

PREDICTIONS IN PUBLIC

UNDERSTANDING THE DESIGN, COMMUNICATION, AND
DISSEMINATION OF PREDICTIVE MAPS TO THE PUBLIC

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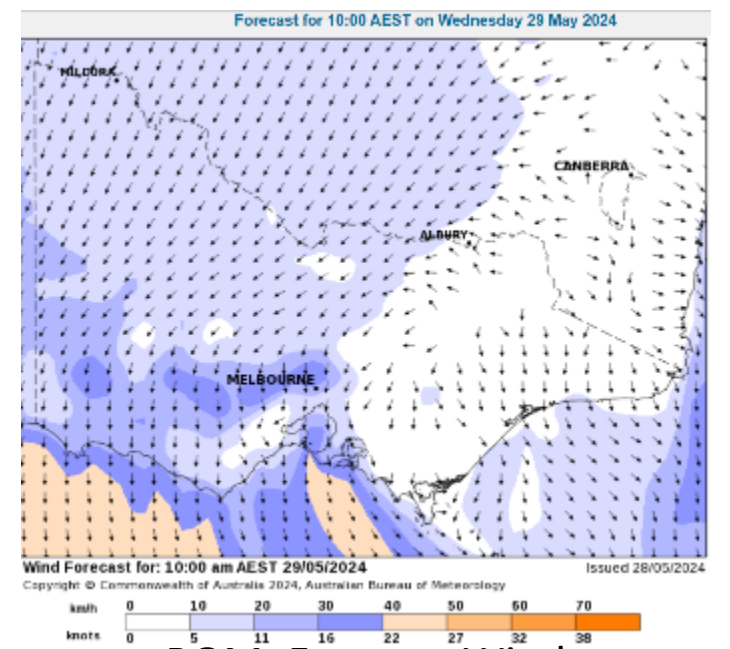
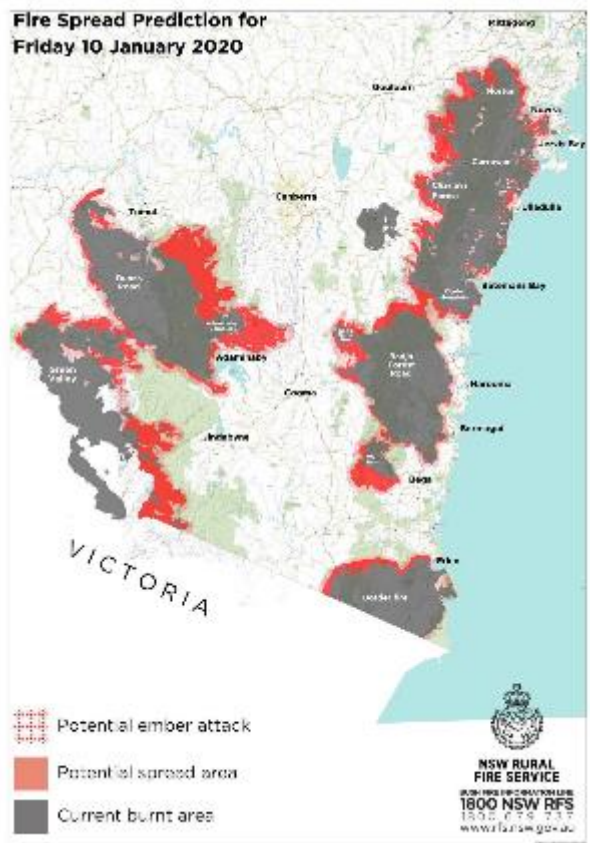
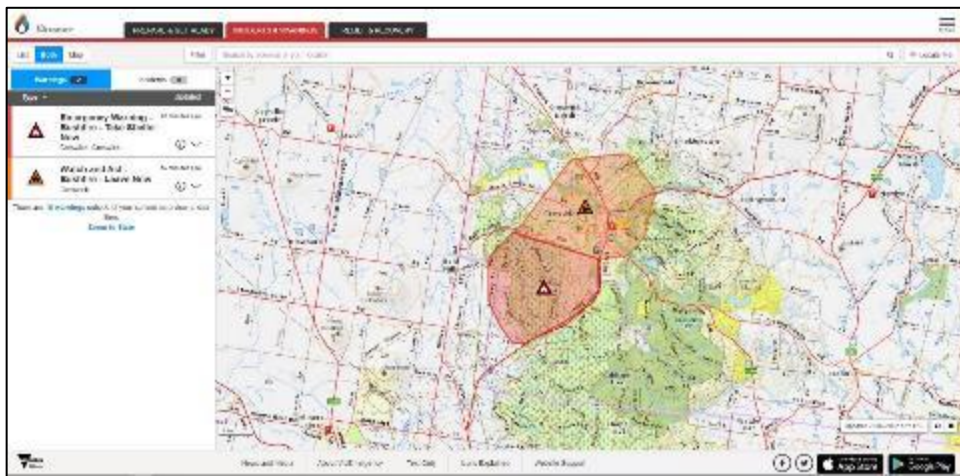
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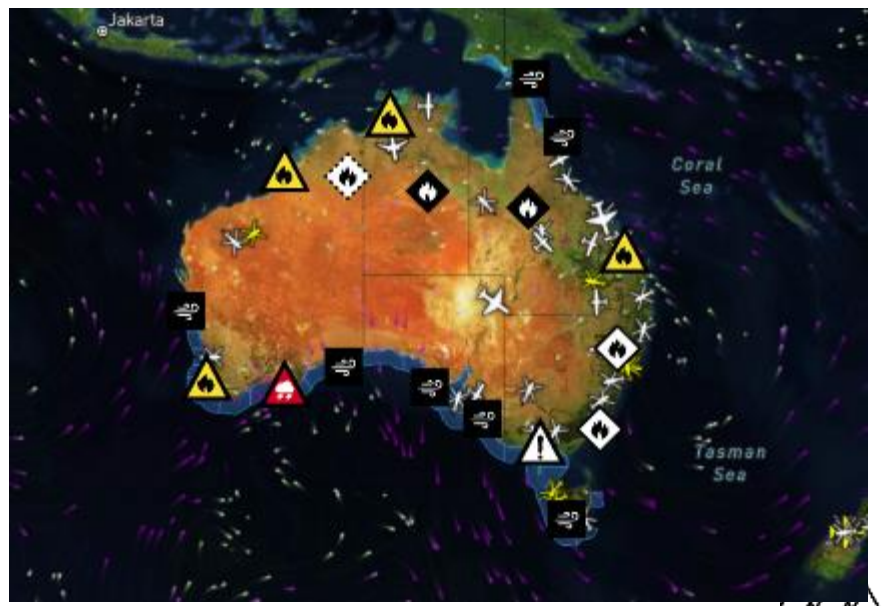
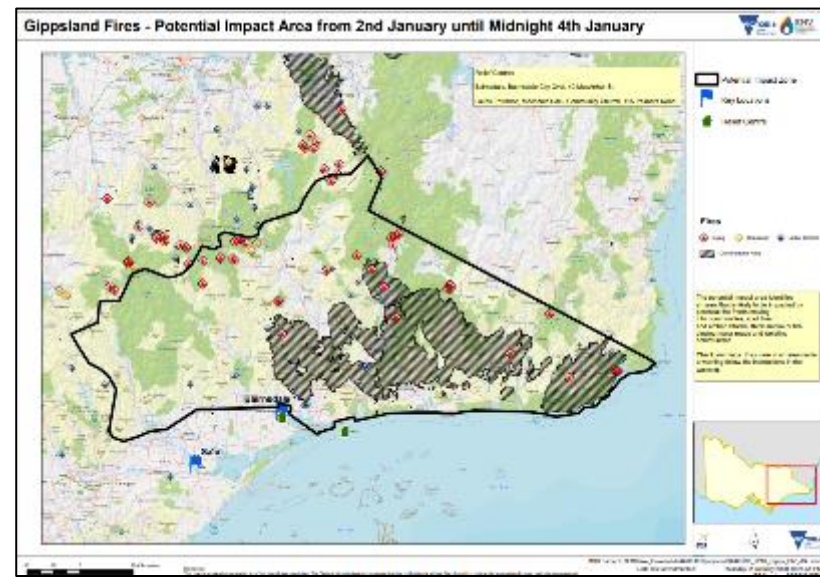


