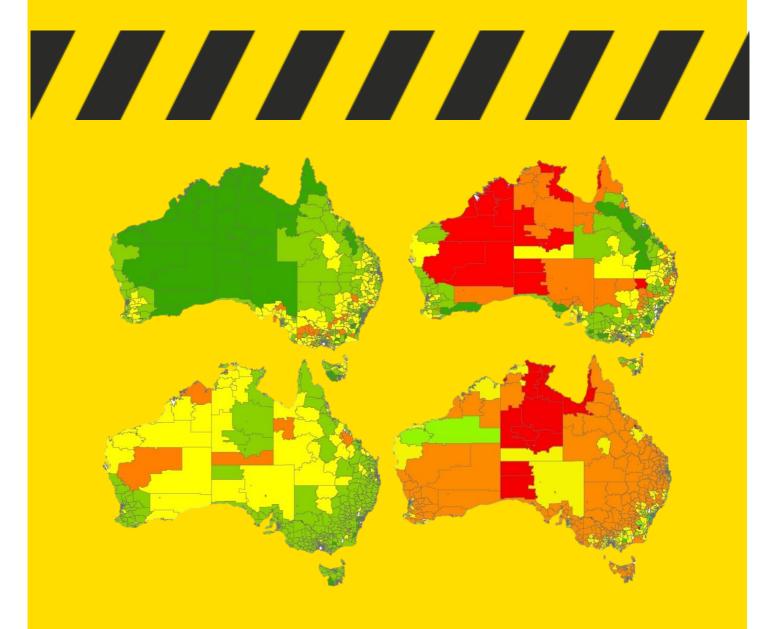bnhcrc.com.au

THE AUSTRALIAN NATURAL DISASTER RESILIENCE INDEX
Annual project report 2015-2016

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EXECUTIVE SUMMARY

What is the Problem?

In 2010, the Council of Australian Governments (COAG) adopted resilience as one of the key guiding principles for making the nation safer. The National Strategy for Disaster Resilience (Australian Government 2011) outlines how Australia should aim to improve social and community resilience with the view that resilient communities are in a much better position to withstand adversity and to recover more quickly from extreme events. The Sendai Framework for Disaster Risk Reduction 2015-2030 also uses resilience as a key concept and calls for a people centred, multi-hazard, multi-sectoral approach to disaster risk reduction. As such each tier of government, emergency services and related NGOs have a distinct need to be able assess and monitor the ability to prevent, prepare for, respond to and recover from disasters as well as a clear baseline condition from which to measure progress.

Why is it Important?

Society has always been susceptible to extreme events. While the occurrence of these events generally cannot be prevented; the risks can often be minimised and the impacts on affected populations and property reduced. For people and communities, the capacity to cope with, adapt to, learn from, and where needed transform behaviour and social structures in response to an event and its aftermath all reduce the impact of the disaster and can broadly be considered resilience. Improving resilience and thereby reducing the effects of natural hazards has increasingly become a key goal of governments, organisations and communities within Australia and internationally.

How are we going to solve it?

The Australian Natural Disaster Resilience Index project will produce a spatial representation of the current state of disaster resilience across Australia. The index will be composed of multiple levels of information that can be reported separately and represented as colour-coded maps where each point will have a corresponding set of information about natural hazard resilience. Spatially explicit capture of data will facilitate seamless integration of the project outcomes with other types of information. The index and indicators will also be drawn together as a State of Disaster Resilience Report which will interpret resilience at multiple levels and highlight hotspots of high and low elements of natural hazard resilience.

END USER STATEMENT

Suellen Flint, Department of Fire and Emergency Services (Western Australia)

At their best resilient Communities are prepared, are able to adapt to changing situations, are connected to each other and are self-reliant.

Recent reports into disasters has identified that government has a responsibility to prepare for emergencies, however these reports also identified the notion of shared responsibility. It is clear that government bears a responsibility to support the community to build the knowledge, skills and importantly protective behaviours that are part and parcel of disaster resilience.

Emergency Services support its communities by building these characteristics in communities. Not a simple task. It involves highly complex forms of engagement based in a raft of community development based research focused on community and individual psychology, decision making under stress, physiology, knowledge exchange and information take up by the community.

