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Ways of knowing – out-of-sync or incompatible? Framing water quality and farmers' encounters with science in the regulation of non-point source pollution in the Canterbury region of New Zealand

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ABSTRACT

This paper examines farmers' ways of knowing water quality and their encounters with the science used in policy to address the cumulative effects of agriculture. Drawing on constructivist theories of knowledge and discussions with farmers in two locations of New Zealand's South Island region of Canterbury, the research identifies a significant divergence between farmers' conception of the water quality problem compared to the issue's policy framing. In theory, and increasingly in practice, ways of knowing are assumed merely out-of-sync and their integration or coproduction possible and necessary. This paper poses the question: what if the ways of knowing of farmers and science have become incompatible? The presented research indicates incompatibility that derives from epistemic practices that mobilise different ontologies at different scales. It is shown how the predictive practices of science present what appear to be insurmountable obstacles to integration or coproduction. It is argued that collaborative governance needs to find ways to work with divergent ways of knowing – not for the purpose of integration or coproduction but co-existence.

1. Introduction

The diminishment of water quality from diffuse losses of nutrients, sediments and pathogens from agriculture is an issue of concern worldwide. With over half New Zealand's land area dedicated to pastoral and arable farming and thousands of kilometres of rivers and streams and associated lakes and aquifers, diffuse pollution from agriculture is a significant issue that farmers are key to addressing. Blackstock et al. (2010) maintain that gaining agreement on what is the water quality problem is fundamental to engaging farmers in changing land management practices to address water quality. They identify gaps in our understanding of the socio-cultural aspects of how farmers "interpret, translate and respond to measures designed to mitigate diffuse pollution" (p. 5632). With significant water policy, governance and management reforms intended to reduce diffuse pollution gathering pace in New Zealand, and the agricultural sector squarely in the sight of decision makers to address it (Canterbury Mayoral Forum, 2009), the aim of this research was to examine how farmers frame the water quality problem to help improve engagement through an existing collaborative process. The following section presents insights from the science policy literature used in this research.

2. Reconciling divergent ways of knowing and the obstacles

Brugnach and Ingram (2012) use the concept of ambiguity to identify uncertainty between divergent but equally valid problem framings and ways of knowing that inevitably come together in inclusive and integrative natural resource management. They maintain that ambiguity arises from "unrecognized contextual, methodological and substantive differences among knowledge systems" (p. 61). In recognising these elements as unique to knowledge systems, they argue that although knowledge integration cannot be a process of "mere translation" across knowledge systems or the "additive accumulation of facts" (p. 61), coproduction can create "new shared knowledge" (p. 61). Therefore, notwithstanding the pitfalls of integration, coproduction is possible. Efforts to integrate or coproduce knowledges draw heavily on boundary concepts, e.g. boundary objects (Star and Griesemer, 1989) and boundary organisations (Guston, 2001; Cash et al., 2006). A range of useful frameworks and approaches have been proposed to bridge divergences in observation, scale and encounter through integration or coproduction (e.g. Brugnach and Ingram, 2012; Cash et al., 2006; Edelenbos et al., 2011; Giebels

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et al., 2015; Hoppe and Wesselink, 2014; Lejano and Ingram, 2009; Van der Molen et al., 2015). However, it is important to consider the limits of boundary concepts (e.g. Turnhout, 2009) which became necessary in this research through considering how far the quantitative predictive practices of science that operationalise policy diverge from the epistemic practices of farmers (see also Scott, 1998).

These days, water resource policy and management would grind to a halt without the technological and quantitative capability of predictive modelling to assess potential environmental effects, policy options and potential outcomes. With unprecedented computing power, the way policy-relevant science now knows and communicates nature is increasingly derived from interlinked computer-based models that draw on an array of environmental data systems. The predictive knowledge practices of science are more technically sophisticated yet increasingly black-boxed than ever (Duncan, 2006, 2008; Latour, 1987; Pilkey and Pilkey-Jarvis, 2007; Sarewitz et al., 2000). Arguably, as policy imperatives for prediction and compliance in resource policy and allocation continue, the sophistication and black-boxing can be expected to intensify.

How might knowledge practices such as these influence knowledge integration or coproduction? Important from a constructivist perspective is that epistemologies and ontologies are mutually constitutive – one constructs the other (Jasanoff, 2004; Latour, 1993). Different epistemologies (i.e. how we know) constitute different ontologies (i.e. what we know) (Jasanoff, 2004). Divergent ways of knowing that arise from different yet equally valid and contingent socio-cultural knowledge practices evoke or mobilise different scales of encounter and observation (Ahlborg and Nightingale, 2012; Nadasdy, 1999; Rhoades and Nazarea, 2009; Sillitoe, 2009). Notwithstanding explicit recognition of these issues by Brugnach and Ingram (2012, p. 69) and their expectation that resolution rests with dialogue, deliberation, negotiation and learning to "define a problem then develop knowledge to solve it", this paper questions whether the knowledge practices that mobilise such divergent ontologies at different scales can be meaningfully redeployed in a way that fosters epistemic integrity for both knowledge systems (Nadasdy, 1999; Wynne, 1992, 2014).

