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## ASSESSING AUSTRALIA'S RESILIENCE TO NATURAL HAZARDS

### ABOUT THIS PROJECT

This research was conducted as part of the *Australian Natural Disaster Resilience Index* project.

### AUTHORS

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### SUMMARY

This research has developed an index of disaster resilience that is designed to help meet the challenges of Australia's natural hazards. For the first time, this index will assess and report the state of disaster resilience on a large scale across Australia. The index will use a nationally standardised measure that will make it easy for end-users to identify areas of strength and areas needing improvement, to plan future actions, policies and programs, and provide a baseline from which to measure progress in disaster resilience.



▲ **Above:** EMERGENCY SERVICE VOLUNTEERS ARE CRUCIAL TO ENSURING THEIR LOCAL AREA CAN BOUNCE BACK AFTER AN EMERGENCY. PHOTO: SOUTH AUSTRALIA SES.

### CONTEXT

Extreme natural disasters usually cannot be prevented, but their risks can often be minimised, and impacts on people and property reduced. For Australian communities, 'disaster resilience' broadly means the capacity to cope with, adapt to, learn from and transform behaviour and social structures in response to a natural hazard and its aftermath.

The focus in managing natural disasters in Australia and internationally has in recent years moved from risk and vulnerability towards resilience, including an emphasis on shared responsibility. This shift towards disaster resilience recognises the uncertainties inherent in natural hazards.

These uncertainties range from the unpredictability of their location and impact, to the changing patterns resulting from changing climate and demographics.

Understanding how to improve disaster resilience will help communities, governments and organisations to develop the capacities needed for living with natural hazards.

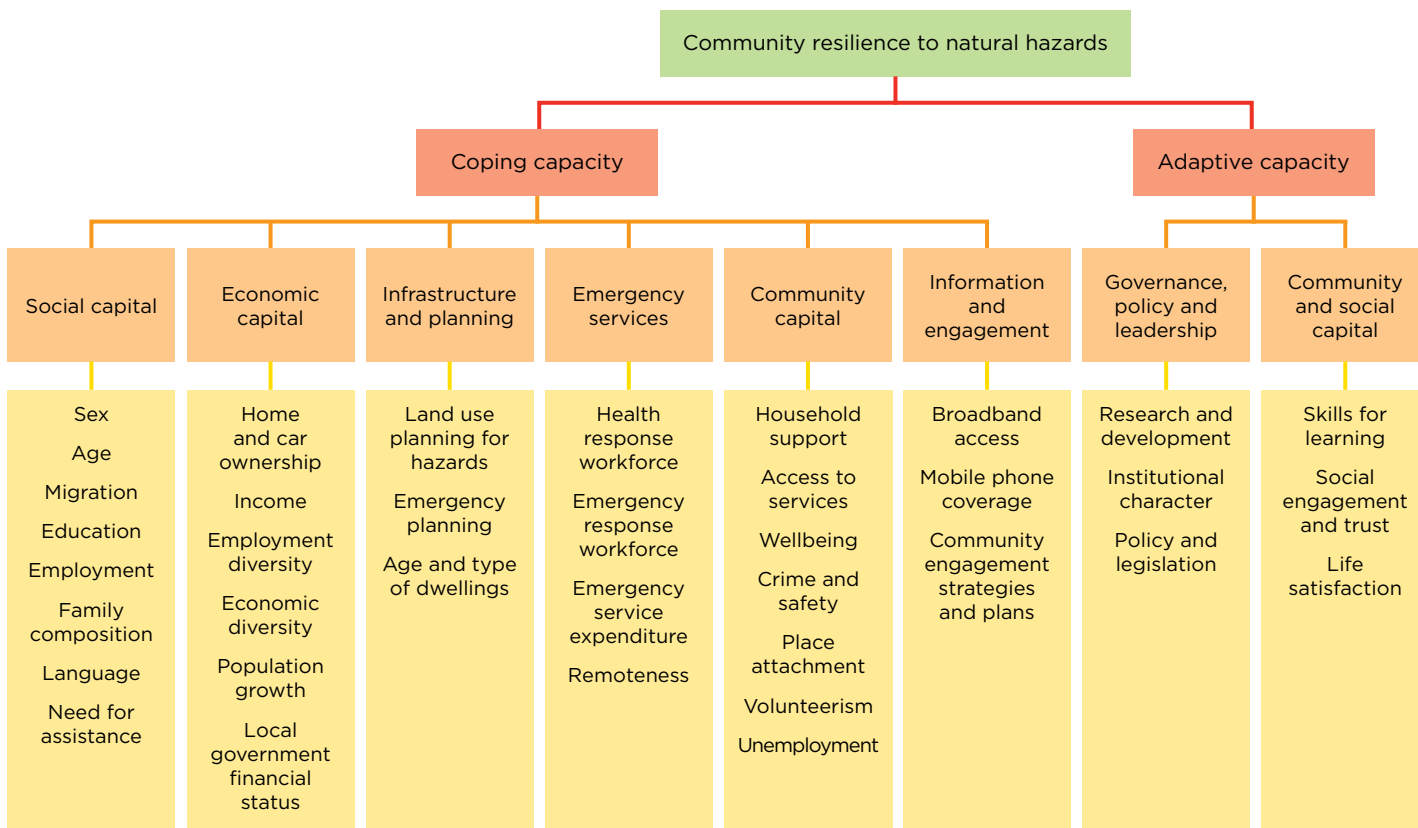
### BACKGROUND

Although resilience is increasingly the focus of natural hazard policy and program directions, there is no nationally standardised assessment of disaster resilience. An evidence-based assessment is crucial for identifying areas of strength and

areas needing improvement, for planning future actions, policies and programs, and to provide a baseline for measuring progress in disaster resilience at scales relevant to state and national policy and programs.

