HAZARD NOTE

bushfire&natural HAZARDSCRC

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TOPICS IN THIS EDITION | RISK ANALYSIS | MODELLING | MULTI-HAZARD

ABOUT THESE PROJECTS

This is an overview of the *Scenario and loss analysis* cluster of Bushfire and Natural Hazards CRC research projects. This cluster has two linked studies:

1. **An analysis of building losses and human fatalities from natural disasters** – Dr Katharine Haynes, Lucinda Coates, Andrew Gissing, Dr Deanne Bird, Dr Rob van den Honert and Dr Ryan Crompton, Risk Frontiers, Macquarie University.
2. **Using realistic disaster scenario analysis to understand natural hazard impacts and emergency management requirements** – Dr Felipe Dimer de Oliveira, Dr Paul Somerville, Dr Valentina Koschatzky, Dr Kevin Roche, Dr Deanne Bird, Professor John McAneney, Dr Rob van den Honert, Dr Katharine Haynes, Andrew Gissing, Risk Frontiers, Macquarie University, and Dr Matthew Mason, University of Queensland.

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CONTEXT

This cluster focuses on understanding the historical costs to Australia from natural disasters and how we can develop scenarios for future planning. The understanding of historical losses and human fatalities is a fundamental first step to enabling efficient and strategic risk reduction.

In turn, the development of a series of natural disaster scenarios allows a quantification of their impacts on society, critical infrastructure, lifelines and buildings, and where possible, the natural environment. This enables understanding of the possible implications, supporting the emergency management sector to better prepare for, or mitigate impacts of, events beyond current experience.

LEARNING FROM THE PAST, PLANNING FOR THE FUTURE

▲ **Above:** FLOODING IN BRISBANE IN JANUARY 2011. PHOTO: ISTOCK

AN ANALYSIS OF BUILDING LOSSES AND HUMAN FATALITIES FROM NATURAL HAZARDS

BACKGROUND

This project is measuring and gaining a greater understanding of the impacts of natural hazards in terms of the toll of human life, injuries and building damage in order to provide an evidence base for emergency management policy and practice. Trends over time will be interpreted in the context of emerging issues (e.g. ageing population, population shifts, building codes). Research will also provide an analysis of building damage by hazard and state/territory.

RESEARCH ACTIVITY

This project covers all hazards, but to date has focused on floods. This has involved examining coronial inquests for each state and territory, as well as visiting various archives and coronial offices in order to add more data around the circumstances of each fatality. Work is also concentrating on updating the data on the physical characteristics of the floods where a fatality occurred.

RESEARCH OUTCOMES

Research has so far uncovered 1,131 fatal flood events, accounting for 1,854 fatalities. The names of the deceased for 1,635 of these fatalities are now known. Flood data (names of the deceased and circumstances around each fatality) is complete for the following jurisdictions:

- Up to 1953 for South Australia.
- Up to 1962 for New South Wales.
- Up to 1978 for Queensland.
- Up to 1985 for Victoria.
- Up to 2014 for Tasmania.

Obtaining and analysing data for Western Australia, the ACT and the Northern Territory is ongoing, as is updating the data to as current as possible for the above states.

Although the focus has been on floods, work updating data for other hazards, particularly in terms of the names of fatalities, has also been conducted. Those states and territories with smaller numbers of deaths (Tasmania, South Australia and the Northern Territory) enabled information to be collected for all hazard fatalities during visits to various records offices.

A general overview of heatwave fatalities has also been completed. It was found that between 1844 and 2010, extreme heat has been responsible for a least 5,332 fatalities, more than the combined total number of deaths for all other natural hazards. Over 30% of these fatalities occurred during just nine extreme heat events.

USING REALISTIC DISASTER SCENARIO ANALYSIS TO UNDERSTAND NATURAL HAZARD IMPACTS AND EMERGENCY MANAGEMENT REQUIREMENTS

BACKGROUND

Realistic disaster scenarios can be used to facilitate response planning and policymaking. They allow emergency managers to visualise the impacts of plausible events before they happen. For this study, the scenarios are classed as realistic because they have not occurred previously, but have a high likelihood of occurring and causing extensive damage. As many details as possible are taken into account, such as likely infrastructure damage, likely injuries and fatalities, loss of essential services and utilities and short- and long-term impacts of the disaster.