Yeah, we were kind of living off them really. You'd see something or you'd go around to a neighbour's place and see it from a different angle, and you'd go and check the app again, just trying to get our heads around exactly what was happening – we were really living off it. It was used more – those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





BOM: Forecast Wind



Bushfire.io

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 (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 (PSG) and Heather Stewart (previously Peter Middleton) (WG)
 - **WA** - Jackson Parker (PSG) and Anni Fordham/Deana Pullella (WG)
 - **QLD** - Jack Emeleus/Mandy Price (PSG) David Dumsday (WG)
 - **NSW** - Laurence McCoy/David Field (PSG) and Ben Shepherd (WG)
 - **VIC** - Phillip Brien (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** – Carla Mooney (previously Fiona Dunstan)



Project Design

Phase 1:

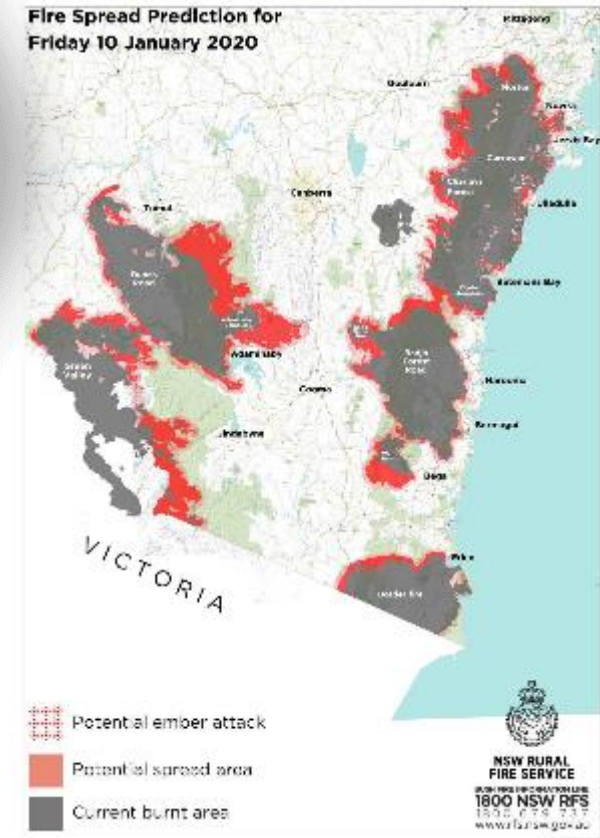
Understanding current agency practice and community comprehension and use of existing public-facing map-based products (i.e., incident warning maps and fire spread prediction maps).