The Australian Natural Disaster Resilience Index will be advantageous in many ways and support National and State and local governments. The ability to identify hot-spots of high or low disaster resilience in Australia, and identify areas of strength in coping and adaptive capacity will support the desired outcomes of the Australian Natural Disaster Resilience Strategy, and potentially help to embed disaster resilience not only into policy and legislation, but to lead to an increase in shared responsibility and resilience across Australia.

I commend the researchers for addressing the challenge in developing the Australian Natural Disaster Resilience Index.

INTRODUCTION

Natural hazard management policy directions in Australia – and indeed internationally – are increasingly being aligned to ideas of resilience. However, the definition and conceptualisation of resilience in relation to natural hazards is keenly contested within academic literature (Klein et al., 2003; Wisner et al., 2004; Boin et al., 2010; Tierney, 2014). Broadly speaking, resilience to natural hazards is the ability of individuals and communities to cope with disturbances or changes and to maintain adaptive behaviour (Maguire and Cartwright, 2008). Building resilience to natural hazards requires the capacity to cope with the event and its aftermath, as well as the capacity to learn about hazard risks, change behaviour, transform institutions and adapt to a changing environment (Maguire and Cartwright, 2008).

However, an assessment of the current of resilience is needed to able identify problems and plan future resilience building actions. There are two principal approaches to assessing disaster resilience. Bottom-up approaches are locally based and locally driven and are qualitative self-assessments of disaster resilience (Committee on Measures of Community Resilience, 2015). Bottom-up approaches survey individuals or communities using a scorecard consisting of indicators of disaster resilience such as preparation, exposure to specific hazards, community resources and communication (e.g. Arbon, 2014). In contrast, top-down approaches are often intended for use at broad scales by an oversight body (Committee on Measures of Community Resilience, 2015) and use secondary spatial sources such as census data to quantitatively derive indicators that describe the inherent characteristics of a community that contribute to disaster resilience (Cutter et al., 2010).

The Australian Natural Disaster Resilience Index will be a tool for assessing the resilience of communities to natural hazards at a large scale. Using a top down approach, the assessment will provide input to macro-level policy, strategic planning, community planning and community engagement activities at National, State and local government levels. First, it is a snapshot of the current state of natural hazard resilience at a national scale. Second, it is a layer of information for use in strategic policy development and planning. Third, it provides a benchmark against which to assess future change in resilience to natural hazards. Understanding resilience strengths and weaknesses will help communities, governments and organizations to build the capacities needed for living with natural hazards.

OUR APPROACH TO DISASTER RESILIENCE

Resilience can be viewed as a process that links a set of capacities to a positive trajectory of functioning and adaptation after a disturbance (sensu Norris et al., 2008). The definition of natural hazard resilience that we adopt for the Australian Natural Disaster Resilience Index is:

> *Resilience is the capacity of communities to prepare for, absorb and recover from natural hazard events and to learn, adapt and transform in ways that enhance these capacities in the face of future events.*
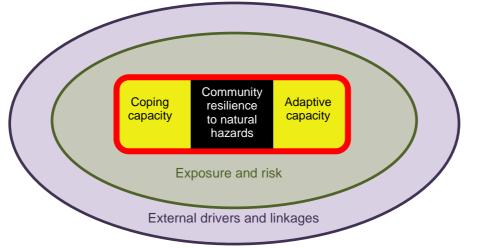
Implicit in this definition are three important elements of the index. First, we are concerned with capacities – or potential – for resilience, not the actual realisation of resilience in a particular hazard event (Norris et al., 2008). However, information about the realisation of resilience can be used to validate potential resilience and refine the index components. Second, learning, adaptation and transformation are vital to resilience because they provide a strategic feedback loop back to the capacities of preparation, coping and recovery (Berkes, 2007; O'Neill and Handmer, 2012). Learning, adaptation and transformation are also mechanisms for adjusting responses and behaviour and provide flexibility for facing an uncertain, unpredictable future (Berkes, 2007) and can be proactive for future events, or reactive in response to an event that has already occurred (Handmer and Dovers, 1996; Engle, 2011). Flexibility is an important element of disaster resilience because natural hazard events will continue to occur, but we do not know where, when, or of what magnitude these events will be. Third, while often used interchangeably we use the term natural hazard events rather than natural disasters because with appropriate preparation, natural hazard events can occur but not result in natural disasters (Annan, 2003). However natural disaster is generally a preferable term for communicating with the general public.

