bushfire&natural HAZARDSCRC

MEASURING THE IMPACTS OF BUSHFIRE ON HUMAN FATALITIES AND BUILDING LOSSES

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An Australian Government Initiative

CRC AUSTRALIA

RISK FRONTIERS

MACQUARIE UNIVERSITY

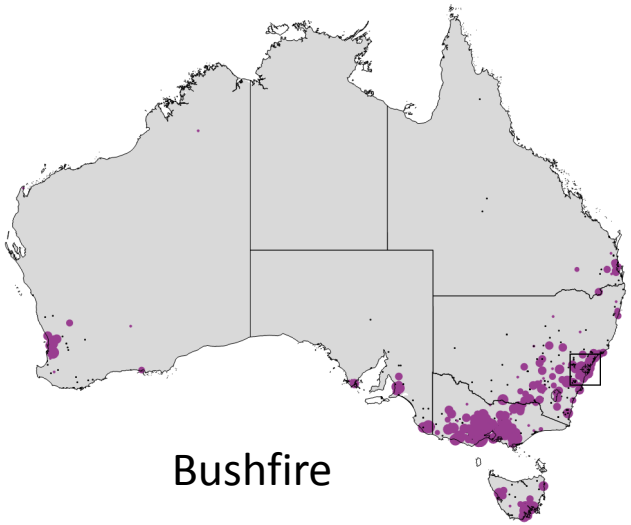
Objectives of the CRC project

To measure and understand the impacts of natural hazards in terms of

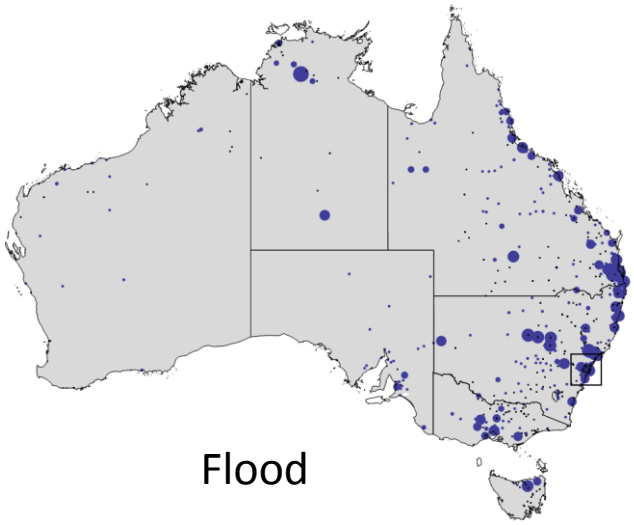
- the toll on human life and injuries, and
- building losses and damage

in order to provide an evidence base for emergency management policy and practise.

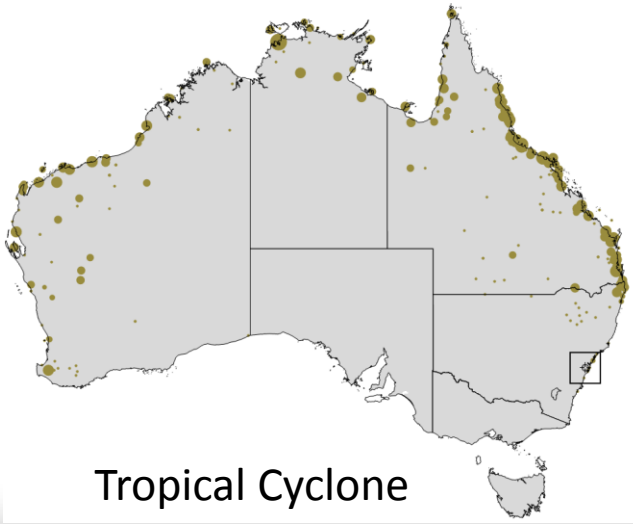
PerilAUS: A History of Natural Disasters



