An analysis of human fatalities and building losses from natural disasters in Australia

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Objectives

To analyse the impacts of:

- floods, cyclones, bushfires, earthquakes, heatwaves and severe storms (wind, hail, lightning, tornados, flash floods)

in terms of:

- demographics, social and environmental circumstances surrounding deaths
- people otherwise affected – injured, near-misses, rescued
- building losses and damage – over the last century
Major outcomes

Evidence-based data to assist with appropriate emergency management and government decision making:

• a longitudinal and geographical examination of trends in the exposure and vulnerability of people and buildings

• an interpretation of these trends in the context of emerging issues (e.g. ageing population, population shifts, climate change), in order to determine potential future trends

• an understanding of the impact of changes to policy and procedures on life and property loss.
Initial objective

To analyse the impacts of **floods** in terms of:

- human fatalities and
- physical characteristics of the flood

Milestones:

- 29 May 2015 – report on flood fatalities alongside a discussion of the results with end-users
- mid-July – submission of journal article
**PerilAUS: a means to the end**

A database of natural hazard impacts in Australia

- **Data held** from 1788; best data is from 1900.

- **14,760** event reports from 1900 to the present (and counting…)

**Coronial inquests:** crucial to augmenting the detail surrounding fatalities.

[garnered for bushfire fatalities (as at 2008) for a previous project for the Bushfire CRC]

First we needed to add as many names as possible…
What we’ve done

Enriching the database (from March 2014 to now):

- Fatal flood events: 548 → 1076 (96%)
- Number of flood deaths 1207 → 1799
- Named flood deaths 606 → 1559 (from 50% → 87%)
- References 16,598 → 19,924

Qld Archives – office Step 2. Having found the most likely page no. on the appropriate microfilm from the inquest register, ensure it’s the right event/person and get the inquest number. Next: order via the online form; wait for the staff to find it; unwrap carefully and photograph. Return to Sydney office and very nicely ask De to input it.
What we’ve done

Coronial inquest reports: types of data

• name, age, occupation, where found, date of death
• actions of deceased; reasoning behind decisions
• knowledge/ forewarning of flood dangers; ability to swim; blood alcohol level
• details of weather; state of river; type of flood

QLD 1920/16555: Inquest gave the reason behind the attempt to cross the river, time, details on the incident and information on where the body was found.

PerilAUS: [deceased] drowned whilst crossing Russell River at the old Chuchabber crossing during the flood.

[deceased] was a labourer and contractor, ~50, unmarried, originally from Inverell. His employer, who was going to Cairns, instructed [him] to remove horses from the opposite side of the river if there was any sign of flood. A witness accompanied [him] at about 5.30am to bring horses from across the river as the river was rising and there was a danger of flood. [He]crossed the river on his horse which appeared to get into difficulties about halfway across. Both disappeared: the horse reappeared downstream but [deceased] did not. The river was running very quickly and the water was muddy. His body was found the following day, caught in the roots of a big tree, about half a mile from where he entered the river.
What we’ve done

Coronial inquest reports

Challenges encountered:

• Accessing some Records offices (WA, NT)
• Inquests aren’t always kept (NSW, WA)
• Variable names in PerilAUS
• Reports difficult to read!
What we’ve done

Current state of play

Inquest reports held at State Archives offices:
- accessed available reports: SA, Vic, Qld, NSW
- end of April will complete Tas, ACT
- unable to access records for NT
- hope springs eternal – WA

May be able to access more recent inquest reports direct from the Coroner for some states

Still closing gaps for physical characteristics of fatal flood events – about four decades’ worth.
What you can expect

Fatalities from natural perils: raw data

Figure 1: Australian natural disaster fatalities, 1900-2010 - raw data
(Data source: PerilAUS database, Risk Frontiers)

Perils include:
bushfire, earthquake, flood, grassfire, wind gust, hail, landslide, lightning, rain, tornado and tropical cyclone
What you can expect

Fatalities from natural perils normalised by population

**Figure 2**: Australian natural disaster fatalities, 1900-2010 – population normalised to year 2010 numbers (Data source: PerilAUS database, Risk Frontiers)