To address this critical gap in disaster management, this project has developed an index of disaster resilience applicable across Australia. The Australian Natural Disaster Resilience Index, developed in partnership with emergency service agencies across the country, will produce a consistent, spatially represented assessment of Australia's current state of disaster resilience and deliver its results as a State of Disaster Resilience report.

FIGURE 1: THE STRUCTURE OF THE AUSTRALIAN NATURAL DISASTER RESILIENCE INDEX\*



\* For brevity, indicators are listed as general areas.

## BUSHFIRE AND NATURAL HAZARDS CRC RESEARCH

### Design of the Australian Natural Disaster Resilience Index

Academic research on disaster resilience is diverse and active, and resilience is increasingly the foundation of public policies and programs in natural hazard and disaster management. There are many definitions of disaster resilience but they are consistent in three aspects.

These are the capacities to:

- absorb or accommodate the effects of an external disturbance or stressor event
- recover and return to a functioning state or to persist following an event
- learn, adapt or transform.

For the Australian Natural Disaster Resilience Index, disaster resilience is defined as the capacities of communities to prepare for, absorb and recover from natural hazards; and to learn, adapt and transform towards resilience.

Importantly, this definition does not highlight the actual realisation of resilience, but the capacities for resilience.

The design of the Australian Natural Disaster Resilience Index is based on two sets of capacities for resilience: coping capacities and adaptive capacities.

### END-USER STATEMENT

At their best, resilient communities are prepared, adaptable to changing situations, connected to each other and self-reliant.

Recent reports into disasters have identified that both governments and communities share responsibility for preparing for emergencies. And it is clear that governments bear a responsibility to support the community to build the knowledge, skills and protective behaviours that are essential to disaster resilience.

The Australian Natural Disaster Resilience Index will support national, state and local governments and, most importantly, communities. The ability to identify hot spots of high or low disaster resilience in Australia will potentially embed disaster resilience into policy and legislation, and increase shared responsibility and resilience across Australia.

**- Suellen Flint, Director Community Engagement, Department of Fire and Emergency Services, Western Australia**

Coping capacity enables people and organisations to use their available resources and abilities to face adverse consequences. These factors influence the capacity of a community to prepare for, absorb and recover from a natural hazard.

Adaptive capacity enables a system to modify or change its characteristics and behaviours to cope with actual or anticipated stresses. It involves deliberate, incremental and transformational change across social, government and economic systems. These factors enable responses and behaviours to adjust through learning, adaptation and transformation.

### Index structure and indicators

The Australian Natural Disaster Resilience Index has a hierarchical design (Figure 1, above). The first level of the hierarchy comprises the coping and adaptive capacity dimensions. Within these are eight themes expressing the main elements of coping and adaptive capacity. The lowest level has the indicator sets that measure the status of a theme.

Coping capacity consists of six themes that express the availability of resources and abilities to prepare for, absorb and recover from a natural hazard: social character; economic capital; infrastructure

**TABLE 1: DEFINITION AND DESCRIPTION OF COPING AND ADAPTIVE THEMES**

THEME	DEFINITION	DESCRIPTION OF THEME
<b>Coping capacity</b>		
Social character	The social characteristics of the community.	Represents the social and demographic factors that influence the ability to prepare for and recover from a natural hazard event.
Economic capital	The economic characteristics of the community.	Represents the economic factors that influence the ability to prepare for and recover from a natural hazard event.
Infrastructure and planning	The presence of legislation, plans, structures or codes to protect infrastructure.	Represents preparation for natural hazard events using strategies of mitigation or planning or risk management.
Emergency services	The presence of emergency services and disaster response plans.	Represents the potential to respond to a natural hazard event.
Community capital	The cohesion and connectedness of the community.	Represents the features of a community that facilitate coordination and cooperation for mutual benefit.
Information and engagement	Availability and accessibility of natural hazard information and community engagement to encourage risk awareness.	Represents the relationship between communities and information, the uptake of information about risks and the knowledge required for preparation and self-reliance.
<b>Adaptive capacity</b>		
Governance, policy and leadership	The capacity within government agencies to learn, adapt and transform.	Represents the flexibility within organisations to adaptively learn, review and adjust policies and procedures, or to transform organisational practices.
Social and community engagement	The capacity within communities to learn, adapt and transform.	Represents the social enablers within communities for engagement, learning, adaptation and transformation.

and planning; emergency services; community capital; and information and engagement (Table 1, above).