Phase 2:

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

Phase 3:

Developing practical outputs for agency use.



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



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%

- 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
- Experienced map users (any type): 54% categorised themselves as daily users



Part 1 Results – Map Usage

- Large majority of participants used maps during their fire experience:
 - Different types of maps (warnings, predictive, hotspot, road closures, firefighting ops, lightning strikes, weather, electricity outages, etc.) from different platforms were used*
 - **NSW/ACT:** FiresNearMe, Windy app, maps shown at community meetings, VicEmergency, ACT Emergency Services website, Google maps, RFS website, bushfire.io, Digital Earth Australia (DEA) hotspots, BOM
 - **Tasmania:** TasFire website, DEA hotspots, BOM, real estate app (1), community meetings, Windy app, Google maps, ABC news
 - **Victoria:** VicEmergency, CFA website, BOM, Ausnet Maps (electricity), community meetings, Google maps

**In no particular order or ranking*



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

- 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 wind 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

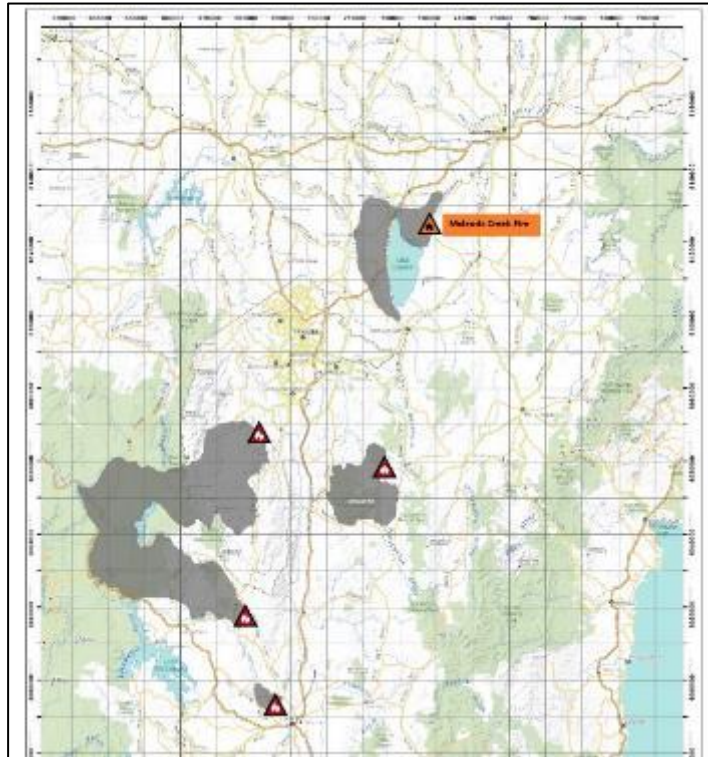
- Kudos to NSW/ACT for putting out predictive maps; BOM predictions; VicEmergency
- The importance of community meetings:

“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)



