

AN AFFECTIVE EXPLANATION OF CLIMATE BELIEFS: EVIDENCE FROM DAIRY FARMERS IN NEW ZEALAND

Daniel Tisch

Lecturer, Department of International Business, University of Auckland,
Auckland, 1142, New Zealand. Email: d.tisch@auckland.ac.nz.

Natasha Hamilton-Hart

Professor, Department of International Business, University of Auckland,
Auckland, 1142, New Zealand. Email: n.hamilton-hart@auckland.ac.nz.

ABSTRACT: How do farmers form and sustain their beliefs about climate as it affects their farms and communities? We draw from two areas of scholarship to provide an explanation of how farmers in a particular industry context form their beliefs about climate change. First, we build on research in psychology that shows how values, political orientations and motivated reasoning are important factors in group identity. Second, we draw from scholarship on group identity and belief formation to suggest that farmers prefer to learn from trusted insiders when forming beliefs about the climate. Based on qualitative interviews with New Zealand dairy farmers, we used thematic analysis of the social and emotive process of group identification associated with farmer beliefs about weather patterns and climate. We discuss the implications for communication among policymakers, regulators and researchers in the agricultural sector with an agenda that addresses farmer responses to climate change by enlisting those with insider status.

KEY WORDS: New Zealand; farmers; climate change; belief formation; communication.

1. INTRODUCTION

Climate trends and weather events matter deeply for farmers. The vulnerability of the agricultural sector to extreme weather events from climate change has been widely reported (IPCC, 2014b). Despite the benefits of anticipating such adversity, as noted by New Zealand's crown research institutes (Clark *et al.*, 2011; Clark and Tait, 2012; Reisinger *et al.*, 2014), high levels of climate change scepticism among farmers in New Zealand persist (Niles *et al.*, 2016; Prokopy *et al.*, 2015) and a research agenda towards science communication in the agricultural sector has taken shape (Church *et al.*, 2018; Prokopy *et al.*, 2017). Surveys in New Zealand, the USA, Australia and Scotland found that most farmers do not agree, or

are uncertain, that humans are a significant cause of climate change; and only between 22 per cent and 45 per cent recognise climate change as a threat to agriculture (Prokopy *et al.*, 2015: 498). Climate change policy support is not evenly distributed across farmer groups and some farmer interest groups have recently reversed their opposition (Radio New Zealand, 2014). Australia's National Farmers Federation joined Farmers for Climate Action to advocate for emissions reduction (Locke, 2016). Studies show significant variation across countries and sectors (Tranter and Booth, 2015), suggesting geographically and temporally context bound studies are needed to advance research. To fill this gap, we explore an alternative explanation of farmer beliefs about climate that rests on social and emotive processes in their work routines and which give farmers a shared identity that shapes their views about climate change.

In both Australia and New Zealand, farmers are politically influential because their farm businesses are primary contributors to national exports and the communities in which they are situated endow them with symbolic capital (Bell, 1997; Gill, 2005). In New Zealand, farmers have dominantly influenced national-level initiatives to reduce greenhouse gas emissions such that they do not include agricultural emissions—which account for around half of New Zealand's total emissions (Cooper *et al.*, 2012; Cooper and Rosin, 2014). Climate change scepticism is strongly associated with lower levels of support for policies to mitigate climate change (Grundmann, 2007; McCright and Dunlap, 2011). Yet we also know that farmers pay close attention to the weather and climate, with awareness to prepare their farm businesses for climate adversity (e.g. Tisch and Galbreath, 2018). With these mixed results, our study aims to unpack belief formation about climate as a way of addressing communication between farmers and other industry stakeholders.

How do dairy farmers form and sustain their beliefs about climate as it affects their farms and communities? We draw on two areas of scholarship to provide an account of how farmers in an industry with a particular socio-political context form their beliefs about climate change. First, we rely on research in psychology about belief formation which has identified predictors of belief generally. Second, we draw from scholarship on the social and emotive processes in group identity and the ways farmers prefer to learn from trusted insiders. Drawing on this scholarship, we contribute an affective explanation of climate beliefs among farmers with implications for industry stakeholders. The next section reviews literature in these areas and provides the background for the conceptual framework in our study. We then introduce the context and qualitative approach we adopted in our study of dairy farmers in New Zealand. Subsequent sections

provide an interpretive account of how belief formation stems from social processes and the importance of this group identity in their beliefs about the climate. We conclude with implications for the communication of climate change science, the limitations of our study and future research suggestions.

