

PREDICTIONS IN PUBLIC

COMMUNITY PERCEPTIONS AND UNDERSTANDING OF PREDICTIVE MAPS

Dr Erica Kuligowski

Principal Research Fellow
RMIT University
Natural Hazards Research Australia
erica.kuligowski@rmit.edu.au

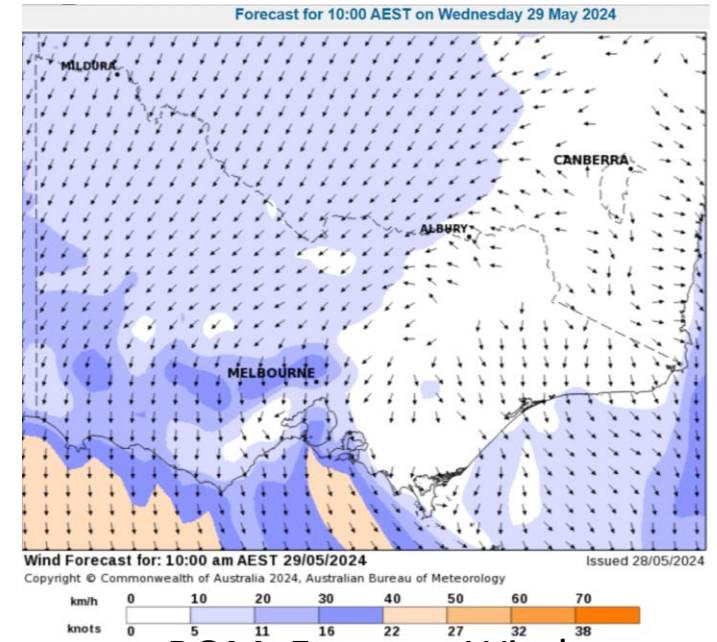
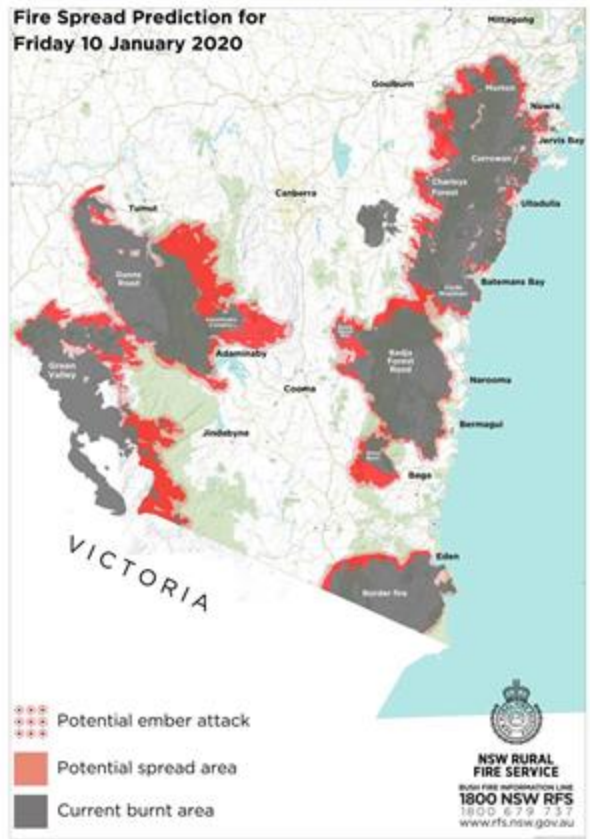
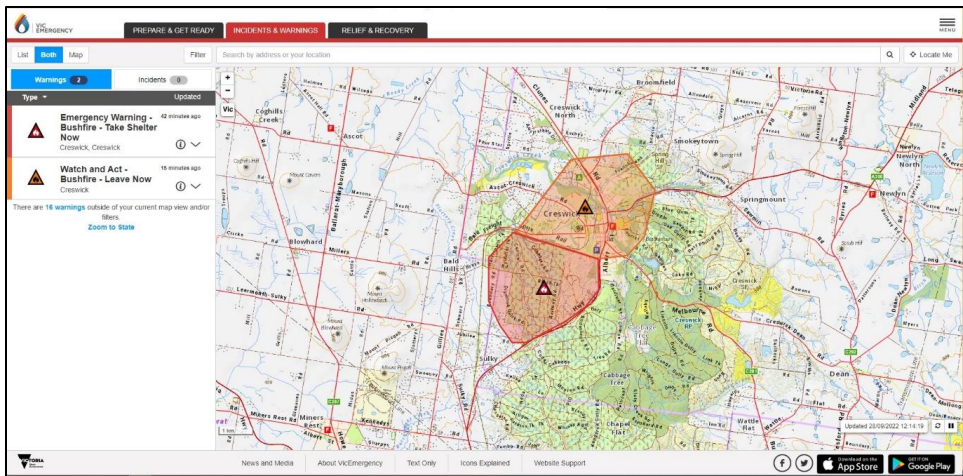
Dr Chloe Begg

Senior Research Scientist,
Research and Development
Victoria's County Fire Authority
chloe.begg@cfa.vic.gov.au

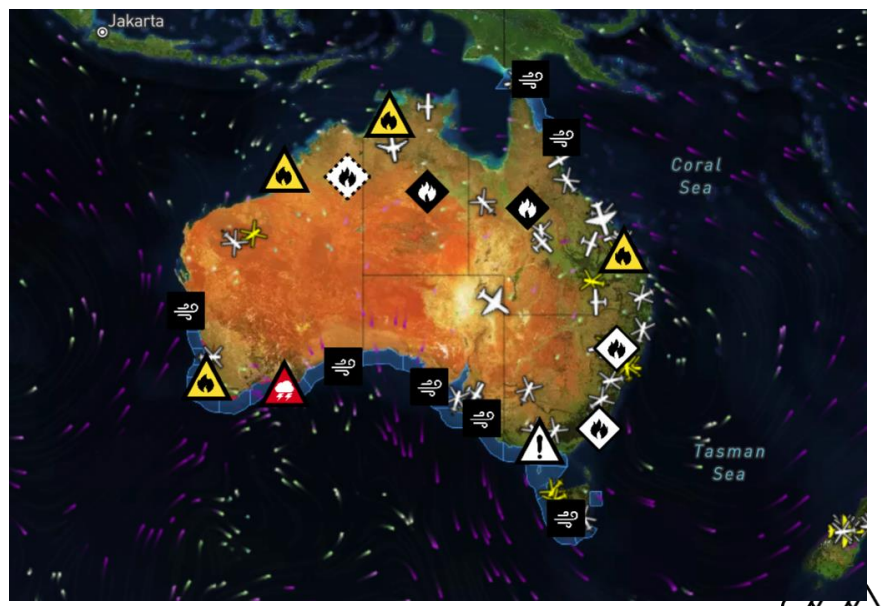
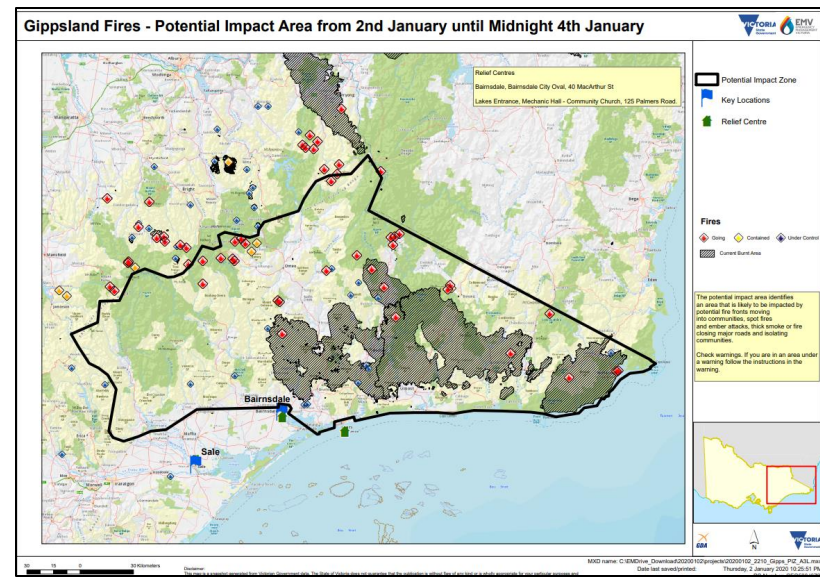


