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SCIENTIFIC DIVERSITY, SCIENTIFIC UNCERTAINTY AND RISK MITIGATION POLICY AND PLANNING

Annual Report: 2016-2017

Dr Jessica K. Weir and Dr Liz Clarke[1,2]
[1] Institute for Culture and Society, Western Sydney University, NSW
[2] The Australian National University, ACT

WESTERN SYDNEY UNIVERSITY

Australian National University

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ABSTRACT

What is the problem?

There is a significant knowledge deficit concerning how science and other forms of knowledge are used and integrated into sector policy and practice, leading to incorrect and counter-productive misunderstandings. The emphasis on the value of scientific knowledge within the natural hazards sector – and particularly in regards to risk mitigation – is legitimate. However, this valuing of science has not been accompanied by research into the opportunities and challenges of using science in policy and practice. It is important to understand the inherent uncertainties in scientific results and methods so that practitioners are more able to judge and use this work, including in terms of evaluating it with respect to other knowledge sources – social science, professional knowledge, experiential knowledge and so on.

Why is it important?

Without greater insight into how science and other forms of knowledge are used and integrated into sector policy and practice, the ability of policymakers and practitioners to explain risk mitigation and translate its scientific basis is compromised. The sector does not receive the full range of information it requires, and it continues to be vulnerable to the perpetuation of received ideas and 'myths' about science, its use and its utility. This work supports the capacity of risk management practitioners to explain and justify mitigation practices to other risk mitigation professionals, the public, the media, and courts and inquiry processes.

How are we going to solve it?

This research project will provide insight into the opportunities and challenges of using science in policy and practice through case studies conducted about and with practitioners. In doing so, it will provide an improved understanding of scientific integration pathways and an improved basis for articulating and defending science-based decision-making in natural hazard risk mitigation. Our findings are showing how knowledge integration and knowledge diversity are essential to navigating risk and uncertainty.

END USER STATEMENT

John Schauble, *Emergency Management Victoria, VIC*

Emergency managers make (and must justify) decisions around risk on a daily basis. Decisions around risk and hazard mitigation policy, however, are a different matter. These invariably involve translating scientific knowledge into practice and being able to explain this process to a variety of audiences, including the general public.

In delving into this process, this research has highlighted the complexity involved in the decision-making but also the problems of translating this into accessible and relatable outcomes. Suffice to say, that the research highlights the inherent uncertainty involved in risk mitigation practice and policy.

If there is one thing that politicians, the media and the public do not abide in emergency management decision-making, it is uncertainty. And yet, uncertainty is just about the only absolute when disasters occur! The public discourse calls for simple fixes before, during and after disasters. As this research shows, there are no such things.

While the natural and physical sciences have long supported the risk management process, these pathways are not enough alone to guide risk mitigation into an uncertain future. Other knowledge sources and other traditions have a role to play. The rise of interest in traditional burning practices is just one example of this.

A range of evidence and different approaches should embraced in the face of uncertainty. Valuing knowledge diversity is critical.

INTRODUCTION

This Annual Report reports on Year 4 (July 2016-June 2017) of the Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning project (or 'RMPP project'). This project commenced in January 2014 and is part of the Governance and Institutional Knowledge cluster of the Bushfire and Natural Hazards Cooperative Research Centre. The RMPP project is led by Western Sydney University and is undertaken in collaboration with The Australian National University.

BACKGROUND

New public policy positions for bushfire and flood risk planning, preparedness, response and recovery rely on best practice scientific evidence, however, scientific evidence does not always meet the knowledge needs of practitioners. Scientific studies are fragmented and highly specialised, constantly evolving, and span diverse disciplinary approaches. Further, scientific evidence is produced, understood and used in relation to other sources of knowledge – professional expertise, experiential knowledge, and so on. *Given that uncertainty is an inherent part of scientific practice and method, and risk mitigation is also inherently uncertainty, how do risk mitigation practitioners manage these uncertainties in their decision-making?*

Efforts to anticipate and mitigate natural hazards have generated a diverse field of natural and physical science that is drawn upon by a wide range of practitioners. By moving beyond simplistic assumptions that this science can be directly translated into policy and practice, we instead analyse how risk practitioners express and manage the different uncertainties inherent to scientific results and methods.

The RMPP project seeks to achieve a better science-governance match in risk mitigation through three key tasks:

1. Investigating the diversity and uncertainty of bushfire and flood science, and its contribution to risk mitigation policy and planning;
2. Exploring how diverse individuals use and understand scientific evidence and other knowledges in their bushfire and flood risk mitigation roles; and,
3. Analysing how this interaction produces particular kinds of opportunities and challenges in the policy, practice, law and governance of bushfire and flood risk mitigation.

