

Hazard Note

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Community interpretation of bushfire prediction maps

About this project

The Predictions in Public: understanding the design, communication, and dissemination of predictive maps to the public project aims to understand how community members interpret and respond to fire spread prediction maps. Work Package 8 in Phase Two of the project involved discussions with community focus groups. The findings will be valuable in improving how such maps are designed and shared, and ultimately, in improving community members' understanding of the information in the maps.

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Summary

Communication during emergency events increasingly relies on maps. In the 2019–20 Black Summer bushfire season, some emergency agencies published fire spread prediction maps for community information. These had conventionally been used for internal operational management.

While research exists on public response to risk communication in Australia, to date there has been limited research focused on fire spread prediction maps. *The Predictions in Public* research project explores how communities comprehend, perceive risk and uncertainty, and act on bushfire spread prediction maps.

Six focus groups were conducted across Queensland (Qld), Western Australia (WA) and South Australia (SA) in July and August 2024, testing three bushfire spread prediction maps using scenarios co-designed with a project Steering Committee comprising emergency services agencies from across Australia.

Findings cover community comprehension, risk perception, uncertainty interpretation, and protective action intentions. The maps were found to provide important information that other maps do not address, in particular, in relation to the timing of impacts. However, issues were identified in relation to how

community members interpret the maps, the modelling behind them, their purpose and value, and various design elements.

The findings show that the maps provide time estimates before the impact of fire that, unlike current maps, guides staged preparation or responses.

Design choices risk unintended consequences, such as where prediction shape detail can imply unintended accuracy levels.

Participants trusted the science and uncertainty was around weather unpredictability (especially wind) rather than modelling itself.

Findings also showed that the first map element noticed drives subsequent information processing. For example, if a person misinterprets what the colour red means, then the rest of their interpretation will be inaccurate.

Community education on the purpose of bushfire spread prediction is needed.

Insights arising from the research will inform future community facing bushfire spread prediction map design and communication practices across Australia.



Photo: Sir Ivan Fire in New South Wales in 2017. Credit: NSW Rural Fire Service

Background

Emergency agencies communicate with the public via a range of means so community members will understand the risk presented by natural hazards and make decisions about how to prepare for and respond to future and current events. To be effective, official messaging during emergencies must be easily understood by people who have little or no knowledge or expertise.

In the 2019–2020 Black Summer bushfire season, some emergency agencies released operational fire spread prediction maps to the public. These maps are conventionally used for

operational management and their audience is typically emergency agency managers and staff who are skilled in interpreting them. To help assess their potential as a tool for communicating with community members, the *Predictions in Public* project conducted focus group discussions to learn how community members comprehend, interpret and act in response to the maps.

While publication of the fire spread prediction maps was largely welcomed by the community, there were questions about their efficacy. To date, there has been limited research on the

use of these maps in Australia. Current national doctrine provides only general guidance on the design of incident maps and there are no guidelines for the design of prediction maps.

Given that emergency communication increasingly relies on maps, this research suggests opportunities for improvement in their development and design. This work builds on previous research including community interviews, nationwide map surveys, co-designed map concepts, and comprehension testing.

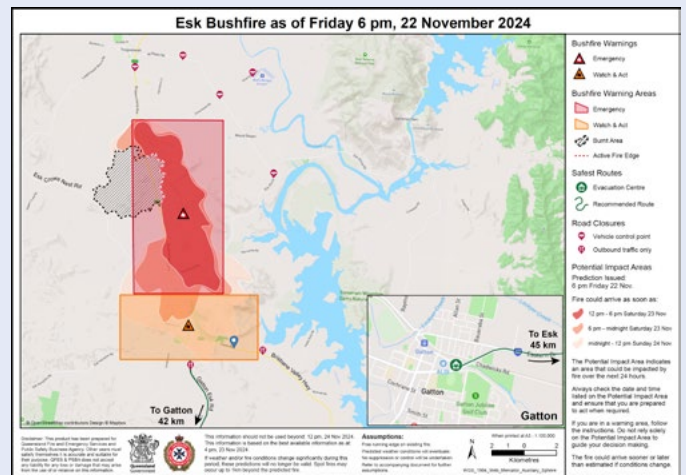
Research methodology

Six focus groups (N = 34 total, ~6 participants each) were conducted in peri-urban/regional areas: Esk (Qld), Roleystone (WA) and Mount Barker (SA). Each 90-minute session was audio recorded and transcribed.