Yeah, we were kind of living off them really. You'd see something or you'd go around to a neighbour's place and see it from a different angle, and you'd go and check the app again, just trying to get our heads around exactly what was happening – we were really living off it. It was used more – those apps were used more than the phone feature of the phone over those days.” (C27)





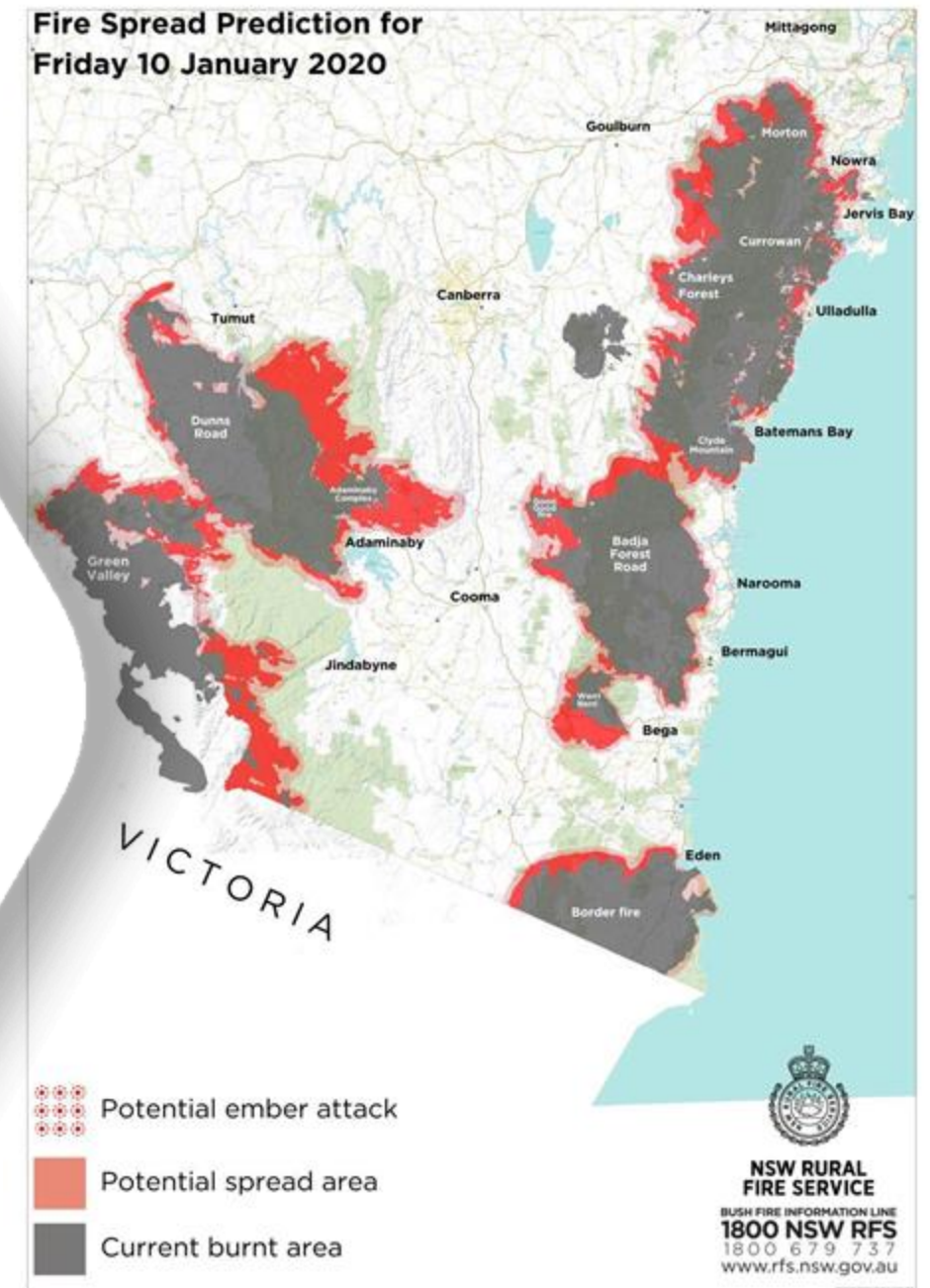
BOM: Forecast Wind



Bushfire.io

Predictions in Public Project: Background

- Expectations from the public
- Technological advancements
- Recommendations from reviews, inquiries, and royal commissions
- Political pressure
- Previous research in Victoria (Begg et al. 2021):
 - Support for use of predictions in public
 - Concerns for how to embed predictions into existing warning products and when and how to release them.



Project Aims

- to use empirical evidence and collaborative processes to contribute to a national approach to the future use of public-facing predictive fire spread products during an emergency.



Project Team

Coordinators

- Chloe Begg (CFA)
- Angela Gardner (Vic Dept. Edu.)

Research Team

- Paula Dootson (QUT)
- Amy Griffin, Erica Kuligowski, & Philippa Perry, Gita Pupedis, Natasha Mondel-McCann, Rosie Morrison (RMIT University)
- Timothy Neale (Deakin University)
- Graham Dwyer (Swinburne)



Project Team

Project Steering Committee:

- Representatives from **AFAC PSG** and **AFAC WG** from each Australian jurisdiction.
 - **TAS** - Chris Collins/Mark Chadil (PSG) and Heather Stewart (previously Peter Middleton) (WG)
 - **WA** - Jackson Parker (PSG) and Anni Fordham/Deana Pullella (WG)
 - **QLD** - Mandy Price (previously Jack Emeleus) (PSG) David Dumsday (WG)
 - **NSW** - Laurence McCoy/David Field (PSG) and Ben Shepherd (WG)
 - **VIC** - Phillip Brien/Alice Gower (PSG) and Reegan Key/Marc Unsworth (WG)
 - **ACT**- Ailish Milner/Ryan Lawery (PSG) and Leighton Bush (previously James Morris) (WG)
 - **SA** - Simeon Telfer (previously Mike Wouters) (PSG) and Monique De Silva (WG)
 - **NT** - Don MacCorquodale and Angus Farlam (previously Akshy Athukorala)
 - **BOM** – Vicki Heinrich/Carla Mooney (previously Fiona Dunstan)



Project Design

Phase 1:

