The Changing Role of Scientists in Supporting Collaborative Land and Water Policy in Canterbury, New Zealand

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ABSTRACT In this case study, we examine the role of science and scientists in community-led collaborative policy processes. We outline the shift from science-led linear policy processes to community-led science-informed policy processes. This case study illustrates how practice evolved to ensure that scientists provided reliable, credible, and salient evidence to help community decision-makers. From this experience, a set of principles for scientists working in these environments was created. These principles include scientists recognising their changing role, scientists sharing the burden of uncertainty, scientists speaking in the communities’ language, and scientists creating fit for purpose assessment frameworks.

KEY MESSAGE

Students will gain an in-depth understanding of the changing role of scientists in collaborative or participatory policy processes, and what is required for scientists to move from science-led policy to science-informed policy.

INTRODUCTION

Collaborative approaches to resource management at the catchment scale have been a global theme in the planning and environmental management literatures over the past 10–15 years [1–4]. In New Zealand, this interest has manifested in the growing popularity of participatory and collaborative environmental decision-making [5–7]. New Zealand’s Land and Water Forum recommended collaborative approaches to plan-making "because communities, national and local, need be involved in the resolution of values and interests that is always necessary, and in the trade-offs involved [8]." The inclusion of communities is particularly important for water management, as it is the cumulative impact of the land use choices of individuals that have a major role in determining the quality and quantity of water in rural catchments.

Traditionally, environmental decision-making has adopted a linear science-led approach [9, 10]. In this way of working, environmental problems are identified, and expertise is mobilised to find potential solutions to the problem. Scientists are privileged by this linear approach because their role is central in both defining and resolving environmental problems [11], especially those employed by governments. Environmental decision-makers seek technical, neutral, and reliable scientific data to make the best decisions possible [12].

The linear model of science-led environmental decision-making has been challenged in practice. Alternative forms of knowledge, such as local and indigenous knowledge, are increasingly incorporated into environmental decision-making [13, 14] and deemed necessary if solutions are to be appropriate and widely accepted [8]. These forms of knowledge challenge the assumption, often embedded in science-led environmental decision-making, that scientific knowledge is the only form of knowledge that is technical, neutral, and reliable [10].

Participatory and collaborative environmental decision-making processes try to enable the genuine participation of citizens including the incorporation of their...
knowledge and expertise. In these processes, non-scientists should be seen as capable and knowledgeable rather than as passive receivers of knowledge \(^{[15]}\). However, these processes also impose new expectations on scientists involved with them. For example, scientists are expected to work alongside the public in the formation of new environmental monitoring and evaluation techniques, which are both scientifically robust and reflect community values.

When Environment Canterbury, the regional government entity responsible for sustainable management of natural resources in Canterbury, New Zealand, decided to adopt a new collaborative approach to create water policy, the role of the scientists is also changed. Our case not only examines the changing role of scientists but also highlights the practical lessons that emerged out of this process.

**CASE EXAMINATION**

The Canterbury Region of New Zealand’s South Island has a vast supply of water, which is valued for cultural, economic, and recreational purposes. Canterbury accounts for \(\sim 70\%\) of irrigated land use in New Zealand \(^{[16]}\). The impacts of land use intensification from irrigation have already become apparent, both in terms of declining water quality and increasing over-allocation of water takes, and conflict over water resources.

Recognising that conflict over water resource allocation in the region was resulting in poor outcomes, Environment Canterbury worked with stakeholders to develop the Canterbury Water Management Strategy (CWMS) \(^{[16]}\). The CWMS articulated aspirations and targets across social, cultural, environmental, and economic wellbeing, and set up a joint pilot project with industry and Iwi partners to develop a preferred approach for land and water decision-making \(^{[17]}\). Two critical elements of the CWMS were the formation of water management zones, based on surface and groundwater catchment boundaries, and the appointment of Zone Committees, consisting of community, Iwi and council representatives. As CWMS implementation started, regional and national policy began to recognise that setting catchment limits for both water quality and quantity was essential for successfully and sustainably managing New Zealand’s water resources \(^{[18]}\). The Zone Committees were given the task of assisting the Regional Council in its management of water and, in particular, of recommending water quality and water quantity limits for their zones.