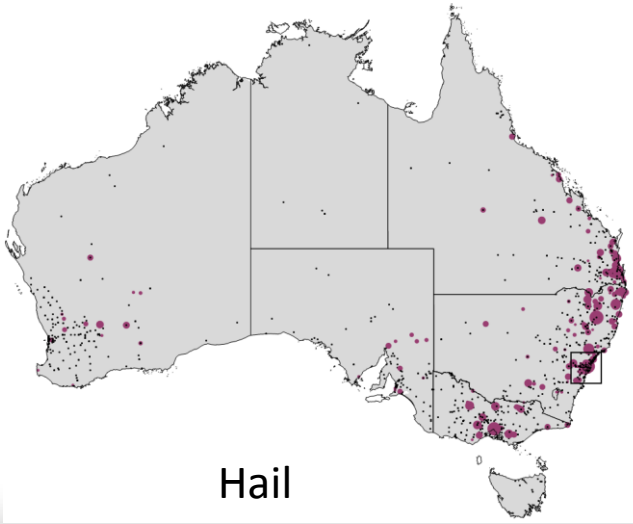
Bushfire



Flood



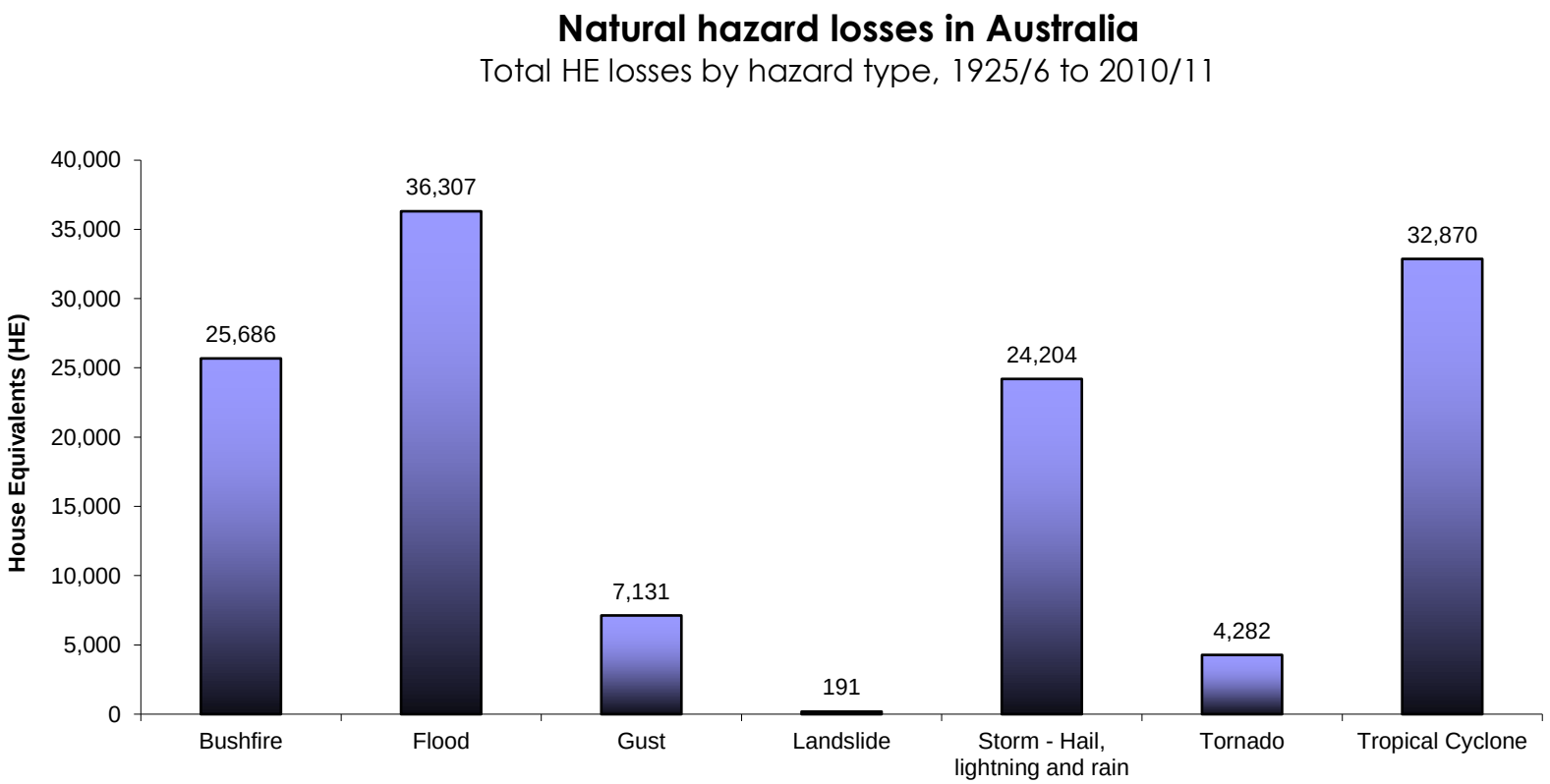
Tropical Cyclone



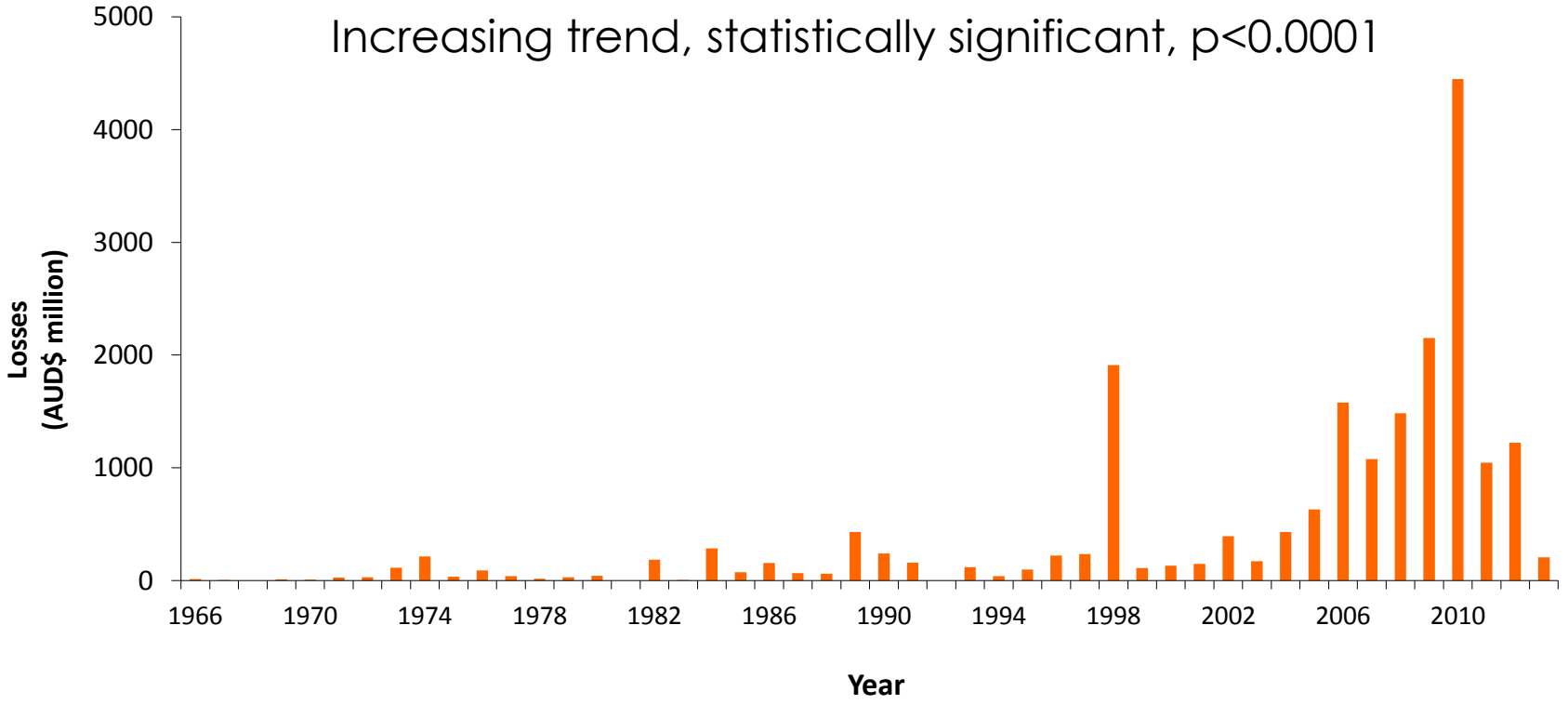
Hail

Historical event losses since 1926. Source: Risk Frontiers' *PerilAUS* database

PerilAUS: A History of Natural Disasters

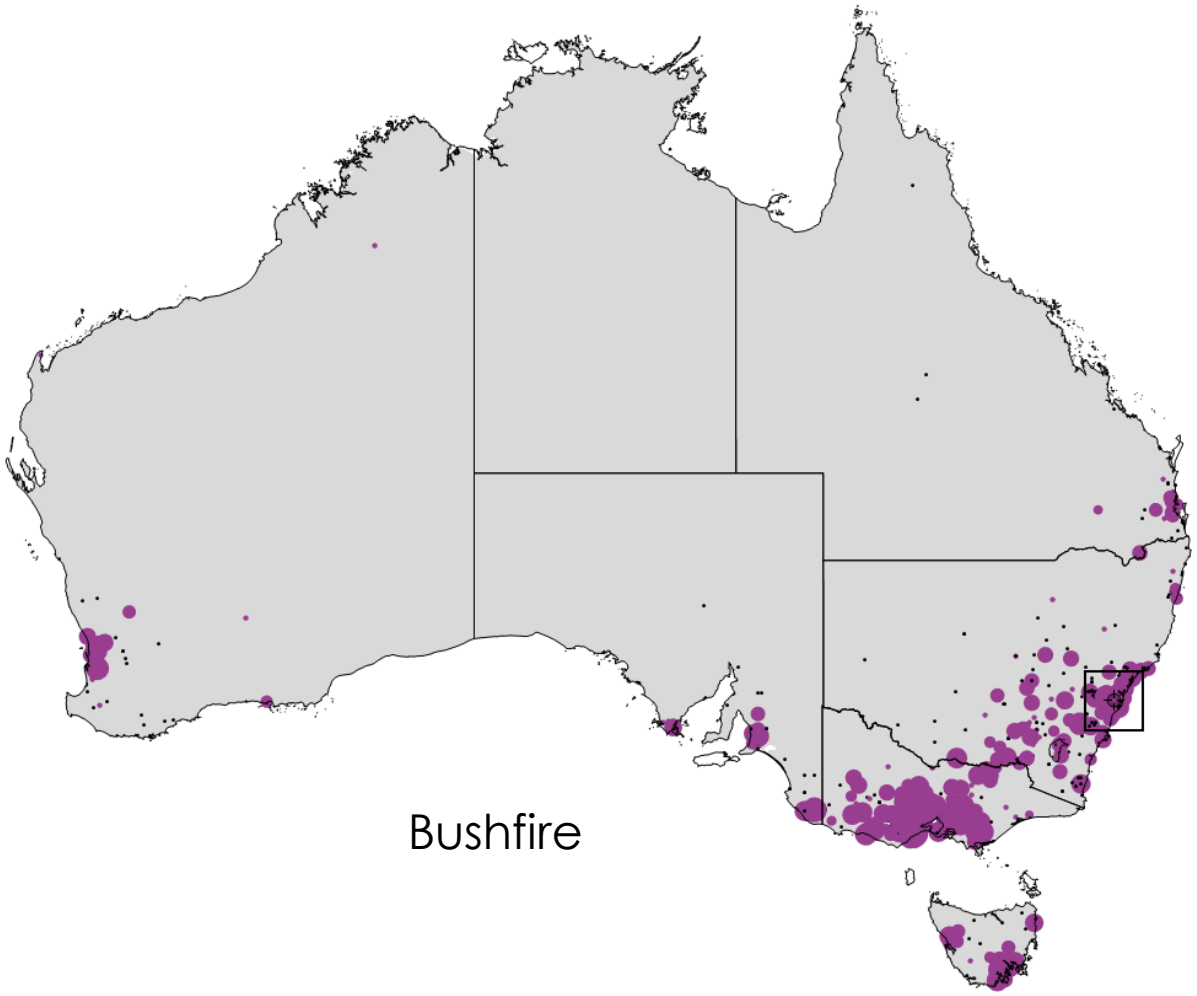


Australian weather-related natural disaster losses



(Crompton et al. 2010)