**Perils include:**
bushfire, earthquake, flood, grassfire, wind gust, hail, landslide, lightning, rain, tornado and tropical cyclone
### Natural hazard fatalities

<table>
<thead>
<tr>
<th>Natural hazard</th>
<th>Deaths 1900–2011</th>
<th>% total natural hazard deaths 1900–2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme heat</td>
<td>4,555</td>
<td>55.2</td>
</tr>
<tr>
<td>Flood</td>
<td>1,221</td>
<td>14.8</td>
</tr>
<tr>
<td>Tropical cyclone</td>
<td>1,285</td>
<td>15.6</td>
</tr>
<tr>
<td>Bush/grassfire</td>
<td>866</td>
<td>10.5</td>
</tr>
<tr>
<td>Lightning</td>
<td>85</td>
<td>1</td>
</tr>
<tr>
<td>Landslide</td>
<td>88</td>
<td>1.1</td>
</tr>
<tr>
<td>Wind storm</td>
<td>68</td>
<td>0.8</td>
</tr>
<tr>
<td>Tornado</td>
<td>42</td>
<td>0.5</td>
</tr>
<tr>
<td>Hail storm</td>
<td>16</td>
<td>0.2</td>
</tr>
<tr>
<td>Earthquake</td>
<td>16</td>
<td>0.2</td>
</tr>
<tr>
<td>Rain storm</td>
<td>14</td>
<td>0.2</td>
</tr>
</tbody>
</table>
What you can expect

Heatwaves: deaths & death rates 1890-2010

- at least 363 heat events since 1788 and 5,332 fatalities since 1844
What you can expect

Heatwaves: summary & policy implications

- Concentrate more resources at all levels of government on risk reduction
  - 5,332 deaths since 1844 and 4,555 deaths since 1900
  - Decrease in death rate BUT future risk: climate change + social vulnerability

  - Who to target? WHS:
    - Those working in hot environments

  - Recreation-related:
    - > 25% fatalities prior to 1956 working at death; < 10% from 1956
    - 1956-2010 – recreation riskiest activity, then working

  - The very old

- Long term risk reduction focus:
  - Planning policies currently are response-focused... and...
  - Many of the most vulnerable groups are difficult to reach
  - We suggest: urban planning, building design, social equity, community development

Another heat disaster is inevitable – not enough has changed since 2009...
What you can expect

Bushfires: gender

Table 2a - Gender and age of bushfire fatalities over three different time periods.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number killed</td>
<td>552</td>
<td>292</td>
<td>260</td>
<td>z-Score</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td>p-Value</td>
</tr>
<tr>
<td>Male</td>
<td>373 (67%)</td>
<td>224 (77%)</td>
<td>149 (57%)</td>
<td>5.011</td>
</tr>
<tr>
<td>Female</td>
<td>147 (27%)</td>
<td>48 (16%)</td>
<td>99 (38%)</td>
<td>-5.856</td>
</tr>
<tr>
<td>Unknown</td>
<td>32 (6%)</td>
<td>20 (7%)</td>
<td>12 (5%)</td>
<td></td>
</tr>
</tbody>
</table>

### What you can expect

**Bushfires: capacity to respond**

<table>
<thead>
<tr>
<th>Table 8 – Awareness/capacity to respond.</th>
<th>1900–2008</th>
<th>1900–1954</th>
<th>1955–2008</th>
<th>Comparison of the two periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>Physically and/or mentally incapable</td>
<td>24</td>
<td>4.3</td>
<td>8</td>
<td>2.7</td>
</tr>
<tr>
<td>Aware of the fire and carrying out a premeditated action</td>
<td>152</td>
<td>27.5</td>
<td>72</td>
<td>24.7</td>
</tr>
<tr>
<td>Aware of the fire but had no plans or did not follow them</td>
<td>110</td>
<td>19.9</td>
<td>54</td>
<td>18.5</td>
</tr>
<tr>
<td>Unaware of the fire and realised too late</td>
<td>59</td>
<td>10.7</td>
<td>28</td>
<td>9.6</td>
</tr>
<tr>
<td>Extenuating circumstances, e.g. heart attack</td>
<td>25</td>
<td>4.5</td>
<td>10</td>
<td>3.4</td>
</tr>
<tr>
<td>Children who followed adults’ decisions</td>
<td>60</td>
<td>10.9</td>
<td>39</td>
<td>13.4</td>
</tr>
<tr>
<td>Unknown</td>
<td>122</td>
<td>22.1</td>
<td>81</td>
<td>27.7</td>
</tr>
<tr>
<td>Total</td>
<td>552</td>
<td>100</td>
<td>292</td>
<td>100</td>
</tr>
</tbody>
</table>