2. CLIMATE CHANGE BELIEF AND FARMER IDENTITIES

Beliefs about climate change vary across countries and among different groups within countries, as well as fluctuating temporally (Lee *et al.*, 2015). There is a near consensus among climate scientists that unless atmospheric greenhouse gas is stabilised at levels significantly lower than that of most predictions, consequences are likely to be adverse for agriculture, economic growth and other measures of well-being (IPCC, 2014a). Single weather events are meaningless to climate science yet perceptions of extreme cold, drought and floods have been shown to influence belief formation about climate change, and this is also mediated by political orientation or worldview (Capstick and Pidgeon, 2014).

Psychological models offer two explanatory pathways. First, belief formation can stem from ‘motivated reasoning’ in that people are biased towards believing and seeing things that conform with what they want to see and believe (Kruglanski and Stroebe, 2005; Kunda, 1990). A second explanatory pathway emphasises the relational nature of identity and belief formation such that people ‘prefer’ to learn from high-status individuals with whom they share a common perceived identity. Furthermore, these beliefs are maintained by strong pressures to hold beliefs and practices that are socially-validated (Harré, 2011). Perceived group opinion, especially as espoused by high-status members, has strong effects on individual belief (Prislin and Wood, 2005). Beliefs and attitudes thus often cluster as a result of social interaction (Crandall and Schaller, 2004; Harton and Bourgeois, 2004) and peer group effects can influence attitudes unconsciously (Spencer *et al.*, 2005). Using a recent Australian experiment as an example, partisan gaps in climate change belief narrowed when experimental subjects were told that leaders of different parties converged in position (Kousser and Tranter, 2018).

Social interactions also influence beliefs about climate change, as found by a study showing that social embeddedness predicted climate attitudes (Leombruni, 2015). In the case of farmer learning and responses to new information, a repeated finding over decades of research is that farmers learn most from trusted insiders, often from other farmers or those with

whom they are connected by repeated interactions in shared networks (Arbuckle *et al.*, 2015; Gray and Gibson, 2013; Oreszczyn *et al.*, 2010; Sligo and Massey, 2007). Spatial location matters, as farmers learn through observing their neighbours' successes and failures (Conley and Udry, 2010). In a study of responses to change among New Zealand farmers, Kenny (2011) summarised: "farmers learn most by looking over the fence and seeing what their neighbours are doing". Taking into account farmer identity, commitments and relationships are thus essential for transmitting scientific information effectively to farmers (Furman *et al.*, 2011).

Emotion and affective attitudes condition how information about climate and climate science is absorbed. Affective or emotional biases are inextricably linked to cognitive and motivated heuristics and biases (Epley and Gilovich, 2006). Subjective feelings of favour or disfavour influence both the search for evidence and the significance accorded to different pieces of evidence (Marsh and Wallace, 2005). Emotion may thus operate together with social and relational influences on belief formation, with the result that people are more readily convinced by role-models and sources of information that they view positively: as having high status within their peer group or with whom they have a sense of shared identity (Harré, 2011). In this research, we drew from these areas of scholarship to investigate how emotions and group identity shape beliefs about climate change using a sample of farmers in New Zealand.

3. NEW ZEALAND CONTEXT, METHOD AND ANALYSIS

Dairy farmers, like the New Zealand agricultural sector more generally, claim a dominant position in New Zealand's political discourse as producers of food and national wealth (Cooper and Rosin, 2014). Exports of milk, butter and cheese are the single largest category of exports from New Zealand, accounting for 18 and 16 per cent of total exports in 2015 and 2016 respectively (Statistics New Zealand, 2016). Of the country's approximately 18 000 dairy farms, most employ pasture-based production systems, although the use of supplementary feed sources is increasing (DairyNZ, 2014b).

Climate models predict that New Zealand will experience more frequent droughts and more extreme weather events, with more local forecasts varying by region (Clark *et al.*, 2011; Mullan *et al.*, 2008). Reisinger *et al.* (2014) estimate time spent in drought in eastern and northern parts of the country will double or triple by 2040. Time spent in drought is expected to increase in the region that spans from Northland to Waikato, accounting for about 40 per cent of New Zealand dairy production (Clark *et al.*, 2011).

Four droughts occurred in different regions of New Zealand between 2003 and 2013, at significant cost. The 2008 drought, for example, cost over \$US 1.5 billion (Butcher and Ford, 2009) and lowered annual GDP by 0.6 per cent (Kamber *et al.*, 2013).

We conducted 15 qualitative unstructured interviews with dairy industry experts and 38 semi-structured interviews with dairy farmers in 2013. Following a process of purposeful sampling (Lincoln and Guba, 1985), we conducted our research in two phases. First, we interviewed 15 industry experts using an unstructured format to gain an understanding of major issues in the industry and refine the interview questions we would later use with farmers. We targeted those whose work history, based on publicly available information (such as employer's website, media coverage and professional networking sites), qualified them as experts within farming or agricultural policy stakeholder communities.