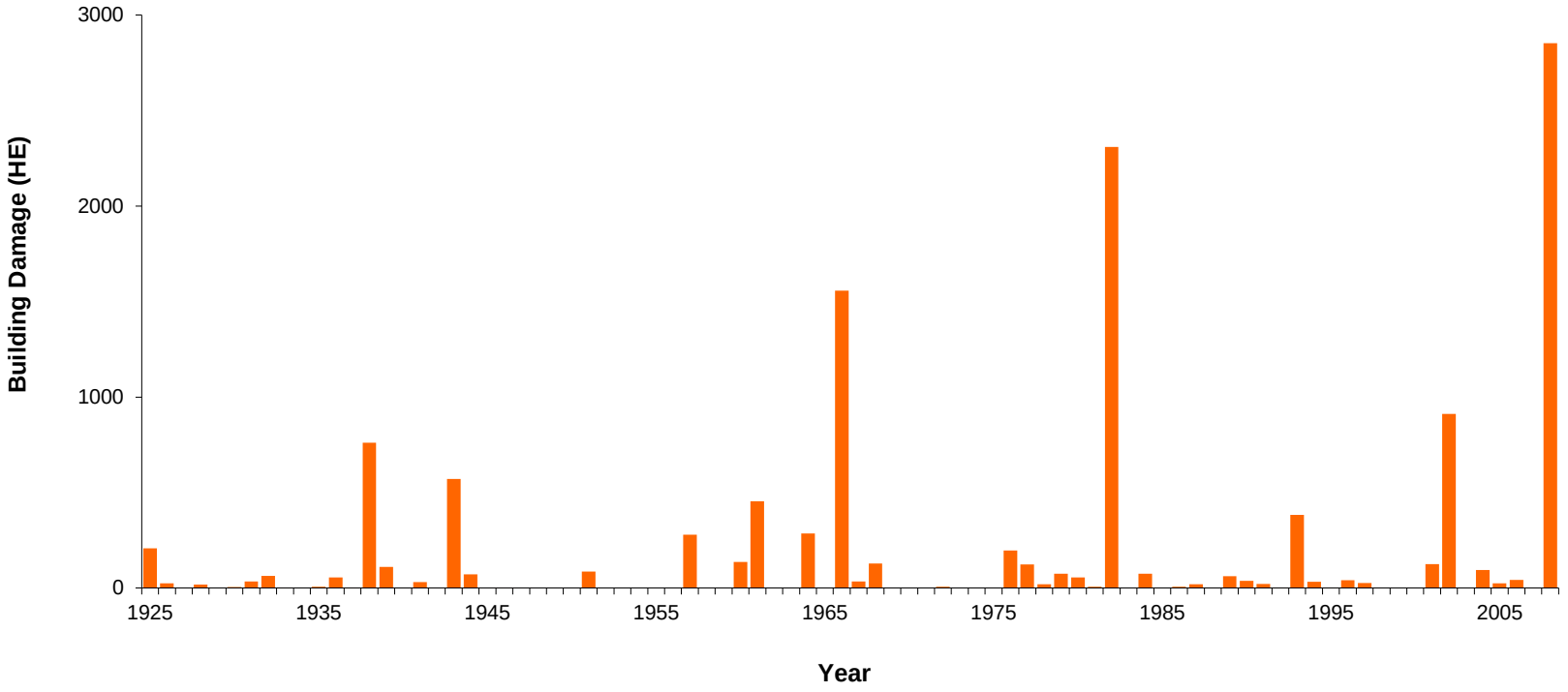
PerilAUS: A history of bushfires



Historical event losses since 1926. Source: Risk Frontiers' *PerilAUS* database

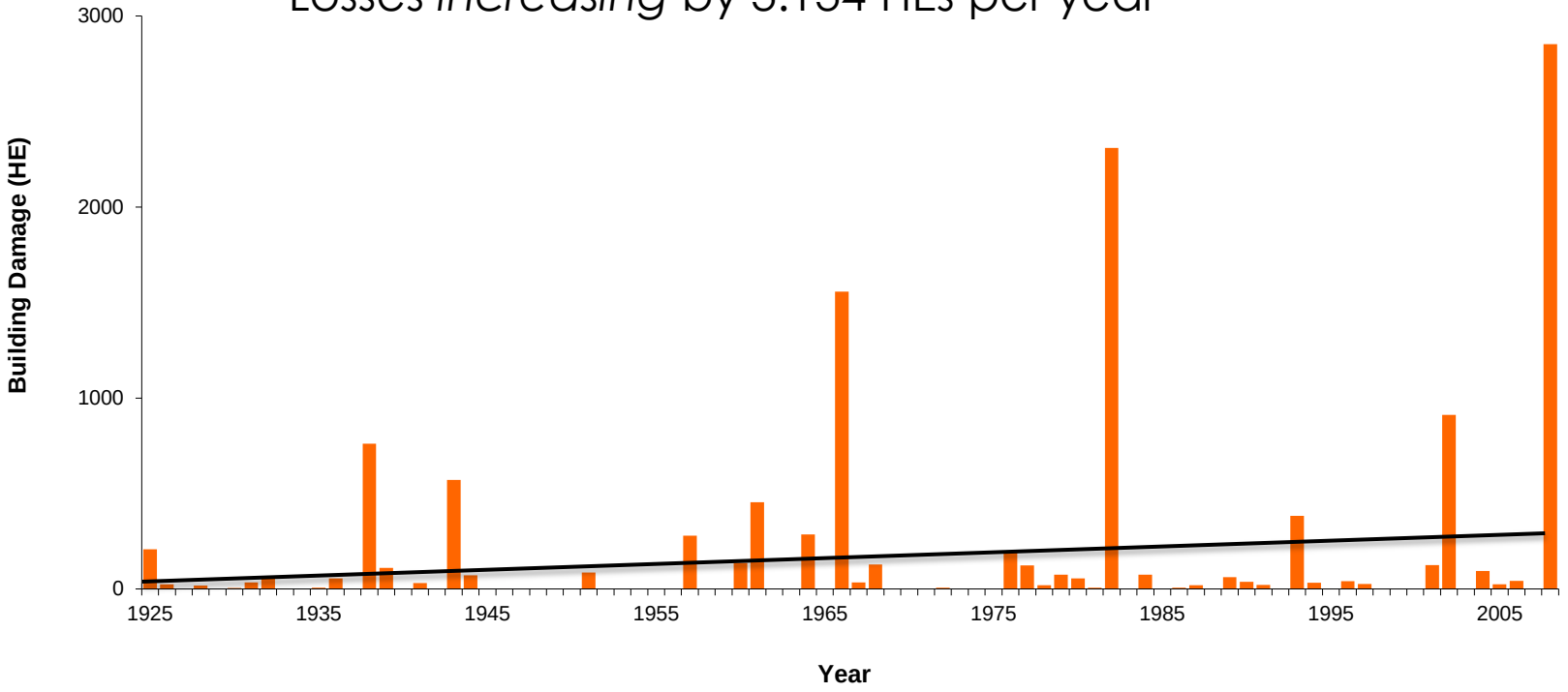
Building damage due to bushfire, 1925-2009

- Bushfire losses occur consistently across time
- HE – "house equivalent"



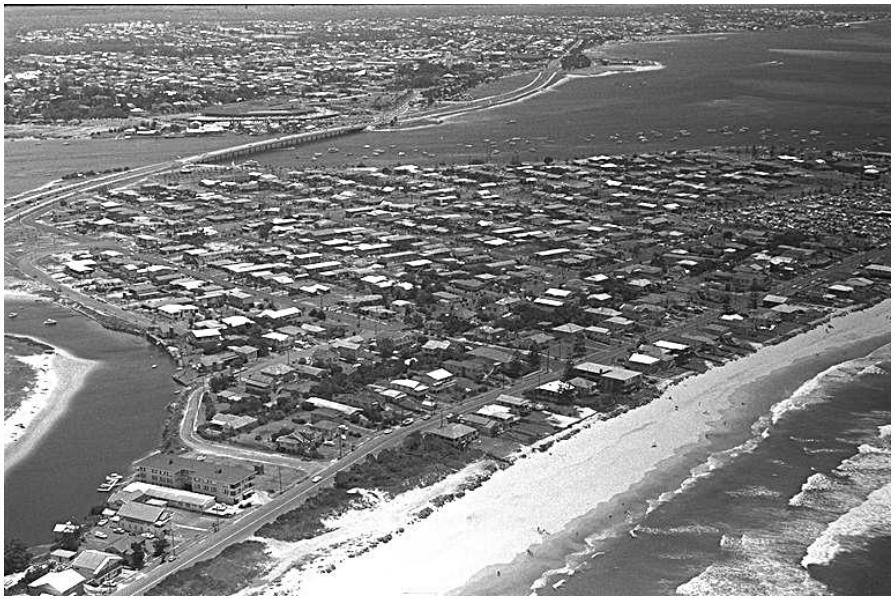
Building damage due to bushfire, 1925-2009

- Bushfire losses occur consistently across time
- HE – "house equivalent"
- A nearly statistically significant increasing trend (p=0.12)
- Losses *increasing* by 3.134 HEs per year



Australia – coastal developments

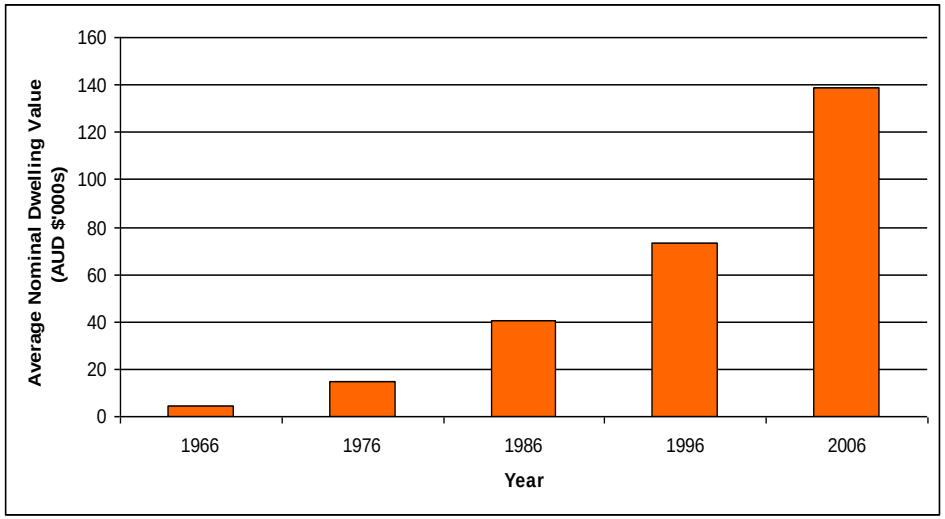
Gold Coast Main Beach
circa 1970



Gold Coast Main Beach
2003

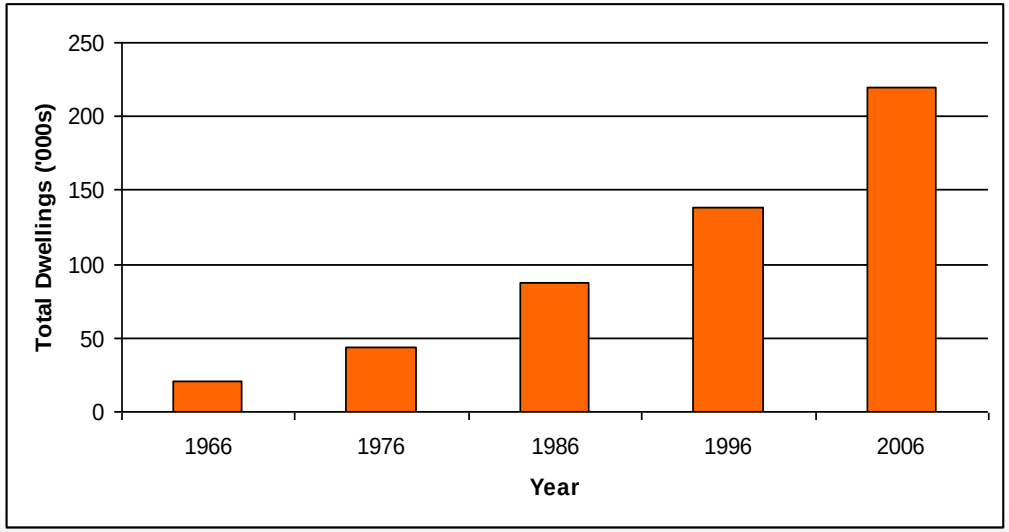
Source: Local Studies Library, Gold Coast City Council

Gold Coast - Tweed Heads



Cost per dwelling

Number of dwellings



Normalisation of natural disaster loss data

- *Normalisation* refers to the process of adjusting historical losses for known societal changes (e.g. numbers of homes, the value of these homes, and improvements in building codes and construction).
- Normalised losses effectively estimate the losses as if *past events* were to impact *present-day society* (i.e. an 'apples-versus-apples' comparison of event losses over time).