This project uses qualitative social science methods including scenario exercises, theoretical tools and case studies, to analyse how diverse knowledges are ordered and judged as salient, credible and authoritative, and the pragmatic meaning this holds for emergency management across the PPRR (prevention, preparedness, response and recovery) spectrum.

Our research activities are supported by the in-kind contributions of the end user panel and the research team, including the international collaboration with the University of Alberta, Canada and the University of Gothenburg, Sweden.

WHAT THE PROJECT HAS BEEN UP TO

STAFFING

In July 2017, Timothy Neale left the position of Principal Investigator to take up a Research Fellowship at Deakin University, continuing on the project on an in-kind basis (0.1 fte). Dr Liz Clarke was recruited to undertake the third and last case study on a part-time basis. Dr Jessica Weir took on all other Principal Investigator responsibilities, including synthesizing the end of project outcomes and organizing the end-of-project workshop.

CASE STUDIES AND SCENARIO EXERCISES

Our case studies are each at different stages. Two are completed, one is in the process of being written up, and a new – international – case study has been added to this comparative work.

1. Barwon-Otway Region

The fieldwork for this case study was completed in early 2016, and results were shared in in various formats. This case study is now forming part of the comparative synthesis of results to support the end of project findings.

A poster and presentation on this and the Darwin case study were included in the AFAC 2016 program.

2. Greater Darwin Area, Northern Territory

The fieldwork for this case study was completed in early to mid 2016, and results were shared in in various formats. This case study is now forming part of the comparative synthesis of results to support the end of project findings.

A poster and presentation on this and the Barwon-Otway case study were included in the AFAC 2016 program.

Dr Tim Neale and Dr Jessica Weir will travel to Darwin in late September 2017 to provide end utilization seminars and tools. This includes reporting back on the Sydney September 2017 End Utilization workshop.

3. Hawkesbury-Nepean Valley Taskforce, New South Wales

In July 2016, we were able to confirm our flood risk case study of the Hawkesbury-Nepean Valley (HNV), in partnership with the HNV Taskforce (now Directorate). This included preparing a two page briefing for Infrastructure NSW in July, and a meeting with them in September to discuss our research activities in further detail.

During 2016-17, the project team:

- Worked collaboratively with end user partners, particularly Ms Maree Abood, Infrastructure NSW and Peter Cinque, NSW SES.
- Conducted 22 semi-structured interviews (October-November)
- Was hosted by NSW SES for a one day field trip, starting from Warragamba Dam and travelling through the catchment looking at the complexity of flood behaviours, evacuation routes and strategies, and the population centres.
- Convened a one-day workshop, adapting the scenario exercise methodology to incorporate project co-learnings.

The HNV Taskforce has worked with a variety of expert knowledges and sciences, including working with multiple perspectives on these knowledge sources, so as to embrace uncertainty and complexity in risk mitigation. We designed the November 2016 one-day workshop to respond to some of the concerns and needs raised during the interview process, and theoretical constructs and relevant theory for them to reflect on their practice. A collaborative action research approach was taken to allow for data collection as well as some useful inputs for the workshop participants.

- Clarke, L and Ashhurst C. 2016. Sensemaking Workshop: A focus on data and information in the RMPP Project', SES Western Sydney, Seven Hills, 21 November 2016.

Results from this fieldwork and workshop are currently being analysed for publication and presentation, as well as inclusion in the project synthesis. A joint-paper and presentation with end users have been prepared for the AFAC 2017 conference.

4. Lac La Biche, Alberta, Canada

As planned for and pursued, we have been able to add a fourth case study to access international comparative learnings from our Canadian partners, as well as broader reach for our Australian findings. Both outcomes are of great benefit at home.

Team member Professor Tara McGee successfully applied to the Alberta Provincial government for CAD $20,000 to support a case study looking at the use of science in risk mitigation decision making in the Lac La Biche area. The funds will be used to recruit a graduate student to undertake the interviews and organize the scenario exercise. The scenario exercise will be held in late August 2017 and Dr Tim Neale will be attending using RMPP and Deakin university funds.

SYDNEY END-OF-PROJECT UTILISATION WORKSHOP

End users have expressed a clear need for assistance in navigating the complexity of working with scientific knowledge in natural hazard risk mitigation. The Sydney workshop is designed explicitly to address these professional requirements. The workshop 'Making Science Social: Making sense of risk &

uncertainty' is an invitation only Practitioner Workshop, to be held in Sydney on 7 September 2017. Workshop participants have been identified through our case study work and in consultation with our end user committee.

