not be used for research evaluation and what the alternatives are. *Agricultural Systems*, 78, 166–184.
- FRAME, T. M., GUNTON, T. I. & DAY, J. C. 2004. The role of collaboration in environmental management: an evaluation of land and resource planning in British Columbia. *Journal of Environmental Planning and Management*, 47, 59–82.
- FUNTOWICZ, S. O. & RAVETZ, J. R. 1993. Science for the post-normal age. *Futures*, 25, 739–755.
- GILLER, K. E., LEEUWIS, C., ANDERSSON, J. A., ANDRIESSE, W., BROUWER, A., FROST, P., HEBINCK, P., HEITKÖNIG, I., VAN ITTERSUM, M. K., KONING, N., RUBEN, R., SLINGERLAND, M., UDO, H., VELDKAMP, T., VAN DE VIJVER, C., VAN WIJK, M. T. & WINDMEIJER, P. 2008. Competing claims on natural resources: What role for science? *Ecology and Society*, 13.
- GODIN, B. 2006. The linear model of innovation: The historical construction of an analytical framework. *Science Technology and Human Values*, 31, 639–667.
- GUNTON, T. I., PETER, T. & DAY, C. 2007. Evaluating collaborative planning: A case study of a land and resource management planning process. *Environments: a journal of interdisciplinary studies* 34(3):19–37.

- HALL, A. & CLARK, N. 2010. What do complex adaptive systems look like and what are the implications for innovation policy? *Journal of International Development*, 22, 308–324.
- HASSAN, Z. 2014. *The social labs revolution: A new approach to solving our most complex challenges*, Berrett-Koehler Publishers.
- HAUG, C. C., HUITEMA, D. & WENZLER, I. 2010. Learning through games?: Evaluating the learning effect of a policy exercise on European climate policy. *Technological Forecasting and Social Change*, 78, 968–981.
- HUITEMA, D., CORNELISSE, C. & OTTOW, B. 2010. Is the jury still out?: Toward greater insight in policy learning in participatory decision processes – the case of Dutch citizens' juries on water management in the Rhine Basin. *Ecology and Society*, 15 (1/art.16), 1–22.
- ISAACS, W. 1999. *Dialogue and the art of thinking together*, Random House.
- KAHUI, V. & RICHARDS, A. C. 2014. Lessons from resource management by indigenous Maori in New Zealand: Governing the ecosystems as a commons. *Ecological Economics*, 102, 1–7.
- KAPLAN, A. 2002. *Development practitioners and social process: Artists of the invisible*, Pluto Press.
- KEMP, R., LOORBACH, D. & ROTMANS, J. 2007. Transition management as a model for managing processes of co-evolution towards sustainable development. *International Journal of Sustainable Development and World Ecology*, 14, 78–91.
- KLÄY, A., ZIMMERMANN, A. B. & SCHNEIDER, F. 2015. Rethinking science for sustainable development: Reflexive interaction for a paradigm transformation. *Futures*, 65, 72–85.
- KOONTZ, T. M. & THOMAS, C. W. 2006. What do we know and need to know about the environmental outcomes of collaborative management? *Public Administration Review*, 66, 111–121.
- KURTZ, C. F. & SNOWDEN, D. 2003. The new dynamics of strategy: Sense-making in a complex and complicated world. *IBM Systems Journal*, 42, 462–483.
- LAWF 2012a. Second report of the Land and Water Forum: Setting limits for water quality and quantity freshwater policy- and plan-making through collaboration. <http://www.landandwater.org.nz/>. [Accessed 16 August 2015].
- LAWF 2012b. Third report of the Land and Water Forum: Managing water quality and allocating water, Land and Water Forum. <http://www.landandwater.org.nz/>. [Accessed 16 August 2015].
- MAUSER, W., KLEPPER, G., RICE, M., SCHMALZBAUER, B. S., HACKMANN, H., LEEMANS, R. & MOORE, H. 2013. Transdisciplinary global change research: The co-creation of knowledge for sustainability. *Current Opinion in Environmental Sustainability*, 5, 420–431.
- MINISTRY FOR THE ENVIRONMENT 2013. *Freshwater reform 2013 and beyond*. Wellington: Ministry for the Environment.
- MINISTRY FOR THE ENVIRONMENT 2014. *National Policy Statement for Freshwater Management*. Rep. No. ME 1155. Wellington, Ministry for the Environment.