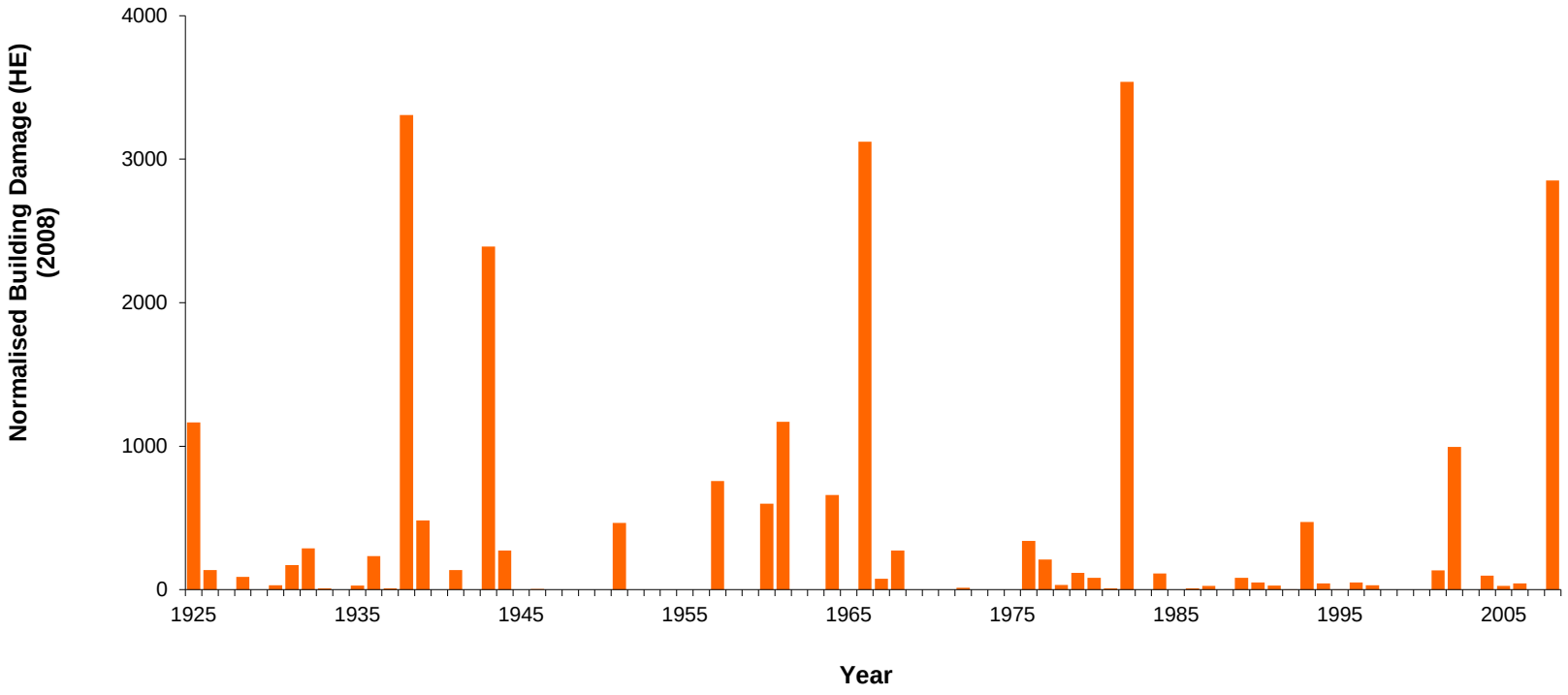
Major Australian Disaster Losses (normalised)

What perils have caused the greatest losses (in $ terms)?

Event	Ranking	Year	Normalised cost
Sydney hailstorm	1	1999	AU$ 4.3 billion
TC Tracy	2	1974	AU$ 4.1 billion
Newcastle earthquake	3	1989	AU$ 3.2 billion
Queensland floods	5	2011	AU$ 2.5 billion
Ash Wednesday fires	7	1983	AU$ 1.8 billion
Victoria fires		2009	AU$ 1.3 billion
Canberra fires		2003	AU$ 660 million
Hobart fires		1967	AU$ 610 million

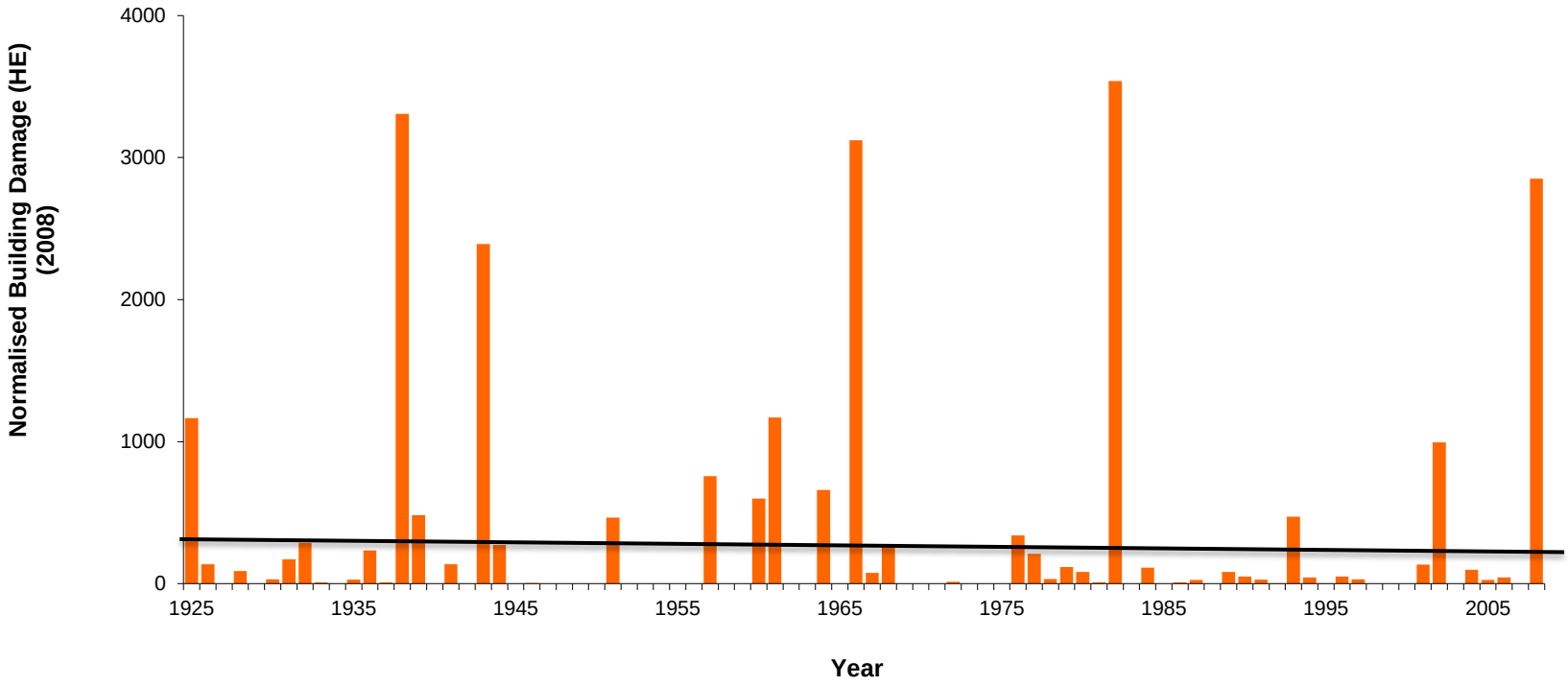
Normalised insured losses as if all events were to impact upon 2011 societal and demographic conditions .
ICA list since 1967 only. (Source: ICA/Risk Frontiers)

Normalised building damage due to bushfire, 1925-2009

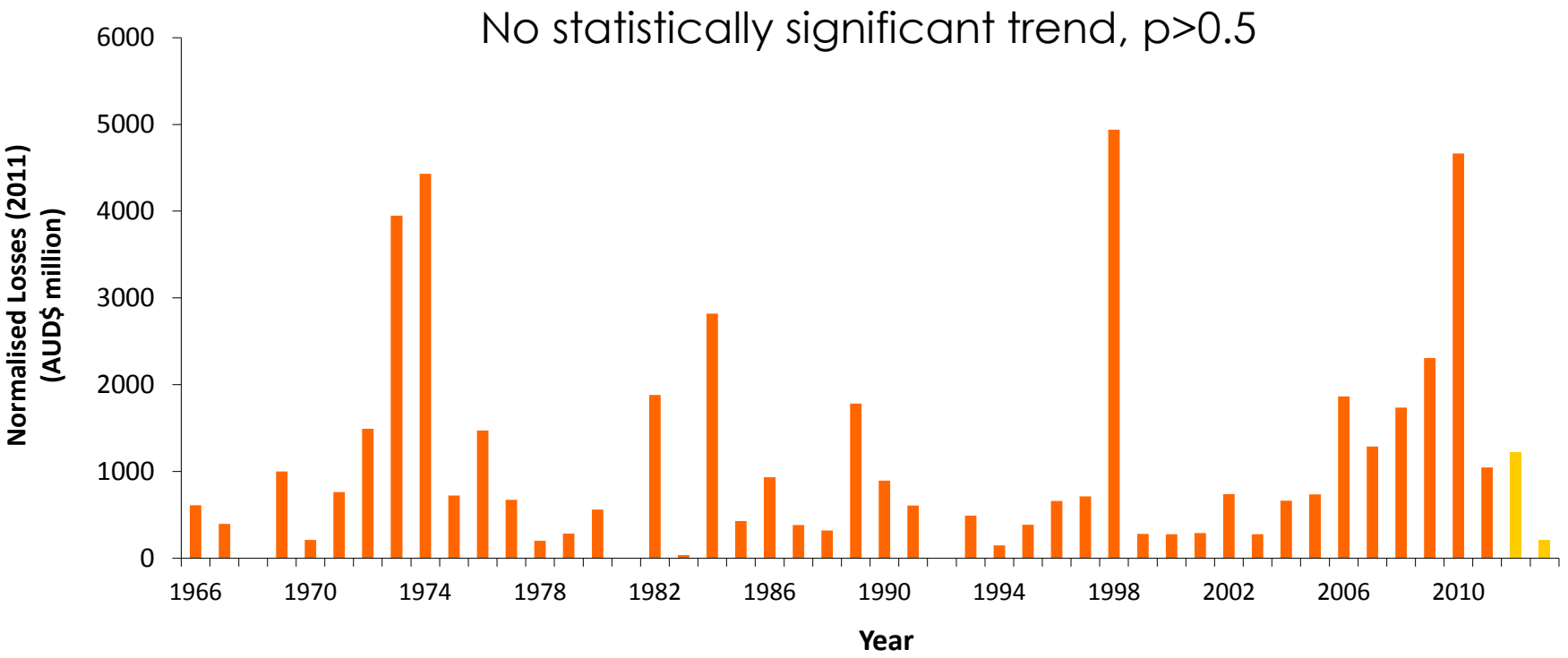


Normalised building damage due to bushfire, 1925-2009

- No statistically significant trend (p>0.5)
- Normalised building losses *decreasing* by 0.672 per year