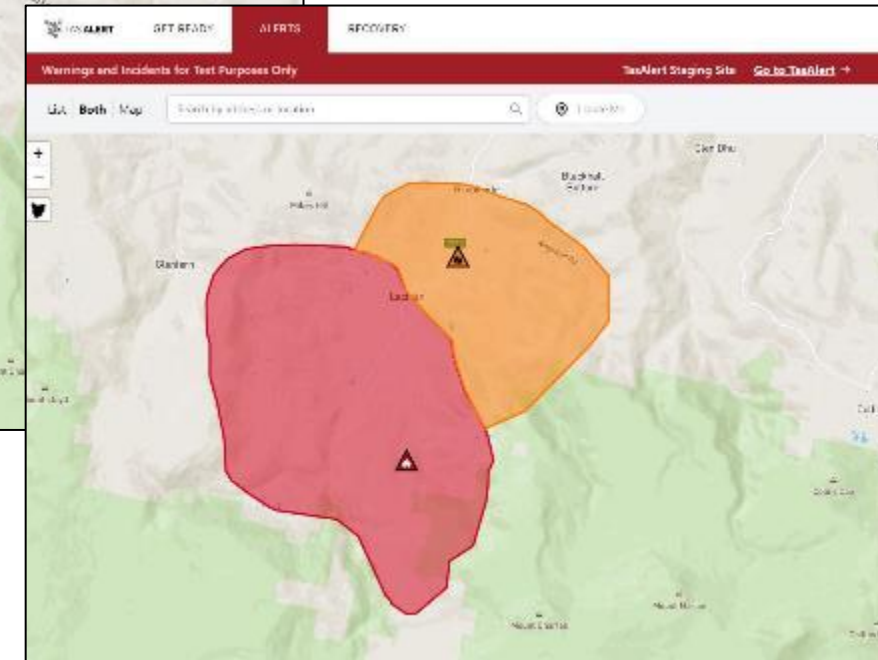
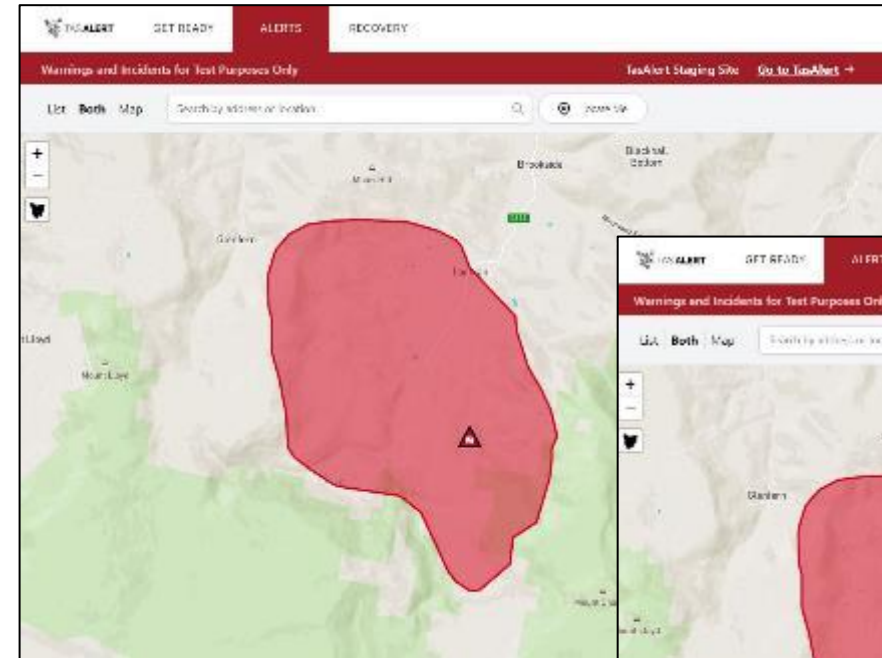
Part 2 Results – Comprehension Issues with Incident Maps

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 – 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*



Key Take-aways for Phase 2:

- **Why is information so important?**

When information was missing from the map -- people looked for it elsewhere. So, they will fill in the gaps with their own knowledge and/or experience, which may not always lead to accurate conclusions.

- **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.

- **Principle 3:** Ensure maps communicate risk and uncertainty



Phase 2 (WP9): National Survey

RQ: To what extent do individuals perceive risk and uncertainty in predictive bushfire maps?

Is there a difference in perceived risk, uncertainty, and intentions to take protective action when viewing a predictive bushfire map with different design elements?

To what extent does hazard literacy, map literacy, and past bushfire experience impact perceptions of risk and uncertainty in predictive bushfire maps, and intentions to take protective action?



Research Method

Survey: online, recruited via Qualtrics

Sample size: N= 3190 across all States and Territories

Maps: 4 incident warning maps (plus associated warning message) and 40 fire spread prediction maps (total = 44 maps)