Based on these expert interviews, we decided to avoid introducing the term 'climate change' in our interviews with farmers. As one expert put it, farmers would 'roll their eyes' at the mention of climate change. Instead, in interviews with farmers we asked about extreme weather patterns, to reflect the more accepted view among farmers that the climate is always changing. Mention of climate change during the interview was usually made by the farmer and, if not, the interviewer would probe with questions to identify farmer belief about whether the climate was changing or not and whether it was anthropogenic. We purposefully selected farms from a variety of regions and farming systems. Production systems in New Zealand are classified by the ratio of pasture-based feed and other feed inputs (DairyNZ, 2014a). Variance in these production systems changes the dependence a farmer has on the ecosystems which support pastures. We also selected farms from three different regions in New Zealand, with different topographic, climate and soil characteristics: Northland, Waikato and Canterbury. Farm sizes ranged from 93 hectares to 6 000 hectares, with a mean size of 360 hectares. Total farm assets of each farm that provided financial data ranged from NZ\$ 1 million to NZ\$ 260 million, with a mean of NZ\$ 7.6 million. One large corporate farm was excluded from the calculation so that the means are more representative of the sample.

We interviewed 38 farmers from 27 different farms. All interviews were conducted between April and December 2013. Interviews were recorded, amounting to a total of 34 hours of audio recording. We also employed Angrosino's (2007) observational methods, recording about 60 pages of notes to corroborate interview data and reflect on the meaning of interview responses. Interviews followed a semi-structured format, with questions

about the effect of recent and earlier droughts, whether the farmer had made improvements or changes to the farm, how concerned they were about weather compared to other risks, their main sources of information about weather and its impacts, and how they rated different information sources in terms of usefulness.

We used Braun and Clarke's (2006) thematic analysis to explore themes that emerged from interviews and other data. Node descriptions in NVivo were designed to create analytical boundaries that added to the intuitive inferences we made about farmer emotions, identity and beliefs about climate change. First-order themes were guided by questions that addressed the main concepts in our framework and subcategories: How does this passage show emotion? How does emotion link to identity? How does identity result in belief formation about climate change? In this step, we coded the interview transcripts, gathering a total of 356 passages. We compared interview data, the research journal entries of the first author and publicly available sources that described the frequency and severity of droughts, floods and extreme weather patterns. Whenever possible, we have used direct quotes to present findings to let readers experience the meaning of words rather than paraphrase what we thought interviewees meant (Eriksson and Kovalainen, 2008). Though our research is statistically unrepresentative by design, our results were in line with other surveys of New Zealand farmers (cf. Milfont *et al.*, 2015; Niles *et al.*, 2016) and roughly consistent with surveys of the New Zealand public that find climate change beliefs are influenced by age, gender, political orientation and education (cf. Milfont *et al.*, 2017). We found that 27 out of 38 farmers believed the climate was changing (71 per cent) but significantly fewer (20 out of 36 farmers, 55 per cent) believed that human activity was responsible for climate change. Younger farmers in our sample believed in anthropogenic climate change more often but had mixed views on whether farmers should pay to implement farming practices that reduce emissions.

4. EMOTION AND GROUP IDENTITY

Farmers spoke about the physicality of daily work and the importance of local weather patterns. In their own words, learning how to farm is an experiential process: "it takes a life; you actually have to absorb your life into it" (Farmer 7). Farmer 8 explained, "innovation and things...it was all just, well it was done by trial-and-error." Physically doing work was part of the iterative process of making sense about what needed to be done: "doing it on a wait-and-see what the results are." (Farmer 9). In discussing how one learns farming, Farmer 5 stated: "...you can only tell someone so

much or talk to them so much.” Or as another put it, “you can’t come in with a text book and run a farm” (Farmer 7). Being present matters: “it’s attention to detail that makes the difference ... You know, it’s watching cows” (Farmer 10).

Both industry experts and farmer informants frequently pointed to the stress of farm work, often rating extreme weather events as the highest risk and highest stress events in their lifetimes. The depth of emotional feeling associated with a drought or flood event was thematically ubiquitous. Farmer 4 commented on drought causing “high stock losses, cows just dying in terrible, absolutely distressing conditions”. Farmer 1 commented, “You know there’s nothing worse than seeing a skinny cow that is struggling. And I know a lot of seasonal sharemilkers out there, the stress on them because of that.” Farmer 4 commented on how staff in frequent direct contact with suffering cows took on the most stress during a drought: “The staff’s job then is just nearly, simply focussed on animal welfare, they spend their whole day feeding cows and seeing the stress on the animals.” Farmer 11 explained how the staff, sharemilkers and owners are affected by drought: “for the wider staff mentally ... for the wider family. I think most dairy farmers and sharemilkers don’t realise the stress they put on their wives because they come home and tell them all the time.”