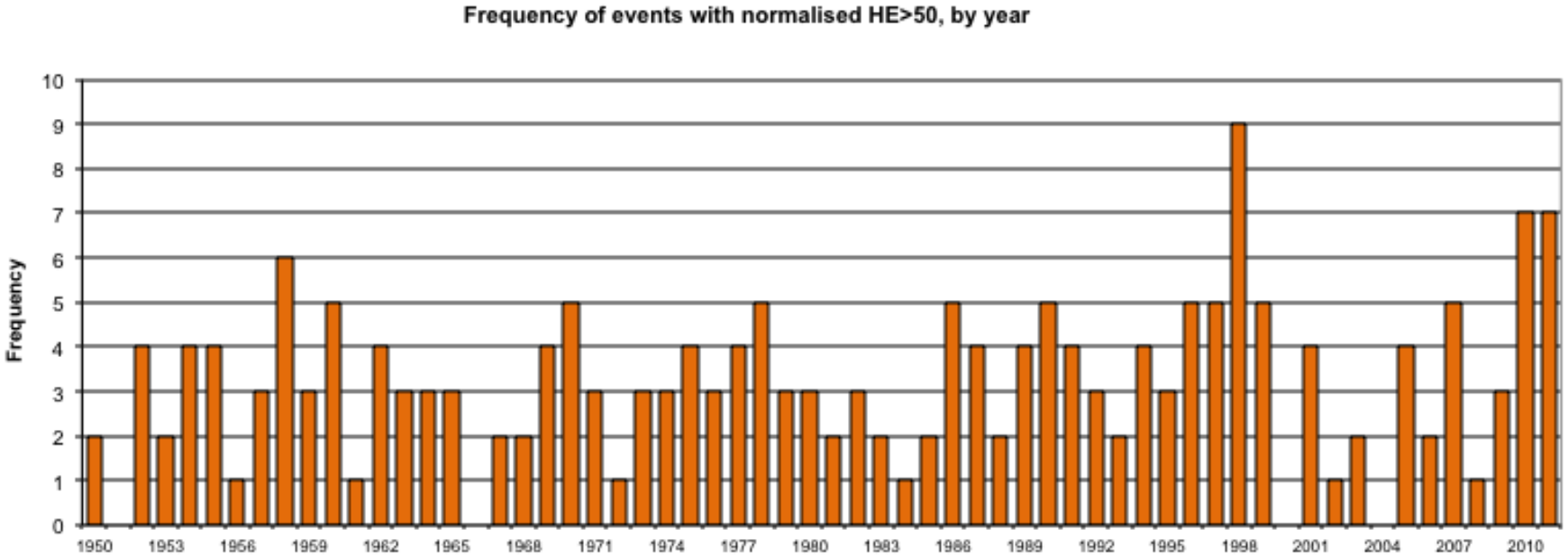


Normalised Australian weather-related natural disaster losses



(Crompton et al. 2010)

Australian bushfire frequency



- Normalised losses > 50 HE, i.e. fairly large fires only
- Slope is *not* statistically significant

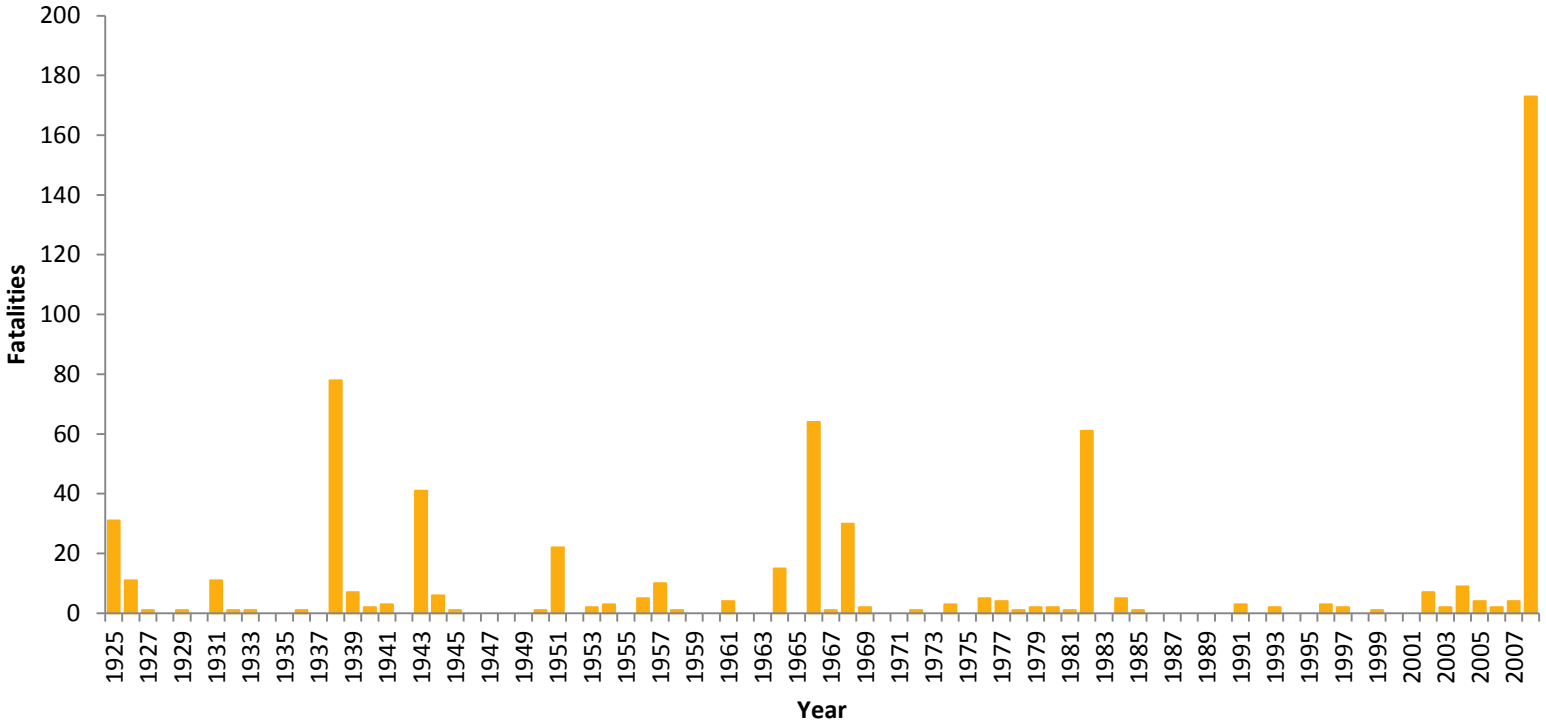
Natural hazard fatalities

Natural hazard	Deaths 1900–2011	% total natural hazard deaths 1900–2011
Extreme heat	4,555	55.2
Flood	1,221	14.8
Tropical cyclone	1,285	15.6
Bush/grassfire	866	10.5
Lightning	85	1
Landslide	88	1.1
Wind storm	68	0.8
Tornado	42	0.5
Hail storm	16	0.2
Earthquake	16	0.2
Rain storm	14	0.2

(Coates et al. 2014)

