SCIENCE IN MOTION

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…MISCONCEPTIONS AND REALITIES

- ‘Outside-the-sector’ views of science, policy and practice tend to come:
  - without insider knowledge of practical realities
  - through official inquiry processes or political controversy

- Two misconceptions:

1. The ‘pipeline’ model of scientific research
   - See: Hunt J and Shackley S. (1999) Reconceiving science and policy: academic, fiducial and bureaucratic knowledge. *Minerva* 37: 141-164; Rayner S, Lach D and Ingram H. (2005) Weather forecasts are for wimps: why water resource managers do not use climate forecasts. *Climatic Change* 69: 197-227.

2. The necessary alignment of policy and practice

- Reality: we all begin *in media res* (in the middle of things)…

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

Warragamba Dam, NSW

KEY OBJECTIVES:

1) To investigate the diversity and uncertainty of bushfire and flood science, and its contribution to risk mitigation policy and planning;

2) To explore how diverse individuals use and understand scientific evidence and other knowledges in their bushfire and flood risk mitigation roles; and,

3) To analyse how this interaction produces particular kinds of opportunities and challenges in the policy, practice, law and governance of bushfire and flood risk mitigation.

LITERATURE REVIEWS:

1. Wodak, J. Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning Scenario Exercise Literature Review. (BNHCRC, 2014).
   - Wodak, J. & Neale, T. A Critical Review of the Application of Scenario Exercises to Environmental Challenges. (Under review).
2. Neale, T. Scientific Knowledge and Scientific Uncertainty in Bushfire and Flood Risk Mitigation: Literature Review. (BNHCRC, 2015).
   - Neale, T. & Weir, J. Navigating scientific uncertainty in wildfire and flood risk mitigation: A qualitative review. *International Journal of Disaster Risk Reduction* 13, 255-265 (2015).

SCIENTIFIC UNCERTAINTIES REVIEW:

1) HISTORICIST UNCERTAINTIES:

- gaps and inconsistencies in data
- relative rarity, uniqueness and force of hazard
- ‘stationarity’ and climate change

Table 1
Categories of scientific uncertainty in wildfire and flood risk mitigation.

Uncertainty type	Key question	Elaboration
Historicist: the uncertainties arising out of reliance on historical data, due to methodological relationships between the past, the present and the future	To what extent do gaps and inconsistencies in the datasets of relevant environmental variables affect confidence?	Gaps and inconsistencies can arise out of innovations in measuring apparatuses, variations in metrics, variations in the geographical spread of measuring apparatuses, unreliable apparatuses, the commercial sensitivity of some data, fragmented storage, funding constraints, and many other factors.
	Does the relative rarity, uniqueness and force of the given hazard event effect confidence?	A lack of historical exemplars is a barrier to prediction. For example: catchment data sets that are based on mean and medium river flow have limited insights into flood discharges; measuring apparatuses can be destroyed during wildfire and flood events; relative randomness of wildfire ignition points; and, fire behaviour unique to fire–terrain and fire–atmosphere interactions.
	To what extent do we assume that natural systems fluctuate within an envelope of stationarity?	Climate change requires recognition of both temporal and spatial variability into the future, the parameters of which are uncertain. Incorporating this ‘new’ variability can present significant obstacles.
Instrumental: the uncertainties arising out of limitations of a given apparatus, heuristic or theory[a]	To what extent are wildfire behaviours accounted for in algorithms and simulators?	Hazard behaviours are highly complex (e.g. feedback mechanisms between fire and atmosphere, the non-linearity of catchment responses to rainfall). Difficulties with capturing behaviours in models and algorithms may also stem from the limitations of computational resources, reporting requirements and historicist uncertainties, such as available data.
	What are the obstacles to assessing consequences to at-risk assets and values?	Assets and values may be spatially static (e.g. property, infrastructure) or spatially dynamic (e.g. human life, flora and fauna), which influences their incorporation into topographical modelling. Dynamic entities may be excluded or rendered through static proxies.
	To what extent are the relevant methodological standards contested?	Standards of analysis (e.g. FFDI, ARI) may be contested by researchers and others because they do not include all available data or relevant variables. These standards often inform the framing of scientific research.
Interventionist: the uncertainties arising out of calculating mitigation interventions and their effects	What are a baselines and metrics through which intervention effects have been quantified?	The calculation of the benefits and effects of mitigation interventions is subject to specific forms of historicist and instrumental uncertainty, particularly in regards to quantifying the benefit of interventions. What counts as ‘risk’? Is additionally directly measureable?
	To what extent are we interrogating the parameters and primary, secondary and emergent consequences of interventions?	Are uncertain effects of interventions on at-risk values (e.g.: social effects such as ‘safe development paradox’ or ‘levee effect’, or the ecological effects of prescribed burning and dams and levees) considered? As Mitigation strategies and methods are influenced by non-scientific aspects such as policy priorities, social values, and political context, these unintended consequences should be considered calculable and non-calculable uncertainties.