The deeply-etched emotional impact of farming through extreme weather events is a central marker of farmer identity and a core process in group identification among farmers. The visible nature of farm work in comparison to other types of work makes identification subconscious. The physicality of work is embodied in callouses and skin from exposure to sun and wind. These characteristics underline in-group identity and belief patterns.

The cultivation of social relationships and in-group ties among farmers were important to our interviewees. They reported that social ties within the farm or community of farmers were not only helpful to relieve stress during extreme weather events, but also defined who you could rely on. Practices for managing the stress reinforced in-group ties. Farmer 3, a Dairy New Zealand Discussion Group convenor with 30 years of farming experience emphasised the importance of community events such as Dairy New Zealand Discussion Groups, town hall meetings and catching up with other farmers in the local pub.

Among the more extreme examples of behaviour associated with stress, Farmer 12 noted feelings of helplessness and desperation: “they’ll get frustrated with what’s happening and they’ll start, yeah, bashing cows in the cowshed.” Referring to the combination of drought and high debt

levels, Farmer 9 commented: “Amongst the sharemilkers, not a good picture... farming has the highest suicide rate in the country.” Judge Neil MacLean, New Zealand’s Chief Coroner confirmed this and noted that rural suicides are disproportionately high citing these conditions: “Farming is tough. You’re at the whims of nature and markets and you have no control over this and it’s hard and demanding work in isolation” (3NEWS, 2013); as well as citing the farmer suicide rate had been constant at about 28 each year over the past 10 years (New Zealand Herald, 2015). Overall, the social and emotive processes in group identification emerged as a final theme (Figure 1).

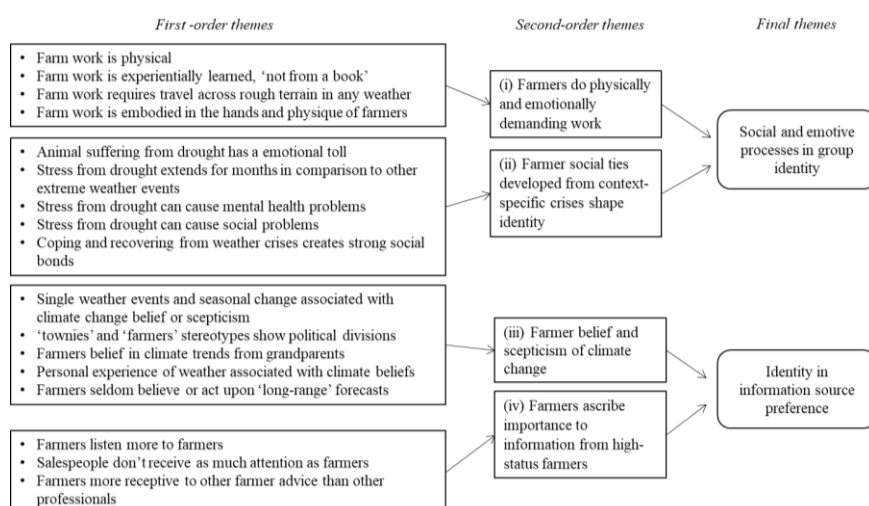


Figure 1. Data Structure in Thematic Analysis. Source: the Authors.

5. IDENTITY AND INFORMATION SOURCE PREFERENCE

In the second final theme, the social and emotive processes of group identification were associated with farmer belief formation about the climate. Both climate change ‘believers’ and ‘sceptics’ cited single event or single season evidence to reason about belief in climate trends. While farmers are no different than most people in how that associate single events and climate, the way they form beliefs is uniquely associated with their preference for in-group members as sources of information and as role models. As put simply by one informant: “farmers like learning from farmers far more than they like learning from anyone else” (Farmer 13). The group-identity processes were associated with how farmers ascribed

importance to information from other farmers. Furthermore, the visibility and experiential quality of information was important for how much attention it received, which in turn, accounted somewhat for its importance to a farmer.

In contrast, information coming from individuals not identified as part of the farmer in-group was discounted. Many farmers commented on the tensions between farmers and city-dwellers, most notably for non-farmer council inspectors in the act of enforcing regulatory compliance. Farmer 12 summarized the general sentiment: “but the townies are saying, well hey, they’re just whingeing farmers.” Stereotypically, this comment pokes at the adversarial relationship between townies and farmers: “Yeah, exactly, a couple of tanker loads of green stuff, see what the townies think of that. (Laugh)” (Farmer 1). In general, we found a strong bias that legitimises information that comes from farmers to farmers. We found this consistent with the way farmers physically met, not to read or talk about new practices, but to experience them. Farmer 14 explained that walking or riding a motor bike around a farm was often the forum for a meeting—that contrasts with meeting in a room or the act of sitting or standing in meeting settings typical of other industry environments.

