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OVERVIEW OF INDICATORS

The Australian Natural Disaster Resilience Index

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Version	Release history	Date
1.0	Initial release of document	24/11/2016

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

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Publisher:
Bushfire and Natural Hazards CRC

November 2016

Citation: Parons M, Morley P, McGregor J, Hastings P, Glavac S, Marshall G, Reeve I, Stayner R, McNeill J, (2016) Overview of indicators: The Australian Natural Disaster Resilience Index, Bushfire and Natural Hazards CRC

Cover: Country Fire Authority, Victoria

TABLE OF CONTENTS

PURPOSE OF THIS REPORT 3

SHORT REFRESH: THE CONCEPTUAL MODEL 3

INDICATOR THEMES 4

INDICATORS 7

REFERENCES 12

PURPOSE OF THIS REPORT

The Australian Natural Disaster Resilience Index is an assessment of disaster resilience at a large, all-of-nation scale. It is the first national snapshot of the capacity for community resilience to natural hazards.

The conceptual model outlining the reasoning and design of the index has been reported previously in two publications:

- The Australian Natural Disaster Resilience Index: Milestone report on conceptual framework and indicator approach. Available from: http://www.bnhcrc.com.au/research/resilient-people-infrastructure-and-institutions/251
- An academic manuscript titled "Top-down assessment of disaster resilience: a conceptual framework using coping and adaptive capacities". This is available in open access from the International Journal of Disaster Risk Reduction.

This report overviews the indicators being used in the index, including their justification, source and measurement level.

Once the data for all indicators have been collected and compiled, statistical analysis will then commence to compute the Australian Natural Disaster Resilience Index.

SHORT REFRESH: THE CONCEPTUAL MODEL

The Australian Natural Disaster Resilience Index is based on two sets of capacities: coping capacities and adaptive capacities (Figure 1). **Coping capacity** is defined as the means by which people or organizations use available resources, skills and opportunities to face adverse consequences that could lead to a disaster (IPCC 2012). Coping capacity captures the characteristics of a system that allow it to anticipate, act, achieve goals and manage resources (Wisner et al. 2004) or which are associated with absorptive capacity and mobilization when a natural hazard event occurs (Cutter et al. 2008, Tierney 2014). In a practical sense, coping capacity relates to the factors influencing the ability of a community to prepare for, absorb and recover from a natural hazard event.

Adaptation involves deliberate incremental and transformational change across social, government and economic systems. The capacities which enable adaptation are related to the existence of institutions and networks that learn and store knowledge and experience, create flexibility in problem solving and balance power among interest groups (Folke et al. 2002). **Adaptive capacity** is defined as the arrangements and processes that enable adjustment through learning, adaptation and transformation.

Adaptive capacity differs from coping capacity in that adaptive capacity focuses on the potential for the facilitation of adaptation by governance, institutional, management and social arrangements and processes whereas coping capacity focuses on the capacities of communities to anticipate and respond to hazards.

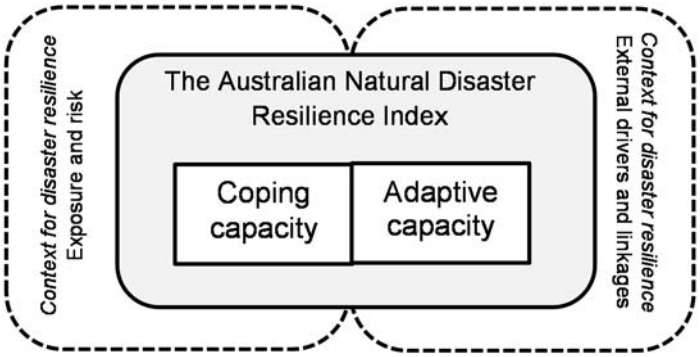

Figure 1. Conceptual model for the Australian Natural Disaster Resilience Index.

INDICATOR THEMES

The Australian Natural Disaster Resilience Index assessment has a hierarchical structure (Figure 2). The first level of the hierarchy comprises the coping and adaptive capacity dimensions. Nested within these are eight themes expressing the main elements of coping and adaptive capacity.