Scenario: a co-designed bushfire event, set in Western Australia

Communication: maps embedded in a Facebook post



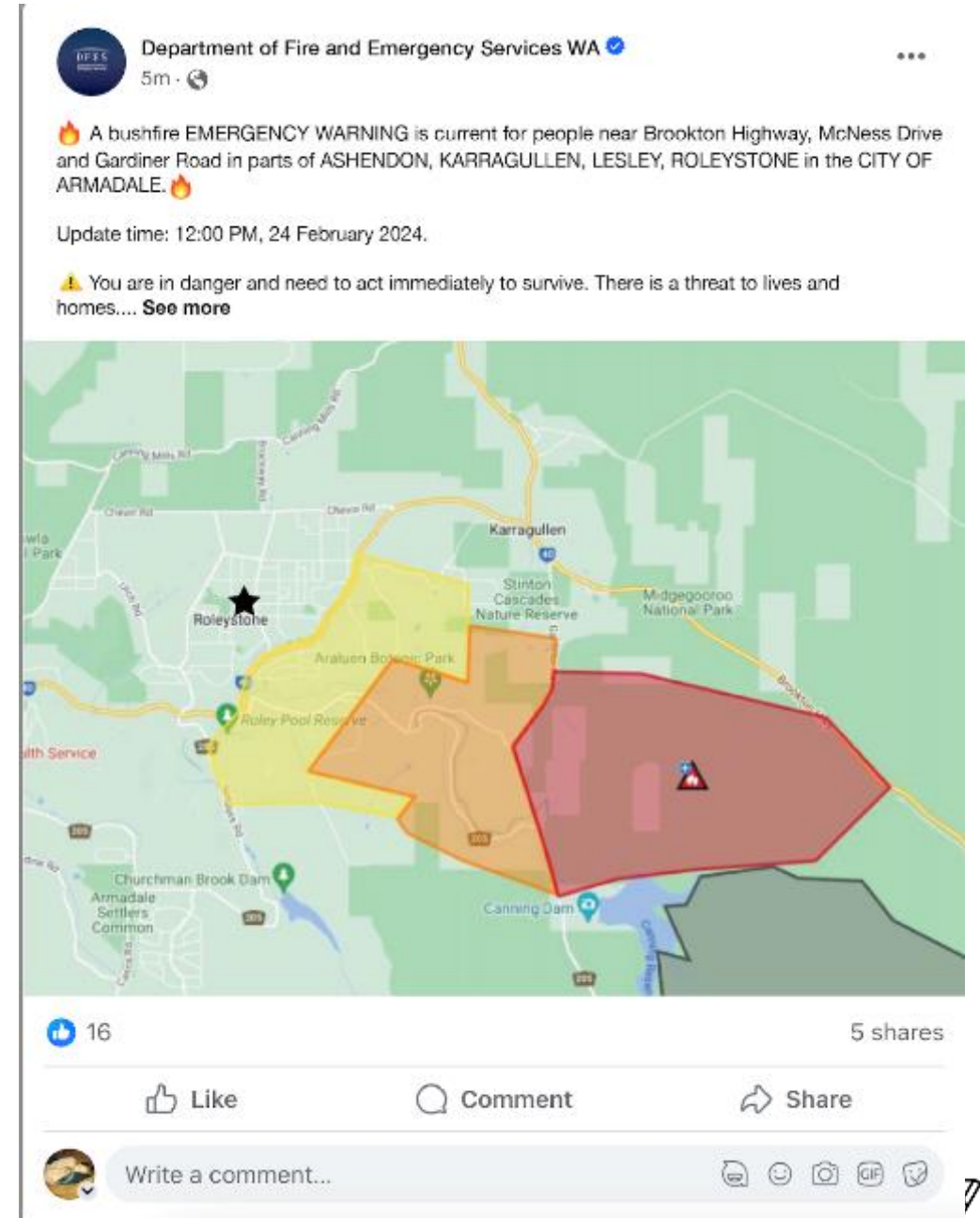
Scenario and incident map

Read the scenario below and look at the map provided before answering some more survey questions.

A bushfire has been burning near Jarrahdale State Forest, south of Brookton Highway, in Ashendon for four days. Today is a hot, windy summer's day and the fire activity is expected to increase. The Incident Controller has called Public Information to issue an Emergency Warning for parts of Karragullen.

The bushfire is heading in a northerly direction however a wind change will move the fire in a north westerly direction towards Roleystone. The fire may impact Brookton Highway within 24 hours, cutting off a major thoroughfare and route out of the Perth Hills. If the fire continues in this direction it will start impacting people in Roleystone.

Imagine you are located where the black star is on the map below.

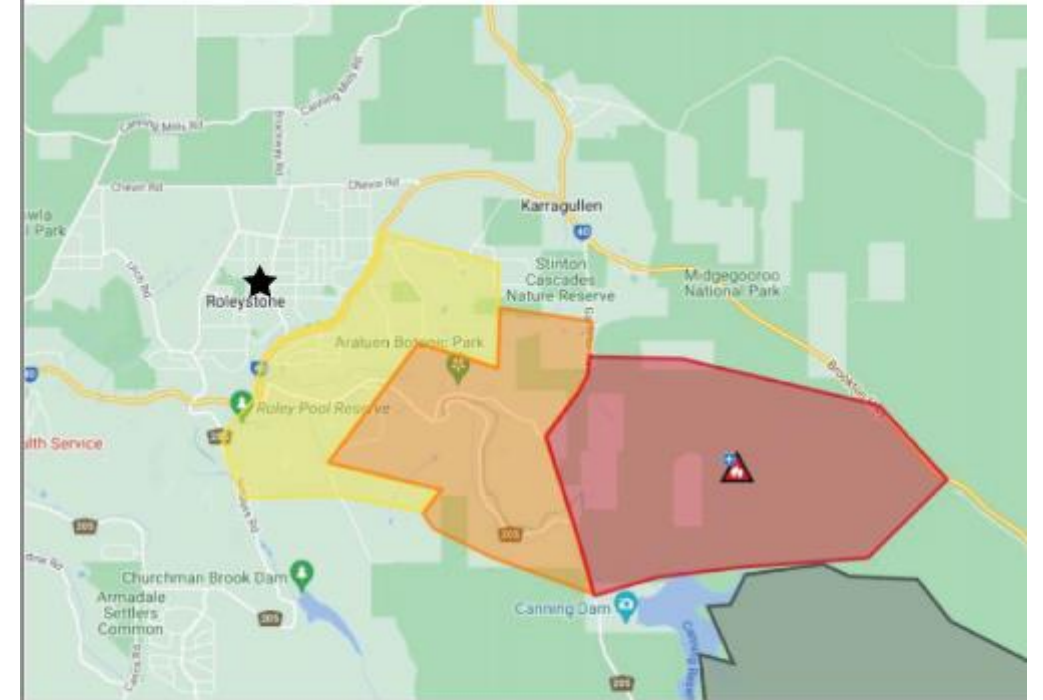


Department of Fire and Emergency Services WA · 5m · 🌐

🔥 A bushfire EMERGENCY WARNING is current for people near Brookton Highway, Mc Ness Drive and Gardiner Road in parts of ASHENDON, KARRAGULLEN, LESLEY, ROLEYSTONE in the CITY OF ARMADALE. 🔥

Update time: 12:00 PM, 24 February 2024.