Farmers ascribed more importance to information on weather and climate from other farmers, in comparison with scientists, and their beliefs about climate change are consistent with discounting of information sources. Some interviews yielded conflicting evidence: a few farmers commented that extreme weather events were becoming more frequent, but simultaneously denied scientific forecasts of increasingly frequent extreme weather from government channels. Farmer 8 explained ‘new’ behaviours in response to drought as just part of a longer pattern: “a wet cycle came in and everybody forgot [about drought] and now it’s back to all these drought strategies which is how it was when I started farming”. Another said that “These things [droughts and floods] may have existed before ... I don’t know if they’re any more severe or anything, but people are just made that much more aware of them” (Farmer 1).

Most farmers held the view that weather patterns were always changing, and the effects of so-called climate change were no different: “Some of the old farmers say it happened back in the 70s or 60s. It’s just a cycle. Thirty-year cycle or thereabouts.” (Farmer 13) Many farmers reasoned that severe extreme weather was not relevant: “Not in the near future, but then maybe if it comes more regular” (Farmer 11). Forecasts of extreme weather from climate change were often consciously discounted. As Farmer 3 stated: “...they said to us some years we’re going to have a

really cold winter. Well I don't go out and buy a shit load of supplementary feed because of it". Yet another farmer said that changes in the flooding pattern meant that he built his new milking shed on higher ground, but that the decision came primarily because he needed a new milking shed, not because of forecasts of more extreme weather events (Farmer 15).

"...to be honest I kind of struggle with this changing weather pattern thing because, I'm not, I am not a full believer in, in the fact that we are having a lot of change. I think we've always had weather extremes and, I don't know? We, like at the moment we have had about three weeks of rain. Right and it's quite cold.... We are getting dry, we get a dry spell in summer but I am not sure that it's any different to what we were getting 20 or 30 years ago?" (Farmer 16).

Our interviews suggested that farmer scepticism about climate change is not based on a cognitive failure to understand climate science, but is rooted in affective reasons. Similar to the conclusive findings of cognitive research on the inability of the human mind to grasp probabilities over vast time periods and distances (Kahneman, 2011; Tversky and Kahneman, 1973), farmers incorrectly associated climate change and extreme weather events using personal experience.

"...if we have a dry summer you get every whacko out there saying the climate's all changed and New Zealand's gone down the toilet, and climate change and blah, blah, blah. But twelve months previous when we had the wettest summer we've ever had ...they were quiet, they didn't have much to say about it... farmers kind of see through that sort of stuff." (Farmer 2)

Yet weather is central to farming and this a key difference between farming and other work.

"The first question people ask you, how's the weather. They're not just talking about the weather because they've got nothing else to talk about; it's the trigger that makes all their decisions." (Farmer 4)

Farmers often used expletives or a frustrated tone of voice when referring to the weather forecasts—whether they were short or long range—noting they were often wrong and could not be used.

“During the drought you’d read, oh we’re going to get some rain this weekend and then by the time the weekend comes it’s sort of scattered showers, and by the time the weekend actually comes it’s sort of like nothing...So you think you bloody bastards, you know, Jim Hickey [a prominent weather forecast TV presenter], you asshole (laughter). So, my experience is that most farmers take the weather forecasts with a grain of salt and especially the long-range stuff.” (Farmer 3)

We found farmer scepticism is not just driven by negative emotions associated with inaccurate weather forecasts. It may be that farmer dislike of inaccurate forecasts drives negative attitudes towards weather forecasters and, by association, the scientists who make forecasts about extreme weather arising from climate change in a circular manner.

6. BELIEF FORMATION AND SAVVY COMMUNICATION

Previous research has underlined the importance of social psychology, political identification and values in influencing beliefs about climate change. Answering our research question, our contribution consists of the conceptualisation of two social processes which explain how farmers form and sustain their beliefs about climate as it affects their farms and communities among a sample of New Zealand dairy farmers. First, we found that emotion, particularly the lived experience of shared emotions, figures strongly in the forging of group identity and self-identification with other farmers. Second, we found that this shared identity fostered a preference to learn from insiders—other farmers. We concur with studies such as Jones *et al.* (2017) that sustained relationships between producers and users of climate information are often necessary if users are taking up this information in long-term planning.