PUBLICATIONS

- Neale, T, 2017, 'Are we wasting our time?': bushfire practitioners and flammable futures in northern Australia. *Social & Cultural Geography* 1-23.
- Neale T. 2016, Burning Anticipation: wildfire, risk mitigation and simulation modelling in Victoria, Australia. *Environment & Planning A*, 48, 2026-2045.
- Magee, L, Handmer, J, Neale, T & Ladds, M. 2016, 'Locating the intangible: integrating a sense of place into cost estimations of natural disasters', *Geoforum*, vol. 77, December, pp. 61-72.
- Weir, JK, Neale, T and L Clarke (in press) 'Science is critical, but it is not everything: Our Findings', conference proceedings paper, AFAC 2017, Sydney.
- Dovers, S, (in press) 'Emergency Management and Policy: Research Impact and Utilization', conference proceedings paper, AFAC 2017, Sydney.
- Clarke, L, Weir, JK, Neale, T Cinque, and M Abood (in press) 'Making sense of Hawkesbury-Nepean flood risk: Bringing science and society together', conference proceedings paper, AFAC 2017, Sydney.

Additionally, our associated PhD student Graham Dwyer has published:

- Dwyer, G and C Hardy 2016 We have not lived long enough: Sensemaking and learning from bushfire in Australia, *Management Learning*, 47(1) 45-64.

RRESENTATIONS AND POSTERS

- Neale, T and JK Weir. 2016, The social life of science in natural hazards policy and planning: tales from Victoria and the Northern Territory, AFAC presentation, 30 August 2016, Brisbane.
- Neale, T and JK Weir. 2016, The social life of science in natural hazards policy and planning: opportunities and challenges, AFAC poster, Brisbane, Qld.
- McGee, T. 2016, Canadian case study: Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning Project, Alberta Agriculture and Forestry, Wildfire Management Branch, Edmonton, 16 November 2016.
- Tim, N 2016,Burning Anticipation, 4S/EASST conference (European Association for Science and Technology Studies (EASST) and the Society for Social Studies of Science) (4S), 4 September 2017, Barcelona

- Clarke, L (2016). 'Feedback on research interviews', Sensemaking Workshop: A focus on data and information in the RMPP Project', SES Western Sydney, Seven Hills, 21 November 2016.
- Neale, T 'Embracing Uncertainty, presentation to AFAC's Predictive Services Group, 15 June 2017.
- Weir, JK, Neale, T and L Clarke 2017. What to do with uncertain science, BNHCRC RAF Perth April.

END USER ENGAGEMENT

The RMPP project team have established and built strong end user engagement in the project's development and outputs from the start. Our research methodology is inherently an engaged approach with end users throughout the life of the project, so as to facilitate multiple opportunities for adaptive learning and feedback information to keep improving project design.

Engagement with end user agencies through the case studies has provided the opportunity for immediate utilisation by the sector. For example, the scenario exercises and workshops held with end users during fieldwork were opportunities for sector reflection, networking, and the co-production of knowledge for policy and practice. The fire science seminar we provided to DWELP in 2016 provided a valuable forum that contributed to a change in state-wide prescribed burning policy.

End users have been vital to the successes of Year 4, and the project team is committed to continuing to meet regularly with end users to continue these successes. Engagement with end users and sector representatives has taken five primary forms:

- An 'End User newsletter' is circulated to end users every quarter to brief end users of project progress, foreshadow emerging challenges and opportunities and solicit feedback on case studies and project outputs. The newsletter has been well received by end users, and is regularly republished on the BNHCRC website.
- The circulation and discussion of project outputs. These exchanges have been very important in guiding the project team and the development of project outputs.
- In-person and teleconference meetings between project team members and end users. These have provided important opportunities to discuss the project, its case studies and the utilisation of its research.
- Online engagement via social media platforms. Dr Neale (@tdneale) has 624 followers on Twitter and Dr Weir (@drjkweir) has 154 followers on Twitter and both actively user the platform to disseminate research findings and project news.
- Attendance at industry events, specifically the annual AFAC Conference and BNHCRC Research Advisory Forum.

Timothy Neale also provided the following presentation:

- Neale, T 'Embracing Uncertainty', presentation to AFAC's Predictive Services Group, 15 June 2017.

PROJECT FINDINGS

Our findings are continuing to be analysed and synthesized so as to distil the results for practice and policy, as well as to guide future research. More results on this will be forthcoming.

We can say that our investigation into uncertainty and complexity has revealed further uncertainty and complexity, that efforts to 'fix' or simplify complexity and/or uncertainty only leads to 'unruly' issues appearing, often when least welcome, and yet decisions still have to be made.