The Australian Natural Disaster Resilience Index will assess resilience based on two sets of capacities – coping capacity and adaptive capacity:

- Coping capacity enables people or organisations to use available resources and abilities to face adverse consequences that could lead to a disaster (sensu UNISDR, 2009). 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.
- Adaptive capacity is the ability of a system to modify or change its characteristics or behaviour to cope with actual or anticipated stresses (Folke et al., 2002). Adaptive capacity entails 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). In a practical sense, adaptive capacity relates to the factors that enable adjustment of responses and behaviours through learning, adaptation and transformation.

Together, these coping and adaptive capacities form the core of our assessment of resilience to natural hazards (Figure 1). Coping capacity and adaptive capacity help to answer the question 'How able is a community to prepare for, respond to and recover from a natural hazard event and return to a satisfactorily functioning state in a timely manner, and to strategically learn and adapt to improve its resilience to future natural hazard events?'

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

The conceptual model also reveals how coping and adaptive capacity are not independent of other contextual factors. The first of these contextual factors is risk and exposure. Risk expresses the probability and potential loss from natural hazards. Risk assessment is the process of identifying, analysing, evaluating and treating the risks of natural hazard events. Closely aligned to risk is exposure which is the spectrum of natural hazards that occur at different geographical locations and at different magnitudes. We have deliberately excluded risk and exposure from the assessment of resilience to natural hazards as we intend for the Australian Natural Disaster Resilience Index to be able to be overlain with risk maps developed as part of risk assessment and planning. Similarly, the index will assume that the capacities that enable community resilience to one type of natural hazard also enable resilience to other types of natural hazards.

The second contextual factor that influences capacities of resilience is external drivers and linkages. External drivers and linkages include Commonwealth, State and regional policies or legislation in areas such as emergency management, regional development, natural resource management and land use planning. External drivers and linkages also encompass broad conditions that influence the characteristics of communities, such as demographic and economic trends.

It is also important to define what is meant by the term community. A community can be seen as sharing a common place or location, a common interest, or a common attachment (Jenkins, 2013). In this project we take the view that a community shares a common location.

AN INDEX TO ASSESS DISASTER RESILIENCE IN AUSTRALIA

Resilience to natural hazards can be assessed using indicators of the components of resilience - in this case coping and adaptive capacities – and combined to form an index. An index is a way of summarising and reporting complex relational measurements about a particular issue. An index should capture change and respond directionally according to the behaviour of the system (Burton, 2015). As such, an index can be arrayed along a continuum of good to poor condition. The status of an index along the continuum can be

used as a baseline against which to measure change through time, or change following intervention or treatment.

An index conveys the overall status of the issue at hand. It can be reported as one number, or more commonly, as sets of numbers related to themes. These themes should be related to the purpose of the index as described by the underlying philosophical approach – in this case, resilience. Indicators are variables that are used to 'indicate', or measure, the status of the theme. Resilience is not always a directly observable phenomenon, particularly in a top-down, large scale approach (Tate, 2012) and proxies can be used to convey an indicator when the relationship between the proxy and the phenomenon of interest is known. In addition, disaster resilience is influenced by many factors, often with complex interactions. Thus, a robust index requires careful design of component indicators. The structural design of an index can be deductive, hierarchical or inductive. The choice of structure depends largely on the formulation of the conceptual framework but the type of structure used can affect the robustness of individual indicators and the overall index (Tate, 2012).

We have used a hierarchical structure for the Australian Natural Disaster Resilience Index (Figure 2). A hierarchical structure allows levels with similar concepts, processes and spatial/temporal organisation to emerge. Lower levels can be summarised into higher levels, and higher levels constrain the elements of levels sitting within it. The first level in our hierarchy is made up of the adaptive capacities and coping capacities that make up our conceptual premise of disaster resilience. The second level in our hierarchy is made up of themes that convey the components of adaptive capacity and coping capacity. The third level is comprised of indicator sets that measure the status of a theme. It is possible that one indicator is relevant across different themes or capacities.

Figure 2. The hierarchical structure of the Australian Natural Disaster Resilience Index. Indicator themes (blue boxes) and component indicators (orange boxes) are outlined in Section 3.1 and 3.2.