Our study also has some managerial implications. Understanding the role of emotion and group identity in farmer beliefs about climate change information can help policymakers, regulators and researchers develop more effective strategies for communicating among agricultural stakeholders. Communication can take into account the social and emotional processes at play in determining how different groups respond to information. The IPCC (2014b) noted that the communication of climate science involves “...*complex interactions between formal and informal knowledge that cannot be bridged by better science or better predictions but require social and culturally mediated process of engagement*”

(Burkett *et al.*, 2014, p. 202). Because our study was exploratory and qualitative, our study is limited to the rich descriptions of informants and the inferences we have made using thematic analysis. While we provide a robust starting point, further research is needed to provide construct definition, confirm causal relationships and explore the extent to which the processes we found are interwoven. Future research may also focus more on values and less on science (Luers, 2013) and the importance of interpersonal communication through social networks (Leombruni, 2015). Studies specifying communication among farmers affirms the importance of social relationships in communicating information (Furman *et al.*, 2011). This is important not only because farmers are politically influential on climate change policy, but because many professionals have stakeholder agendas aimed at better responses to climate change and would benefit from being savvy about farmer group identity and learning processes.

REFERENCES

- 3NEWS (2013). Suicide Figures Prompt Calls for Change. Online version accessed 23 July, 2018, <https://www.newshub.co.nz/nznews/suicide-figures-prompt-calls-for-change-2013082617#axzz3O6w1m23p>.
- Angrosino, M. (2007). *Doing Ethnographic and Observational Research*. Sage, London.
- Arbuckle, J. G., Jr., Morton, L. W. and Hobbs, J. (2015). Understanding Farmer Perspectives on Climate Change Adaptation and Mitigation: the Roles of Trust in Sources of Climate Information, Climate Change Beliefs, and Perceived Risk. *Environment and Behavior*, 47(2), pp. 205-234. doi:10.1177/0013916513503832.
- Bell, C. (1997). The 'Real' New Zealand: Rural Mythologies Perpetuated and Commodified. *Social Science Journal*, 34(2), pp. 145-158. doi:10.1016/S0362-3319(97)90047-1.
- Braun, V. and Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3(2), pp. 77-101. doi:10.1191/1478088706qp063oa.
- Burkett, V. R., Suarez, A., Bindi, M., Conde, C., Mukerji, R., Prather, M. J. and Yohe, G. W. (2014). *Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge.
- Butcher, G. V. and Ford, S. (2009). *Modeling the Regional Economic Impacts of the 2007/08 Drought: Results and Lessons*. Retrieved from New Zealand Agricultural Resource Economics Society:
- Capstick, S. B., and Pidgeon, N. F. (2014). Public Perception of Cold Weather Events as Evidence for and Against Climate Change. *Climatic Change*, 122(4), pp. 695-708. doi:10.1007/s10584-013-1003-1.
- Church, S. P., Dunn, M., Babin, N., Mase, A. S., Haigh, T. and Prokopy, L. S. (2018). Do Advisors Perceive Climate Change as an Agricultural Risk? An In-Depth Examination of Midwestern U.S. Ag Advisors' Views on Drought, Climate Change, and Risk Management. *Agriculture and Human Values*, 35(2), pp. 349-365. doi:10.1007/s10460-017-9827-3.

- Clark, A., Mullan, B. and Porteaous, A. (2011). *Scenarios of Regional Drought under Climate Change, NIWA Client Report WLG2012-32*. Prepared for Ministry for Agriculture and Fisheries.
- Clark, A. and Tait, A. (2012). *Drought, Agricultural Production and Climate Change – A Way Forward to a Better Understanding, NIWA Client Report WLG2008-33*. Retrieved from NIWA, Wellington, New Zealand:
- Conley, T. G. and Udry, C. R. (2010). Learning About a New Technology: Pineapple in Ghana. *American Economic Review*, 100(1), pp. 35-69. doi:10.1257/aer.100.1.35.
- Cooper, M. H., Boston, J. and Bright, J. (2012). Policy Challenges for Livestock Emissions Abatement: Lessons from New Zealand. *Climate Policy*, 13(1), pp. 110-133. doi:10.1080/14693062.2012.699786
- Cooper, M. H. and Rosin, C. (2014). Absolving the Sins of Emission: the Politics of Regulating Agricultural Greenhouse Gas Emissions in New Zealand. *Journal of Rural Studies*, 36, pp. 391-400. doi:10.1016/j.jrurstud.2014.06.008
- Crandall, C. S. and Schaller, M. (2004). Scientists and Science: How Individual Goals Shape Collective Norms. *The Psychological Foundations of Culture*, pp. 201-224.
- DairyNZ (2014a). The 5 Production Systems. Online version accessed 23 October, 2014, <http://www.dairynz.co.nz/farm/farm-systems/the-5-production-systems/>.
- DairyNZ. (2014b). DairyNZ Economic Survey 2013-2014. Online version accessed October 23rd, 2014, <https://www.dairynz.co.nz/media/2108596/dairynz-economic-survey-2013-14.pdf>.
- Epley, N. and Gilovich, T. (2006). The Anchoring-and-Adjustment Heuristic: Why the Adjustments are Insufficient. *Psych Sci*, 17(4), pp. 311-318. doi:10.1111/j.1467-9280.2006.01704.x
- Eriksson, P. and Kovalainen, A. (2008). *Qualitative Methods in Business Research*. Sage, London.
- Furman, C., Roncoli, C., Crane, T. and Hoogenboom, G. (2011). Beyond the "Fit": Introducing Climate Forecasts Among Organic Farmers in Georgia (United States). *Climatic Change*, 109(3-4), pp. 791-799. doi:10.1007/s10584-011-0238-y
- Gill, N. (2005). Life and Death in Australian 'Heartlands': Pastoralism, Ecology and Rethinking the Outback. *Journal of Rural Studies*, 21(1), pp. 39-53. doi:10.1016/j.jrurstud.2004.08.005