[a] Note that wildfire risk is typically figured on likelihood of conducive conditions not on likelihood of occurrence. Flood risk is usually calculated in two ways: the likelihood of occurrence of rain-driven flood events; and, the spatial modelling of flood behaviour.

SEE: 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.

Neale T. (2015) Scientific knowledge and scientific uncertainty in bushfire and flood risk mitigation: literature review, Melbourne, Vic.: Bushfire & Natural Hazards CRC.

2) INSTRUMENTAL UNCERTAINTIES:

- capturing hazard behaviours in simulators and algorithms
- capturing dynamic and static assets and values
- methodological standards

3) INTERVENTIONIST UNCERTAINTIES:

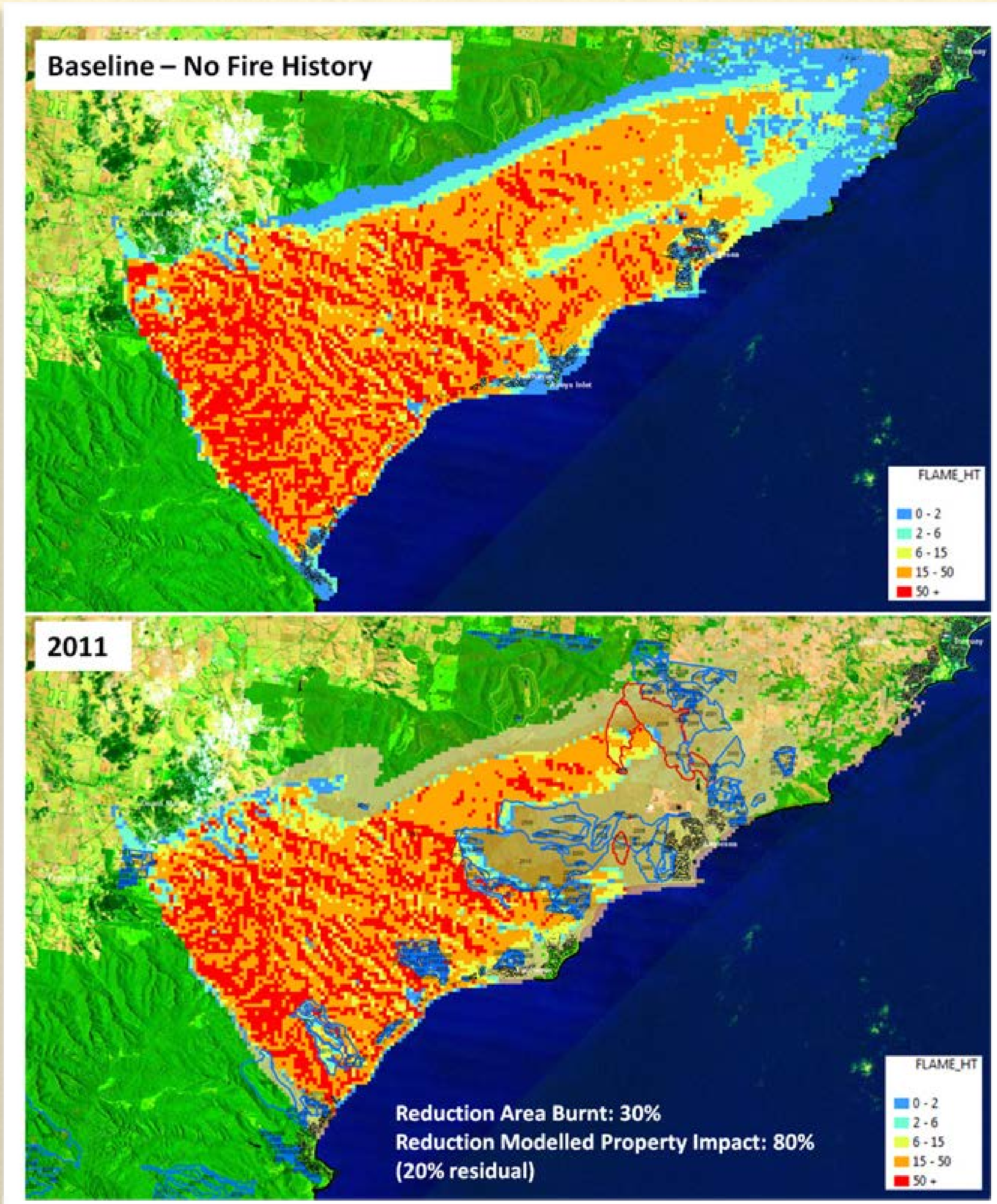
- quantifying additionality
- reflexivity regarding parameters and consequences

