Measuring the use of science for collaborative watershed management in New Zealand's Canterbury Region

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Introduction

The use of scientific information is a crucial element in watershed planning. In collaborative settings, diverse stakeholders work with scientific and other kinds of information to develop comprehensive watershed plans. Prior research indicates the topics of collaborative watershed group meetings evolve over time, and that scientific information is rarely discussed. In addition, collaborative ecological management plans most often cite government/grey literature rather than peer-reviewed scientific information, and that social science is scarcely used. Besides science, other forms of knowledge such as community support and indigenous knowledge are important and brought into collaborative groups. Following a presentation, audience discussion with presenters is a helpful way to increase understanding and use of the information.

In collaborative settings, more research is needed to understand how scientific and other types of information are brought to and discussed in collaborative watershed partnerships. This study examines 6 research questions:

1. How many meeting items include science, and does this change over time?
2. What are the most common sources of scientific information presented?
3. Is natural science or social science more frequently presented?
4. Besides science, how much of the presented information is about community support?
5. How much of the presented information is from indigenous knowledge?
6. After a presentation, what is the level of audience discussion and how does this change over time?

Methods

- **Document analysis** is a qualitative research method that uses documents created by others as a primary data source. Multiple researchers ("coders") read each document and **apply predetermined codes** based on the study aims. Then the codes are checked for consistency, reconciled, and compiled into a spreadsheet.
- Our documents here are **meeting minutes from local collaborative organizations** called "zone committees", each covering a small watershed in the Canterbury region of New Zealand. We coded 12 meetings from each of 3 zone committees spanning 2010-2013, when the zone committees were getting started. We coded a **total of 36 meetings**.
- Coders coded **blocks of text that described presentations** occurring in meetings, applying categories corresponding to our research questions. These **categories included 24 yes/no items** about each presentation such as: Is it scientific information? Is the topic about status/trends of an issue? Is the topic about community support? Does the presentation include natural science? Does it include indigenous knowledge? Did the audience ask questions?
- Initial intercoder reliability ranged from 54 % to 100 %, and subsequent discussions **reconciled codes to 100 % agreement** for each presentation.
- Across the 36 meetings, we coded a total of **107 presentations**.

7. NEW BIODIVERSITY PROJECTS

The Committee received a presentation from Robyn Russ, Environment Canterbury updating progress on the approved Immediate Steps projects in Banks Peninsula. Robyn also introduced two new biodiversity projects for the Committee's consideration and future project suggestions (refer **attachment**). The Committee **agreed** to proceed with the Owhetoro Stream project in Port Levy/Koukourarata. Robyn will report back to the Committee with further information regarding Okana River Confluence project.

Example of Presentation identified from meeting minutes

I	J	K	L	M	N	O	P
Title of Presentation	Presenter Name	Home Org	ZC Member?	Science?	Status/Trends	Causal Factors	Priorities P
Drinking and Stock Wate	Hugh Blake Ma	Selwyn District Council		1	1		

Example of coding a presentation Yes/no (1/blank) for each category in the spreadsheet

References

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Results and Discussion

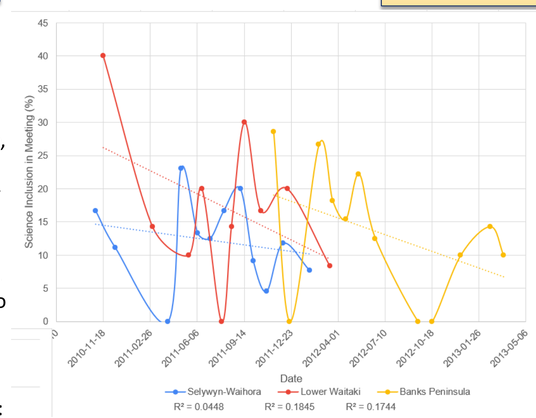

Figure 1a. Scatter Plot of percentage of agenda items that include science as a topic for every meeting in our data, depending on time, for each of the three zone committees

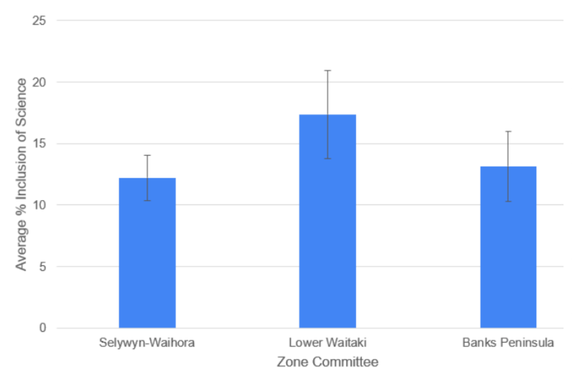

Figure 1b: Average percentage of agenda items that include science as a topic for each of the three zone committees