- Gray, B. J. and Gibson, J. W. (2013). Actor-Networks, Farmer Decisions, and Identity. *Culture, Agriculture, Food and Environment*, 35(2), pp. 82-101. doi:10.1111/cuag.12013
- Grundmann, R. (2007). Climate Change and Knowledge Politics. *Environmental Politics*, 16(3), pp. 414-432. doi:10.1080/09644010701251656
- Harré, N. (2011). *Psychology for a Better World: Strategies to Inspire Sustainability*. University of Auckland Department of Psychology, Auckland.
- Harton, H. C. and Bourgeois, M. J. (2004). Cultural Elements Emerge from Dynamic Social Impact. *The Psychological Foundations of Culture*, pp. 41-75.
- IPCC. (2014a). *Climate Change 2014 Synthesis Report*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IPCC. (2014b). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA:
- Jones, L., Champalle, C., Chesterman, S., Cramer, L. and Crane, T. A. (2017). Constraining and Enabling Factors to Using Long-Term Climate Information in Decision-Making. *Climate Policy*, 17(5), pp. 551-572. doi:10.1080/14693062.2016.1191008.
- Kahneman, D. (2011). *Thinking, Fast and Slow*. Macmillan, New York.
- Kamber, G., McDonald, C. and Price, G. (2013). Drying Out: Investigating the Economic Effects of Drought in New Zealand. *Reserve Bank of New Zealand Analytical Note Series No. AN2013/02*, Reserve Bank of New Zealand, 31.
- Kenny, G. (2011). Adaptation in Agriculture: Lessons for Resilience from Eastern Regions of New Zealand. *Climatic Change*, 106(3), pp. 441-462. doi:10.1007/s10584-010-9948-9.
- Kousser, T. and Tranter, B. (2018). The Influence of Political Leaders on Climate Change Attitudes. *Global Environmental Change*, 50, pp. 100-109. doi:10.1016/j.gloenvcha.2018.03.005.

- Kruglanski, A. W. and Stroebe, W. (2005). The Influence of Beliefs and Goals on Attitudes: Issues of Structure, Function, and Dynamics. In D. Albarracin, B. Johnson, and M. Zanna (Eds) *The Handbook of Attitudes*. pp. 323-368. Lawrence Erlbaum Associates, Mahwah, NJ.
- Kunda, Z. (1990). The Case for Motivated Reasoning. *Psychological Bulletin*, 108(3), pp. 480-498. doi:10.1037/0033-2909.108.3.480.
- Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C. Y. and Leiserowitz, A. A. (2015). Predictors of Public Climate Change Awareness and Risk Perception Around the World. *Nature Climate Change*, 5(11), pp. 1014-1020. doi:10.1038/nclimate2728.
- Leombruni, L. V. (2015). How You Talk About Climate Change Matters: a Communication Network Perspective on Epistemic Skepticism and Belief Strength. *Global Environmental Change*, 35, pp. 148-161. doi:10.1016/j.gloenvcha.2015.08.006
- Lincoln, Y. S. and Guba, E. G. (1985). *Naturalistic Inquiry*. Sage, Beverly Hills.
- Locke, S. (2016). National Farmers Federation partner with Climate Action farmers. Online version accessed, 23 November, 2016, <http://www.abc.net.au/news/rural/2016-11-23/nff-link-with-farmers-for-climate-action/8049846>.
- Luers, A. (2013). Rethinking US climate Advocacy. *Climatic Change*, 120(1-2), pp. 13-19. doi:10.1007/s10584-013-0797-1.
- Marsh, K. and Wallace, H. (2005). The Influence of Attitudes on Belief Formation and Change. In D. Albarracin, B. Johnson, and M. Zanna (Eds) *The Handbook of Attitudes*. pp. 369-395. Lawrence Erlbaum Associates, Mahwah, NJ.
- McCright, A. M. and Dunlap, R. E. (2011). Cool Dudes: The Denial of Climate Change Among Conservative White Males in the United States. *Global Environmental Change*, 21(4), pp. 1163-1172. doi:10.1016/j.gloenvcha.2011.06.003.
- Milfont, T. L., Milojev, P., Greaves, L. and Sibley, C. G. (2015). Socio-Structural and Psychological Foundations of Climate Change Beliefs. *New Zealand Journal of Psychology*, 44, pp. 17-30.
- Milfont, T. L., Wilson, M. S. and Sibley, C. G. (2017). The Public's Belief in Climate Change and its Human Cause are Increasing Over Time. *PLoS ONE*, 12(3). doi:10.1371/journal.pone.0174246