- MORST 2007. Vision Mātauranga: Unlocking the innovation potential of Māori knowledge, resources and people. Wellington, Ministry of Research, Science and Technology: Te Manatū Putaiao.
- MORTON, C., GUNTON, T. I. & DAY, J. C. 2012. Managing aboriginal populations in collaborative planning: An evaluation of a two-tiered collaborative planning model for land and resource management. *Journal of Environmental Planning and Management*, 55, 507–523.
- MUNARETTO, S. & HUITEMA, D. 2012. Adaptive comanagement in the Venice lagoon?: An analysis of current water and environmental management practices and prospects for change. *Ecology and Society*, 17, 1–16.
- NEWIG, J. 2007. Does public participation in environmental decisions lead to improved environmental quality. *CCP (Communication, Cooperation, Participation. Research and Practice for a Sustainable Future)*, 1, 51–71.
- OECD 2009. *Focus on citizens: Public engagement for better policy and services*, Organisation for Economic Co-operation and Development.
- OECD 2010. *Water resources in agriculture: Outlook and policy issues* [online]. Available: <http://www.oecd.org/dataoecd/15/16/48498988.pdf>.
- PATEL, M., KOK, K. & ROTHMAN, D. S. 2007. Participatory scenario construction in land use analysis: An insight into the experiences created by stakeholder involvement in the Northern Mediterranean. *Land Use Policy*, 24, 546–561.
- POHL, C., RIST, S., ZIMMERMANN, A., FRY, P., GURUNG, G. S., SCHNEIDER, F., SPERANZA, C. I., KITEME, B., BOILLAT, S., SERRANO, E., HADORN, G. H. & URS, W. 2010. Researchers' roles in knowledge co-production: Experience from sustainability research in Kenya, Switzerland, Bolivia and Nepal. *Science and Public Policy*, 37, 267–281.
- REED, M. 2007. Participatory technology development for agroforestry extension: An innovation-decision approach. *African Journal of Agricultural Research*, 2, 334–341.
- ROBINSON, C. J., MARGERUM, R. D., KOONTZ, T. M., MOSELEY, C. & LURIE, S. 2011. Policy-Level Collaboratives for Environmental Management at the Regional Scale: Lessons and Challenges From Australia and the United States. *Society & Natural Resources* 24(8):849–859.
- ROBSON, M. 2014. *Technical report to support water quality and quantity limit setting in Selwyn Waihora catchment: Predicting consequences of future scenarios: Overview Report*. Report No. R14/15. Christchurch, Environment Canterbury.
- ROSENHEAD, J. & MINGERS, J. 2001. *Rational analysis for a problematic world revisited*, John Wiley and Sons.
- ROTMANS, J., KEMP, R. & VAN ASSELT, M. 2001. More evolution than revolution: Transition management in public policy. *Foresight*, 3, 15–31.
- SABATIER, P. A., FOCHT, W., LUBELL, M., TRACHTENBERG, A., V., VEDLITZ, A. & MATLOCK, M. 2005. Collaborative approaches to watershed management. In: SABATIER, P. A., FOCHT, W., LUBELL, M., TRACHTENBERG, A., V., VEDLITZ, A. & MATLOCK, M. (eds.) *Swimming upstream: Collaborative approaches to watershed management*, Massachusetts Institute of Technology.

- SINNER, J., BROWN, P. & NEWTON, M. 2016. Community perceptions of collaborative processes for managing freshwater resources. *Ecology and Society*, 21, 5.
- SMALL, B., BLACKETT, P. & TURNER, J. A. 2013. *An organic shift from an adversarial to a collaborative approach to lake water management: Lake Rotorua case study*. Keynote paper presented at Symposium Veolia eau/REEDS International, Economie Ecologique, Analyse Intégrée et Gouvernance Environnementale: Les Grands Cycles de la Biosphere dans leurs Territoires. REEDS – Centre International de Recherches en Economie écologique, Eco-innovation et ingénierie du Développement Soutenable, Université de Versailles St-Quentin-en-Yvelines, Rambouillet, France.
- SMALL, B., PAYNE, T. & MONTES DE OCA MUNGUÍA, O. 2015. Developing reliable and valid measures for science team process success factors in transdisciplinary research. *The International Journal of Interdisciplinary Organizational Studies*. 10, 2, 1-22.
- SPIELMAN, D. J., EKBOIR, J. & DAVIS, K. 2009. The art and science of innovation systems inquiry: Applications to Sub-Saharan African agriculture. *Technology in Society*, 31, 399–405.
- VMO 2017. *Freshwater values, monitoring and outcomes*.
<http://www.landcareresearch.co.nz/science/portfolios/enhancing-policy-effectiveness/vmo>.
 [Accessed 15 February 2017].
- VOSS J. P., SMITH, A. & GRIN, J. 2009. Designing long-term policy: Rethinking transition management. *Policy Sciences*, 42, 275–302.
- WEBER, E. P., MEMON, A. & PAINTER, B. 2011. Science, society, and water resources in New Zealand: Recognizing and overcoming a societal impasse. *Journal of Environmental Policy and Planning*, 13, 49–69.
- WEIBLE, C., SABATIER, P. A. & LUBELL, M. 2004. A comparison of a collaborative and top-down approach to the use of science in policy: Establishing marine protected areas in California. *Policy Studies Journal*, 32, 187–208.