For example, there are multiple perspectives about:

- what the hazard is and what is at risk,
- what the mitigation solutions might be,
- how science should be used to address this, and
- the contribution of other sources of knowledge.

Reaching consensus on risk mitigation is unlikely. Further, proposed solutions will probably not be able to resolve all the problems, and will even produce new ones.

Practitioners work with this complexity and uncertainty every day, but they do so without the full reach of research support they need. The natural and physical sciences are absolutely central in providing support to this complex and uncertain management context; however, they must be investigated and used in tandem with insights from other knowledge sources, including other disciplinary traditions. Rather than privileging one source of information, different evidenced based approaches need to work together in order to ensure the industry has the best information possible.

This embrace of complexity and uncertainty is not a disabling of our capacity to uncover knowledge, and to then act on that knowledge; rather, it ensures that we have more rigorous and targeted information collection, analysis and use. The evidenced-based knowledge provided to industry is more transparent, more translatable and thus easier to be evaluated in relation to professional expertise, experiential knowledge, and so on.

If uncertainty and complexity are not understood as normal, then practitioners, as well as the scientists, will continue to be held to unrealistic expectations by communities, the media, inquires, and others who assume there are clear facts to be uncovered that can be smoothly translated into best-practice decision making. Instead, by taking a reflexive approach, engaging with not just the evidence but the assumptions that have produced it, we have the basis for the co-production of practice and policy knowledge with practitioners.

Valuing knowledge diversity is a critical part of this work. Before asking *how*, we need to ask *what* are we seeking to protect and *why*? These are deeply socio-cultural questions, requiring an investigation of our diverse socio-ecological priorities.

PUBLICATIONS LIST

JOURNAL ARTICLES

- Neale T and Weir JK. 2015, Navigating scientific uncertainty in wildfire and flood risk mitigation: a qualitative review. *International Journal of Disaster Risk Reduction* 13: 255–265.
- Wodak J and Neale T. 2015, A critical review of the application of environmental scenario exercises. *Futures* 73: 176-186.
- Neale T, Weir JK and McGee TK. 2016, Knowing Wildfire Risk: scientific interactions with risk mitigation policy and practice in Victoria, Australia. *Geoforum* 72: 16-25.
- Neale T, Weir JK and Dovers S. 2016. Science in Motion: integrating scientific knowledge into bushfire risk mitigation in southwest Victoria. *Australian Journal of Emergency Management* 31: 13-17.
- Neale T. 2016. Burning Anticipation: wildfire, risk mitigation and simulation modelling in Victoria, Australia. *Environment & Planning A*, 48, 2026-2045.
- Magee, L, Handmer, J, Neale, T & Ladds, M 2016, 'Locating the intangible: integrating a sense of place into cost estimations of natural disasters', *Geoforum*, vol. 77, December, pp. 61-72.
- Neale, T, 2017, 'Are we wasting our time?': bushfire practitioners and flammable futures in northern Australia. *Social & Cultural Geography* 1-23.

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CONFERENCE PROCEEDINGS AND OTHER PUBLICATIONS

- Weir, JK, Neale, T and L Clarke (in press) 'Science is critical, but it is not everything: Our Findings', AFAC 2017 conference proceedings paper.
- Dovers, S, (in press) 'Emergency Management and Policy: Research Impact and Utilization', AFAC 2017 conference proceedings paper.
- Clarke, L, Weir, JK, Neale, T Cinque, and M Abood (in press) 'Making sense of Hawkesbury-Nepean flood risk: Bringing science and society together', AFAC 2017 conference proceedings paper.

POSTERS

- Wodak J and Neale T. 2014, Can We Better Understand How Scientific Knowledges Work in Risk Mitigation Through Scenario Exercises? 2014 AFAC/Bushfire and Natural Hazards CRC conference. Wellington, NZ.
- Neale T and Weir JK. 2015, Navigating scientific uncertainty in wildfire and flood risk mitigation. 2015 AFAC/Bushfire and Natural Hazards CRC conference. Adelaide, SA.
- Neale, T and JK Weir 2016, The social life of science in natural hazards policy and planning: opportunities and challenges, AFAC poster, Brisbane, Qld.

