

bnhcrc.com.au

THE AUSTRALIAN NATURAL DISASTER RESILIENCE INDEX VOLUME II – INDEX DESIGN AND COMPUTATION

**Melissa Parsons, Ian Reeve, James McGregor, Graham Marshall, Richard Stayner,
Judith McNeill, Peter Hastings, Sonya Glavac and Phil Morley.**

University of New England, Armidale, NSW

and

Bushfire and Natural Hazards Cooperative Research Centre, Melbourne, VIC





Version	Release history	Date
1.0	Report submitted to BNHCRC	30/08/2019
1.1	Initial release of document	29/07/2020



Australian Government
 Department of Industry, Science,
 Energy and Resources

Business
 Cooperative Research
 Centres Program

All material in this document, except as identified below, is licensed under the Creative Commons Attribution-Non-Commercial 4.0 International Licence.

Material not licensed under the Creative Commons licence:

- Department of Industry, Science, Energy and Resources logo
- Cooperative Research Centres Program logo
- Bushfire and Natural Hazards CRC logo
- Any other logos
- All photographs, graphics and figures

All content not licenced under the Creative Commons licence is all rights reserved. Permission must be sought from the copyright owner to use this material.



Disclaimer:

University of New England and the Bushfire and Natural Hazards CRC advise that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law University of New England and the Bushfire and Natural Hazards CRC (including its employees and consultants) exclude all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Publisher:

Bushfire and Natural Hazards CRC

ISBN: 978-0-6482756-2-6

Citation: Parsons, M., Reeve, I., McGregor, J., Morley, P., Marshall, G., Stayner, R., McNeill, J., Glavac, S. & Hastings, P. (2020) *The Australian Natural Disaster Resilience Index: Volume II – Index Design and Computation*. Melbourne: Bushfire and Natural Hazards CRC.

Cover: Cover image developed by Cassandra Hunt, UNE. Austock image 000042057, Jamestown SA, under licence.



ACKNOWLEDGEMENTS

There are many individuals and groups to thank for their contributions to the Australian Natural Disaster Resilience Index. Foremost are the project end-users who have co-developed aspects of the resilience index with researchers, commented on the index findings and identified opportunities for utilisation of the resilience index into organizational initiatives and strategies. These organisations are: WA DFES, SA CFS, Emergency Management Victoria, VIC CFA, NSW SES, NSW RFS, VIC MFB, SA MFS, VIC DEWLP, TAS Fire Service, AFAC and AIDR. Through the life of the project, many individuals from these, and other, organisations have contributed insights, data or information including: Andrew Richards, Anthony Bradstreet, Sunara Fernando, Tony Jarrett, Melissa O'Halloran, Gwynne Brennan, Karen Enbom, Stefanie Russell, Chris Barber, Suellen Flint, Rachel Armstrong, Susan Davie, Geoff Kaandorp, Trent Curtin, Paul Fletcher, Peta O'Donohue, Fiona Dunstan, Holly Foster, John Schauble, Steve Cameron, Sarah Anderson, Mandy Moore, Sandra Barber, Noreen Krusel, Amanda Leck, Alan Musk, Andrew Stark and Tamara Beckett. The authors thank these organisations and individual representatives for their input into the development of the index, and for their ongoing support and utilisation of this research.

Several individuals particularly championed the resilience index work, forming vital bridges between the research and research utilisation. Suellen Flint (WA DFES) led the resilience research cluster within the Bushfire and Natural Hazards CRC for several years. Amanda Leck (AFAC and AIDR) has raised awareness of the resilience index research and linked it into various programs developing in Australia. Dr Holly Foster (EMV) recognised opportunities to apply the index research to underpin various Victorian emergency management sector initiatives, and has led the development of those opportunities within Victoria. The AFAC Community Engagement Technical Group, chaired by Fiona Dunstan (SA CFS), provided input and commentary at various stages of index development, and integrated awareness of the resilience index across community engagement managers Australia-wide.