⚠️ You are in danger and need to act immediately to survive. There is a threat to lives and homes.... [See more](#)



👍 16 5 shares

👍 Like 💬 Comment ➦ Share

👤 Write a comment...




Scenario and prediction map



Read the scenario below and look at the map provided before answering some more survey questions.

A bushfire has been burning near Jarrahdale State Forest, south of Brookton Highway, in Ashendon for four days. Today is a hot, windy summer's day and the fire activity is expected to increase. The Incident Controller has called Public Information to issue an Emergency Warning for parts of Karragullen.

The bushfire is heading in a northerly direction however a wind change will move the fire in a north westerly direction towards Roleystone. The fire may impact Brookton Highway within 24 hours, cutting off a major thoroughfare and route out of the Perth Hills. If the fire continues in this direction it will start impacting people in Roleystone.

Imagine you are located where the black star is on the map below.

 Department of Fire and Emergency Services WA 
5m · 



 The Potential Impact Area for the Roleystone Bushfire 

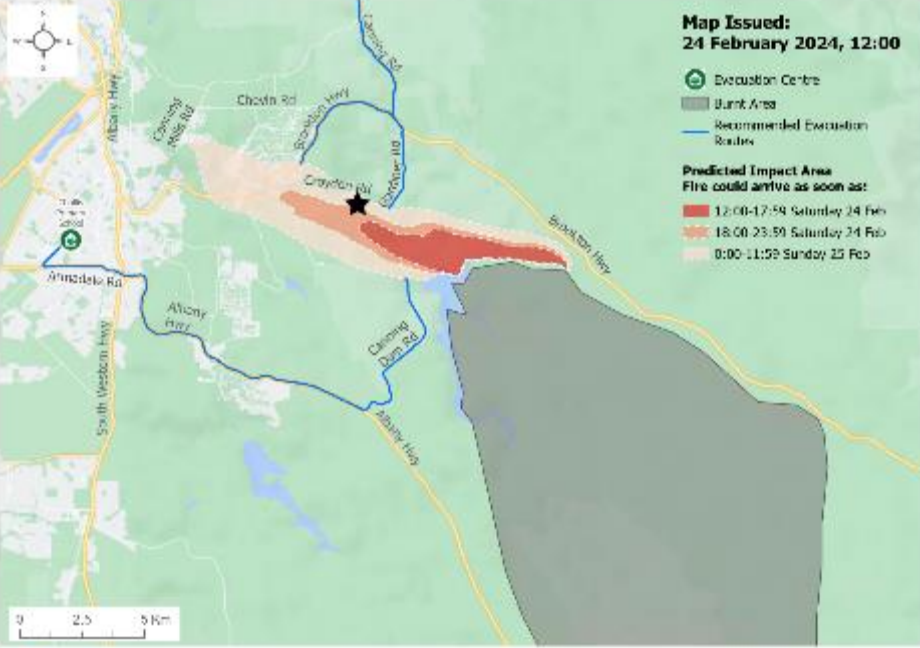
The Potential Impact Area indicates an area that could be impacted by fire over the next 24 hours.

Always check the date and time listed on the Potential Impact Area and ensure that you are prepared to act when required.

If you are in a warning area, follow the instructions. Do not rely solely on the Potential Impact Area to guide your decision making.

The fire could arrive sooner or later than estimated if conditions change.

 For the latest Alerts and Warnings visit www.emergency.wa.gov.au
 To create or update your bushfire plan visit www.mybushfireplan.wa.gov.au or download the app.






Map Issued:
24 February 2024, 12:00



- Evacuation Centre
- Burnt Area
- Recommended Evacuation Routes

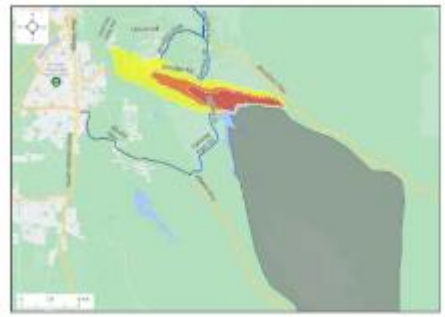
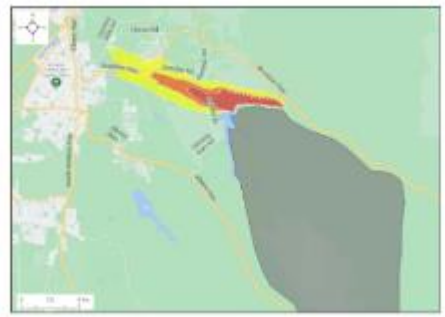
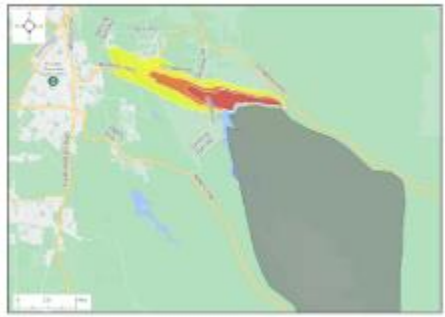
Predicted Impact Area
Fire could arrive as soon as:

- 12:00-17:59 Saturday 24 Feb
- 18:00-23:59 Saturday 24 Feb
- 0:00-11:59 Sunday 25 Feb

16 5 shares

 Like  Comment  Share

 Write a comment... 