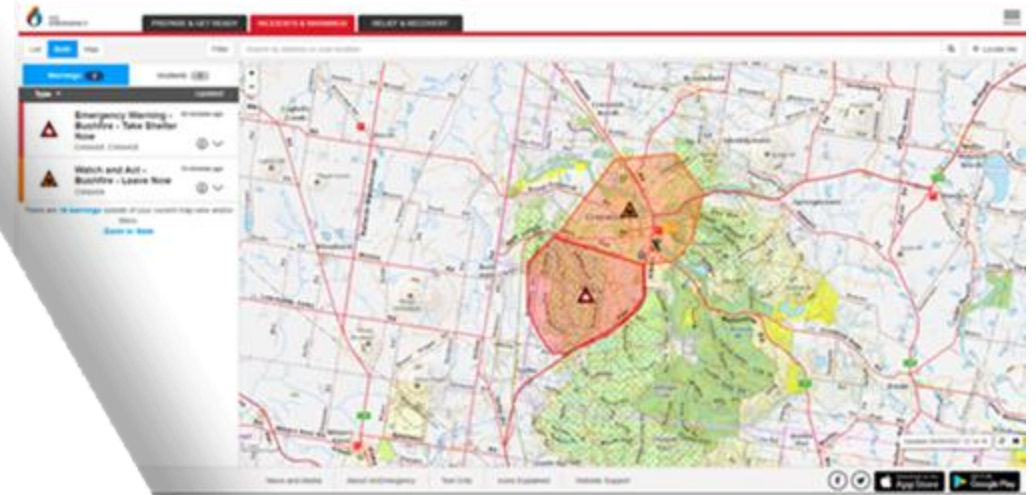
Understanding current agency practice and community comprehension and use of existing public-facing map-based products (i.e., incident warning maps and fire spread prediction maps).

Phase 2:

Developing and testing public-facing fire spread prediction map concepts.

Phase 3:

Developing practical outputs for agency use.



Comprehension, risk
perception and intended
protective actions shared in
webinar

REGISTER TODAY



Hazardous
WEBINARS

Wednesday 31 July

1–2pm AEST

Webinar recording can be found here: <https://www.naturalhazards.com.au/news-and-events/news-and-views/comprehension-risk-perception-and-intended-protective-actions-0>



Phase 1 (WP4): Community Interviews

RQ: How do community members with bushfire experience understand, use and take action in response to existing bushfire maps (incident and prediction)?

- **94 participants** were interviewed between November 2022 and April 2023
- **3 locations:** Cardinia Shire, Vic; Snowy Monaro, NSW and S ACT; and Huon Valley, Tasmania

Part 1: During their previous experience with fire events

- 2019 Bunyip Complex fire (Vic)
- 2019-2020 Black Summer fires (NSW/ACT)
- 2019 Riveaux Road fire (Tas)

Questions: experiences with information and use of maps; their responses and the role of maps; perspectives on map utility

Part 2: When shown 2-3 map types displaying a location in their state

Questions: information obtained from the map; elements 'walk-through' and attention points; areas with the highest risk of harm; appropriate responses for different areas; suggestions for improvement



Phase 1 (WP4): Community Interviews Thank you!

*To the **residents from Cardinia Shire, the Huon Valley, southern ACT and the Snowy Monaro** who shared their experiences of previous fires and perspectives on current incident and fire spread prediction maps with the research team.*

*To the members of the **project's Steering Committee** for facilitating collaboration between project team members and local council and fire agencies in each of our three study locations.*

*To **local councils and local fire agency units** for their help in finding places to hold interviews and sending out information about the study to participants.*



Sample Overview

Gender			
State/Territory		Female	Male
VIC (n = 33)		52%	48%
TAS (n = 32)		63%	38%
ACT/NSW (n = 29)		34%	66%
All States (n = 94)		50%	50%

Age	
Age Bracket	Percentage (n = 91)
35-44	10%
45-54	13%
55-64	37%
65-74	27%
75+	12%

Education	
Education Level	Percentage (n = 92)
Left School Before Year 10	2%
Completed High School Year 10	11%
Completed High School Year 12	8%
TAFE Qualification	20%
Bachelor Degree	34%
Postgraduate Degree	26%

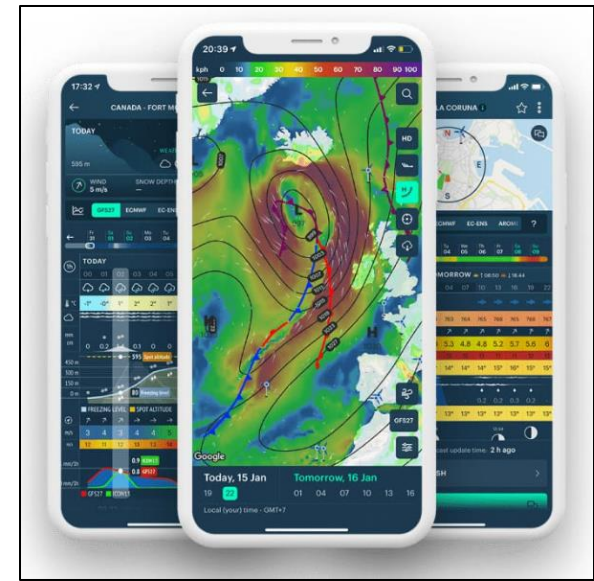
- Experienced map users (any type): 54% categorised themselves as daily users
- Participants had experience with previous fires: 40% had been in 5+ fires
- 60% had evacuated at least once
- 40% had experienced property damage to home
- ~84% had performed some home mitigation
- 40% (or someone in their household) had fire service experience



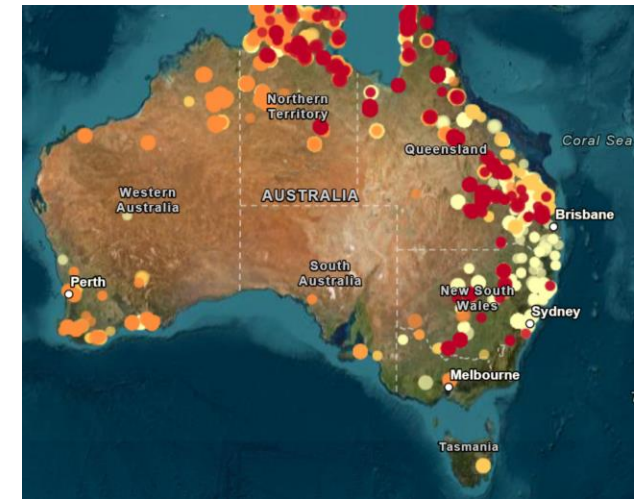
Part 1 Results – Map Usage

Large majority of participants used maps during their fire experience:

- Different types of maps from different platforms were used
- **NSW/ACT:** FiresNearMe, ACT Emergency Services website, RFS website, VicEmergency, maps shown at community meetings, **Windy app**, Google maps, Digital Earth Australia (DEA) hotspots, **BOM**, bushfire.io
- **Tasmania:** TasFire website, community meetings, **Windy app**, Google maps, **DEA hotspots**, **BOM**, real estate app (1), ABC news
- **Victoria:** VicEmergency, CFA website, community meetings, Google maps, **BOM**, Ausnet Maps (electricity)



