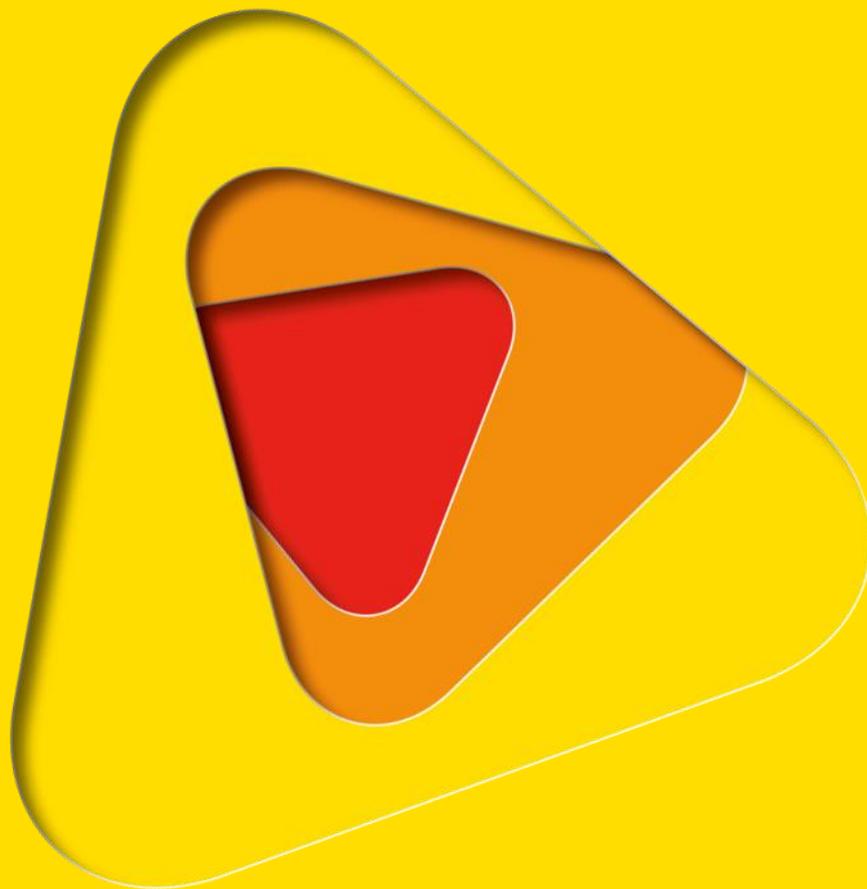


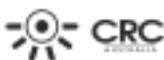


# NATURAL HAZARDS EXPOSURE INFORMATION MODELLING FRAMEWORK

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Geoscience Australia  
Bushfire and Natural Hazards CRC

**Annual Report 2014**





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# Natural Hazards Exposure Information Modelling Framework

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GEOSCIENCE AUSTRALIA

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**Australian Government**  
**Geoscience Australia**



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# **NATURAL HAZARDS EXPOSURE INFORMATION MODELLING FRAMEWORK**

## **CONTEXT**

### **What is the Problem?**

Disaster Risk Reduction (DRR) is a systematic approach to identifying, assessing and reducing the risks from natural hazards. A disaster's severity depends on how much impact a hazard has on exposure (communities and environment). The scale of impact in turn depends on the choices we make as a part of disaster mitigation. Exposure information is a fundamental requirement for decision-making in disaster mitigation. The information needed for DRR should be nationally consistent, follow standards and consist of a comprehensive list of elements to support various levels of disaster governance.

### **Why is it Important?**

Natural hazards have a profound impact on the Australian communities. The Hyogo Framework for Action (HFA, United Nations 2005) and subsequent national strategies such as the Australian National Strategy for Disaster Resilience (NSDR 2011), highlight the importance of assessing risks and preparing for them. Communities are subject to the damaging impacts of disasters caused by destructive bushfires, floods, and severe storms. The impacts of these disasters on people, economy, infrastructure and environment remind us of the need to continue improving our resilience to disasters (NSDR, 2011).