What you can expect

Floods: location
Total flood deaths (and %) by state/territory, 1788-1996, and in 50-year intervals

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New South Wales</td>
<td>1090</td>
<td>49.3</td>
<td>76</td>
<td>562</td>
<td>196</td>
<td>256</td>
</tr>
<tr>
<td>Queensland</td>
<td>741</td>
<td>33.5</td>
<td>2</td>
<td>336</td>
<td>301</td>
<td>102</td>
</tr>
<tr>
<td>Victoria</td>
<td>178</td>
<td>8.0</td>
<td>3</td>
<td>81</td>
<td>82</td>
<td>12</td>
</tr>
<tr>
<td>South Australia</td>
<td>78</td>
<td>3.5</td>
<td>5</td>
<td>50</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Tasmania</td>
<td>60</td>
<td>2.7</td>
<td>0</td>
<td>21</td>
<td>33</td>
<td>6</td>
</tr>
<tr>
<td>Western Australia</td>
<td>28</td>
<td>1.3</td>
<td>0</td>
<td>24</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>26</td>
<td>1.2</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>12</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>2213</td>
<td>100.0</td>
<td>86</td>
<td>1084</td>
<td>636</td>
<td>407</td>
</tr>
</tbody>
</table>

What you can expect

Lightning: circumstances

339 known deaths out of 650 total deaths
- indoors (47) 13.9%
- outdoors (292) 86.1%
- exposed (162) 55.5%
- shelter sought (81) 27.8%
- unknown (49) 16.7%

<table>
<thead>
<tr>
<th>Activity of casualty at time of strike</th>
<th>Unknown (7)</th>
<th>En route (19)</th>
<th>Other (40)</th>
<th>On the land (94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>work related (176) 62.6%</td>
<td>4.0%</td>
<td>10.8%</td>
<td>22.7%</td>
<td>53.4%</td>
</tr>
<tr>
<td>incidental (48) 17.1%</td>
<td>72.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>near chimney (11) 22.9%</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

281 known deaths out of 650 total deaths

Activity of casualty at time of strike

Milestones

• 30 Mar 2014 – Submit journal article on heatwave deaths based on current knowledge
• 28 Nov 2014 – Report on data quality and completeness of historical natural hazard building losses
• 31 Dec 2014 – Report on data quality for fatalities from flood and the social and environmental circumstances surrounding each fatality
• **CM 1.03.2** – 29 May 2015 – report on flood fatalities alongside discussion of results with end-users
• *mid-July* – submission of journal article on flood fatalities
• **CM 1.03.3** – 31 Dec 2015 – Report on data quality for fatalities from tropical cyclone, earthquake, heatwaves and severe storm and environmental and social circumstances surrounding each fatality
• 31 May 2016 – Workshop with end-users and stakeholders to discuss fatality and building loss data
• **CM 1.03.4** – 31 July 2016 – Report and journal article on fatalities from tropical cyclone, earthquake, heatwaves, bushfire, and severe storm
• **CM 1.03.5** – 31 Dec 2016 – Report and journal article of detailed analysis of all historical natural hazard building losses (by state and time period), alongside presentation to relevant end-users
• 30 Mar 2017 – Report on the analysis of injury, near-miss and rescue data
• 15 Jun 2017 – A report on the impact of changes to policy and procedures related to natural hazard risk
THANK YOU!

http://www.riskfrontiers.com/

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