Windy app

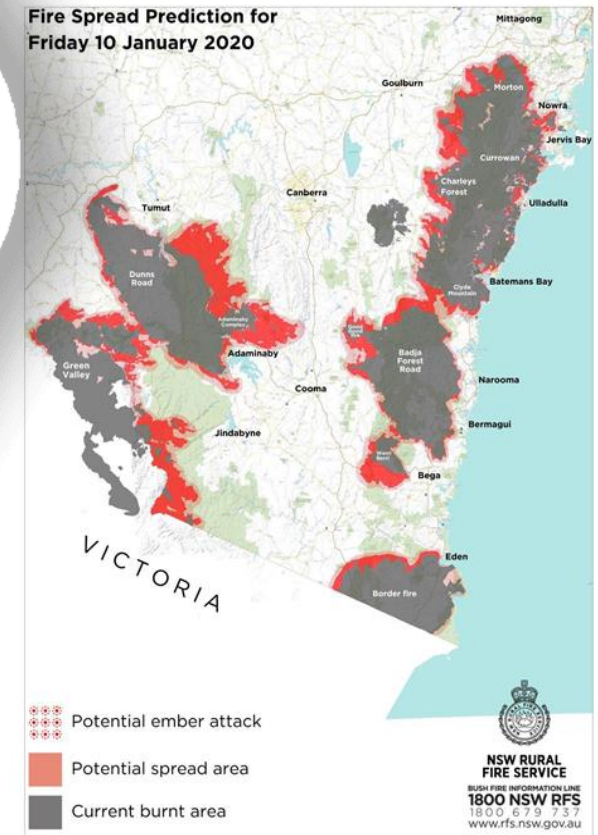


DEA Hotspots

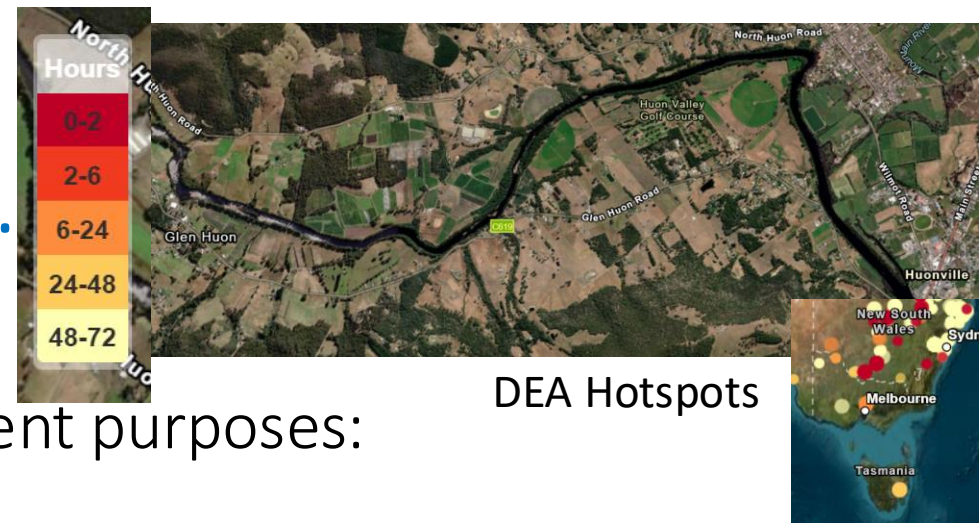


Part 1 Results – Map Usage, cont.

- Participants used maps (~20-50/day) for different purposes:
 - To self-localise
 - Gather information about the fire event and what to do next
 - Monitor the extent or rate of spread
 - Cross-reference map information with other sources
 - Confirm or explain the physical cues that they were seeing around them
 - Make judgements about how the fire might spread and the level of risk
 - Inform or warn others who may be at risk
 - Monitor the impact of the fire on their or others' properties, especially after evacuation.



Part 1 Results – Map Usage, cont.



- Participants used maps (~20-50/day) for different purposes:
 - To self-localise

“... the best map that I actually started looking at was at the DEA hot spot map of Australia and that was fantastic because I could really drill in and actually see where the fires are in relation to our property because we were never really sure about how close they were, and wind direction, and of course fires can move pretty quick.” (B13)



Part 1 Results – Map Usage, cont.

- Participants used maps (~20-50/day) for different purposes:
 - To self-localise
 - Gather information about the fire event and what to do next
 - Monitor the extent or rate of spread
 - Cross-reference map information with other sources

“I get notified if there’s a fire within 50 or 60 kilometres of me, and I look at it, and then I look at the BOM and see where the wind’s coming from, and then I look back at a fire map, and I spent a lot of time on the fire maps actually and I spent a lot of time checking it against the wind and the predicted wind direction.” (C12)



Part 1 Results – Map Usage, cont.

- Maps seen as one tool in the toolbox (of many information sources)

“it was again, this on-and-off and on-and-off routine and you ended up being quite obsessed in the end of checking alerts, checking maps, listening to ABC, phoning everybody, messaging everybody” (B24)



Part 1 Results – Challenges with Maps

- Difficulty ascertaining whether information was up-to-date;

*“I felt like if I went to the Windy app, that was really current, and then sometimes when I’d be looking at the Fires Near Me app or the Emergency Services one, I’d be like ‘Is this old? Has this actually changed since this had been updated or is this up-to-date?’ I do think I had that feeling about ‘**How much can I trust this information?**’” (C27)*

- Missing, inconsistent or inaccurate information;
- Inaccessibility of information due to lack of internet or coverage, device used, or comprehension issues



Part 1 Results – Positive Feedback

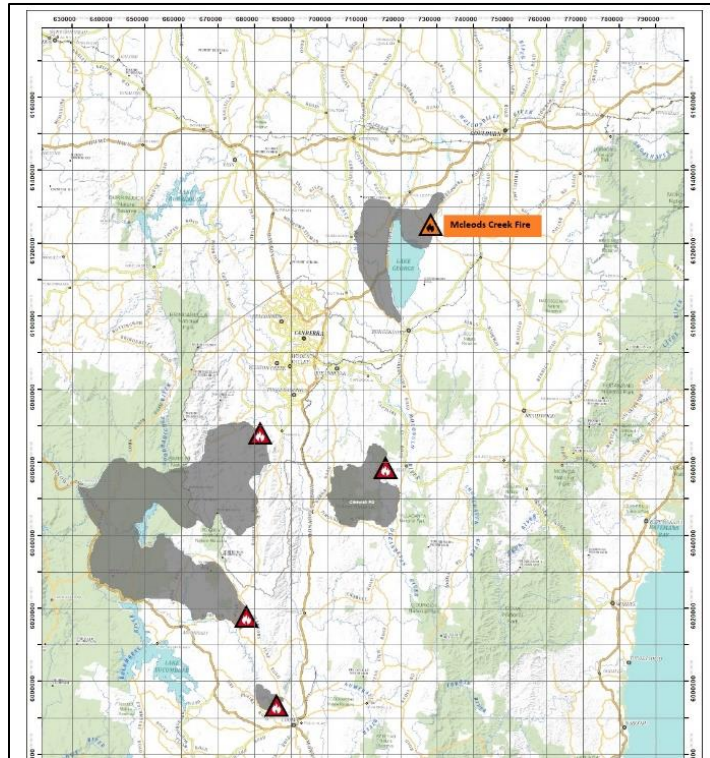
- Kudos to NSW/ACT for putting out predictive maps; BOM predictions; VicEmergency
- The importance of community meetings:

“There were daily community meetings after that point, so we probably got a better understanding after we’d had a couple of those sessions where they explained how the maps were being updated because ... I guess you expect them to use like real-time updates on the map ...once we’d had that explained to us a few times it was like ‘Okay. Well, you can’t...’.” (A18)