- Each of the 3 zone committees show a slight tendency of a decline over time in the **proportion of meeting items that include scientific information** (Figure 1a). The proportion increases and decreases in a similar manner across the groups. With only a weak correlation between time and the inclusion of science, other factors not included may be more influential.
- Overall, of the three zone committees, Lower Waitaki appeared to have the highest average **percentage of science integrated into their meetings**, whilst Selwyn-Waihora appeared to have the lowest (Figure 1b).
- These results match prior studies showing that although scientific information has become more abundant over time (Thelwall et al. 2022**), a wide array of influential factors in meeting dynamics limit its usage and integration** (Lauber et al. 2011, Koontz and Thomas 2018).
- In order to prioritize the sharing of scientific information in meetings, managers should **consider a mix of executive and technical meetings**.
- Further research should **statistically compare which factors have significantly different impacts on percentage of science integrated into their meetings.** Two-way ANOVA tests are a useful statistical test that could compare the influence of two different variables on the percentage of science integrated in each meeting.

	Presentations In study	Environmental Canterbury Presentation	Citation: Government report	Citation: Scientific Journal	Citation: Academic book
Science	47	15	5	1	0
Non-science	61	27	2	0	0
Total	**108**	**42**	**7**	**1**	**0**

Figure 2. Table showing citation sources for scientific information versus environmental Canterbury Presenters, non-scientific information, and total presentations.

- Across the 3 zone committees, **sources of scientific information** are rarely cited. Of those that do, government reports/grey literature is most common. Scientific data was accessed mostly through expert presentations from the government.
- These results match prior studies showing a preference for government reports/grey literature and expert testimony over peer-reviewed journals or studies. (Koontz, 2018). Research suggests that the digestion of scientific information benefits from an expert explanation or translation for less science-versed members.
- Results suggest managers ought to be selective in finding digestible sources for less science-versed members. It would be beneficial to work with an agency who can assist in information sharing and translation, such as Environment Canterbury.
- Further research should explore how grey literature is created in government agencies and its relevancy to peer reviewed journals.

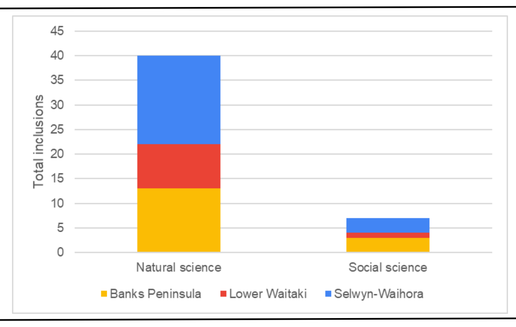

Figure 3. Total inclusions of natural and social science from the three zones committees

- **Natural science is presented far more than social science** (Figure 3). Natural science was included in presentations 40 times and social science only 7 times.
- These results match prior studies showing that there is **a lack of social science utilized** for the benefit of environmental management (Safford & Norman 2011; Colavito 2017; Koontz & Thomas 2021).
- Results suggest policy makers and managers should consider how social scientists can contribute to understanding how social **behavior affects collaborative processes**.
- Further research should analyze the differences in the committee meetings that included natural science with those that included social science and **how each science affected collaboration efforts in water management**.

Zone Commitee	Community Support/Engagement (number of meetings)	Community Support/Engagement (number of presentations)
Selwyn-Waihora	5 (14%)	18 (17%)
Lower Waitaki	7 (19%)	9 (8%)
Banks Peninsula	8 (22%)	12 (11%)
Total	**20 / 36 (55%)**	**39 / 107 (36%)**

Table 4. Table showing percentage and number of meetings and presentations that mention Community Support/Engagement

- Across the 3 zone committees, topics of community support are included in 36% of the presentations and (55%) of the meetings (Figure 4).
- Overall, our data shows Banks Peninsula had the greatest **number of meetings** discussing community support, while Selwyn-Waihora had the fewest. Selwyn-Waihora had the greatest **number of presentations** including community support, while Lower Waitaki had the fewest.
- These results match Heikkila and Gerlak's (2016) study findings that 15% of meetings minutes are dedicated to public comment. The percentage of meetings and presentations here are similar. They argue communicating with stakeholders is a valuable aspect of collaborative processes.
- Our results suggest managers and policy makers should have more **in-depth discussions** about the different ways their actions may impact communities and stakeholders.
- Further research should study the Zone Committees over an **extended period** (e.g., 10 years) to observe **trends in meetings and presentation percentages**. Additionally, analyze the **discussion topics** and identify **who** members are conversing with such as locals, farmers, etc.