INDICATOR THEMES

Themes divide coping capacity and adaptive capacity into its sub-components. Themes are the factors – related to coping capacity or adaptive

capacity – that contribute to community resilience to natural hazards. Themes have a basis in the literature: some with empirical evidence of the relationship between the theme and resilience, and others that conceptualise this relationship but with little empirical testing. We will account for these different evidences, and associated uncertainties, as we produce the index (see Section 3.2).

Coping capacity is comprised of six themes that encapsulate the factors influencing the resources and abilities that communities have to prepare for, absorb and recover from natural hazard events (Table 1). Adaptive capacity is comprised of two themes that encapsulate the factors that enable institutional and social learning, flexibility and problem solving (Table 2). The relationships between the theme and natural hazard resilience are established through the literature, where quantitative and qualitative studies explain the resilience responses of communities. Gathering the evidence for the relationship between a theme, or component indicator, is an important part of the study and is explained further in Section 3.2.

INDICATORS

Indicators provide the data for a theme – together the indicators measure the status of the theme. Many indicators have a basis in the literature and have demonstrated relationships with aspects of natural hazards or disasters. For example, there is a documented relationship between income, housing type and gender and the ability to prepare for and respond to natural hazard events (Morrow, 1999). Selecting indicators is both an art and a science. The indicators used to measure the status of the theme can be selected using a set of criteria that increase confidence in the associations between an indicator and disaster resilience (Winderl, 2014). While there will always be trade-offs between indicator specificity, data availability, cost effectiveness and sensitivity (Winderl, 2014) the selection of indicators can be guided by criteria that help to bound large sets of potential indicators. The criteria used to guide the selection of indicators are outlined in Table 3. These criteria will guide the selection of indicators for the Australian Disaster Resilience Index. Several criteria will be more prominent in guiding this selection. First, the data used for the indicator needs to have a whole of nation geographic coverage (Criteria 3, 4 and 6) such as from census data, policy documents or economic data. Second, there will be statistical challenges or requirements that may require us to modify the indicators included in each theme (Criteria 5). Third, the indicator needs to be supported by evidence of how it contributes to resilience and how it behaves along a continuum of low to high resilience, including any verification of the indicator in independent studies (Criteria 1, 2 and 5).

Table 1. Explanation of coping capacity themes within the Australian Natural Disaster Resilience Index. The right hand column overviews the relationship between the theme and natural hazard resilience, although a review process will further explore these relationships as part of the project (see Section 3.2)

Theme	Description	Influence on natural hazard resilience
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 building activities (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, capability and resourcing of emergency services, warning systems and disaster response plans. • Represents the potential to respond to a natural hazard event.	• Emergency response capabilities and systems support resilience through the entire PPRR cycle.

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, engagement of the community with natural hazards and public-private or other partnerships to encourage risk awareness. • Represents the relationship between communities and information and the uptake of information about risks and the knowledge required for preparation and self-reliance.	• Emergency management community engagement is made up of different approaches including information, participation, consultation, collaboration and empowerment (EMA, 2013). • Community engagement is a vehicle of public participation in decision making about natural hazards (Handmer and Dovers, 2013).

Table 2. Explanation of coping capacity themes within the Australian Natural Disaster Resilience Index. The right hand column overviews the relationship between the theme and natural hazard resilience, although a review process will further explore these relationships as part of the project (see Section 3.2)

Theme	Description	Influence on natural hazard resilience
Governance, policy and leadership	• The capacity within government agencies to adaptively learn, review and adjust policies and procedures, or to transform organisational practices. • Represents the flexibility within organisations to learn from experience and adjust accordingly.	• Effective response to natural hazard events can be facilitated by long term design efforts in public leadership (Boin, 2010). • 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).
Community capital and social character	• The cohesion and connectedness of the community and the social and demographic character of a community. • Represents the resources and support available within communities for engagement, learning and adaptation and the factors influencing the uptake of adaptation information and strategies.	• 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; Kaufman, 2012).

Table 3. Generalised criteria for indicator selection. Compiled from Brown (2009), Bene (2013) and Winderl (2014).

