Developing a WebGIS Based Household Specific Bushfire Risk Communication Framework

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Current Risk Communication for Bushfire

- **Ignition Location**
- **Fire Spread Prediction**
- **Road Closure Maps**

**Fire Danger Ratings**
- National Community Safety Policy
- Shared responsibility: Family Fire Plan

**Prepare, stay and defend**
- It is only safe to stay and defend adequately prepared properties

**Leave Early**
- Late evacuation is the most dangerous action

**Bushfire Alerts**

<table>
<thead>
<tr>
<th>Category</th>
<th>Fire Danger Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic (Code Red)</td>
<td>100+</td>
</tr>
<tr>
<td>Extreme</td>
<td>75 – 99</td>
</tr>
<tr>
<td>Severe</td>
<td>50 – 74</td>
</tr>
<tr>
<td>Very high</td>
<td>25 – 49</td>
</tr>
<tr>
<td>High</td>
<td>12 – 24</td>
</tr>
<tr>
<td>Low to moderate</td>
<td>0 – 11</td>
</tr>
</tbody>
</table>
Facts on Black Saturday

Post-fire study on the community safety shows:

✓ Some people don’t have a proper family fire plan (18% of interviewed survivals and 53% of the fatalities did not have a proper family fire plan)

✓ ‘Leave early’ is ambiguous – many did not understand the actual risk situation and waited for more clear indication of “trigger”, leading to the most dangerous action - late evacuation! (14% of the fatalities were fleeing at the time of death)

✓ ‘Stay and Defend’ is well understood, while ‘Prepare’ less so. (80% of the fatalities who had a plan to stay and defend did not make prior preparation, leading to passive sheltering or late evacuation)


Gaps

Household’s Safe Action(s)
Research Objective

To explore an effective method to communicate *household-specific* risk information and action advices to householders and residents through GeoVisualization techniques

- Facilitate a more efficient deployment of household-specific risk information during a fire – GIS (Geographic Information System) based risk communication

- Allow users to perceive their own risk more accurately – map-based visualisation of household specific risk indicators

- Assist users to make decisions more appropriately under stress – modelling of household specific safe actions along with associated advices
Conceptual Framework of SHAARC
(Standardised Household Action Advice and Risk Communication)

Household Action Advice Model

1. Household Preparedness
   - Ignition Point
   - Fire Weather
   - Fire Spread Simulation
   - Fire Danger Rating
   - Bushfire Alert
   - Road Closure

2. Safe Action(s)
   - Stay and defend
   - Leave Early

3. Tailored Action advices
   - Geovisualisation of bushfire risk indicators

- Ignition Point
- Fire Weather
- Fire Spread Simulation
- Fire Danger Rating
- Bushfire Alert
- Road Closure

- Safe Action(s)
- Stay and defend
- Leave Early

- Household Preparedness
- Geovisualisation of bushfire risk indicators
‘Active defence is only safe if the household is prepared to a sufficient level.’ (AFAC 2010, p.11)

<table>
<thead>
<tr>
<th>Providers</th>
<th>Source File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country Fire Authority (VIC)</td>
<td>Prepare. Act. Survive</td>
</tr>
<tr>
<td>Rural Fire Service (QLD)</td>
<td>Prepare. Act. Survive</td>
</tr>
<tr>
<td>Department of Fire and Emergency Service (WA)</td>
<td>Prepare. Act. Survive</td>
</tr>
<tr>
<td>ACT Fire &amp; Rescue (ACT)</td>
<td>Prepare. Act. Survive</td>
</tr>
<tr>
<td>NSW Rural Fire Service (NSW)</td>
<td>Prepare. Act. Survive</td>
</tr>
<tr>
<td>Tasmania Fire Service (TAS)</td>
<td>Prepare. Act. Survive</td>
</tr>
<tr>
<td>American Red Cross</td>
<td>Wildfire preparedness</td>
</tr>
<tr>
<td>Federal Emergency Management Agency</td>
<td>Checklist for Homeowners</td>
</tr>
</tbody>
</table>

Reviewed materials regarding household preparedness as distributed by related agencies
Developing a Household Preparedness Measure
-Literature Review

- Required preparedness in relation to FDRs

<table>
<thead>
<tr>
<th>FIRE DANGER RATING</th>
<th>STAYING AND DEFENDING CAN ONLY BE CONSIDERED IF YOUR HOME IS...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CFA(VIC)</td>
</tr>
<tr>
<td>CATASTROPHIC</td>
<td>Never</td>
</tr>
<tr>
<td>EXTREME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>situated and constructed or modified to withstand a bushfire, prepared to the highest level and can be actively defended</td>
</tr>
<tr>
<td>SEVERE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>well prepared and can be actively defended</td>
</tr>
<tr>
<td>VERY HIGH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>not stated</td>
</tr>
<tr>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>LOW-MODERATE</td>
<td></td>
</tr>
</tbody>
</table>

No Definition of Required Preparedness Levels!
Lack of Consistency!

