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SCIENTIFIC DIVERSITY, SCIENTIFIC UNCERTAINTY AND RISK MITIGATION POLICY AND PLANNING PROJECT

Annual project report 2014-2015

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Cover: Burnt landscape at Moggs Creek, Victoria.

Photo: Timothy Neale

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EXECUTIVE SUMMARY

Efforts to anticipate and mitigate natural hazards have generated a diverse field of natural science that is drawn upon by a wide range of practitioners and decision makers as part of making strategic decisions to anticipate and mitigate natural hazard events. This project asks, *Given that uncertainty is an inherent part of scientific practice and method, how do those engaged in risk mitigation manage these scientific uncertainties in their decision-making?*

By moving beyond simplistic assumptions that science can be directly translated into policy and practice, we instead analyse how risk professionals and others express and manage differing opinions about the diverse forms of knowledge and uncertainties inherent to mitigation practice – including in terms of their relative influence and changeability – and to investigate how science comes to inform risk mitigation policy and practice. This work supports the capacity of risk management practitioners to explain, justify and discuss mitigation practices to other risk mitigation professionals, the public, the media, and in court and inquiry processes.

The second year of the *Scientific Diversity, Scientific Uncertainty And Risk Mitigation Policy And Planning* (RMPP) project has been occupied with project development, literature reviews, fieldwork, publication development and end user engagement. Some key activities in this second year include:

- The appointment of Principal Investigator Dr Timothy Neale.
- The completion of two comprehensive literature reviews, one examining scenario exercises and the other examining the forms of scientific uncertainty encountered in bushfire and flood risk mitigation. The project team will use and develop the findings from this work to inform the case studies and other research.
- A journal article published in the International Journal of Disaster Risk Reduction.
- The scoping of the project's three case studies of bushfire and/or flood risk mitigation.
- The completion of interviews, a survey and a scenario exercise as part of the Barwon-Otway case study.
- The visit of project team member Associate-Professor Tara McGee from the University of Alberta, Canada.
- The development of end user engagement through a regular newsletter and circulated reports, draft publications and end user meetings.

The RMPP project has developed quickly, thanks to robust engagement with industry and support from end users and the project team. The project is well placed to continue to build on this successful year of research and engagement by developing the second and third case studies and disseminating emerging research results.

END USER STATEMENT

John Schauble, *Emergency Management Victoria, VIC*

The increasing and – it must be said – highly justified demand for evidence - based formulation of public policy is placing a higher than ever premium on the need to translate scientific knowledge into common understandings.

There is enormous potential, especially in the immediate aftermath of major disasters or events, for the development of public policy that is deeply flawed for lack of understanding of the risk and consequences of such events.

Matching the available scientific evidence with the needs of social policy makers in particular can be problematic. Risk adverse governments at all levels need to be reassured and to understand what can and cannot be done in terms of planning, preparedness, response and recovery.

Developing a common language between risk professionals, policy makers and the broader community (including politicians, lawyers and the media) will be a significant step towards managing differing opinions and uncertainties in relation to natural hazards. This project is already making significant inroads in developing a capacity in the field of risk mitigation and planning to explain and justify the forms of scientific uncertainty encountered in bushfire and flood risk mitigation.

The potential for the application of that thinking across a broader range of hazards is an exciting prospect.

PROJECT 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, local knowledge, law, politics and so on. *Given that uncertainty is an inherent part of scientific practice and method, how do those engaged in risk mitigation manage these scientific uncertainties in their decision-making?*

Efforts to anticipate and mitigate natural hazards have generated a diverse field of natural science that is drawn upon by a wide range of practitioners and decision makers who need to understand the character and influence of these sciences, their uncertainties and their contribution amongst diverse scientific and other knowledges. They do so as part of making strategic decisions to anticipate and mitigate natural hazard events. By moving beyond simplistic assumptions that science can be directly translated into policy and practice, we instead analyse how risk professionals and others express and manage differing opinions about the different uncertainties inherent to mitigation practice, including in terms of their relative influence and changeability. 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.

The *Scientific Diversity, Scientific Uncertainty And Risk Mitigation Policy And Planning* (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 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

Dr Timothy Neale was recruited as principal investigator and commenced in July 2014. Dr Neale comes to the project from the University of Melbourne, where he completed a doctoral degree on environmental regulation and development relating to the *Wild Rivers Act 2005 (Qld)* in far north Queensland.

CASE STUDIES AND SCENARIO EXERCISES

Three case studies for the scenario exercises are at different stages of development.

Ethics approval for the fieldwork has been formally received from the University of Western Sydney's Human Research Ethics Committee.