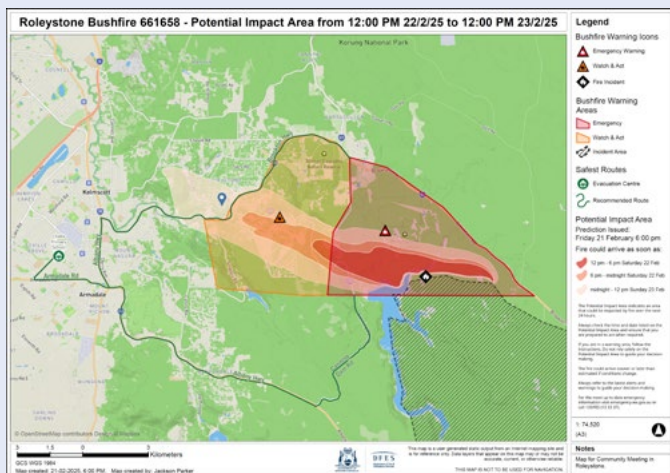
The methodology involved testing 'familiar' and 'unfamiliar' maps with co-designed videos and scenarios (see Figure 1). Stimuli included local agency staff introducing maps via video, replicating a press conference or social media dissemination. Two maps overlaid warning areas onto a fire's predicted spread (Qld and WA), while one showed only predicted fire spread (SA). All maps depicted predictions across three timeframes.

The sample comprised: 44% female, 56% living in the mapped areas, 62% employed. All participants had direct or vicarious bushfire experience.

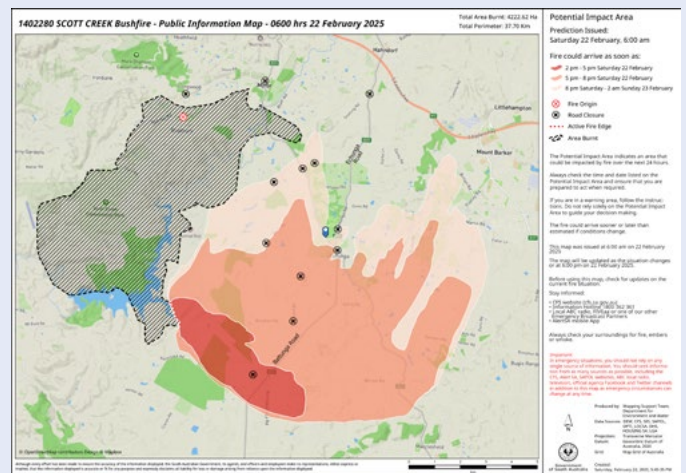
Figure 1: Stimuli used in focus groups



Queensland: Participants were located at the blue and white marker, in the Watch and Act warning area, but outside of the third time frame's bushfire spread prediction, near an outbound-traffic-only road closure and close to an evacuation route.



Western Australia: Participants were located at the blue and white marker, in the third time frame's bushfire spread prediction, outside of any warning areas, near an evacuation route.



South Australia: Participants were located at the blue and white marker, at the edge of the third time frame's bushfire spread prediction, inside the peninsulas of the third time frame's fire spread prediction, surrounded by road closures.

Research findings

Awareness

Participants first noticed red colour, initially misinterpreting it as the current fire location. Attention also focused on threat scale, evacuation routes and centres, road closures, participants' home locations (on familiar maps) and temporal elements (for example, time on the map and timing of the predicted fire paths). Initial attention typically anchored participants' subsequent interpretation of the map. Participants noted the need to better highlight the fire's current location and burnt areas.

Comprehension

Participants generally understood evacuation routes and centres, and base map elements (roads, suburbs, rivers, vegetation). Road closure implications were only clear when labelled 'outbound traffic only'. Terms like 'incident area' were less understood than 'burnt area' or 'active fire front'. Topographical features were not universally understood, affecting interpretation of fire spread direction. Warning areas and fire spread predictions were not always seen as distinct elements, and some participants incorrectly referred to predictions as "essentially a Watch and Act area".