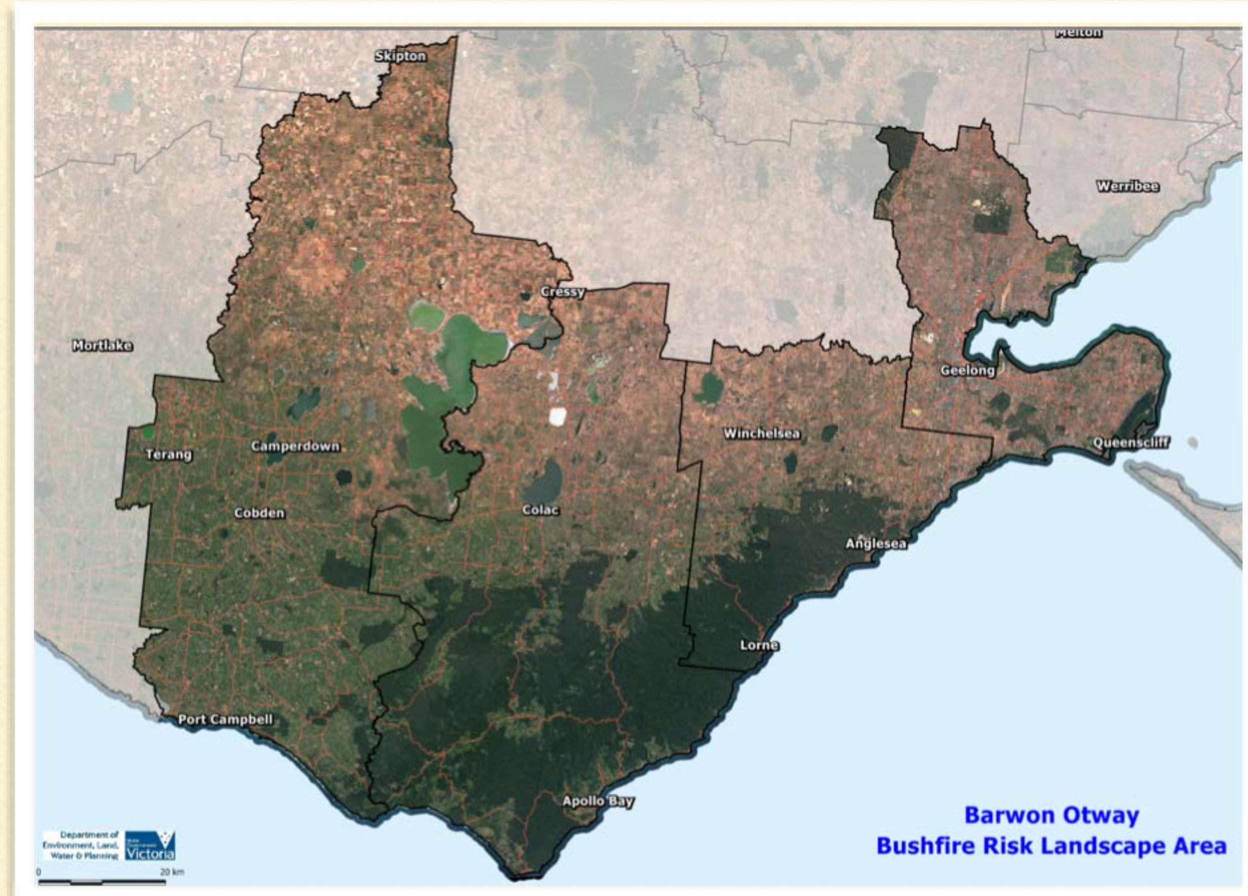
SEE: Neale T and Weir JK. (2015) Navigating scientific uncertainty in wildfire and flood risk mitigation: a qualitative review. *International Journal of Disaster Risk Reduction* 13: 255–265.