It was evident that science needed to evolve if it was to produce knowledge that was fit for purpose, given the new demands on freshwater policy development such as environmental limit setting, and the need for accessible knowledge for new participants in collaborative processes. Environment Canterbury progressively brought multiple science disciplines together into project teams to inform and support a separate limit-setting process for each of its zones. These processes posed particular challenges for project teams: they were “live” processes where decision-makers were trying to tackle complex real-world problems in real time and where their decision had an impact; the problems were highly complex; the processes often had time, resource, and knowledge constraints; each point in the process happened once and actions, both mistakes and successes, had consequences; and the processes were often highly political and highly contested.

The multiple zone-based processes were run sequentially rather than in parallel, enabling progressive learning and refinement of both the process steps and the nature of science involvement. In the early processes, the technical teams drew on established concepts such as credibility, salience, and legitimacy from the study by Cash et al. \(^{[19]}\) as touchstones for their informing role. Although such concepts were useful for overarching guidance, what became necessary on the ground was an evolving set of practice-based principles that could guide the project teams. As processes were developed and refined, we came to recognise four key principles for science-informed collaborative policy: recognise the role, share the burden of uncertainty, speak the language of the community, and create fit for purpose assessments. These four principles are detailed in the following sections.

**Recognise the Changing Role of Scientists**

Setting outcomes and natural resource limits for catchments and deciding on the available capacity for resource use are not solely scientific questions \(^{[20]}\), or questions where a single discipline can supply a right answer. Recognising that these decisions are ultimately value judgements that involve weighing up, trading off, and balancing between competing outcomes and values was critical. It

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1. Iwi is a Māori phrase, which describes an extended kinship group, tribe, or nation. It often refers to a group of people descended from a common ancestor and associated with a distinct territory. In this case, it refers to the inclusion of local Iwi in zone committees.
enabled the shift from trying to find the right “science” answer and then defending that position, to a role of supporting and informing, or knowledge brokering [18]. Importantly, this shift continued beyond the duration of the collaborative policy-making process through the hearings process. In the hearings process, scientists were not there to defend the final decision, but only to explain how the supporting research was generated.

The emerging role of the broker or translator of knowledge was of particular importance in maintaining a science-informed rather than a science-led process. In many cases, the broker was the technical lead of a project team. The role of the scientist as a knowledge broker differed from the role of a scientist in the linear policy development model. First, brokers had to understand the needs of the different knowledge uses [15] and focus on supplying relevant information to those different users. Next, they had to mediate and translate information between scientists and non-scientists [15], between scientists of different disciplines, and between knowledge sources. Then, they had to facilitate the integration of knowledge across knowledge sources and levels of detail; they actively co-produced knowledge; and they expanded and clarified the scope of the resource management options available [21].

The boundaries of the project teams’ role were repeatedly tested throughout these processes with different communities wanting and requiring different levels of support. Despite these difficulties, knowledge brokers maintained the principle of informing the decision-making process rather than leading it.

Share the Burden of Uncertainty

Uncertainty is a situation involving imperfect and/or unknown information. Addressing conflicts over water quality and/or water allocation is difficult because the effects of land and water resource use are complex, interconnected, and contingent on uncertain future events, making it very difficult for scientists to make definitive predictions about them. Uncertainty further burdens the knowledge brokers and the supporting science teams because the stakeholders involved are often unrealistic in demanding certainty from scientists to pursue specific solutions.

To support and inform the collaborative decision-making processes, the project teams needed to generate sufficient information for decision-makers to be able to make recommendations with knowledge of the likely consequences. This means that an understanding of the inevitable uncertainty of the science was integral to the decisions being made. The various reasons that uncertainty was highlighted to decision-makers were to give an assessment of the adequacy of available evidence, to allow decisions to make provision for things that can go wrong [22], and ultimately to help the decision-makers reach the best possible decisions on information available at the time.