- Checklists of household preparatory items for staying and defending
Developing a Household Preparedness Measure
- Method

Checklist of Critical Items for **Extreme** FDR
- Raked up leaf litter and twigs under trees
- Cut long grass
- ...

Checklist of Critical Items for **Severe** FDR
- Raked up leaf litter and twigs under trees
- Cut long grass
- ...

Checklist of Critical Items for **Very High** FDR
- Raked up leaf litter and twigs under trees
- Cut long grass
- ...

Checklist of Critical Items for **High, Low-Moderate** FDR
- Raked up leaf litter and twigs under trees
- Cut long grass
- ...

A Minimum and Essential Preparatory Condition for Staying and Defending
Developing a Household Preparedness Measure
- Method

What does ‘critical’ mean?

*Example:*

When a fire starts and the FDR in the fire district is **Severe**, for households with a plan to stay and defend their properties…

- Completed ALL items: Can Stay and Defend!
- Failed to Complete any one item: Cannot Stay and Defend!
Developing a Household Preparedness Measure
-pilot study

Household Preparedness Survey

Materials:
An inclusive list of 104 preparatory actions collected from the 9 sources

Method:
Rate, for each preparatory item, at which FDR(s) one item is critical to be completed by a household for the goal of successfully defending a home.

Responses:
36 valid responses across the nation.

Results:
✓ High inter-rater agreement indicates the possibility of building such a household preparedness measure
✓ Raters might have adopted different approaches, suggesting a further experts’ consultation through a workshop
✓ Qualitative feedback for some items helps identify several types of items that require further clarification
Developing a Household Preparedness Measure  
- Workshop with relevant bushfire experts

Objective:

Obtain experts’ consensus & clarification on the ‘criticalness’ of each preparatory item for defending a home in different Fire Danger Rating (FDR) scenarios.

Participants:

10 agency experts specialising in bushfire community safety issues from 5 states.
Developing a Household Preparedness Measure
- Workshop with relevant bushfire experts

Method:
A modified consensus decision-making approach

Step 1. Small group ratings
Rate, in each small group, at which FDR(s) one item is critical to be completed by a household for the goal of successfully defending a home.

Step 2. Large group discussion
Compare group answers to obtain consensus on the rating results & better understand the controversial items.

Question Example:
At the FDR of ___, households neglecting or failing to complete this item should not stay and defend their property during a bushfire. (Please tick ONE option)
- Low-Moderate, High and all levels above
- Very High and all levels above
- Severe and Extreme
- Extreme only
- Not critical at any levels

Note: The FDR level of Catastrophic is not included, because according to Australian fire authorities, people should never stay and defend under this circumstance regardless of preparedness.
Developing a Household Preparedness Measure
- Workshop with relevant bushfire experts

Results:

✓ Refined list of 97 preparatory items

✓ A checklist of 36 critical preparatory items rated as critical (regardless of FDRs) by all three small groups

✓ A list of 33 preparatory items that were identified as helpful but not critical by all three small groups

✓ A list of 28 controversial preparatory items for which consensuses were not obtained among the three small groups
Designing the Household Action Advice Model

How should an appropriate action be determined for an individual household based on the relevant bushfire risk indicators?

Method:

1. Literature review
2. Preliminary design based on current policy and communication of action advices
3. Presentation to relevant agency experts through teleconference and distribution of a report on the Household Action Advice Model
4. Model revision according to agencies’ feedback
5. Model assessment through a scenario approach
Designing the Household Action Advice Model

Revised operational framework (decision-tree) based on the written feedback from 3 state agencies
Users’ Needs Assessment

Participants:
Residents living in fire prone areas with different family fire plans

Method:
1. Test the effectiveness of different representation methods
2. Follow-up interviews
   - Understandability
   - Perception of risk
   - Intention of response
   - Subjective preference
Thank you!

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