Current disaster preparedness strategies often focus on building resilience for known disaster risks. However, disasters are characterized by interdependent and systemic risks that can trigger cascading effects (Lorenz et al., 2009) which are hard to predict. The 'unexpected' is already part of life for many communities. For this reason, there is an urgent need to investigate ways to prepare for what we are not able to predict or to communicate to the communities (Antonella, 2014).

To address this issue and support disaster mitigation initiatives, provision of comprehensive exposure information is fundamental for risk assessments and to underpin decision making for disaster mitigation. An exposure information modelling framework is a significant step towards developing national exposure information capabilities for Australia.

### **How are we going to solve it?**

Improvement in the availability of relevant, consistent and high quality exposure information will assist decision making in all phases of disaster mitigation such as planning, preparedness, response and recovery, at federal, state and local government levels. An exposure information framework assists in developing and promoting more unified national information capabilities within an appropriate conceptual framework.

Geoscience Australia (GA) has developed a nationally consistent exposure information capability: 'National Exposure Information System (NEXIS)', to assist the development of risk assessment capabilities for GA's Community Safety program. NEXIS has also been augmented to meet requirements for climate change adaptation guidelines. However, NEXIS is not comprehensive enough to support all hazards and levels of disaster management.

Building on the existing NEXIS framework with the support of BNHCRC research funding, GA will prepare a comprehensive exposure information modelling framework. The framework will be designed to provide pathways to improve current capabilities by identifying

key issues, needs, gaps, overlaps and deficiencies to build exposure information capabilities.

## **BACKGROUND KNOWLEDGE**

A good understanding of the risk of natural hazards is vital to minimise their potential impact (Middlemann, 2007). An understanding of hazard, exposure and vulnerability is fundamental in any rigorous analysis of the risk posed by natural hazards. Exposure is the collection of elements at risk to potential losses (UNISDR, 2009) or that may suffer damage due to a hazard impact. Exposure refers to the communities, businesses, services, lifeline utilities and infrastructure subjected to risk. Exposure information is fundamental in the development of risk-assessment models for natural hazards, lifeline and infrastructure failures and also consequences of climate change (Nadimpalli, 2014). Exposure data is also highly useful to underpin early warning systems and support national priority outcomes as described in the National Disaster Resilience Strategy (NSDR, 2011): Understanding risks; Reducing the risks in the built environment; and, Supporting capabilities for disaster resilience.

GA has developed an exposure database, National Exposure Information System (NEXIS), which provides information about building attributes at a range of resolutions (Nadimpalli, 2009). NEXIS provides physical exposure such as building counts as well as statistical aggregations of buildings at different geographic areas to assess the quantitative risk from natural hazards. NEXIS development was initiated in response to the Council of Australian Governments Report (COAG, 2002) to establish a nationally consistent system of data collection, research and analysis to ensure a sound knowledge base on natural disasters and disaster mitigation. The aim of developing NEXIS was to support GA's risk assessment capabilities and the Government's climate change adaptation policy framework. NEXIS information has supported several climate change adaptation initiatives including climate change risks to Australia's coast (Commonwealth of Australia, 2009).

Decision making at all levels of the disaster governance process is very complex and depends on multiple attributes, objectives, criteria and functions. A nationally consistent exposure information framework for natural hazard risk reduction provides pathways to strengthen existing information capabilities such as NEXIS and forms the basis of an essential element for decision making. To be effective the framework should also be aligned with the National Emergency Risk Assessment Guidelines (NERAG, 2014).

## **PROJECT ACTIVITIES**

This research project will draw upon reviewing the current literature on exposure information requirements and existing capabilities to develop a framework to improve information for disaster mitigation capabilities. These improved capabilities will provide more comprehensive, authoritative and reliable information for policy, business and community decisions to reduce risk.