Results

#Use: Map use in past bushfire event

#Familiarity with fire spread prediction maps: ~44% unsure

#Definition of a fire spread prediction map: *a map showing where the bushfire will go*

#Why use? To find out where I am in relation to the fire event
Information about the fire; monitor extent or rate of spread; risk level judgements; what to do next

#Demand: Interest to use the maps

#Expectations: Agency website/ channels; in real-time or as situation changes

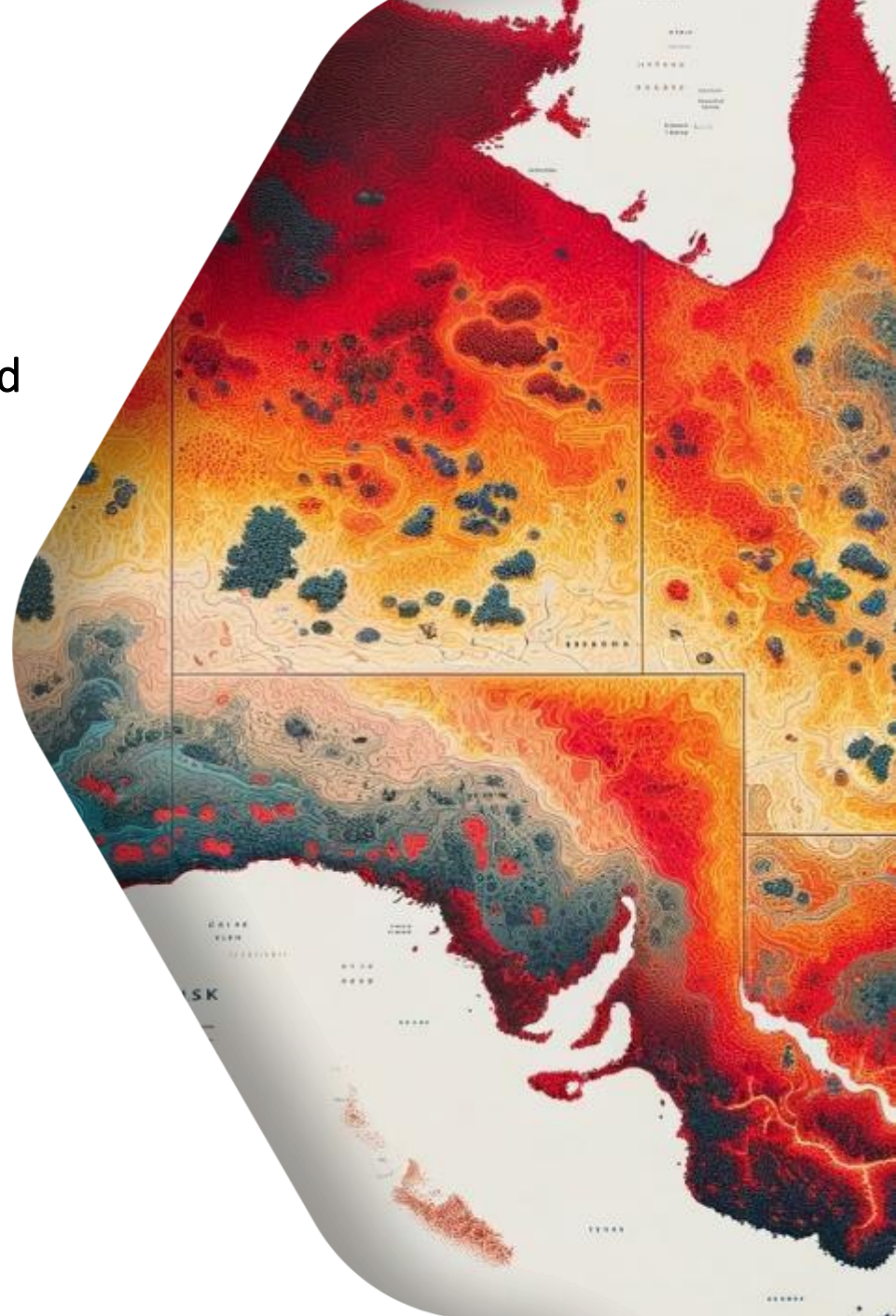


Results – risk perceptions

An evaluation of both the severity of the bushfire and the likelihood of it occurring.

- Australian Warning System (AWS) colours[^],
- being located **inside** the isochrone,
- seeing a fire spread prediction map,
- low self-reported **hazard literacy**, and
- high self-reported **map literacy**

were all associated with higher reported risk perceptions.