1. Bushfire risk mitigation in the Barwon-Otway area, Victoria

Since 2009, the Barwon-Otway area in south-western Victoria has been a pilot site for a new approach to bushfire risk calculation and mitigation led by the Department of Environment, Land, Water and Planning (DELWP). This approach utilises new scientific tools to plan mitigation activities, quantify mitigation effects, and inform community stakeholders. For this case study:

- A participant group has been recruited
- 21 in-depth interviews were completed in November-December 2014
- A survey was conducted in February-March 2015, and
- A scenario exercise with 12 Barwon-Otway participants was convened in April 2015.

2. Bushfire risk mitigation in the Greater Darwin area, Northern Territory

Though a significant portion of its grassland is burnt each year, the Greater Darwin area is not historically a high-risk bushfire area. However, the recent spread of highly flammable gamba grass (*Andropogon gayanus*) and the continuing subdivision of floodprone and marginal lands in peri-urban Darwin are changing the level of risk and the need for mitigation solutions. For this case study:

- a participant group is being recruited in anticipation of fieldwork beginning in mid 2015.

3. Flood risk mitigation in the Hawkesbury-Nepean Valley, NSW

In the words of one 2006 State government report, the Hawkesbury-Nepean Valley 'has been described as exhibiting a combination of the worst characteristics of riverine flooding (depth and extent), and the worst characteristics of flash flooding (rapid rise of floodwaters and limited warning time)'.[1] The issue of flood risk mitigation is currently the object of the Hawkesbury-Nepean Valley Flood Management Taskforce, which is due to report in late 2015. For this case study:

- A participant group is being recruited in anticipation of fieldwork beginning in early 2016.

SCOPING OF CASE STUDIES

Scoping for these three case studies began in the first quarter through discussions with project team members, end users and BNHCRC contacts.

- The Barwon-Otway bushfire risk case study in southwest Victoria was first raised in discussions between Dr Weir and Prof. Dovers. Prof Dovers had been involved in a review of a new approach to risk mitigation in this area. The project team then approached contacts in responsible agencies to discuss this new approach, before reviewing the grey literature to further scope the issues faced by professionals.
- The Hawkesbury-Nepean Valley flood risk case study was first raised in discussions between Dr Weir and Prof. Handmer. Prof. Handmer has extensive experience with the issue of flood risk in New South Wales. Project team members then met with relevant responsible agencies, scoping the key issues they face, as well as reviewing grey literature on the scientific knowledge and uncertainties encountered and managed.
- The Greater Darwin area bushfire risk case study was first proposed through discussions between Dr Weir and end users at a BNHCRC forum in Adelaide. Dr Weir and Prof Dovers then had further discussions with BNHCRC researchers from Charles Darwin University. Dr Neale is approaching contacts in responsible agencies to further discuss the suitability of the area for a case study, and reviewing relevant grey literature.

Dr Neale is using the established 'snowball' method to develop participant groups for all of the case studies.[2]

FIELDWORK AND FIRST SCENERIO EXERCISE

This year has been a period of extensive fieldwork for the Barwon-Otway case study:

- In November-December 2014, Dr Neale travelled to Victoria to complete in-depth interviews with 21 participants engaged in bushfire risk mitigation in the Barwon-Otway area.
- In mid April 2015, Dr Neale returned to the case study area to observe a 2-day stakeholder workshop, before being joined by Dr Weir and A-Prof. McGee the following week for a scenario exercise. Facilitated by Prof. Paul James (UWS), the scenario exercise brought together 12 participants from the Barwon-Otway area to discuss the future of the area, the challenges of bushfire risk mitigation, and the forms of knowledge required to meet those challenges.

Additionally, Dr Christine Hansen has been conducting background research on the different forms of historical knowledge relating to bushfire and developing fieldwork contacts.

INTERNATIONAL VISITOR

In April 2015 project team member Associate Prof. McGee travelled from the University of Alberta to Australia. A-Prof. McGee's research focuses on individual, community, and organisational responses to environmental hazards, and a major area of research focus is wildfire risk perception and mitigation activities by homeowners and local governments. While in Australia, A-Prof. McGee:

- Met with project team members Dr Weir, Dr Neale, Prof. Handmer and Prof. Dovers to discuss emerging project findings and a possible Canadian case study of bushfire risk mitigation in central Alberta.
- Participated in the Barwon-Otway scenario exercise
- Presented two research seminars, the first at the Institute for Culture and Society and the second at The ANU's Fenner School.

A-Prof. McGee's visit was an important opportunity for the RMPP project to foster collaboration and build the international relevance of our research.

PUBLICATIONS

The project team has completed two literature reviews, which are summarized below. The project team will use and develop the findings from this work to inform the case studies and other research.