Criteria for indicator selection	Requirements
1. The indicator reflects a justifiable element of natural hazard resilience	• The relationship between the indicator and natural hazard resilience has been verified in the academic/professional literature
2. The indicator can track change and variability in natural hazard resilience	• Change in the indicator can be determined and associated with change in resilience spatially and temporally
3. The indicator is relevant to the scale(s) of assessment	• The indicator aligns with the scale at which the assessment is undertaken. There may be a requirement for an indicator to remain valid across scales (e.g. local to national).
4. The indicator is measurable and readily interpretable	• The indicator is specific and precisely defined. • The indicator is quantifiable and spatially referenced • The indicator is easy to define, understand and communicate
5. The measurement method for the indicator is robust	• Measurement is reliable (and verifiable) and representative of reality • Measurement occurs regularly enough for the purpose • Measurement is methodologically sound
6. The indicator is achievable – data are available, accessible and cost effective	• Data are available at the required scales across most of the study area • Data are readily available from secondary sources • Data can be accessed within the cost and resource framework

A literature review revealed many indicators that have been used to assess disaster vulnerability or resilience in top-down, large scale approaches (e.g. Cutter et al. 2003, Cutter et al. 2010, Sherrieb et al. 2010, Birkmann et al., 2012, Frazier et al., 2013, Orencio and Fujii, 2013). These indicators describe factors influencing disaster resilience, including economic capital, social capital, dwelling type, dwelling tenure, family structure, health and well-being, infrastructure, institutions and demographics. We used these indicators as a basis for identifying potential indicators for the Australian Disaster Resilience Index. Most of the published indicators are aligned with the coping capacity part of the conceptual model (Figure 1). This arises largely from the conceptual approaches that have been used in the aforementioned large scale assessments, where resilience is viewed as the capacities of communities to absorb and moderate the impacts of natural hazards (e.g. Cutter et al. 2010, Sherrieb et al. 2010). The idea of adaptive capacity and the agency of societies to transform and learn in the face of natural hazards is a newer conception in large scale assessment, although it has been a core theme of the theoretical literature on disaster resilience (Engle, 2011). Deriving indicators of adaptive capacity in relation to natural hazards is even rarer. For example, Cutter et al. (2010) did not attempt to include adaptive capacity indicators, despite adaptive capacity being part of the BRIC Model (Cutter et al., 2008). However, much attention has been paid to the assessment of adaptive capacity in the climate change literature (Engle, 2011; IPCC, 2012). We will

explore the climate change adaptation approach as the basis for deriving adaptive capacity indicators, refining to suit the definition associated with natural hazard adaptation. Table 4 outlines the current set of indicators being used under each theme and capacity. It is also important to note here that each indicator has associated with it a variable (or variables) forming the data set. The variables are defined by the type of data available for each indicator. For example, the indicator educational attainment (Table 4) is comprised of the variable 'Ratio of population with high school education to post-secondary education' calculated from the Australian Bureau of Statistics 2011 Census data on population. The types of variables used as the data for each indicator depend on data availability at the whole-of-Australia geographic scale of assessment.

The generalised process for indicator selection, literature review and index calculation is given in Figure 3. Sitting alongside the selection of indicators will be a process of determining the relationship between the indicator and resilience. There can be a positive or negative relationship between an indicator and natural hazard resilience. For example, families with a large number of dependents often do not have the financial resources to prepare for natural hazard events (Cutter et al. 2003) and renters also may not be able to make modifications to premises that may confer resilience (Morrow, 1999). Quantitative and qualitative studies will be reviewed to extract evidence for the relationship between the indicator and resilience. Both peer-reviewed and grey literature will be considered, as will Australian and international studies. A data set will be established and meta-analysis techniques used to set the relationship between an indicator and resilience, with confidence bounds. This will determine the directionality of the indicator along a continuum of high to low resilience.

Table 4. Indicators of coping and adaptive capacity in the Australian Natural Disaster Resilience Index. *. ABS = Australian Bureau of Statistics.

Theme	Indicator dimension	Indicators	Data source(s)	Status (June 2016)
Coping capacity				
Social character	Immigration	Population arrived in Australia 2001 onwards		
	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	ABS 2011 Census	Complete
		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		
		Population owning home with a mortgage	ABS 2011 Census	Complete
		Population renting		
		Median rent		
		Income to mortgage differential		
		Car ownership		

Theme	Indicator dimension	Indicators	Data source(s)	Status (June 2016)
Economic capital (cont.)	Income	Median total family income Low income residents	ABS 2011 Census	Complete
	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		