PRESENTATIONS

- McGee, T. 2014, Social science research insights into public support for wildfire mitigation. *Forest Fuels Management Workshop*. Hinton, Alberta, Canada.
- Weir JK. 2014, Scientific Diversity and Uncertainty: Bushfire and Flood Risk Mitigation. *BNHCRC Research Advisory Forum*. Adelaide.
- Eburn, M. 2014, Science and Fire Litigation. ANU College of Law. Canberra.
- Weir J and Neale T. 2015, Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning: Project Update. *Research Advisory Forum.* RFS NSW.
- Neale T. 2015, Inexistent Fires: imagining risk, knowledge and uncertainty in southwestern Victoria. *Fenner School Seminar, The Australian National University.* Canberra.
- McGee TK. 2015, Exploring Indigenous Peoples' Experiences of Wildfire Evacuation: First Nations Wildfire Evacuation Partnership. *Fenner School Seminar, The Australian National University.* Canberra.
- McGee TK. 2015, Exploring Indigenous Peoples' Experiences of Wildfire Evacuation: First Nations Wildfire Evacuation Partnership. *Institute for Culture and Society, Western Sydney University.* Parramatta.
- Neale, T. 2015, Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning, *Information Share,* NSW Rural Fire Services, Homebush.
- Neale, T. 2015, Practising Calculability: wildfire, risk mitigation, and simulation modelling in southwest Victoria, *Research Institute for the Environment and Livelihoods Seminar Series*, Charles Darwin University, Darwin, NT.
- Neale, T. 2015, Practising Calculability: wildfire, risk mitigation, and simulation modelling in southwest Victoria,' *Institute for Culture and Society Seminar Series*, Western Sydney University, Parramatta, NSW.

- Neale, T. 2015, Inexistent Fires: imagining risk, knowledges and uncertainties in southwestern Victoria, *Institute of Australian Geographers Conference*, Canberra, ACT.
- Neale T. 2016, RMPP Project: Barwon-Otway case study. *Presentation to Department of Environment, Land, Water and Planning*, Melbourne, VIC.
- Neale T. 2016, Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning: Project Update. *Research Advisory Forum.* Hobart, TAS.
- Neale, T and JK Weir 2016, The social life of science in natural hazards policy and planning: tales from Victoria and the Northern Territory, AFAC presentation, 30 August 2016, Brisbane.
- McGee, T. 2016, Canadian case study: Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning Project, Alberta Agriculture and Forestry, Wildfire Management Branch, Edmonton, 16 November 2016.
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- Neale, T. 2017, 'Embracing Uncertainty, presentation to AFAC's Predictive Services Group, 15 June 2017.
- Weir, JK, Neale, T and L Clarke 2017, What to do with uncertain science, BNHCRC RAF Perth, April 2017.

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- Wodak J. 2014, Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning: Scenario Methods literature review. Parramatta, NSW: Institute for Culture and Society, Western Sydney University.
- Neale T and Weir JK. 2014, Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning: Annual project report 2014. Melbourne, Vic: Bushfire & Natural Hazards CRC.
- Neale T. 2015, Scientific knowledge and scientific uncertainty in bushfire and flood risk mitigation: literature review, Melbourne, Vic.: Bushfire & Natural Hazards CRC.
- Neale T and Weir JK. 2015, Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning: Annual project report 2015. Melbourne, Vic: BNHCRC.

BNHCRC BLOG POSTS

- Neale, T 2016, *Mitigating future risk with science*, 2 March, BNHCRC, <http://www.bnhcrc.com.au/news/blogpost/timothy-neale/2016/mitigating-future-risk-science>.

- Neale, T 2016, *The social life of science in policy and planning*, 12 April, BNHCRC, <http://www.bnhcrc.com.au/news/blogpost/timothy-neale/2016/social-life-science-policy-and-planning>.

CURRENT TEAM MEMBERS

PROJECT LEADER

Dr Jessica K. Weir, Institute for Culture and Society, Western Sydney University
Tel: +61 2 9685 9533
Email: j.weir@westernsydney.edu.au

PRINCIPAL INVESTIGATOR

Dr Liz Clarke, Institute for Culture and Society, Western Sydney University
Tel: +61 2 9685 9552
Email: l.clarke@westernsydney.edu.au

PROJECT TEAM

Dr Timothy Neale, Deakin University
Dr Christine Hansen, University of Gothenburg, Sweden
Associate Professor Tara McGee, University of Alberta, Canada
Associate Professor Michael Eburn, College of School, Australian National University
Professor Stephen Dovers, Fenner School, Australian National University
Professor John Handmer, RMIT University

END USERS

Will Luker, Department of Premier and Cabinet, South Australia
Don Cranwell, Metropolitan Fire Service, South Australia
Chris Irvine, State Emergency Service, Tasmania
Leigh Miller, Country Fire Service, South Australia
Ed Pikusa, Fire and Emergency Services Commission, South Australia
Dylan Rowe, Department of Environment, Land, Water and Planning, Victoria
John Schauble, Emergency Management Victoria, Victoria
Patrick Schell, Rural Fire Service, New South Wales