The literature reviews have been revised into two co-authored journal articles for international journals, one has been published and the other is peer review:

- Neale, T and J.K Weir 2015., Navigating scientific uncertainty in wildfire and flood risk mitigation: a review, *International Journal of Disaster Risk Reduction*, 13: 255-265.
- Wodak, J and T Neale (under review), A critical review of the application of scenario exercises to environmental challenges

Wodak, *Scientific diversity, scientific uncertainty and risk mitigation policy and planning: scenario methods literature review* (2014)

This report outlines what scenario exercise are, why they are used, and how they can be used to achieve the aims of the RMPP project. Approximately 250 sources on scenario exercises, methodology, analysis, and design were reviewed.

Key findings:

- Two dominant approaches to scenario exercises exist. In one, scenario exercises involve the generation of predictive models of possible future events through combined quantitative analyses. In the other, scenario exercises involve participants of various kinds responding to possible future events in order to pay attention to how knowledge of such futures is produced.
- There are many methodological lessons to be drawn from the existing use of scenario exercises:
- While they can bring together diverse expert knowledges to better

understand complex systems, the focus is often on the product and not the process.

- While they can allow participants to test decision options, evaluate implications and analyse pathways, they are also vulnerable to being influenced by the interests of dominant participants.

Neale, *Scientific knowledge and scientific uncertainty in bushfire and flood risk mitigation: literature review* (2015)

This report surveys the key scientific uncertainties encountered, managed and utilised by practitioners and decision-makers involved in bushfire and flood risk mitigation practices in Australia. Scientific uncertainties are those 'known unknowns' and 'unknown unknowns' that emerge from the development and utilisation of scientific knowledge.

Key findings:

- While bushfire and flood risk mitigation sciences have their own specific uncertainties, they also share some common practices and common uncertainties. For example, imperfect historical data, fluid entities (climate, weather, flora, fauna and human populations), and widespread practical issues, such as the 'data and computational friction' generated by modelling and the unavoidably fragmented work of data collection and storage.[3]
- Scientific uncertainties encountered in bushfire and flood risk mitigation can be categorised as historicist, instrumental and interventionist uncertainties:
    - *Historicist uncertainties* are those uncertainties which emerge from the reliance of scientific knowledge on archives of historical data;
    - *Instrumental uncertainties* are those uncertainties which emerge from the limitations of a given apparatus, heuristic or theory;
    - *Interventionist uncertainties* are those uncertainties which emerge from a given mitigation intervention.

This categorisation of scientific uncertainties will be tested in the case studies. Framing these uncertainties categorically as well as technically will help analyse the management of uncertainty by risk mitigation professionals and others.

PRESENTATIONS AND POSTERS

A poster based on the Scenario Methods literature review report, prepared by Dr Wodak and Dr Neale, was presented at the AFAC 2014 conference in Wellington, New Zealand, in September 2014.

A poster, based on the journal article and literature review, has been submitted to the BNHCRC for inclusion in the AFAC 2015 conference in Adelaide.

Associate Professor Michael Eburn gave a lecture at the ANU's College of Law on 'Science and Fire Litigation' in February 2015. In April 2015,

Dr Weir and Dr Neale presented an overview of the RMPP project's literature

reviews and fieldwork at the BNHCRC's Research Advisory Forum, staged at NSW Rural Fire Service Headquarters.

In April-May 2015, Associate Professor Tara McGee presented a seminar on the First Nations Wildfire Evacuation Partnership at the Institute for Culture and Society and at the ANU's Fenner School.

In May 2015, Dr Neale presented a seminar on preliminary findings from the Barwon-Otway case study at the ANU's Fenner School.

In June 2015, Dr Neale presented a brief on the RMPP project at NSW Rural Fire Service Headquarters.

END USER ENGAGEMENT

The RMPP project team have worked to establish and build strong end user engagement in the project's development and outputs from the start. End users have been vital to the successes of Year 2, and the project team is committed to continuing to meet regularly with end users to continue these successes. Engagement with end users has taken four primary forms.

- An 'End User newsletter' is circulated to end users every five to six weeks to brief end users of project progress, foreshadow emerging challenges and opportunities and solicit feedback on case studies and project outputs (see figure 1.1). The newsletter has been well received by end users, and has since been 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 July 2014, the 'Scenario Methods' literature review was sent to end users, ahead of a teleconference with Dr Weir and Dr Neale to discuss end user comments. End user feedback was incorporated into the final draft before forwarding the final document to the BNHCRC.
- In September 2014, Dr Neale circulated a briefing paper on the preliminary themes of the project to end users, inviting comments. Comments were subsequently received from end users, which in turn informed the development of the 'Scientific Knowledge' literature review.
- In February 2015, Dr Neale circulated a draft of the 'Scientific Knowledge' literature review to end users, the project team, and the BNHCRC. Comments were received from several end users and were subsequently incorporated into the final version published by the BNHCRC in April 2015.
- In-person and teleconference meetings between project team members and end users (see figure 1.2). These have provided important opportunities to discuss the project, its case studies and the utilisation of its research.
- Attendance at industry events:
- The AFAC 2014 Conference and BNHCRC Research Forum, 2-5 September 2014, Wellington, NZ.