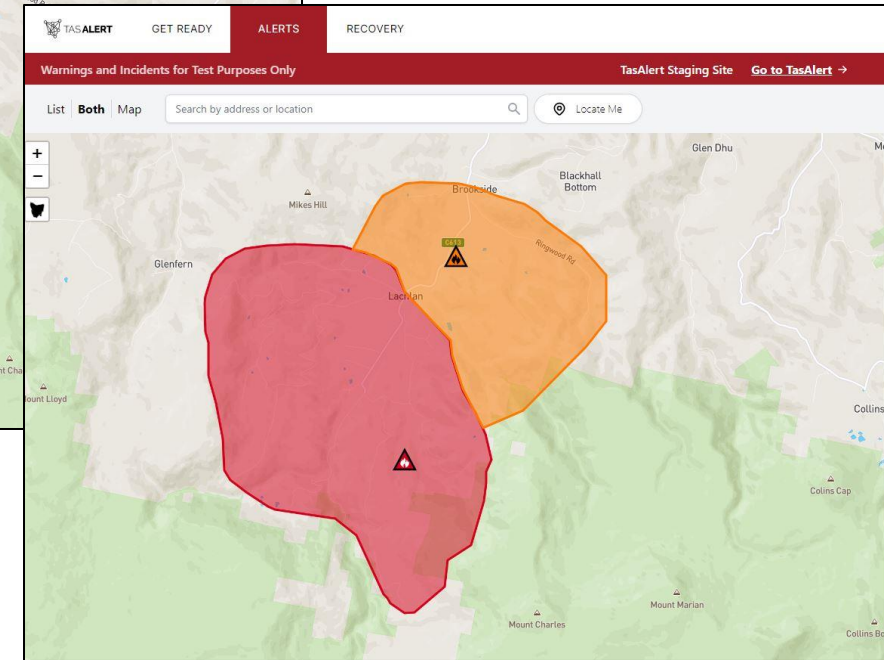
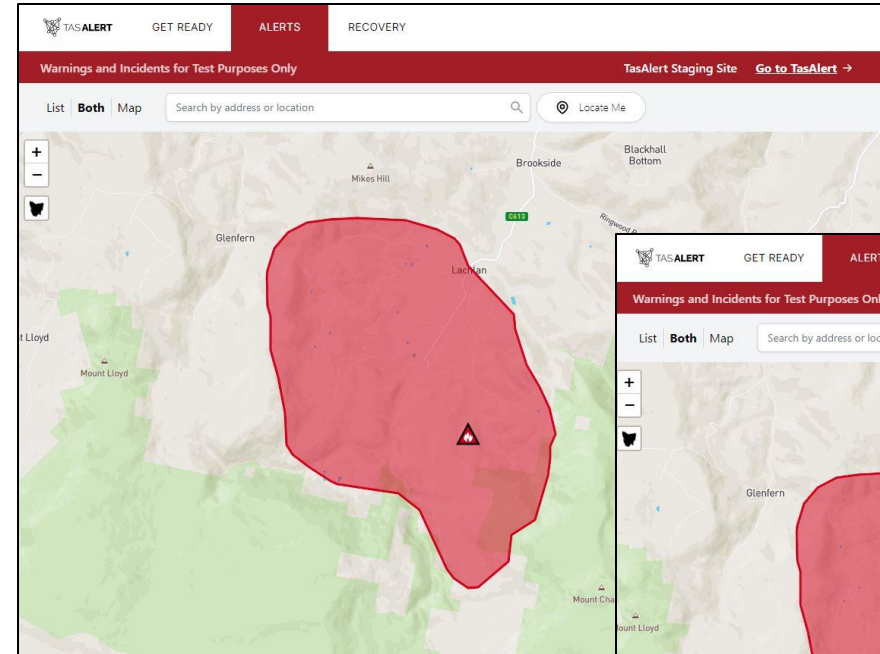
Part 2 Results – Comprehension Issues with Incident Maps

Map 1



Triangle location: *“I’m assuming that’s where it’s burning, but I think before I thought about it a little bit more I thought maybe that’s where the original fire was, like where it started but I’ve kind of changed my mind on that after reading that they’re burning in an easterly direction.” (C27)*

Map 2



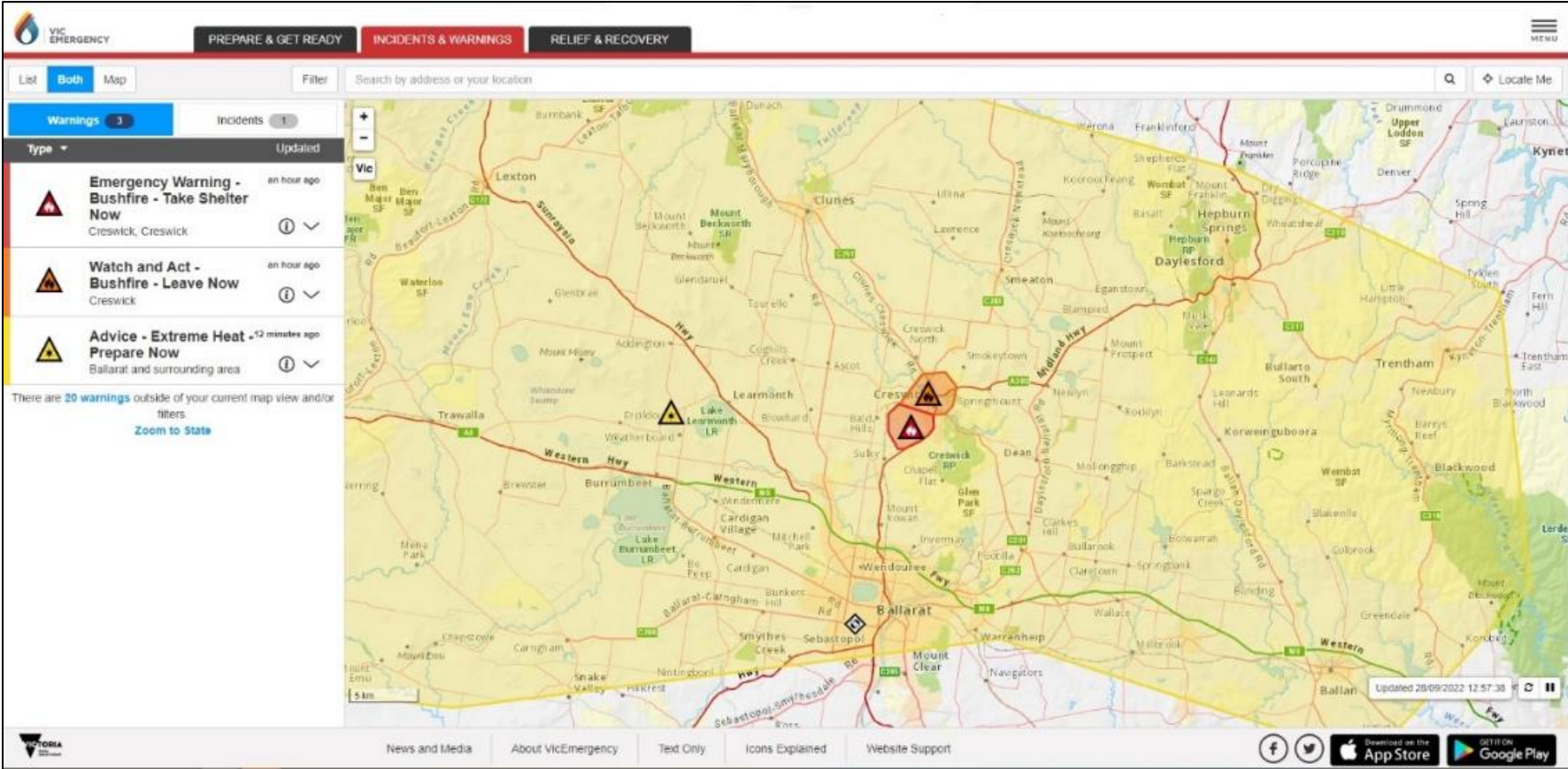
After seeing Map 2: *“Ooh. Oh, now I understand. That was actually the “Emergency warning” area versus the “Watch and act” area, and I’ve totally misunderstood it (Map 1) as fire extent.” (B15)*



Part 2 Results – Comprehension Issues with Incident Maps, cont.