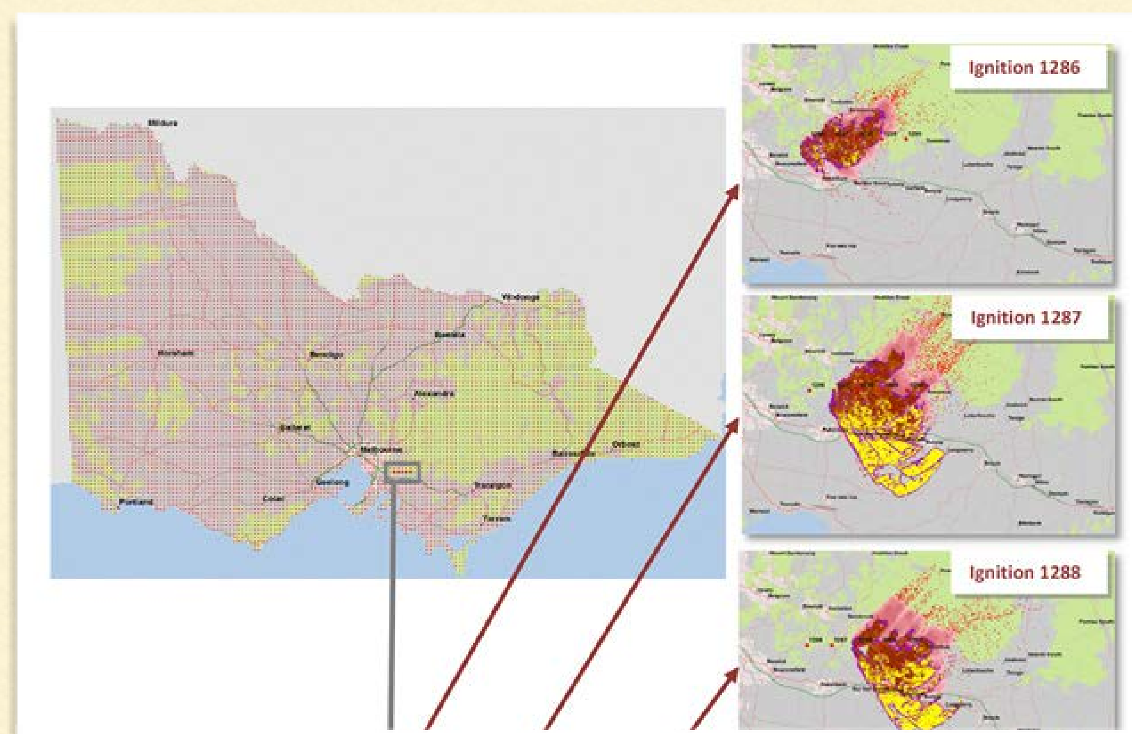
Neale T. (2015) Scientific knowledge and scientific uncertainty in bushfire and flood risk mitigation: literature review, Melbourne, Vic.: Bushfire & Natural Hazards CRC.

CASE STUDY

Bushfire risk mitigation in the Barwon-Otway area, Victoria







FROM: DELWP; DEPI. 2013. Victorian Bushfire Risk Profiles: A foundational framework for strategic bushfire risk assessment. Melbourne, Vic.: Department of Environment and Primary Industries.

MANAGING UNCERTAINTIES

- Incorporating dynamic assets and values
- 'Humans' and feedback effects
- Policy and political context

INTEGRATING SCIENCE

- Availability of new tools and data
- Forms of ‘license’ and social relationships
- Leadership and institutional change

THANKS

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Project team: Dr Christine Hansen (University of Gothenburg); Associate Professor Tara McGee (University of Alberta); Associate Professor Michael Eburn (ANU); Professor Stephen Dovers (ANU); Professor John Handmer (RMIT)

End users: Mick Ayre (Country Fire Service, South Australia); Monique Blason (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)

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Batchelor, NT

For more on the literature reviews see the BNHCRC website and:
Neale, Timothy, and Jessica K. Weir. 2015. "Navigating scientific uncertainty in wildfire and flood risk mitigation: a qualitative review." *International Journal of Disaster Risk Reduction* 13 (3):255–265.