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	Regional Australia Institute	60% complete
		Distance to airport		
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 organisation or group	ABS 2011 Census	Complete
	Place attachment	Residence in area longer than 5 years		
	Crime and safety	Crime, offences against property	State crime data	90% complete
		Crime, offences against the person		
		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		
			Annual reports & budgets	50% complete
		Emergency service agency community engagement strategy		
	Telecommunications	Mobile phone coverage	Department of Communications	50% complete
		Broadband access		

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, organisational 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 organisations	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		
		Community involvement	Regional Wellbeing Survey	50% complete
		Sense of belonging		
		Community economic wellbeing		
		Community leadership and collaboration		

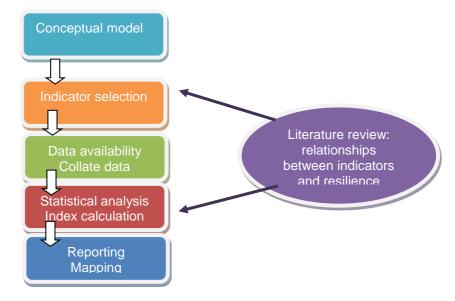| Theme	Indicator dimension	Indicators	Data source(s)	Status (June 2016)
Coping capacity				
Social character	Immigration	Population arrived in Australia 2001 onwards		
	Internal migration	Households with all or some residents not present one year ago		
	Language proficiency	Population speaks English 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	ABS 2011 Census	Complete
		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		
		Population owning home with a mortgage		
		Population renting	ABS 2011 Census	Complete
		Median rent		
		Income to mortgage differential		
		Car ownership		

Figure 3. The generalised process for deriving the Australian Natural Disaster Resilience Index.

Index calculation is the process of bringing together the indicators to form an index. There is much debate in the literature about the derivation of an index from component indicators, and the relationship between an index and reality (Tate, 2012; Burton, 2015). Deductive and hierarchical designs tend to use additive models of index derivation. Weighting may be applied to emphasise some indicators with greater contribution to resilience, although weighting strongly influence index sensitivity (Tate, 2012). Inductive designs (e.g. Cutter et al. 2003) use factor analysis to extract factors describing the relative contribution of indicators to overall variation. Factor analysis is sensitive to the choice of indicator set (Tate 2012). Recent symposia suggest that index designs are leaning towards deductive designs that use simple but robust additive models, because these facilitate more meaningful communication of index results.

WHAT WILL THE AUSTRALIAN NATURAL DISASTER RESILIENCE INDEX LOOK LIKE?

The Australian Natural Disaster Resilience Index is a spatial representation of the current state of disaster resilience across Australia. It will be composed of multiple levels of information that can be reported separately – an overall index, themes and indicators. Information will be conveyed primarily as maps that are colour coded along a continuum of high to low resilience status (see Figure 4 for an example).   The index and indicators will also be drawn together as a State of Disaster Resilience Report. This document will interpret resilience at multiple levels and highlight hotspots of high and low elements of natural hazard resilience.

CURRENT PROGRESS

The project began in March 2014 and is expected to continue until June 2018 after working through the three distinct stages of conceptual development, data collection and analysis and the final stage of revision and reporting. The initial conceptual framework stage was completed in 2015 and project staff are currently working on data collection and analysis.

Overall the project will require the completion of 54 quarterly milestones lodged with the BNHCRC of which 31 have been completed. The project initially included outcomes for local planning guidelines that described how the Australian Natural Disaster Resilience Index could be used by local government. These outcomes were developed during the proposal stage and before end-users were engaged. As our project end-users are Emergency Service related agencies the outcomes of the project have been adjusted towards their needs.

PUBLICATIONS & PRESENTATIONS

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

- Parsons, M., Morley, P., Marshall, G., Hastings, P., Glavac, S., McGregor, J., Stayner, R., McNeill, J. and Reeve, I. (2015). The Australian Natural Disaster Resilience Index. Planning Institute of Australia Northern Branch Meeting, Armidale, May 2016.

- Morley, P., Parsons, M., Argent, N. Glavac, S., Marshall, G., McGregor, J., McNeill, J., Reeve, I., Stayner, R., Thoms, M. (2015) The Australian Natural Disaster Resilience Index, Developing an Index of Resilience for Australian communities. 5th Annual Building Resilience Conference, Newcastle

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- Parsons, M. (2015) Resilience: Buzzword or blueprint? NSW SES Retain Leadership Conference, Armidale.

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