However, being explicit about uncertainty also had the potential to increase risks, including raising anxiety among the general public and participants [23], providing opponents the means by which to undermine the process or outcomes, and increasing the sense of responsibility of the project teams for the existence of that uncertainty. To promote greater transparency about unknowns and uncertainty and to avoid the project teams feeling that they have the sole responsibility for managing uncertainty, sharing the burden approach was adopted with zone committees and policy-makers. This approach included a more open discussion about unknowns and sources of uncertainty, the use of scenarios to explore alternative futures, sensitivity, and range assessment techniques, and colour coding to communicate the degree of uncertainty associated with various decisions. This approach reminded the project teams of their responsibility to inform rather than lead, while providing a clear distinction of where the responsibility for making decisions lay.

Speak the Language of the Community

Critical to the success of the collaborative policy processes was the ability of the project team to present information in a way that could be easily used by the community decision-makers; what we termed speaking the language of the community. Some of the techniques used to translate research results into the community’s own language included using visual tools, metaphors, stories, and field trips, and supporting those within the decision-making groups themselves in a way that enabled them to translate for each other. The project team was also mindful that different people need different things to make information credible and relevant, so information was presented at different degrees of complexity and specificity to cater for differing levels of expertise and comfort. Listening and responding to community values, knowledge and questions, and translating that so that it could be understood by the project team was important, a role often played
by the technical lead or broker. Integration of knowledge was also an important concept to ensure that the decision-makers were not swamped with detail. For example, information from multiple disciplines was synthesised to predict the likely consequence of a future scenario on community values. In addition, we tried to integrate the large amount of detail into a single coherent narrative around the research results.

Create Fit-for-Purpose Assessments
A fit-for-purpose assessment framework is one which is legitimately constructed, is considered credible among researchers and the community, and generates relevant information. We found that credibility was considered differently for the community and researchers and therefore differentiated these as local and global credibility, respectively. The framework also needed to generate information at a level of detail that was useful and usable. In general, the assessment frameworks were made up of four key elements: assessment of scope and boundaries, models and technical assessments (social, cultural, economic, and environmental), indicators, and scenarios.

Each element of the framework was considered for fitness of purpose. The scope of the research was determined by community values covering environmental, economic, social and cultural aspects, and boundaries modified in agreement with the Zone Committee. The modelling approach was based on a conceptual understanding of how water and nutrients move through the catchment and affect stakeholder values. This was built from discussions between the technical team, zone committee, and wider community, taking into account multiple sources of knowledge. The indicators were generally developed in a two-stage process, with the zone committee describing what their outcomes for the catchment would look like. These descriptions were useful for the project team in understanding what success would look like and in selecting appropriate indicators. The scenarios were used to increase the understanding of the catchment, facilitate discussions among all parties, and examine various alternative futures. They were used to test “what if” questions. Treating all scenarios in the same way aided in building a sense of legitimacy, even when the results of some scenarios were less palatable to sections of the community. It also allowed the project teams to be more transparent about the likely impacts of different future scenarios across all of the community values.

CONCLUSION
This case study highlighted how the role of scientists can change in collaborative or participatory policy development processes. New skills and aptitudes were required from scientists, such as “speaking the language” of the community, acting as a translator of knowledge, and showing the community how they could incorporate uncertainties into their decisions. The principles presented in this case study offer a guide to how scientists could engage effectively in future collaborative policy processes.

CASE STUDY QUESTIONS
1. How does the role of a scientist change in a collaborative or participatory policy process? Give some examples from this case study.
2. Do you agree with the principles of science-informed policy presented in this case study? Are there any other principles you would add or delete?
3. How does the case study change or inform your thinking about the role of scientists in policy processes in your country, state, or province?

AUTHOR CONTRIBUTIONS

COMPETING INTERESTS
The authors have declared that no competing interests exist.

REFERENCES