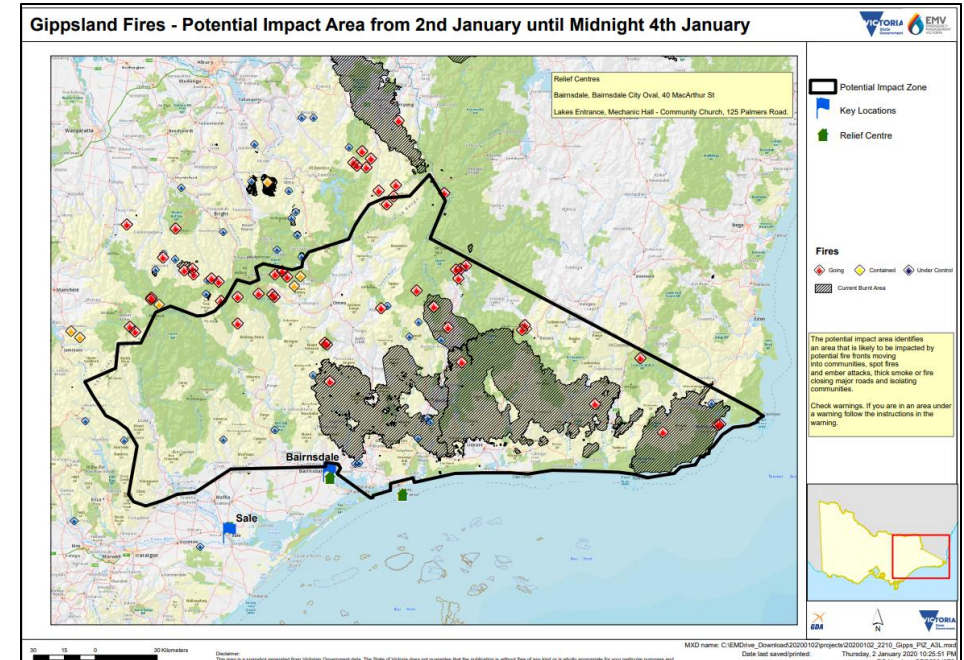
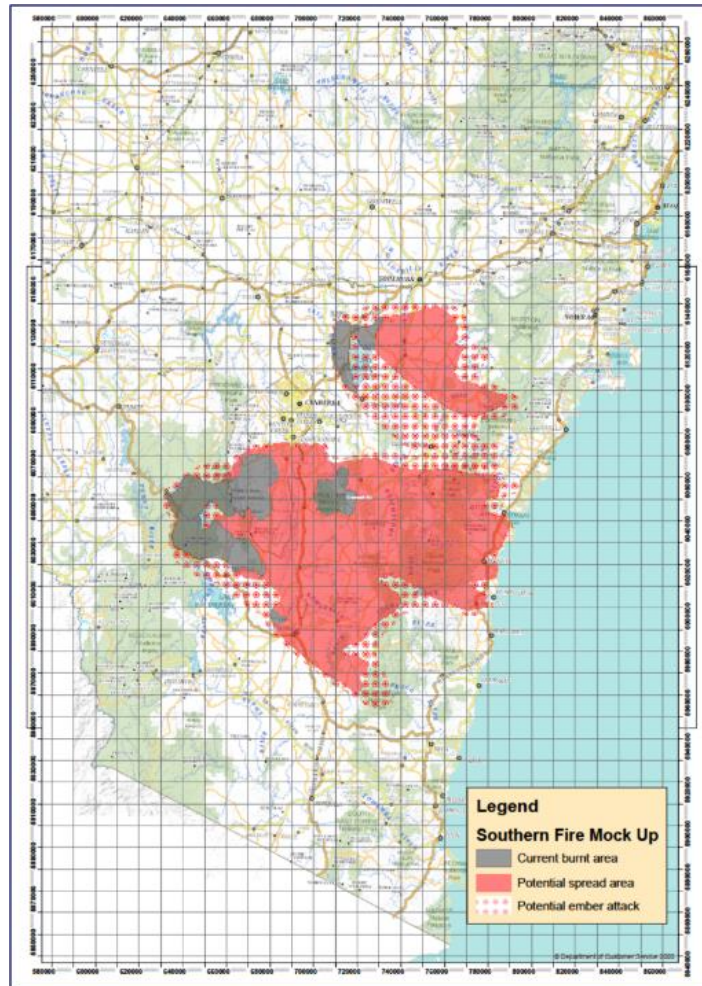
“Yeah, it means there’s not a fire; it just means to me it’s stable, and it’s very clear to me – it’s got shades of green where I guess there are more trees and green areas” (A12)

“...it’s unusual to have an extreme heat day there [pointing to a map location within the yellow polygon] and quite cool conditions here [pointing to a map location outside of the yellow polygon] – it’s not very far away.” (A13)



Part 2 Results – Comprehension Issues with Prediction Maps

Red areas: “I don’t have any sense of intensity being different in any one area over another.” (C10)



“I’m not quite sure what the black line means because you’ve got fires in and out. I know that’s New South Wales and things like that but I’m not sure what the black one means.” (A6)



Part 2 Results – Levels of Confidence in Maps

Higher levels of confidence linked with:

- Higher levels of trust in the map source
- Higher understanding of the inherent uncertainty in the products

“They’re never going to be 100 percent accurate because you can’t predict; you can’t predict the weather, you can’t predict wind changes and the fires create their own weather so they could go wild and go in a completely different direction. This is just the best guesstimate really.” (C28)



Part 2 Results – Levels of Confidence in Maps, cont.