- The BNHCRC Research Advisory Forum, 8-9 April 2015, NSW Rural Fire Service, Sydney, NSW.
- The NSW Rural Fire Service Information Share, 16 June 2015, NSW Rural Fire Service, Sydney, NSW.

Figure 1.1: End User Newsletters in Year 2

Newsletter 1	11 September 2014
Newsletter 2	21 October 2014
Newsletter 3	5 December 2015
Newsletter 4	10 February 2015
Newsletter 5	23 March 2015
Newsletter 6	6 May 2015

SUMMARY OF END USER NEWSLETTERS IN YEAR 2

Figure 1.2: Key end user and sector meetings in Year 2

Activity	Date	Project team
Teleconference with BNHCRC lead end user and end users regarding Year 1 outcomes	24 July 2014	Weir, Neale
Meeting with cluster researchers, BNHCRC lead end user and end users regarding research cluster	4 September 2014	Neale, Handmer, Weir, Eburn
Meeting with BNHCRC colleagues regarding potential Darwin case study	5 September 2014	Weir
Meeting with Department of Environment and Primary Industries (Vic) representatives regarding Barwon-Otway case study	9 October 2014	Neale
Meeting regarding Hawkesbury-Nepean case study with Molino Stewart	17 October 2014	Neale, Handmer, Weir
Teleconference with Office of Environment and Heritage (NSW) representative regarding Hawkesbury-Nepean case study	28 October 2014	Neale
Meeting with Infrastructure NSW representatives regarding Hawkesbury-Nepean case study	14 November 2014	Neale
Meeting with IAG representatives regarding Hawkesbury-Nepean case study	21 November 2014	Neale
Meeting with SES NSW representatives regarding Hawkesbury-Nepean case study	13 January 2015	Neale
Meeting with Bewsher Consulting representative regarding Hawkesbury-Nepean case study	27 January 2015	Neale

Meeting with WMAWater representative regarding Hawkesbury-Nepean case study	28 January 2015	Neale
Teleconference with DELWP representative regarding Barwon Otway case study	3 March 2015	Neale
Teleconference with BNHCRC end user regarding RMPP update and project team presentations	13 March 2015	Weir
Teleconference with BNHCRC end user regarding RMPP update and Barwon-Otway case study	24 March 2015	Neale
Teleconference with BNHCRC end user regarding RMPP literature reviews	3 April 2015	Neale
Meeting with BNHCRC lead end user and end users regarding research utilisation	8 April 2015	Weir, Neale, Handmer, Dovers, Eburn
Meeting with BNHCRC lead end user and end users regarding project planning	9 April 2015	Weir, Neale, Handmer, Dovers, Eburn
Meeting with cluster researchers, BNHCRC lead end user and end users regarding research cluster	9 April 2015	Weir, Neale, Handmer, Dovers, Eburn
Attendance at DELWP stakeholder workshop regarding bushfire risk mitigation planning	22-23 April 2015	Neale
Discussion of RMPP project with project team and research community at ANU Fenner School	4-5 May 2015	Weir, Neale, Dovers, McGee
Teleconference with Department of Land Resource Management (DLRM) representative regarding Darwin case study	8 June 2015	Neale
Teleconference with BNHCRC colleague regarding Darwin case study	9 June 2015	Neale
Teleconference with Department of Lands, Planning and the Environment (DLPE) representative regarding Darwin case study	15 June 2015	Neale
Discussion of RMPP project with BNHCRC end users, research community and sector representatives at NSW RFS 'Information Share'	16 June 2015	Neale
Teleconference with BNHCRC lead end user and end users regarding Year 2 outcomes	25 June 2015	Weir, Neale

SUMMARY OF KEY ENGAGEMENT ACTIVITIES IN YEAR 2

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.

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.

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, University of Western Sydney.* Parramatta.
- Neale, T. (2015) Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning, *Information Share,* NSW Rural Fire Services, Homebush.

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CURRENT TEAM MEMBERS

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Associate Professor Tara McGee, University of Alberta, Canada

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Professor Stephen Dovers, Fenner School, ANU

Professor John Handmer, RMIT University

END USERS

Mick Ayre, Country Fire Service, SA

Monique Blason, Department of Premier and Cabinet, SA

Don Cranwell, Metropolitan Fire Service, SA

Chris Irvine, State Emergency Service, Tas

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Dylan Rowe, Department of Environment, Land, Water and Planning, Victoria

John Schauble, Emergency Management Victoria, Vic

Patrick Schell, Rural Fire Service, NSW

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[2] Chaim Noy, "Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research," *International Journal of Social Research Methodology* 11, no. 4 (2008).

[3] Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, Mass.: MIT Press, 2010).