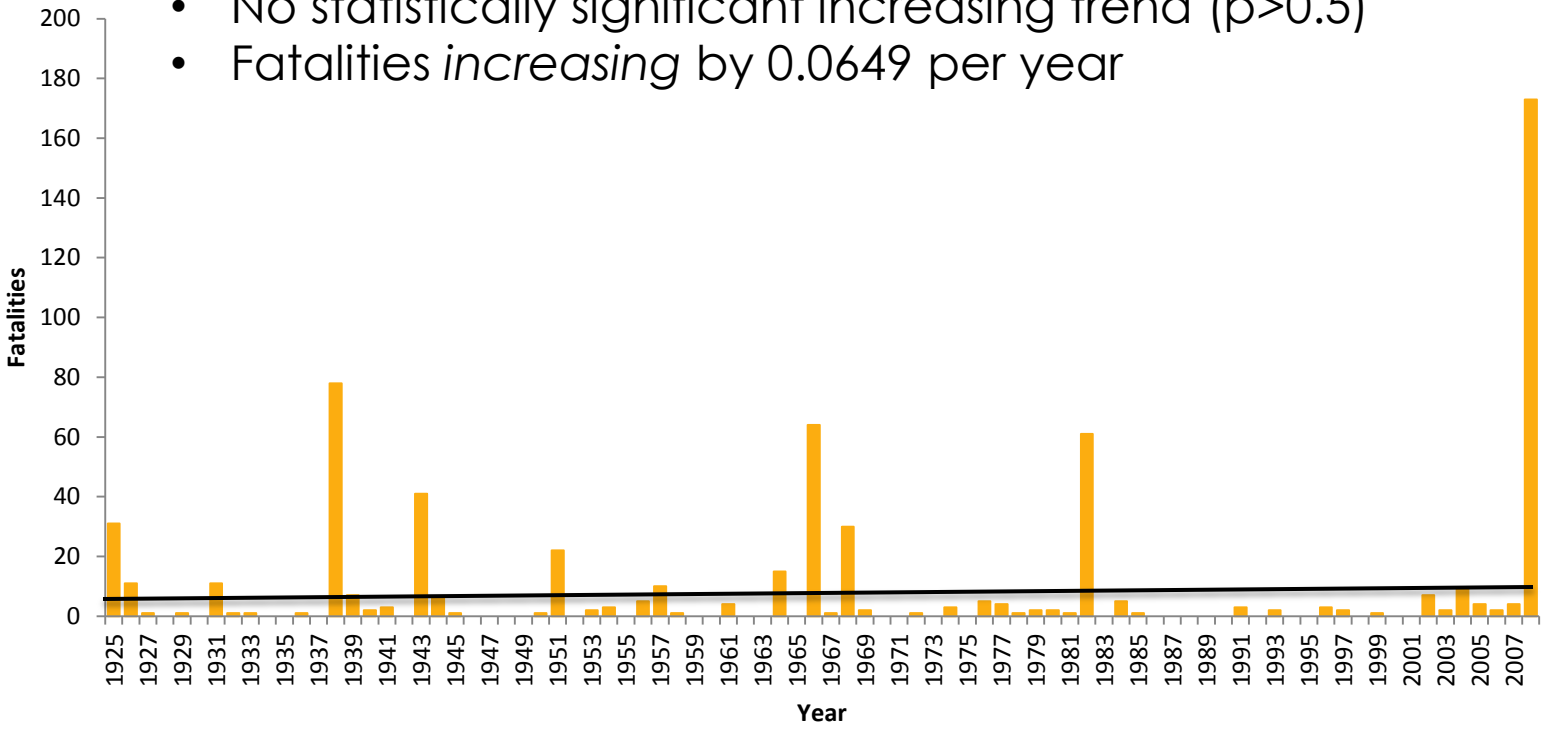
Bushfire fatalities, 1925-2009

- Bushfires with fatalities occur consistently across time

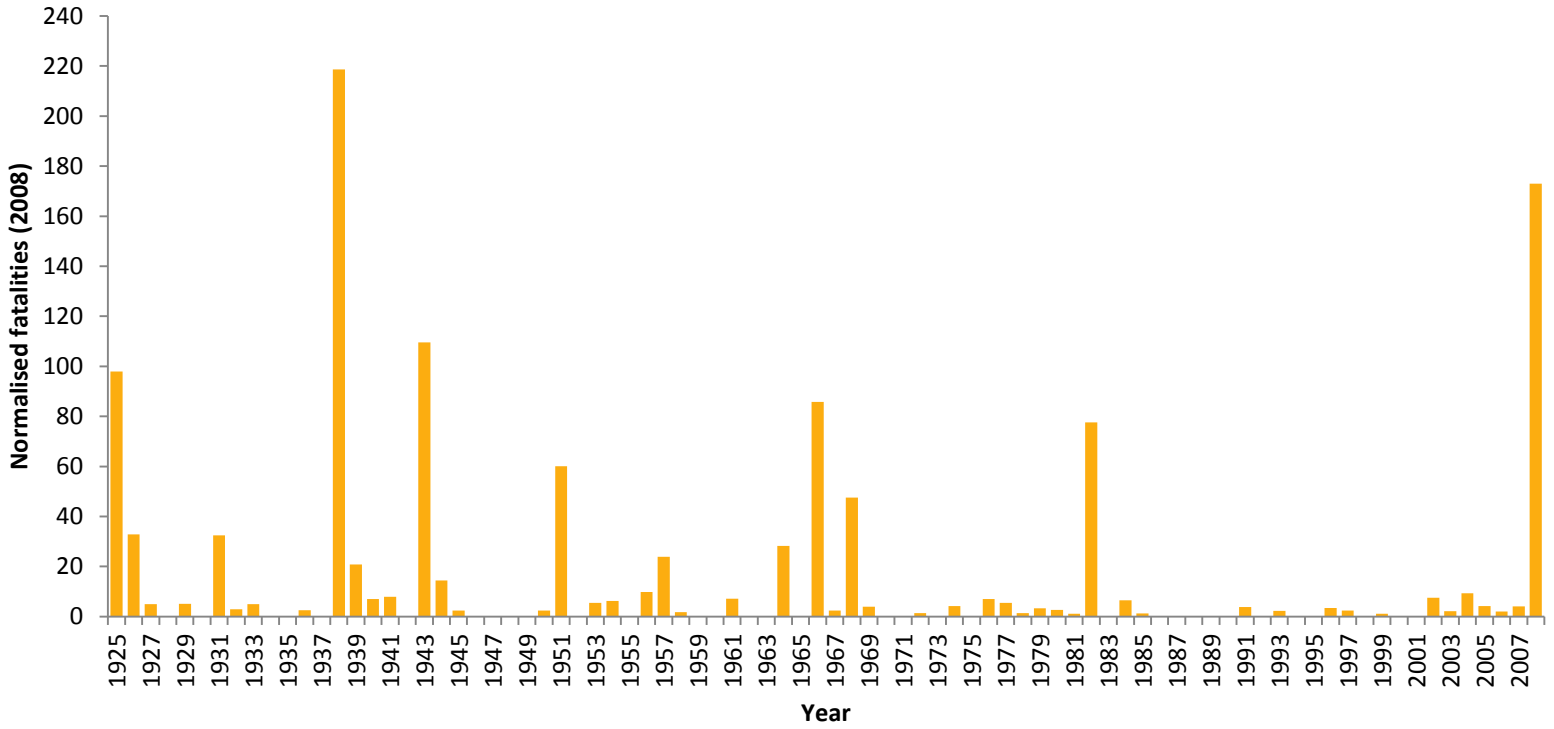


Bushfire fatalities, 1925-2009

- Bushfires with fatalities occur consistently across time
- No statistically significant increasing trend (p>0.5)
- Fatalities *increasing* by 0.0649 per year

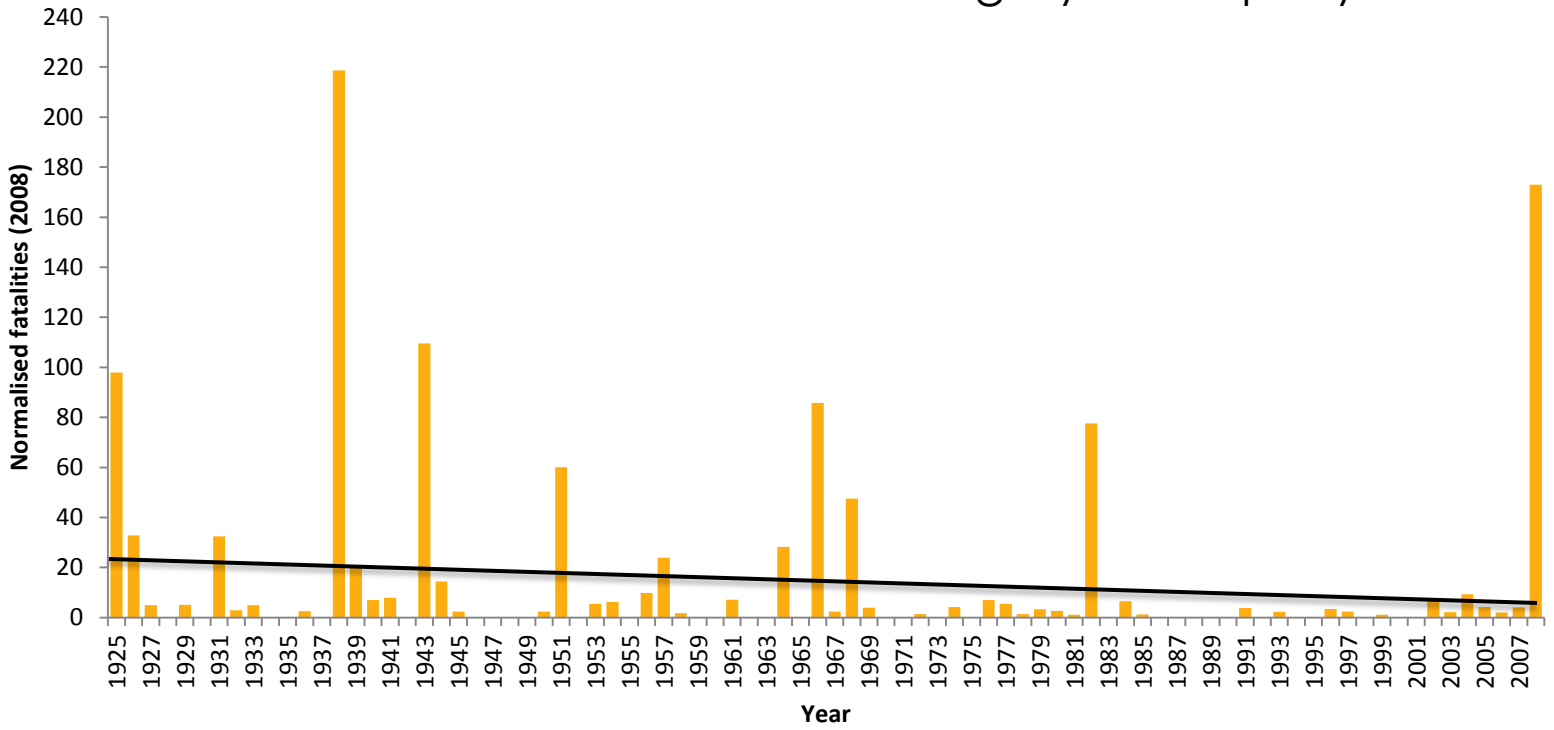


Bushfire fatalities, 1925-2009, *normalised* by population



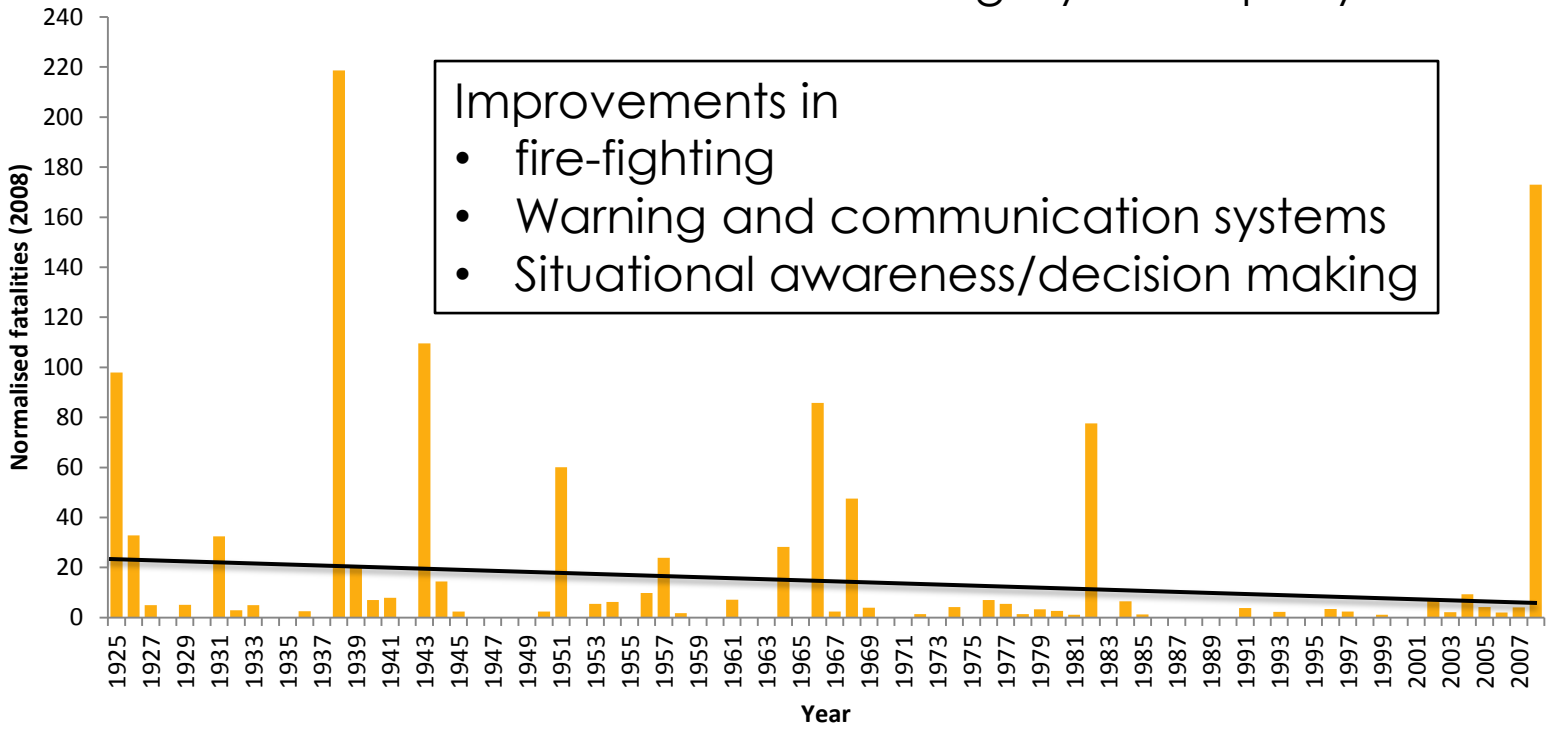
Bushfire fatalities, 1925-2009, *normalised* by population

- No statistically significant (p>0.2)
- Normalised fatalities *decreasing* by 0.1761per year



Bushfire fatalities, 1925-2009, *normalised* by population

- No statistically significant (p>0.2)
- Normalised fatalities *decreasing* by 0.1761per year



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MODELLING BUSHFIRES AND THEIR CONSEQUENCES

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MAIN POINTS

1) Importance of distance to bushland as indicator of risk

2) Random nature of fires – variability of outcomes?