Uncertainty

Participants somewhat trusted the science and expertise behind predictions but understood weather unpredictability, especially wind changes. Earlier timeframe predictions were seen as more certain than later ones due to less time for weather changes. More specific prediction shapes (jagged lines, peninsulas) appeared more accurate. Participants expected map updates as conditions evolved. Few participants acknowledged non-weather uncertainty factors like ember attacks, fuel and topography.

Risk perceptions

Risk perceptions were highly personal. They were shaped by previous bushfire experience, understanding of fire behaviour, map reading confidence, where they were located on the map (see Figure 1), area familiarity and map design elements. Higher perceived prediction certainty correlated with higher perceived risk. All participants acknowledged bushfire risk but differed on degree, typically related to timeframes. Shorter timeframes raised questions of when fire would arrive; longer timeframes questioned if it would arrive before conditions changed or response teams controlled it.

Protective action

Maps with warning areas overlaid prompted actions aligned with 'Watch and Act' and 'Emergency Warning' levels. Maps without warning areas still prompted 'Watch and Act' actions. Participants were more likely to evacuate from 'red' areas (immediate predictions/Emergency Warning areas). Those located in third timeframe predictions or just outside a prediction area (see Figure 1) were more likely to prepare or wait. Those waiting were seeking environmental cues, map updates or direct contact from emergency services. Unfamiliar locations prompted faster evacuation decisions with fewer caveats.

Map expectations and use

Mixed intentions to seek bushfire spread prediction maps reflected existing incident map usage. Some participants preferred bushfire spread prediction maps for their temporal guidance, which is absent from incident warning maps. All participants expected maps on official agency channels but acknowledged the need for TV and radio access. There was no expectation of distribution of maps at community meetings due to timing. Participants saw value in having agency representatives explain maps on TV and social media and called for dynamic maps that included wind and toggleable information.

Research impact

Dissemination of the findings includes Steering Committee briefings, AFAC group presentations, and publication across academic journals, industry magazines, and news media.

The findings give rise to several insights that should inform future design and dissemination of fire spread prediction maps for community use.

Key insights

- **Bushfire spread prediction maps offer temporal certainty unavailable in current incident warning maps.** They provide estimated time to impact, guiding staged preparatory or response actions that current maps do not address. Frequent updates were expected but may not be operationally viable, so agencies should communicate expected update timing.
- **Design choices risk unintended consequences.** Prediction shape detail can imply unintended accuracy levels. Three-timeframe predictions led participants to focus on immediate timeframes while discounting later risks.
- **Uncertainty is attributed to weather (especially wind) rather than modelling itself.** Participants trusted the science but understood weather unpredictability.
- **Communities need clear directions for interpreting the map.** The first map element noticed drives subsequent information processing. If a person misinterprets what the red means (for example, 'where fire is now') then the rest of their interpretation will be inaccurate.
- **Community education is needed on the purpose of bushfire spread prediction.** Without specific communication, communities may conflate spread predictions with incident warning areas. Communities should always be directed to incident warning maps alongside fire spread predictions.

The public relies on maps alongside text warnings for situational awareness and protective decision making. This part of the *Predictions in Public* project's findings provide significant insight for future Australian bushfire spread prediction map design, in particular, to meet the public's needs in understanding and acting on bushfire predictive and incident maps design. This will benefit communities around Australia.

Combined with other *Predictions in Public* work packages, the findings are an important contribution to practical emergency management. Results are being triangulated with agency insights, community interviews and nationwide surveys to develop and test and refine specific map concepts in subsequent *Predictions in Public* projects.

End-user statement

Simeon Telfer, Strategic Operations, South Australian Country Fire Service, South Australia

Communicating complex bushfire information during emergencies is critical for fire agencies globally. Uncertainty in fire predictions is difficult to convey while maintaining simple, effective public messaging. The Predictions in Public research program systematically tests communication effectiveness with exceptional end-user engagement and tailored workshops replicating fire scenarios. This research will directly and profoundly influence how fire agencies display predictions on maps, websites and communications.

Further reading

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Miller, G., Neale, T., Griffin, A. L., Dootson, P., Begg, C., & Gardner, A. (2025). Putting predictions in public: professional perspectives on the risks and benefits of changing wildfire warning systems. *Environmental Hazards*, 1-22.

Full report: <https://www.naturalhazards.com.au/resources/publications/report/predictions-public-understanding-design-communication-and-0>

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