- Mullan, B., Wratt, D., Dean, S., Hollis, M., Allan, S., Williams, T. and Kenny, G. (2008). *Climate Change Effects and Impacts Assessment: A Guidance Manual for Local Government in New Zealand (2nd edition)*. Ministry for the Environment, Wellington, New Zealand.
- New Zealand Herald. (2015). Stress Too Much for Farmers. Online version accessed 23 July, 2018, https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11384751.
- Niles, M. T., Brown, M. and Dynes, R. (2016). Farmer's Intended and Actual Adoption of Climate Change Mitigation and Adaptation Strategies. *Climatic Change*, 135(2), pp. 277-295. doi:10.1007/s10584-015-1558-0.
- Oreszczyn, S., Lane, A. and Carr, S. (2010). The Role of Networks of Practice and Webs of Influencers on Farmers' Engagement with and Learning About Agricultural Innovations. *Journal of Rural Studies*, 26(4), pp. 404-417. doi:10.1016/j.jrurstud.2010.03.003.
- Prislin, R. and Wood, W. (2005). Social Influence in Attitudes and Attitude Change. In D. Albarracín, B. T. Johnson, and Z. M. P. (Eds) *The Handbook of Attitudes*. pp. 671-705. Lawrence Erlbaum Associates Publishers, Mahwah, NJ, US.
- Prokopy, L. S., Arbuckle, J. G., Barnes, A. P., Haden, V. R., Hogan, A., Niles, M. T. and Tyndall, J. (2015). Farmers and Climate Change: a Cross-National Comparison of Beliefs and Risk Perceptions in High-Income Countries. *Environmental Management*, 56(2), pp. 492-504. doi:10.1007/s00267-015-0504-2.
- Prokopy, L. S., Carlton, J. S., Haigh, T., Lemos, M. C., Mase, A. S. and Widhalm, M. (2017). Useful to Usable: Developing Usable Climate Science for Agriculture. *Climate Risk Management*, 15, pp. 1-7. doi:10.1016/j.crm.2016.10.004.
- Radio New Zealand (2014). Farmers Group Takes No Climate Stance. Online version accessed 4 June, 2018, <https://www.radionz.co.nz/news/national/246288/farmers-group-takes-no-climate-stance>.

- Reisinger, A., Kitching, R. L., Chiew, F., Hughes, L., Newton, P. C. D., Schuster, S. S., . . . Whetton, P. H. (2014). 2014: Australasia. In V. R. Barros, C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (Ed) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. pp. 1371-1438. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Sligo, F. X. and Massey, C. (2007). Risk, Trust and Knowledge Networks in Farmers' Learning. *Journal of Rural Studies*, 23(2), pp. 170-182. doi:10.1016/j.jrurstud.2006.06.001.
- Spencer, S., Fein, S., Strahan, E. and Zanna, M. (2005). The Role of Motivation in the Unconscious: How Our Motives Control the Activation of Our Thoughts and Shape Our Actions. In J. Forgas, K. Williams, and S. Laham (Eds) *Social Motivation: Conscious and Unconscious Processes*. pp. 113–129. Cambridge University Press, Cambridge.
- Statistics New Zealand. (2016). *Goods and Services Trade by Country: Year ended June 2016*. Online version accessed from, http://www.stats.govt.nz/browse_for_stats/industry_sectors/import_and_exports/GoodsServicesTradeCountry_HOTPYeJun16.aspx.
- Tisch, D. G. and Galbreath, J. (2018). Building Organizational Resilience Through Sensemaking: The Case of Climate Change. *Business Strategy and the Environment*, 27(8), pp. 1197-1208. doi:10.1002/bse.2062.
- Tranter, B. and Booth, K. (2015). Scepticism in a Changing Climate: a Cross-National Study. *Global Environmental Change*, 33, pp. 154-164. doi:10.1016/j.gloenvcha.2015.05.003.
- Tversky, A. and Kahneman, D. (1973). Availability: A Heuristic for Judging Frequency and Probability. *Cognitive Psychology*, 5(2), pp. 207-232. doi:10.1016/0010-0285(73)90033-9