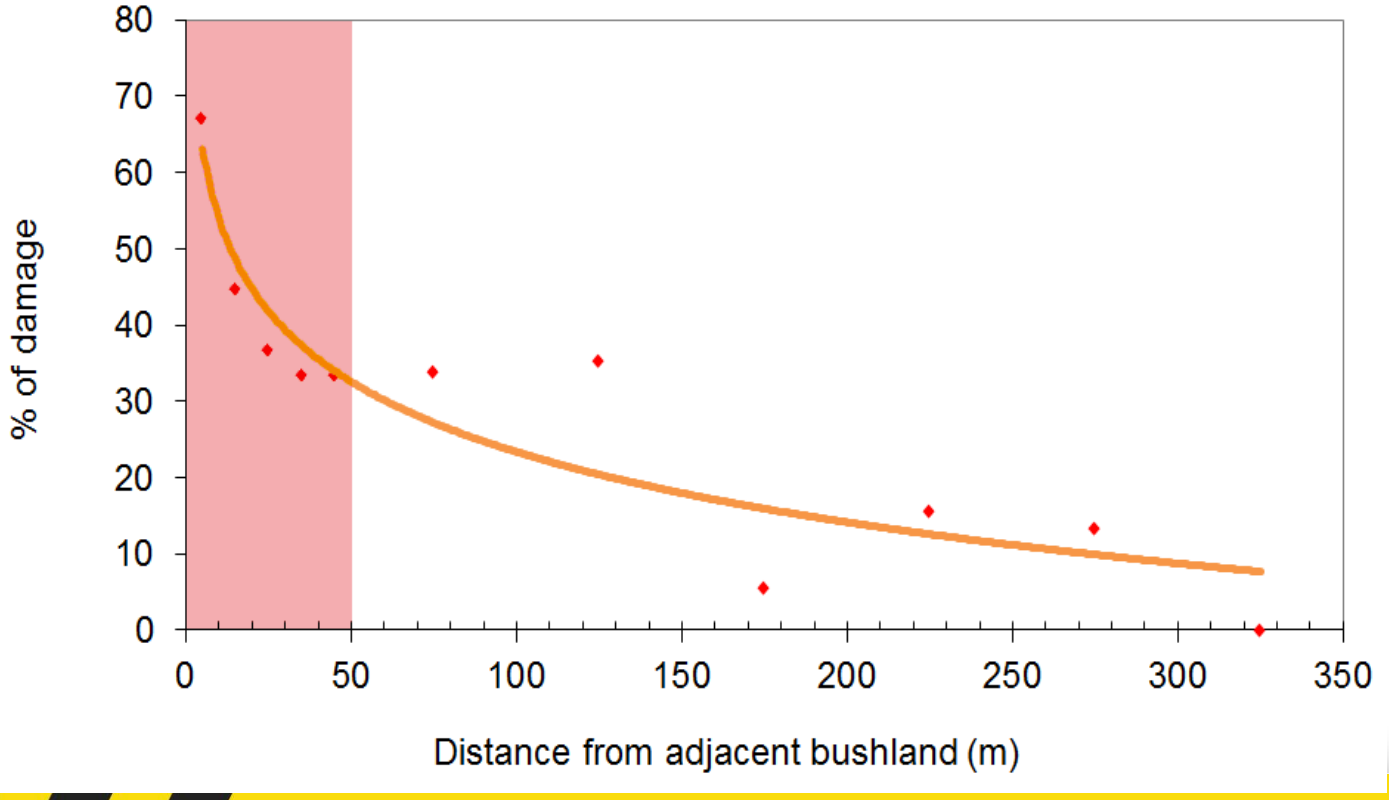
3) Is there a patterns in property damage?

4) What can be realistically done for large fires?

Springwood, Blue Mountains: Oct 2013

BUILDING VULNERABILITY

Closer to bushland have to contend with radiant and convective heating and direct flames, in addition to increasing ember loading.

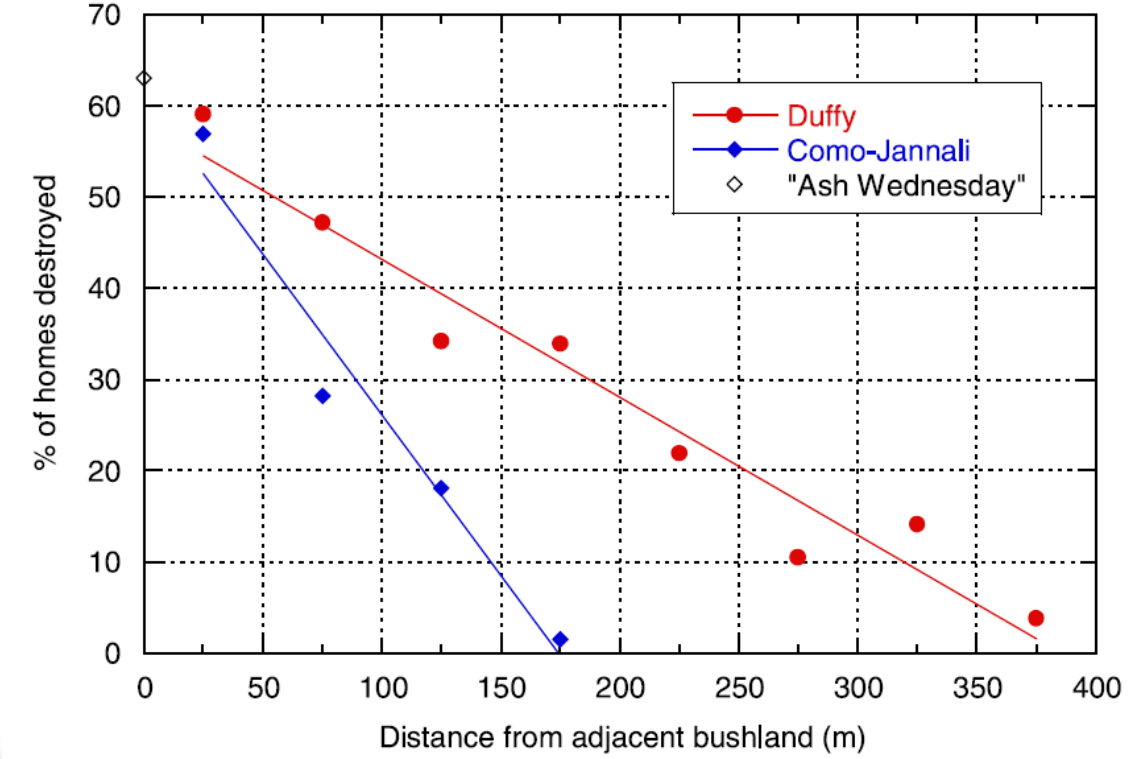


Function of % of houses destroyed with distance to the bush

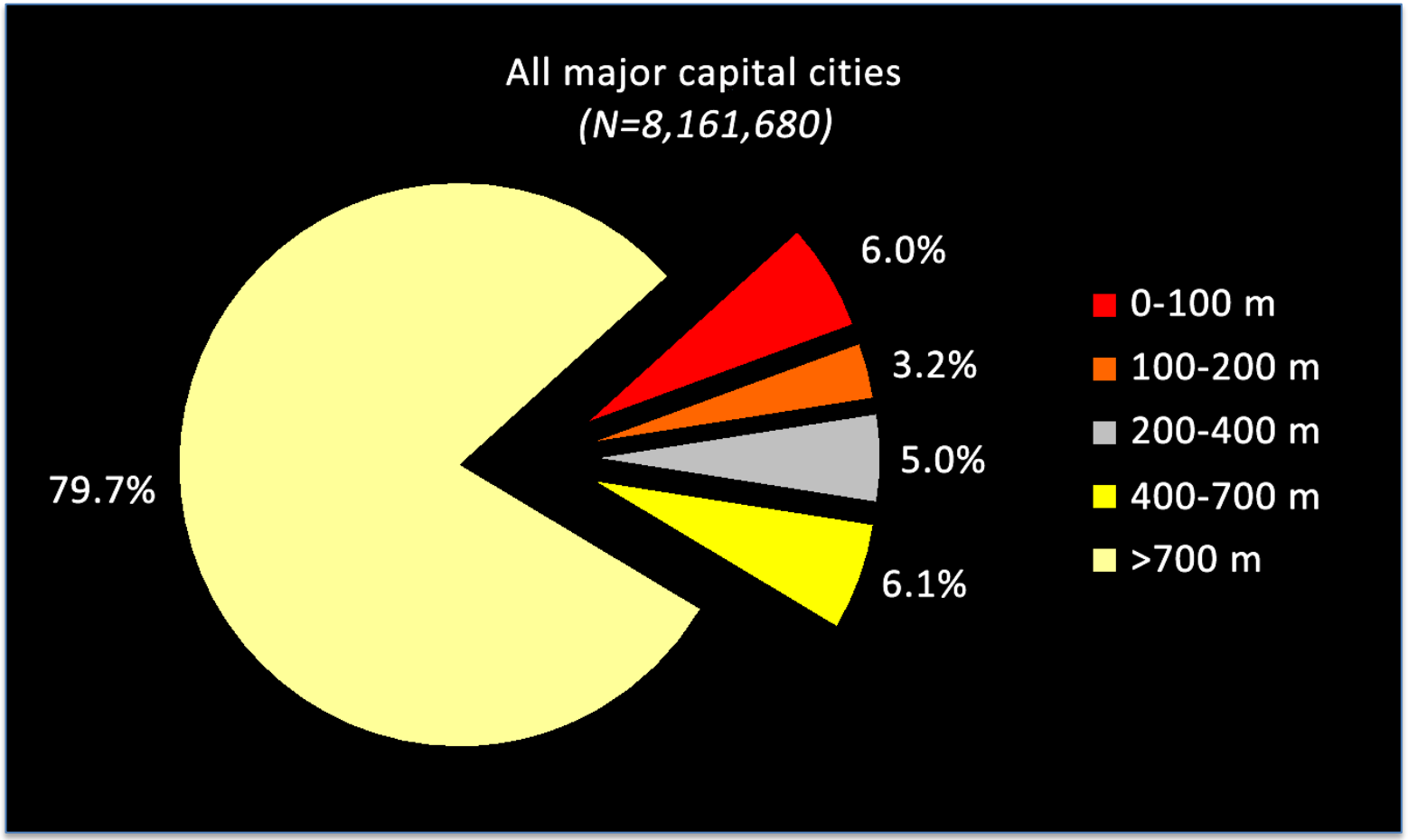
(Source: Risk Frontiers research)