Adaptive capacity consists of two themes that express the processes that enable adjustment through learning, adaptation and transformation: governance, policy and leadership; and social and community engagement (Table 1).

The social, economic, government, infrastructure and community measures used in the Australian Natural Disaster Resilience Index are consistent with those used internationally in previous assessments of disaster resilience. The Australian index extends these themes by including important elements of emergency management in Australia such as emergency services, emergency planning, land-use planning and community engagement. The Australian index also advances the field of disaster resilience assessment by incorporating adaptive capacities related to learning, adaptation and transformation.

Indicators are the variables that determine the status of a theme: the raw data used to compute the index.

The indicators were chosen using three key criteria. First, data had to cover the whole of Australia. This includes data from the Australian Census (or its derivatives),

as well as state or local government level data with compatible data in each jurisdiction (for example, crime rate, local disaster-management plans, land-use plans).

Second, the indicators had to be measurable and interpretable in the context of disaster resilience.

Third, the relationship between the indicator and natural hazard resilience was considered using available literature, particularly that pertaining to Australian circumstances. For example, areas with a stable population have increased familiarity with the hazards prevalent in the area, while areas with high levels of income will have greater capacity to prepare for and respond to natural hazards.

Figure 1 (page 2) summarises the indicators that will be collected under each theme.

#### Computing the index

The index is calculated using numerical data related to the indicators in each theme. For example, it might be using the percentage of people over 65 in a town, or the percentage of people that are involved in formal volunteering activities. This involves using various statistical methods for composite index construction. Each theme will be

reported separately and will be spatially represented on maps using colour coding along a continuum of high to low resilience. For any location in Australia, users of the index will be able to access a corresponding set of information about natural hazard resilience.

The index will provide a snapshot of the current state of disaster resilience at a national scale and results will be released as a State of Disaster Resilience report by the CRC when complete.

#### RESEARCH OUTCOMES

The project began in 2014 and has three distinct stages: conceptual development and index design; data collection and analysis; and reporting. As of September 2017, the team was conducting data collection and analysis (stage two). Collection of data regarding most of the project's indicators has been completed, which will total more than 70. While collecting the indicators, the team discovered that some states and regions have excellent data that could not be used because the project requires national coverage. It was also found that a complete data set was needed, covering all eight themes, to conduct the intensive statistical analysis.

The next stage, statistical analysis, is expected to take several months. It



▲ **Above:** THIS PROJECT IS DEVELOPING A NATIONALLY STANDARDISED MEASUREMENT FOR RESILIENCE ACROSS AUSTRALIA. PHOTO: MARK THOMASSON, COUNTRY FIRE SERVICE.

will involve standardising the indicators, removing any correlated indicators and aggregating the indicators into an index.

Once the index results are complete, design and framing of the State of Disaster Resilience report will begin. The principles underlying the reporting of disaster resilience will include a strengths-based interpretation of the index results, which will highlight areas of strength, emerging strengths and opportunities for improvement. The index will also be transparent in its design, methods and limitations. Where possible, it will link to previous research and provide a baseline against which changes in disaster resilience can be examined over time.

### HOW COULD THE RESEARCH BE USED?

The Australian Natural Disaster Resilience Index is expected to deliver many benefits to a very broad range of end-users and its findings will be available in the State of Disaster Resilience report. The index's map-based outputs will allow community members to see the broad influences of disaster resilience in their area. For example, are there strengths in some themes but opportunities for improvement in others?

Emergency service organisations will be able to use the Australian Natural Disaster Resilience Index results in community engagement activities and initiatives. The

### FURTHER READING

Parsons M, Glavac S, Hastings P, Marshall G, McGregor J, McNeill J, Morley P, Reeve I and Stayner R (2016), Top-down assessment of disaster resilience: a conceptual framework using coping and adaptive capacities, *International Journal of Disaster Risk Reduction*, **19**, pp.1-11.

index results will also inform evidence-based policy-making at state and national levels. They will be a call to action by supporting business cases for resilience-oriented policy and programs in Australian emergency management.

The project team is working with its end-users, which includes: Emergency Management Victoria; Victoria's Metropolitan Fire Brigade; Victoria's Country Fire Authority; Victorian Department of Environment, Land, Water and Planning; New South Wales State Emergency Service; New South Wales Rural Fire Service; Western Australia Department of Fire and Emergency Services; South Australia Metropolitan Fire Service; Tasmania Fire Service and AFAC. This collaborative process will align the results and outputs from the Australian Natural Disaster Resilience Index with agency policy and programs. The researchers will work with agencies to develop fact sheets that agencies can use in community profiling and community engagement tools. The index results can also be included in risk assessments. The maps provide quantitative spatial information about resilience for community planning and community engagement activities.

### FUTURE DIRECTIONS

The data collection, analysis and reporting phases of the project will continue until June 2018, after which another stage of agency implementation and utilisation will continue through to June 2020.

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*Hazard Notes* are prepared from available research at the time of publication to encourage discussion and debate. The contents of *Hazard Notes* do not necessarily represent the views, policies, practises or positions of any of the individual agencies or organisations who are stakeholders of the Bushfire and Natural Hazards CRC.

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