Results - emotions

Eight emotions were tested including **calm, alert, interested, confident, relieved, afraid, anxious, and worried.**

Specifically, the following emotions was present in the following conditions:

interested – solid border[^]; fire spread prediction map; low hazard literacy, and **high map literacy**

relief – outside the isochrone, **high hazard literacy**;

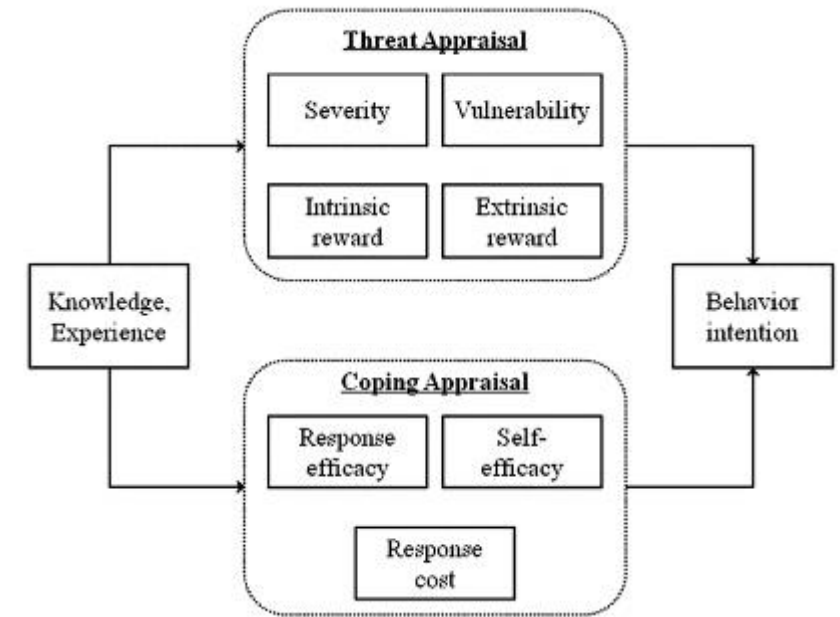
alert – inside the isochrone, **high map literacy**;

calm and *confident* – bushfire experience, **high hazard literacy**, and **high map literacy**;

Afraid - AWS colour compared to red colour conditions[^];

worried - **high map literacy**, and

negative emotions comprising afraid, worried, and anxious, **high hazard literacy.**



Results - uncertainty

Communicated uncertainty was tested to understand if respondents believed the fire spread would occur as modelled for the 6-, 12-, and 24-hour time intervals.

Experienced uncertainty, the feeling that respondents needed to know more information, was impacted by:

- past bushfire experience,
- low hazard literacy, and
- high map literacy.

Intent to **seek further information** can be used as a proxy for managing feelings of uncertainty (Brashers, 2001).


In the survey, respondents indicated they would seek further information to:

- know more about the threat,
- find out what to do,
- to confirm their understanding of the threat.

guide your decision making.

The fire could arrive sooner or later than estimated if conditions change.

 For the latest Alerts and Warnings visit www.emergency.wa.gov.au

 To create or update your bushfire plan visit www.mybushfireplan.wa.gov.au or download the app.



Results – trust judgement

Trust the information presented in the map

Judge the information to be accurate

- AWS (compared to both red and grey colour conditions)^;
- solid texture (compared to hash texture)^,
- inside the isochrone (compared to outside the isochrone);
- low hazard literacy (compared to high hazard literacy), and
- high map literacy (compared to low map literacy)

all reported high trust judgements of the maps.

Experienced uncertainty, the feeling that respondents needed to know more information, was impacted by:

- past bushfire experience,
- low hazard literacy, and
- high map literacy.



Results – protective action

Protective action intentions tested:

- do nothing
- seek further information
- check the Emergency App for more information
- seek direction from emergency service App
- stay away from the shaded area on the map
- stay and enact your bushfire plan
- stay without a bushfire plan
- evacuate to an evacuation centre
- evacuate to another location in a safer area

Protective Action Intention	Experience	Hazard Literacy	Map Literacy
<i>Do nothing</i>	Significant [#]	Significant [#]	NS
<i>Seek further information</i>	Significant [†]	Significant [†]	Significant [†]
<i>Check the Emergency App for more information</i>	NS	Significant [#]	NS
<i>Seek direction from emergency services</i>	Significant [†]	Significant [†]	Significant [†]
<i>Stay away from the shaded area</i>	NS	Significant [#]	Significant [#]
<i>Stay and enact your bushfire plan</i>	NS	NS	Significant [†]
<i>Stay without a plan</i>	Significant [#]	Significant [#]	NS
<i>Evacuate to the evacuation centre</i>	NS	Significant [†]	Significant [†]
<i>Evacuate to another location in a safer area</i>	Significant [#]	Significant [#]	Significant [#]



Key Insights

- Respondents appear to hold **similar expectations of incident and fire spread prediction maps** in terms of their currency, purpose, and whether they would actively seek such products out during a bushfire event. This research offers support for coordinating the design and use of incident and fire spread prediction maps.
- **Design concepts had small effects** on risk, uncertainty, emotions, trust, perceptions of map effectiveness, and intentions to take protective action.
- Respondents' **individual characteristics** (e.g., bushfire experience, hazard literacy, map literacy) **and circumstances** (where they were localized on the map) had a more significant impact on the above perceptions and action intentions.
- Overall, given our findings regarding the relative importance of individual characteristics and circumstances over design elements for impacting on perceptions and actions, there is a **significant opportunity and need to explore how these maps are communicated to the public.**



Next steps

- Phase Two continues:
 - Work Package 8 Focus Groups
 - South Australia
 - Queensland
 - Western Australia
 - 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.



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