The authors are grateful to staff at the Bushfire and Natural Hazards CRC for their ongoing support of the project, from conceptualisation through to utilisation. At various times, Dr John Bates, Dr Michael Rumsewicz, Dr Desiree Beekharry, Dr Matthew Hayne, Dr Richard Thornton, David Boxshall, David Bruce, Nathan Maddock, Peter Thornton, Lorian Bethune, Sarah Mizzi, Amy Mulder, Vaia Smirneos and Leanne Beattie assisted with research development, end-user engagement, communication, utilisation and administrative activities.

At UNE, Dr Sahar Alian assisted with data collection tasks and compiled data sets ready for analysis. Michael Coleman developed the Economic Capital data set. Dr Rajesh Thapa conducted GIS analyses associated with the Planning and the Built Environment theme and Shili Wang assisted with data



collection for the planning assessment score. Cathy Coleman, Tania Marshall, Nick Sanders and the staff of Research Services provided administrative assistance to the project. Cassandra Hunt assisted with graphic design. Sue Reeve's hospitality through many hours of project meetings was greatly appreciated.

Various individuals or groups provided data or data advice to the project. The authors thank the Regional Australia Institute, Geoscience Australia, the Public Health Information Development Unit (Torrens University), Australian Bureau of Statistics, Australian Urban Infrastructure Research Network (University of Melbourne) and the Australian Institute of Health and Welfare for supplying data sets, or advice on data sets, used in the index. The authors also thank the hundreds of Australian municipalities or councils who supplied documents associated with emergency or land-use planning. Liz Connell (SAFECOM) supplied emergency plans for South Australia.

The research also benefitted from discussions about aspects of disaster resilience and resilience indicators with other Bushfire and Natural Hazards CRC researchers. This includes Dr Celeste Young and Professor Roger Jones (Victoria University), Professor Jeremy Russell-Smith and Steve Sutton (Charles Darwin University), Professor Holger Maier and Dr Graeme Riddell (University of Adelaide), Dr Kat Haynes and Dr Mel Taylor (Macquarie University), Professor John Handmer and Dr Briony Towers (RMIT), Dr Illona McNeill (University of Melbourne), Professor Vivienne Tippett (QUT), Dr Christine Owen (University of Tasmania) and Professor Steve Dovers (ANU). Dr Ben Beccari (VIC SES) and Professor Eric Tate (University of Iowa) also contributed resilience index insights.

The Australian Natural Disaster Resilience Index used the open source software, R, and a wide range of contributed packages within that software. We thank the authors of these packages for making them available, and reference them at the relevant points in the report.



ABOUT THIS VOLUME

The Australian Natural Disaster Resilience Index project comprises two volumes.

Volume I – State of Disaster Resilience Report

Volume I assesses the state of disaster resilience in Australia, using the Australian Natural Disaster Resilience Index. Volume I gives a brief overview of the design and computation of the index, then assesses the state of disaster resilience in Australia at different levels: overall disaster resilience, coping and adaptive capacity, and the eight themes of disaster resilience. Volume I also presents a typology of disaster resilience that groups areas across Australia that have similar disaster resilience profiles.

Readers interested in the results of the assessment of disaster resilience in Australia should focus on Volume I.

Volume II – Index design and computation

Volume II (this volume) describes in detail the computation of the Australian Natural Disaster Resilience Index. This includes resilience concepts, literature review, index structure, data collection, indicators, statistical methods, detailed statistical outputs, sensitivity analysis and uncertainty analyses.

Readers interested in the technical aspects of the Australian Natural Disaster Resilience Index should also consider Volume II. Volume II is comprised of six chapters:

- Chapter 1** Design of the Australian Natural Disaster Resilience Index
- Chapter 2** Indicators
- Chapter 3** Computation of the Australian Natural Disaster Resilience Index
- Chapter 4** Statistical outputs: ANDRI, coping capacity and adaptive capacity
- Chapter 5** Statistical outputs: disaster resilience themes
- Chapter 6** Uncertainty and sensitivity analysis