BUILDING VULNERABILITY

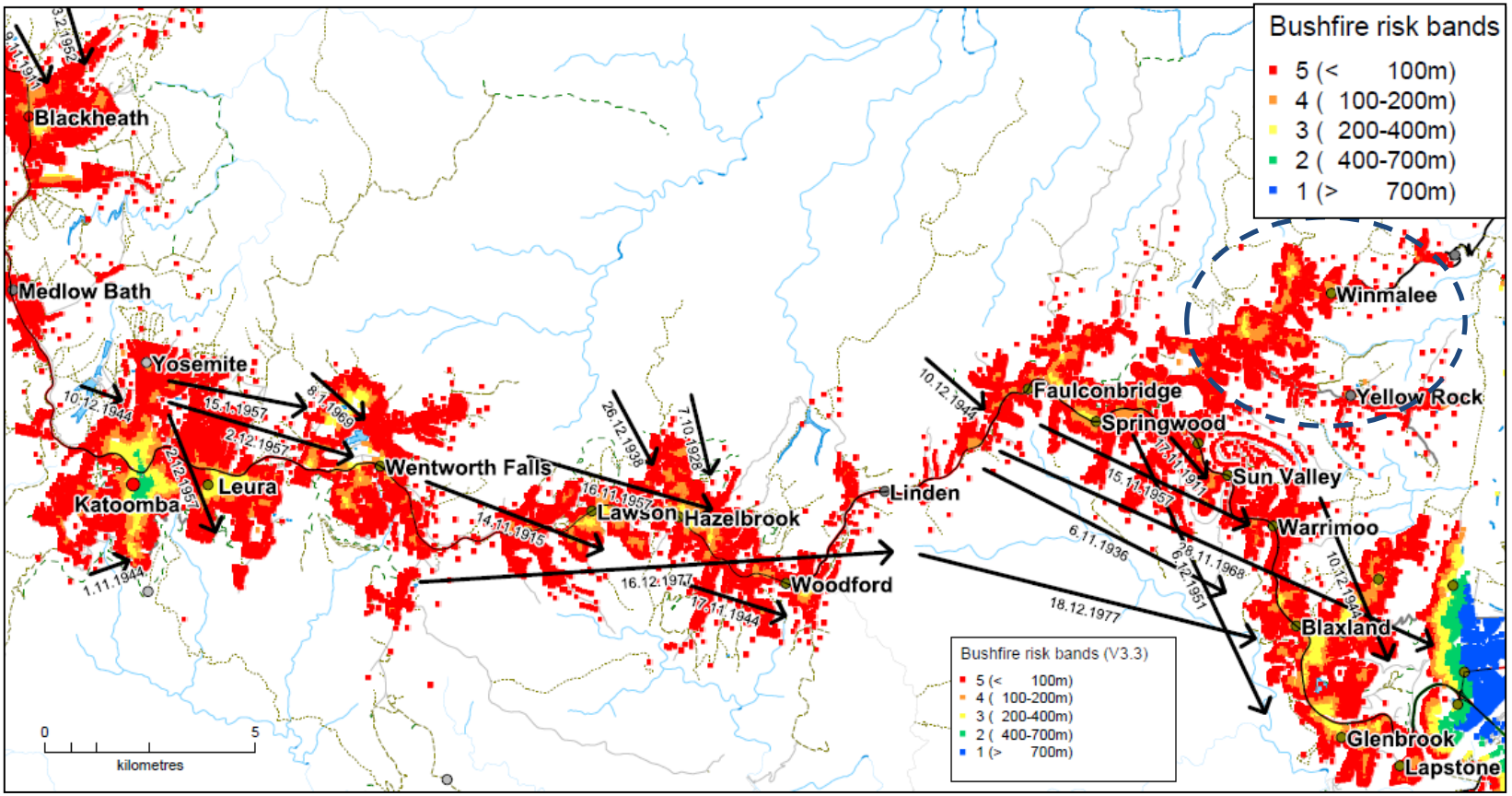
Research shows that beyond 50 m of bushland building vulnerability to ember attack is well modelled as a simple linear function



Bushfire prone properties – about 500,000 in the first 100 m from fire-prone bushland

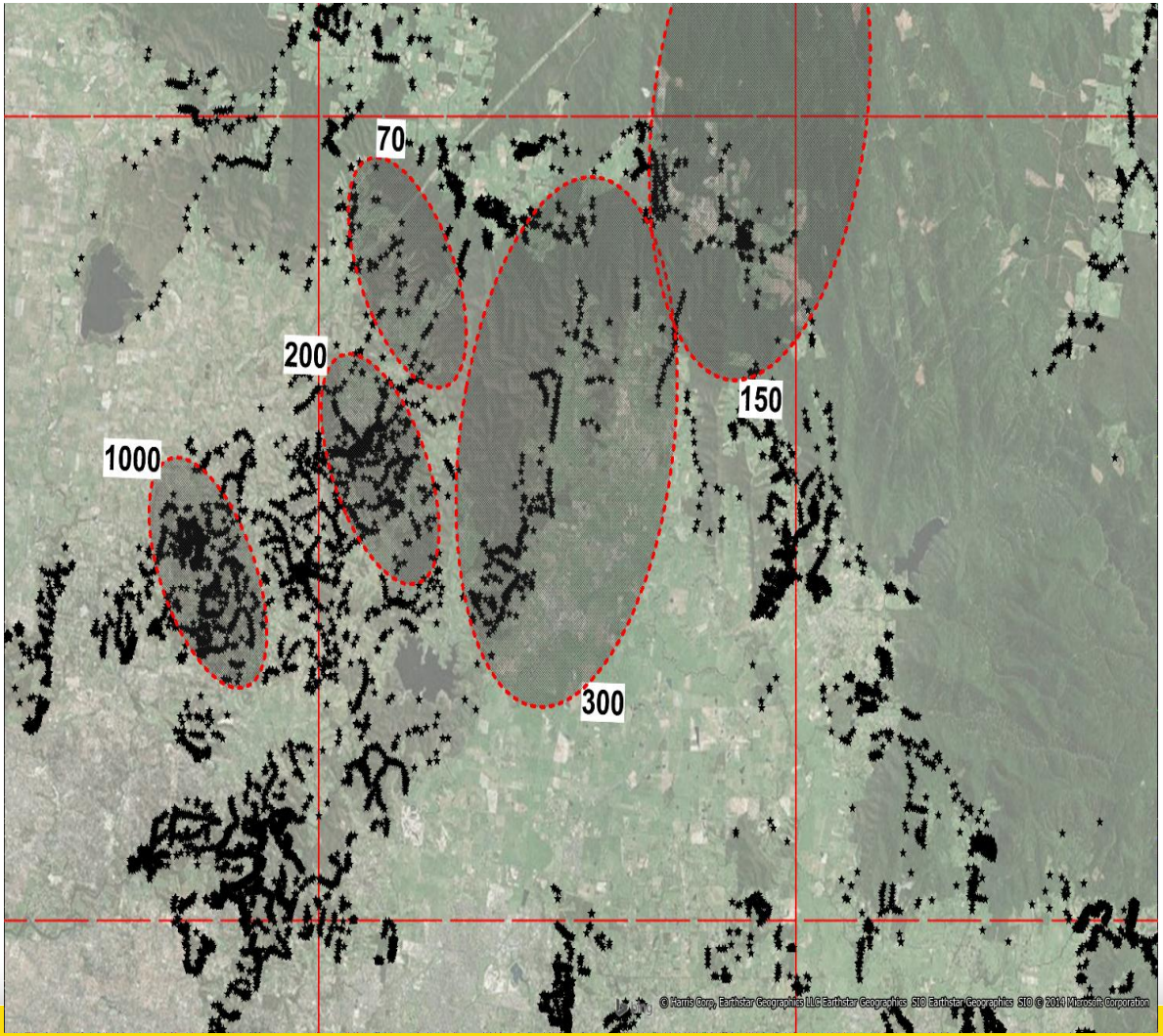


HISTORICAL BLUE MOUNTAINS' BUSHFIRES



Historical fire trajectories (1911 – 1977) overlain on current exposure

BUSHFIRE FOOTPRINTS



Number of addresses less than 100m of the bush

VULNERABILITY VS. BUILDING TYPE

Tasmania Jan 2013

17/10/2013 Blue Mountains

Empirical evidence from other historical major fires:

- 1967 Hobart fires
- 1983 Ash Wednesday fires in SA/VIC
- 1994 Como-Jannali fires in Sydney
- 2003 Canberra fires
- 2009 Black Saturday fires

BINARY DAMAGE RATIOS

Jan 2013 Tasmania fires

QUESTIONS?

1) What can be done against large fires?

2) Should volunteer firefighters be risking their lives to save homes of people who chose to live close to fire-prone bush?

3) Should we get serious about land-use planning and in particular distance of homes to bushland?

4) Should we focus more on risk communication? – accepting that it's difficult and no one does it well

THANK YOU!

http://www.riskfrontiers.com/

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