Zone Committee	Maori Presenters	Environmental Canterbury Presenters	Indigenous Knowledge	Scientific Knowledge
Banks Peninsula	2	15	2	17
Selywn Waihora	1	12	4	18
Lower Waitaki	0	16	1	11
Totals for all three zone committees	3	43	7	46

Figure 5: Number of presentations from indigenous (Maori) vs governmental (Environment Canterbury) presenters, and representing indigenous vs scientific knowledge

- Across the 3 zone committees, **government presenters outnumbered Maori presenters by 93% (43 vs. 3).** Indigenous knowledge was introduced 6.5% of the time (7 presentations) while scientific knowledge was introduced 43% of the time (46 presentations) (figure 5).
- Overall, our research found that there is a **gap between the representation of government and Maori people** in presentations and knowledge sharing.
- "When **credibility, salience, legitimacy, and communication** are not present in collaborative governance, the **science-policy interface can become a divide**" (Koontz, 2024). Our research suggests there is an **unequal distribution of these factors** in this setting.
- Results suggest that zone committees should **invite additional Maori presenters and indigenous knowledge** into zone committee meetings.
- Further research should include **text analyses of zone implementation plans** (ZIP) and other government-driven policies to **study the potential gap between the implementation of scientific and indigenous knowledge** in environmental management plans.

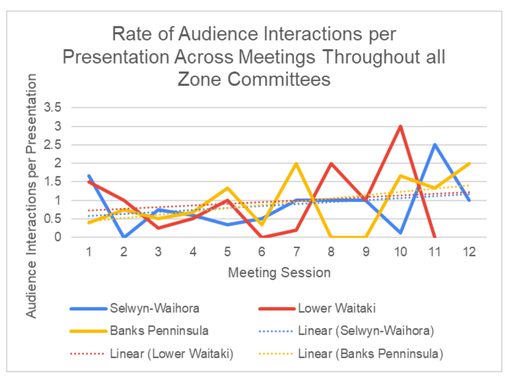

Figure 6a: Rate of audience interactions per presentation across meetings.

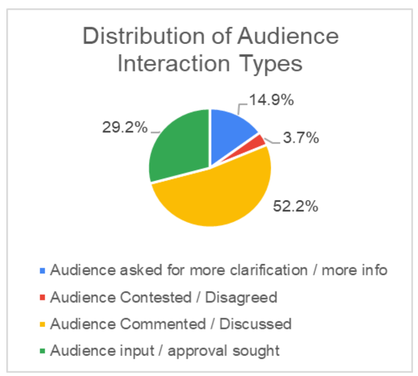

Figure 6b: Distribution of audience interaction types.

- The 36 meetings included 107 presentations, 56 of which featured audience interactions. **52% of presentations had audience interaction.** The frequency of audience interactions per meeting changed through the lifespan of the collaborations. During the first six meetings in each of the zone committees, **audience interaction averaged 0.67 interactions per presentation**. **This grew to 1.17 interactions per presentation in the second half** (Figure 6a).
- The most frequent kind of audience interaction was **comment and discussion**, which **generated 52.2% of audience interaction** (Figure 6b).
- Heikkila and Gerlak (2014) find that discussion began at a high, decreased significantly, but came back up near the end of the ten years of meetings. In contrast, we find that audience interaction increased rather than decreased in the first few years.
- Since 52% of the presentations had audience interaction, **48% of presentations featured no audience interaction, which isn't conducive to collaborative governance.**
- To increase collaboration in governance, **collaborative managers should maintain an environment that fosters audience interaction in presentations.**
- **Researchers should study which types of audience interactions are most common in other collaborative processes** and determine what factors contribute to higher frequencies of certain kinds of interactions over others. There remains an opportunity to further our understanding of how collaborative environmental management in Canterbury evolves over time as there is **still yet to be examined publicly accessible meeting documents spanning 15 years.**