The challenges are imbued with politics. Irwin and Wynne (1996, p. 9) argue that assumptions made by scientists and policymakers about what can be predicted and controlled, and a lack of reflexivity on the "unnegotiated social prescriptions" that become embedded in policy-relevant science, alienate publics. When it comes to predictive modelling, the politics that can be obscured from view enters a new realm. For example, in her study of the knowledge practices of the proponents of a major energy infrastructure project in Australia, known as Basslink, Duncan (2006, 2008) shows how a proponent's contingent optimistic assumptions about the past and the future were mobilised and validated into environmental regulations yet unrecognised as such through a cascade of predictive models. Cases such as this support Wynne's call for researchers to turn their gaze from assumed problems with publics, which perpetuates the so-called "public deficit model", to examine how publics encounter science (2014, p. 62).

These insights are used to evaluate how farmers frame the water quality problem. They also provide an analytical lens to examine farmers' encounters with policy-relevant science and question the possibility of the integration or coproduction of knowledges. The next section explains the research methods.

3. Research methods

To investigate how farmers frame the water quality problem, discussions were held in two sub-regions of the South Island region of Canterbury. The first was the Hurunui-Waiau (HW) where 20 semi-structured interviews were conducted during 2013 with 12 dairy farmers and 8 farmers who owned a mix of sheep/beef/arable farms. Situated across what is known as the Culverden Basin, all farms were irrigated. The latter participants provide dairy support with cows grazing over winter with one farmer providing dairy support by only growing stock feed. With dairy farming recognised as having the greatest impact on water quality, all participants had economic interests at stake with the introduction of regulations to reduce nutrient losses to manage water quality.

Participants were selected from public submissions based on statements about water quality (e.g. recognising its importance but raising questions about how it might be handled) and their long term association with the region. Snowball sampling was also used to access informants across a mix of land uses. Interviews were conducted in farmers' homes and lasted between 45 and 90 min. Topics under discussion were what 'water quality' means; perspectives on the state of the water in local rivers and streams; interactions with those waterways; scientific and lay understandings of how nutrients move between land and water; farm contributions, and the tools used to quantify nutrient losses. Interviews were digitally recorded and transcribed. A thematic analysis was undertaken using a deductive and inductive approach. Descriptive codes were informed by theory and research questions while analytical themes were derived inductively from the codes, informed by the author's knowledge of the theory and the water quality policy issues (Cope, 2005).

While this paper focuses on the HW, it also draws on discussions with farmers in another Canterbury sub-region, Selwyn-Waihora (SW). In 2014, a focus group was held to evaluate the legitimacy of Canterbury's collaborative approach to water management (to be discussed). The group included one recreationist and four farmers. Three farmers had participated in stakeholder workshops run by the regional council to assist in setting water quality limits and were an attempt to coproduce knowledge between scientists and stakeholders (see Duncan, 2013). Through the workshops, SW farmers interacted with scientists and the science used to quantify nutrient losses at the farm and catchment scales (i.e. the models, data and assumptions). Topics discussed included understandings of the role of the collaborative committee in the planning process; knowledge contributions to the process; how decisions were made, and how the community was involved.

The analysis also draws on empirical resources that included scientific reports, plans, public hearing testimonies and evidence as well as observations from attendance at public meetings and regional plan hearings. Given the numbers of farmers involved, the findings cannot be interpreted as representative of all farmers, but they do provide useful insights into how these farmers located in two locations frame the water quality problem, their knowledge practices and how these compare with the policy framing.

4. Shifts in managing water in New Zealand

Water policy has changed significantly in New Zealand in recent years. Central government has embraced setting water resource limits and sees collaborative governance as the means to this end. In 2011, it introduced a long-awaited National Policy Statement for Freshwater Management (NPSFM). Reissued in 2014 with further provisions to address water quality, its key purpose is "[s]etting enforceable quality and quantity limits" (New Zealand Government, 2014, p. 4). The preamble envisages "managing land use and development activities that affect water so that growth is achieved with a lower environmental footprint" (2014, p. 3).

In the South Island region of Canterbury, where dairy farming has expanded significantly over the past two decades, water