The literature review will highlight the information needs for disaster risk reduction which is highly diverse and multi-disciplinary in nature. A number of International (Hygo Framework, Global Exposure Database Framework, Global Assessment Report), US (Disaster Resilience Workshops, Review of Integrated Risk Information System Process, Airborne Chemicals Exposure), New Zealand (RiskScape), Australia (NERAG, NSDR, NEXIS Stakeholder Engagement Workshop Reports, Emergency Management Information

Development Plan (Harper, 2006)), State (QLD Disaster Management strategic Policy Framework, Victorian Government Risk Management Framework) and local (Cities Projects) framework documents are being reviewed.

The start of this component has been delayed due to Commonwealth Government recruitment restrictions. GA has recently signed a research services contract with University of Canberra to provide a researcher to assist the project. Additional resources will be sourced from GA to convene the workshop in November 2014. This delay is not likely to have an impact on the milestone timelines.

*The research project has four components as outlined below:*

- **Built Environment Exposure Information Framework**

GA's existing NEXIS Framework is a baseline for the exposure information modelling framework. The framework comprises of asset location, buildings (residential, commercial, industrial and institutions), infrastructure (transport, energy, communications, water, waste management), and population demographics. Several BNHCRC research projects have linkages with this project and will be users of this information. Over the last few months, research projects from University of Melbourne, Victoria University, RMIT and other institutions like CSIRO have been consulted to better understand their immediate needs and gather information requirements..

- **Business-Economic Exposure Information Framework**

The economic exposure information requirements and known data sources for disaster mitigation, particularly to assess business continuity, disruption, recovery and resilience will be identified and integrated into the overall exposure modelling framework. The University of Melbourne will start working on this component from July 2014.

- **National Standards for Exposure Information**

Develop national exposure information standards and data dictionaries for the sector to ensure consistency. Geoscience Australia will start working on this component in consultation with stakeholders from July 2015.

- **Exposure Information Reliability Assessment Framework**

Develop a framework to assess uncertainty of the data to assist understanding its reliability for various uses. University of Canberra will start working on this component from July 2016.

## **PROJECT OUTCOME**

The modelling framework forms the basis of exposure information capabilities that have greater functionality to support impact and vulnerability assessments of population, buildings and essential infrastructure exposed to natural hazards. The project provides a framework to assess the reliability of exposure information for both tactical and strategic disaster management from multiple hazards. This will assist government (national, state and local) and industry end-users to better understand the reliability of exposure data for decision making.

The outcomes will be communicated to stakeholders through workshops, reports and conference/journal publications.

## **PROJECT STATUS AT THE END OF 2013/2014**

### **List of current integrated project team members**

Lead Researcher: Dr Krishna Nadimpalli (Geoscience Australia)

Researchers: Ms Itismita Mohanty (Geoscience Australia)  
Dr Yogi Vidyattama (University of Canberra)  
Dr Mohsen Kalantari (University of Melbourne)

Lead End users: Dr Leesa Carson (Geoscience Australia)  
Mr Ralph Smith (WA DFES)

End users: Mr Elloitt Simmons (NSW SES)  
Mr Shane Turner (SA DPTI)  
Mr Greg Howard (SA SAMFS)  
Mr Corey Shackleton (NSW RFS)  
Mr Greg Buckley (NSW F&R)

### **Project meetings held in 2013/2014:**

- Hardening Buildings and Infrastructure Cluster meeting. Melbourne. 18 December 2013.
- BNHCRC Research Advisory Forum. Adelaide. 18-20 March 2014.
- Participated in the Disaster Mitigation Workshop at Melbourne organised by Attorney Generals Department and CSIRO on 23<sup>rd</sup> May 2014.

### **Reports issued in 2013/2014:**

- Project management Plan
- 1<sup>st</sup> Quarterly Report (January 2014 - March 2014)
- 2<sup>nd</sup> Quarterly Report (April 2014 - June 2014)
- Annual Report 2014

### **Publications in 2013/2014:**

- Abstract – “Natural Hazard Exposure Information Modelling Framework for Disaster Management in Australia” accepted for poster presentation for AFAC Conference.

### **Agreements:**

- BNHCRC research Contract for Natural Hazards Exposure Information Modelling Framework (A multi-party agreement)
- GA-University of Canberra have signed a contract to provide a researcher.

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