Higher levels of confidence linked with:

- Higher levels of trust in the map source
- Higher understanding of the inherent uncertainty in the products

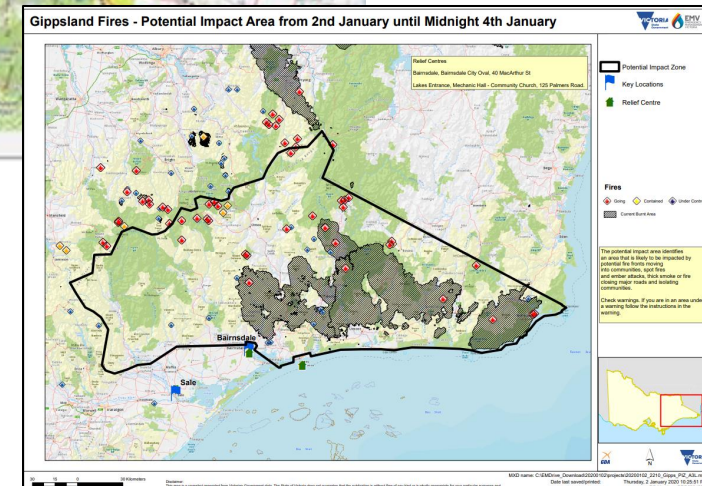
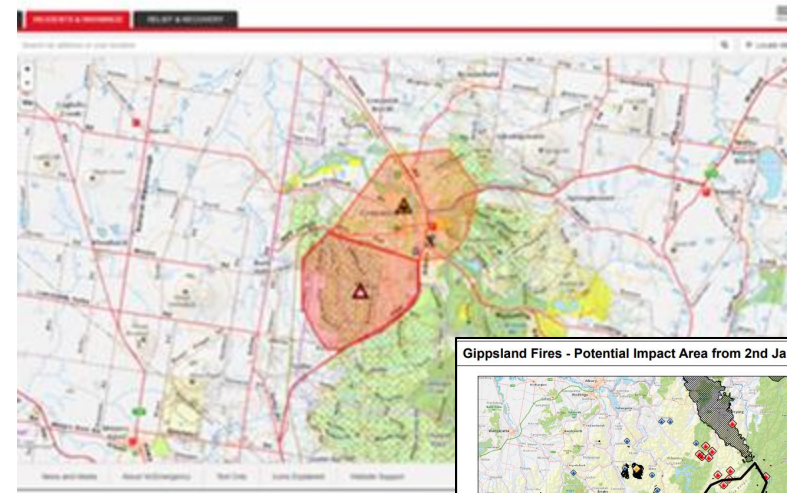
Lower levels of confidence linked with:

- Perceptions: the map was out-dated, lacked sufficient information/detail
- Comprehension issues with the map
- Perceptions that the map was too general in scale (did not provide localised information)



Part 2 Results – Confirmation

Regardless of location, participants needed to confirm the map's message with other sources of information



e.g., Victorian participants:

- still wanted to look out the window to confirm event details (A14) and/or
- look for other sources, including their own judgement (A3)



Part 2 Results – Additional Information Requested

Regardless of map type, all participants requested additional information:

- Wayfinding and navigation information
- Environmental conditions, including fire size, intensity, activity (including burnt areas), location, spread and direction
- Weather information and forecasts
- Emergency response information

Participants also requested map features to help improve their use and understanding of the mapped information: *scale bar, compass, legend, increased resolution and clear colouring*



Summary of Findings

- Map usage and purposes
- Challenges (including comprehension issues) and positive feedback
- Confidence in mapped information
- Additional and consolidated information

Lack of information (specifically timely and consistent):

- Confuses people
- Leaves them to fill in gaps with their own knowledge and/or experience
- Causes decisions to be delayed



Implications of the research findings

- What do the research findings mean for current practice and future research?
 - Can fire agencies meet community expectations, and how?
 - How do we know if the information community members say they need actually lead to improvements in risk comprehension and confident protective actions?

Predictions in Public Project Current Practice Atlas

Atlas of current use of maps to communicate risk and uncertainty during a bushfire

Propose:

This document provides an overview of current agency practice related to the design and use of maps to communicate risk and uncertainty during a bushfire. Specifically, it provides a definition of incident warning maps that has been agreed upon by the project's Steering Committee. It also provides a working definition of the predictive products that will be developed and tested in Phase 2 of the project. Finally, a glossary of key terms used by project partners is provided.

The information presented in this document provides a resource for the project team as it provides an understanding of how maps are currently used by Australian fire agencies to communicate risk and uncertainty. It can also be used as a resource for Australian fire agencies to gain an overview of how different Australian jurisdictions currently produce and use maps for public communication during a bushfire.

Current Agency Practice:

The definition of incident warning maps agreed upon by the project Steering Committee is:

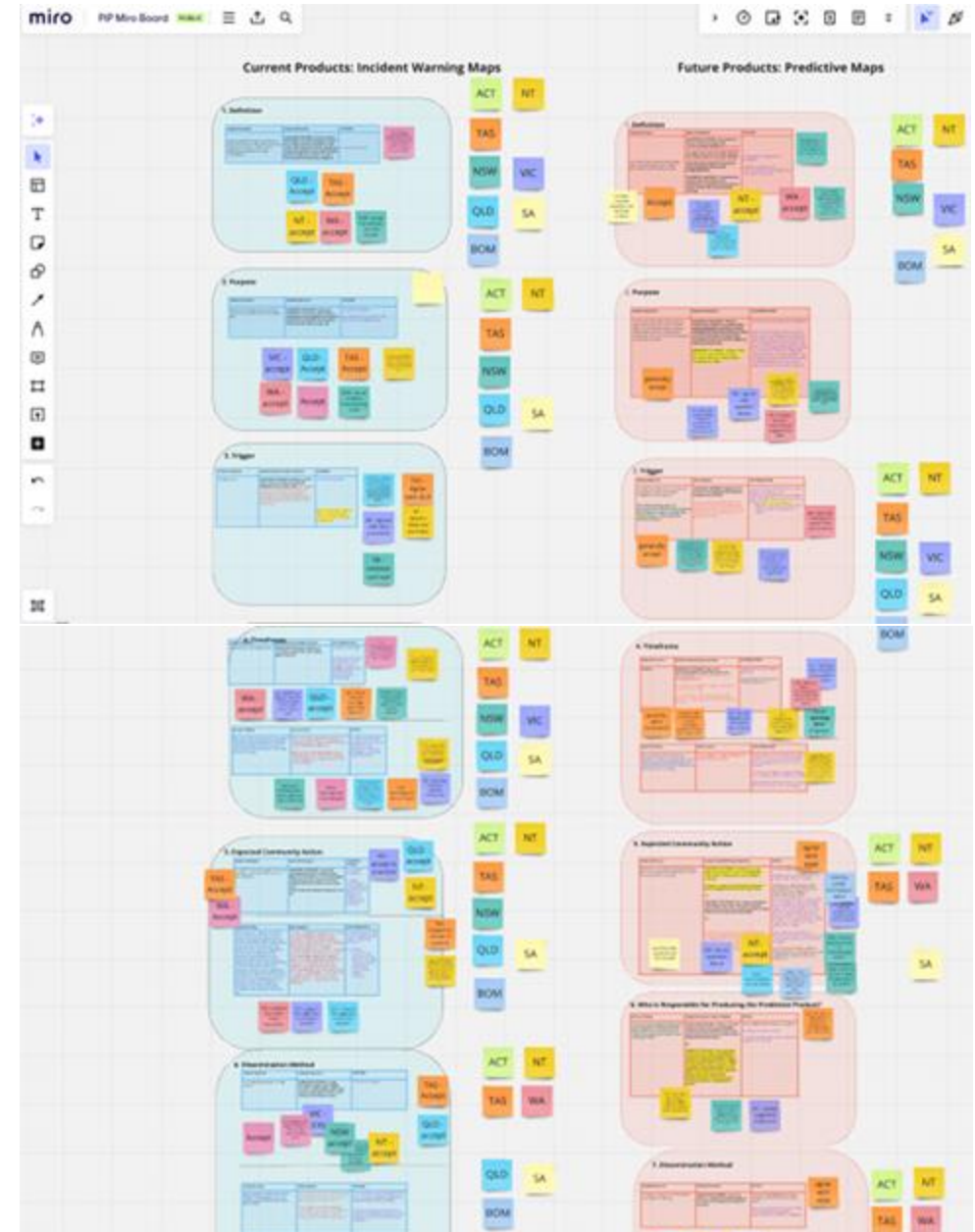
Definition: Incident-specific information that shows the general area of the incident and the communities that need to take protective actions, depending on the warning level, to stay safe. Warning product utilises text content, as well as AWS icons and warning areas/polygons.