RESEARCH ACTIVITY

In consultation with end users, the study has so far conducted two scenarios: a major earthquake with its epicentre beneath Adelaide, and a severe tropical cyclone off the Queensland coast (this scenario is currently being finalised).

Catastrophe loss models (CAT-models) are used to determine the impact of the scenarios. These are mathematical representations of natural disasters, and are developed from statistical analysis of past event data, guided by engineering and technical knowledge and expert judgement. CAT-models consist of three modules: a hazard module, which expresses the probability and intensity of natural processes leading to damage; a vulnerability module, which calculates the amount of human or material loss due to a natural hazard; and an exposure module, which provides the location and quantity of assets at risk.

The next stage of the research will investigate:

- The long-range effects of natural disaster damage, e.g. how damage to roads will affect hospitals. A series of floods in New South Wales will be modelled for this scenario.
- Vulnerable populations, e.g. the elderly, the very young, low socio-economic status, recent migrants etc. This will be modelled using the example of a heatwave affecting one or more Australian metropolitan regions.

▲ **Above:** TO HELP AGENCIES PREPARE FOR FUTURE DISASTERS, RESEARCH IS MODELLING THE POTENTIAL IMPACT OF DISASTERS THAT ARE BEYOND OUR EXPERIENCE, SUCH AS A MAJOR EARTHQUAKE AFFECTING A CAPITAL CITY. PHOTO: JOHN MCCOMBE, NEW ZEALAND RURAL FIRE SERVICE

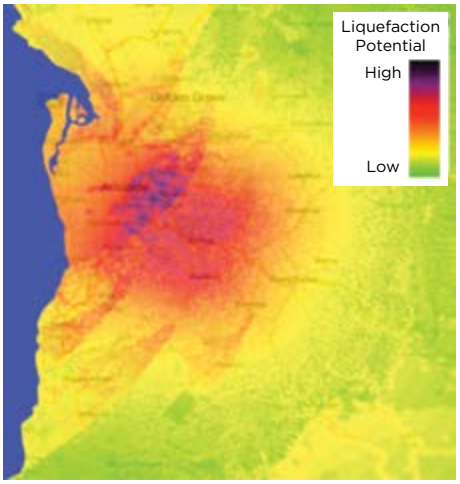
RESEARCH OUTCOMES

Adelaide is situated on and near a number of faults. Its largest recorded earthquake was in 1954, with a magnitude of 5.6. Fortunately its epicentre was far from populated areas, however today this area is densely populated. What would happen if a similar earthquake took place in Adelaide today?

Research modelled a magnitude 6 earthquake occurring on the Para Fault at a depth of seven kilometres, with an epicentre seven kilometres from the Adelaide CBD. The scenario considered the impacts if the earthquake occurred at 2am and 2pm, as these times were expected to result in the highest casualties.

It is predicted that an earthquake like this would result in a large number of homes being destroyed or unsuitable for occupation. For both time periods, casualties could be in excess of 300, with over 100 life-threatening injuries expected. Basic medical aid that could not be self-treated is estimated to be required for approximately 5,000 people.

Worst-case scenarios such as this will help emergency services plan and prepare for natural disasters beyond our current experience.



▲ **Above:** RESEARCH MODELLED THE POTENTIAL IMPACT OF AN EARTHQUAKE ON ADELAIDE. THIS IMAGE SHOWS THE LIQUEFACTION POTENTIAL.

END USER STATEMENT

Both projects are proof of concepts for unleashing data and modelling for emergency planning. These projects will provide a useful repository of information that can be used as an evidence base across many hazards.

A lot of data already exists on fatalities, and much more needs to be updated. So we need to look at how we will exploit this data better. One area is how historical analysis will allow agencies to look at trends in deaths to see what the implications for community safety policies are – measuring the effect of current polices and developing updated polices and approaches.

Scenario modelling of large scale disasters will allow a range of assumptions to be tested against how we plan and respond. The data developed and the ways we explore to present it will provide crucial insights for agencies, allowing us to plan for these worst case scenarios.
– Simon Opper, Senior Planning Officer (Knowledge and Intelligence), New South Wales State Emergency Service.

The Bushfire and Natural Hazards CRC is a national research centre funded by the Australian Government Cooperative Research Centre Program. It was formed in 2013 for an eight-year program to undertake end-user focused research for Australia and New Zealand.

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