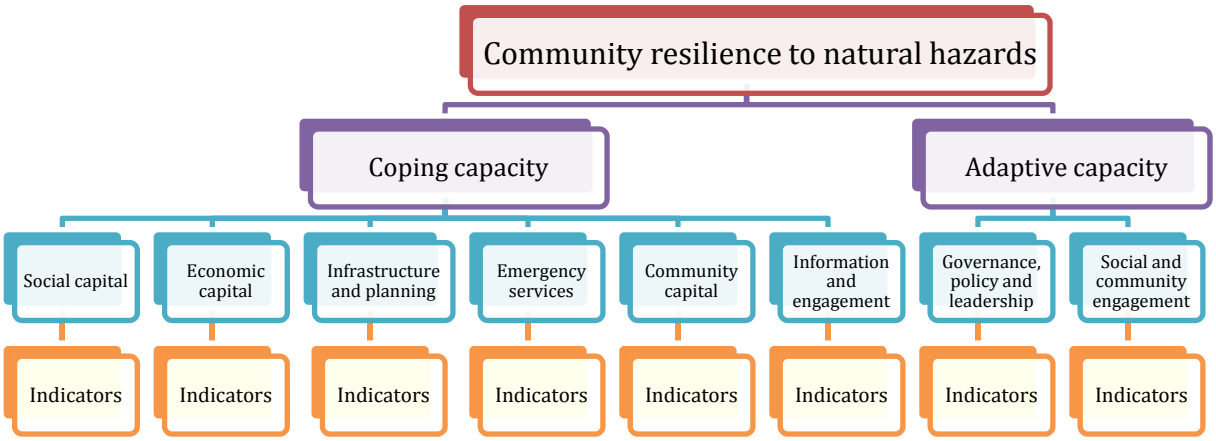

Figure 2. The structure of the Australian Natural Disaster Resilience Index.

Coping capacity consists of eight themes that express the availability of resources and abilities to prepare for, absorb and recover from a natural hazard event: social character, economic capital, infrastructure and planning, emergency services, community capital and information and engagement (Table 1). 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).

Table 1. Themes within the Australian Natural Disaster Resilience Index. The right hand column summarizes the relationships between the theme and natural hazard resilience.

Theme Definition	**Description of theme**	**Relationship of theme to natural hazard resilience**
	COPING CAPACITY	
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.	• Gender, age, disability, health, household size and structure, language, literacy, education and employment influence abilities to build disaster resilience (Morrow 1999, Thomas et al. 2013).
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.	• Access to economic capital may be a barrier to resilience (Bird et al. 2013). • Losses from natural hazards may increase with greater wealth, but increased potential for loss can also be a motivation for mitigation. • Economic capital often supports healthy social capital (Thomas et al. 2013).
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.	• Considered siting and planning of infrastructure is an important element of hazard mitigation. Multiple levels of government are involved in the planning process (King 2008, Crompton et al. 2010). • Planners can be agents of change in building disaster resilience (Smith 2009).
Emergency services The presence of emergency services and disaster response plans.	• Represents the potential to respond to a natural hazard event.	• Emergency response capabilities and systems support resilience through the PPRR cycle (Haddow et al. 2011).

Table 1 (cont.)

Theme Definition	Description of theme	Relationship of theme to natural hazard resilience
Community capital The cohesion and connectedness of the community.	• Represents the features of a community that facilitate coordination and cooperation for mutual benefit.	• Social networks assist community recovery following disaster (Akama et al. 2014). • High levels of social capital can enhance solutions to collective action problems that arise following natural disasters (Aldrich 2012).
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.	• Emergency management community engagement comprises different approaches including information, participation, consultation, collaboration and empowerment. • Community engagement is a vehicle of public participation in decision making about natural hazards (Handmer and Dovers 2013).
ADAPTIVE CAPACITY		
Governance, policy and leadership The capacity within government agencies to learn, adapt and transform.	• Represents the flexibility within organizations to adaptively learn, review and adjust policies and procedures, or to transform organizational practices.	• Effective response to natural hazard events can be facilitated by long term design efforts in public leadership (Comfort et al. 2010, Tierney 2014). • Transformative adaptation requires altering fundamental value systems, regulatory or bureaucratic regimes associated with natural hazard management (O'Neill and Handmer 2012). • Collaborative learning facilitates innovation and opportunity for feedback and iterative management (Berkes 2007, Goldstein 2012).
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.	• High levels of social capital can enhance solutions to collective action problems that arise following natural disasters (Aldrich 2012). • Cooperation and trust are essential to building disaster resilience and arise partly through social mechanisms including social capital (Folke et al. 2002, Goldstein 2012). • Behavioural change has a social and cultural context (Dake 1992, Eiser 2012).

The social, economic, government, infrastructure and community measures used in the Australian Natural Disaster Resilience Index are consistent with those used in previous assessments of disaster resilience worldwide (Beccari 2016). 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

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

Three criteria of indicator selection were prominent in guiding the selection of indicators for the Australian Natural Disaster Resilience Index First, the availability of data covering the whole of Australia was essential in this top-down national-scale assessment. National-scale data coverage includes data derived from the Australian Census (or its derivatives), but also that compiled from State or Local Government level data with compatible data in each jurisdiction (e.g. crime rate, local council disaster management plans, emergency service agency community engagement activity). Second, the measurability and interpretability of the indicator was applied to ensure that indicators could be quantified and interpreted in relation to disaster resilience. The exception was the adaptive capacity policy, governance and leadership theme which is new to disaster resilience assessment and will require derivation of indicators through evaluation of policy documents. Third, the relationship between the indicator and natural hazard resilience was considered using available literature, particularly that pertaining to Australian circumstances.

Table 2 outlines the indicators that will be collected under each theme. Each theme covers several dimensions describing the important processes and functions contributing to disaster resilience.