Purpose: To show an incident on a map. This could include a warning area of a going/active fire and the location of a community that needs to take protective action to stay safe.

Trigger: Going/active fire and a community that needs to take protective action to stay safe.

Timeframe: Updated as situation changes in line with existing agency doctrine.

Expected Community Action: to take the recommended protective action where identified.

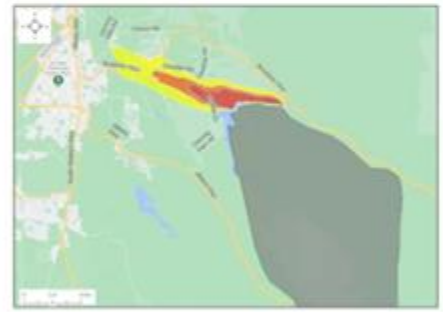
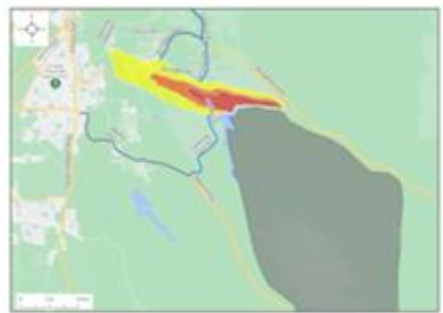
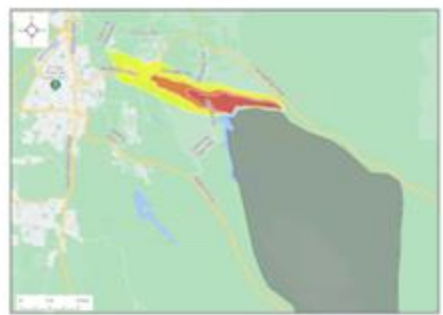


Evidence-Based Principles

Six principles to help structure the design of the empirical studies:

- **Principle 1:** Ensure there are clear triggers for predictive map production, dissemination, and updates.
- **Principle 2:** Ensure that map readers can understand their location in relation to the hazard (self-localisation) and the information that is displayed on the map can support appropriate protective actions.
- **Principles 3:** Ensure maps communicate risk and uncertainty.
- **Principle 4:** Ensure predictive maps complement incident warning maps.
- **Principle 5:** Ensure that maps are accessible to a wide range of audiences.
- **Principle 6:** Ensure cross-border coordination regarding authorisation of map dissemination to the public.





Next steps

- Phase Two:
 - Work Package 8 Focus Groups
 - South Australia
 - Queensland
 - Western Australia
 - Work Package 9 National Survey
 - Work Package 10 Eye-tracking Experiments
 - 2025: interviews (WP11), national survey (WP12)
- Phase 3: translation into agency policy and practice (2025)



This is what GenAI thinks a Public Information Officer looks like (P. Dootson)



Additional Resources:

- For more information on our project, please visit: <https://www.naturalhazards.com.au/research/research-projects/predictions-public-understanding-design-communication-and-dissemination>
- Please have a look at our Hazard Note: <https://www.naturalhazards.com.au/hazard-note-5>
- Newly accepted journal article on Part 1 of our interviews: International Journal of Wildland Fire (Morrison et al. 2024, Understanding the challenges in bushfire map use and effective decision-making amongst the Australian public)

Issue 005 | July 2024

Hazard Note

Natural Hazards Research Australia

Topics in this edition | communication | emergency management | planning | warnings

Community comprehension, perception and use of maps during bushfires

About this project
The way community members with experience of bushfires understood, used and took action in response to existing bushfire maps was investigated so that future maps can be better understood and utilised by members of the public. This project also supports the development of evidence-based principles to inform a nationally consistent approach to the future use of bushfire predictions in public communication during future emergencies. *Predictions in Public: understanding the design, communication, and dissemination of predictive maps to the public* was undertaken by Natural Hazards Research Australia, RMIT University, Queensland University of Technology, Deakin University, Swinburne University of Technology, Country Fire Authority Victoria and Victoria's Department of Education.

Authors
Dr Erica Kuligowski, Philippa Perry, Gita Pupedis, Dr Amy Griffin, RMIT University; Dr Chloe Begg, Country Fire Authority; A/Prof Paula Dootson, QUT; Angela Gardner, Department of Education Victoria; Dr Timothy Neale, Deakin University; Dr Graham Dwyer, Swinburne University of Technology

Contact: erica.kuligowski@rmit.edu.au

Learn more about this project online
[naturalhazards.com.au/predictions-in-public](https://www.naturalhazards.com.au/predictions-in-public)

Summary
When asked about their use of bushfire maps during the 2019-2020 fire season, a participant from New South Wales recalled:
"Yeah, we were kind of living off them really. You'd see something or you'd go around to a neighbour's place and see it from a different angle, and you'd go and check the app again, just trying to get our heads around exactly what was happening – we were really living off it. It was used more – those apps were used more than the phone feature on the phone over these days."


Maps are an important way to communicate spatial information and are increasingly distributed and used in natural hazards, like bushfires. The use of maps, and in particular, fire spread prediction maps that display the likely spread of fire over time, have become an important topic of interest for fire and emergency services agencies across Australia. Therefore, the *Predictions in Public* project turned to the public to explore how community members understood, used and acted on maps during bushfire emergencies, including incident and fire spread prediction maps.

Three locations that experienced recent bushfires were identified: Cardinia, Victoria (the 2019 Bunyip Complex fires), southern Australian Capital Territory (ACT) and the Snowy Monaro, New South Wales (NSW) (2019-2020 Black Summer fires); and the Huon Valley, Tasmania (the 2019 Riveaux Road fire). Across these locations, in-person and online interviews with 94 participants were conducted between November 2022 and April 2023. The interviews explored community members' comprehension, use and actions in response to bushfire maps in two parts:

1. during their previous experiences in bushfires; and
2. when shown two types of maps and associated warning messages with a location in their state during the interview.

Part 1 findings highlighted the different types of mapping platforms participants used and why, when and how often they would consult these maps during bushfires. Researchers found that during a bushfire, participants used maps alongside many other types of information to make sense of the situation and decide what to do next. The challenges participants encountered in understanding bushfire maps were also collated, with participants' recommendations for improvements.

Part 2 findings identified the types of comprehension issues participants faced when viewing both incident and fire spread prediction maps, as well as the areas they assessed to be at highest risk. Participants provided suggestions for map improvements, highlighting the types of information to improve map clarity and better ways that complicated concepts on prediction maps could be communicated, such as the direction of fire spread and uncertainty.



Above: This research explored how people with previous experience of bushfire used bushfire incident and prediction maps during fires, as well as their understanding of key information. Photo: Zanlia Lightart.



PREDICTIONS IN PUBLIC

COMMUNITY PERCEPTIONS AND UNDERSTANDING OF PREDICTIVE MAPS

Dr Erica Kuligowski

Principal Research Fellow
RMIT University
Natural Hazards Research Australia
erica.kuligowski@rmit.edu.au

Dr Chloe Begg

Senior Research Scientist,
Research and Development
Victoria's County Fire Authority
chloe.begg@cfa.vic.gov.au