Many of the indicators have been collected. Work is underway on collecting the remaining indicators. Once all the data have been obtained, statistical work can commence on index computation.

Table 2. Indicators collected within the Australian Natural Disaster Resilience Index. These indicators will form the data set for statistical computation of the index. A standardization procedure will be applied. Not all indicators may be used to compute the index, because of correlation.

Theme	Indicator dimension	Indicators	Data source(s)
Coping capacity			
Social character	Immigration	Population arrived in Australia 2001 onwards	ABS 2011 Census
	Internal migration	Households with all or some residents not present one year ago	
	Language proficiency	Population speaks English not well or not at all	
	Need for assistance	Population with a core activity need for assistance	
	Family composition	One parent families	
		Households with children	
	Household composition	Lone person households	
		Group households	
	Sex	Sex ratio	
	Age	Population aged over 75	
		Population aged under 15	
		Median age of persons	
	Education	Ratio of certificate/postgraduate to high school education	
	Employment and occupation	Population unemployed	
		Population not in the labour force	
		Population managers and professionals	
Economic capital	Home and car ownership	Population owning home outright	ABS 2011 Census
		Population owning home with a mortgage	
		Population renting	
		Median rent	
		Income to mortgage differential	
		Car ownership	

Table 2 (cont.)

Theme	Indicator dimension	Indicators	Data source(s)	Status (June 2016)
Economic capital (cont.)	Income	Median total family income	ABS 2011 Census	Complete
		Low income residents		
	Employment	Single sector employment dependence		
		Businesses employing >20 people		
		Retail and commercial establishments		
	Economy	Economic diversity index		
		Population growth or decline		
Infrastructure and planning	Dwelling type	Caravan, marina, manufactured home, retirement village dwellings	ABS 2011 Census	Complete
	Building codes	Buildings constructed after 1980	Geoscience Nexis Database	80% complete
	Planning for natural hazards	Disaster management planning	Analysis of disaster management plans	80% complete
		Land use planning	Analysis of planning schemes	80% complete
		Local government financial status	Department of Infrastructure and Regional Development	Complete
Emergency services	Health response workforce	Total medical practitioners	Australian Institute of Health and Welfare	Complete
		Total registered nurses		
		Hospital beds		
	Emergency response workforce	Police per capita	ABS 2011 Census & Productivity Commission Report on Government Services	50% Complete
		Ambulance officers per capita		
		Fire and emergency service personnel per capita		
		Fire and emergency service volunteers	Annual reports	Searching for better resolution data
	Emergency response capability	Expenditure per capita: ambulance service	Productivity Commission Report on Government Services	Complete
		Expenditure per capita: fire and emergency services		

Table 2 (cont.)

Theme	Indicator dimension	Indicators	Data source(s)	Status (June 2016)
Emergency services (cont.)	Remoteness	Remoteness category	ABS	Complete
		Distance to medical facility Distance to nearest major highway Distance to airport	Regional Australia Institute	60% complete
Community capital	Household support	Adults able to get support in times of crisis from persons outside the household Adults who provide support to relatives living outside the household Adults whose household could raise $2000 within a week	Social Health Atlas	90% complete
	Access to services	Adults who had difficulty accessing services		
	Wellbeing	Adults with self-assessed health status of fair/poor		
	Unemployment	Jobless families with children under 15		
	Volunteering	Participation in voluntary work for an organization or group	ABS 2011 Census	Complete
	Place attachment	Residence in area longer than 5 years		
	Crime and safety	Crime, offences against property Crime, offences against the person	State crime data	90% complete
		Adults who feel very safe/safe walking alone in the local area after dark	Social Health Atlas	90% complete
Information and engagement	Community engagement and hazard education	Emergency service agency expenditure on community engagement Emergency service agency community engagement strategy	Annual reports & budgets	50% complete
	Telecommunications	Mobile phone coverage Broadband access	Department of Communications	50% complete

Table 2 (cont.)

Theme	Indicator dimension	Indicators	Data source(s)	Status (June 2016)
Adaptive capacity				
Governance, policy and leadership	Institutional character	Capacity for institutional learning	Annual reports, policy documents, organizational plans & budgets	20% complete
		Leadership style		
		Resource levels		
		Capacity for institutional innovation		
	Policy and legislation	Age of legislation and/or policy	Legislation, policy documents, strategic plans	20% complete
		Uptake of resilience strategic directions		
	Research and development	Expenditure on research and development	Annual reports and budgets	20% complete
		Presence of research organizations	Regional Institute of Australia	60% complete
Social and community engagement	Skills for learning	Participation in continuing adult education	ABS 2011 Census	60% complete
		Population with university level education		
	Social engagement	Change in net migration rate	ABS data	30% complete
		Life satisfaction	NATSEM via AURIN database	60% complete
		Generalised trust		
		Having a say and local governance		
		Equity and inclusion		
		Informal social connectedness	Regional Wellbeing Survey	50% complete
		Community involvement		
		Sense of belonging		
		Community economic wellbeing		
		Community leadership and collaboration		

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