



Second Edition

DISASTER RESILIENCE

AN INTEGRATED APPROACH

Douglas Paton
and
David Johnston

DISASTER RESILIENCE

Second Edition

DISASTER RESILIENCE

An Integrated Approach

Edited by

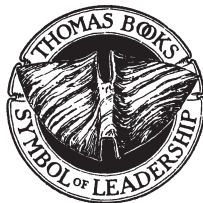
DOUGLAS PATON, PH.D.

*School of Psychological and Clinical Sciences
Charles Darwin University
Darwin
Northern Territory
Australia*

and

DAVID JOHNSTON, PH.D.

*Joint Centre for Disaster Research
Massey University
Wellington
New Zealand*



CHARLES C THOMAS • PUBLISHER, LTD.
Springfield • Illinois • U.S.A.

Published and Distributed Throughout the World by

CHARLES C THOMAS • PUBLISHER, LTD.
2600 South First Street
Springfield, Illinois 62704

This book is protected by copyright. No part of
it may be reproduced in any manner without written
permission from the publisher. All rights reserved.

© 2017 by CHARLES C THOMAS • PUBLISHER, LTD.

ISBN 978-0-398-09169-9 (paper)
ISBN 978-0-398-09170-5 (ebook)

First Edition, 2006
Second Edition, 2017

*With THOMAS BOOKS careful attention is given to all details of manufacturing
and design. It is the Publisher's desire to present books that are satisfactory as to their
physical qualities and artistic possibilities and appropriate for their particular use.
THOMAS BOOKS will be true to those laws of quality that assure a good name
and good will.*

Printed in the United States of America
TO-C-1

Library of Congress Cataloging-in-Publication Data

Names: Paton, Douglas, editor. | Johnston, David Moore, 1966- editor.
Title: Disaster resilience : an integrated approach / edited by Douglas
Paton, PhD and David Johnston, PhD.
Description: Second edition. | Springfield, Illinois: Charles C Thomas,
Publisher, Ltd., [2017] | Includes bibliographical references and index.
Identifiers: LCCN 2017009651 (print) | LCCN 2017019836 (ebook) | ISBN
9780398091705 (ebook) | ISBN 9780398091699 (pbk)
Subjects: LCSH: Disasters--Social aspects. | Natural disasters--Social
aspects. | Hazardous geographic environments. | Risk management. |
Emergency management. | Preparedness. | Community organization. |
Resilience (Personality trait)
Classification: LCC HV553 (ebook) | LCC HV553 .D58 2017 (print) | DDC
363.34/7--dc23
LC record available at <https://lcn.loc.gov/2017009651>

CONTRIBUTORS

Julia Becker, PhD is Team Leader of the Social Science Team at GNS Science, New Zealand, and Programme Leader of the Societal Impact of Hazards (SIH) research program. She has undertaken work in community resilience, risk reduction for land-use planning, emergency management and warnings across weather, flooding, coastal issues, volcanic, earthquake, tsunami and landslide hazards. Her recent work has focused on how to develop earthquake resilience and improve aftershock communication following the Canterbury earthquakes. Julia has worked extensively with central and local government on many projects ranging from improving land-use planning through to how to build resilience in communities.

Arkady Bolotin, PhD was born in St.-Petersburg, Russian Federation, in 1959. After graduation from St.-Petersburg Technical University in 1982, he had been working as a research fellow in Kyrghyz Institute of Oncology and Radiology, Bishkek, Kyrghyz Republic for ten years before emigrating to Israel in 1995. He was awarded Ph.D. degree in Physics and Mathematics by Biophysics Institute of Russian Academy of Science in 1988. Since his immigration to Israel, Bolotin serves at different positions in Department of Public Health of Ben-Gurion University of the Negev, Beersheba, Israel. He is the author of more than 90 scientific publications.

Petra Buergelt, PhD is a lecturer and researcher at Charles Darwin University. She is exploring the psychological and environmental factors and processes that influence DRR for various natural hazards across diverse countries and Indigenous people using qualitative research. Petra published over 60 books, chapters, peer-reviewed papers, government reports, and conference presentations.

Kirby Clark, BSc recently completed her Honours degree at the University of Tasmania. She is now training to be an organizational psychologist.

Dr. Odeya Cohen, PhD is Head of the Masters program, Department of Emergency Medicine. She is a researcher in the PREPARED Center for Emergency Response Research at Ben-Gurion University of the Negev, Israel. Researcher, European H2020 grant. Her MEM dissertation dealt with health legal preparedness for emergency scenarios in Israel. Her study developed the Conjoint Community Resilience Assessment Measure (CCRAM) tool with a focus on research methodology and statistical modeling

Prof. Limor Aharonson-Daniel, PhD specialized in injury epidemiology, and the academization of the field of emergency preparedness and response. She is the founding director of PREPARED Center for Emergency Response Research, headed the Department of Emergency Medicine in the Faculty of Health Sciences between 2011-2016, and now serves as Vice-Rector for International Academic Affairs.

Belinda Davis is a PhD candidate at RMIT University, Melbourne, focusing on children and gender in relation to climate change adaptation and disaster risk reduction. She previously worked at Northumbria University on the emBRACE (Building Resilience Amongst European Communities) project. Belinda has a BSc (Hons) from Deakin University, Melbourne, where she undertook research to develop a typology of human values to the natural environment.

Jezamine R. De Leon, PhD is a registered psychometrician, registered guidance counselor, and a certified specialist in industrial-organizational psychology in the Philippines. Dr. De Leon serves as a consultant to various government agencies and private organizations in the Philippines. Her career philosophy focuses in helping people build hope and have empowered lives through research, education, counseling, training, community service, and broadcast media.

Stephen Garnett is Professor of Conservation and Sustainable Livelihoods at Charles Darwin University. He has worked on environmental issues in the tropics for nearly 40 years, often in places that are hot and uncomfortable, so brings first hand understanding of the issues that will come as hot weather becomes more prevalent. He also works on the effects of climate change on biodiversity and is helping devise appropriate and affordable adaptation strategies.

Diklah Geva, PhD founded and serves as the head of IntegriStat (www.integristat.com). Her professional experience includes: statistician at West Pennsylvania Psychiatric Institute; established a statistical service at Wolfsan Medical Center; biostatistician consultant for the Israeli biotech industry, and consultant to the Ministry of Health, Institute for Quality and Standards of medical products. Recently Diklah assumed post as head statistician at the Israeli Association of Cardiovascular Clinical Trials.

Lisa Gibbs, PhD is Associate Professor and Director of the Jack Brockhoff Child Health and Wellbeing Program in the Centre for Health Equity and Co-Chair of the Children's Lives Research Initiative (University of Melbourne). She is the Academic Lead for Community Resilience and Public Health in the University's Centre for Disaster Management and Public Safety. She explores sociocultural and environmental influences on health and wellbeing and leads a research program focussing on mental health, social connections, and resilience.

Prof. Avishay Goldberg, PhD is Deputy rector of Ben-Gurion University of the Negev, Israel and also a staff member of the Health Systems Management Depart-

ment and of Emergency Medicine Department. Has a PhD in Health Systems Management at Ben-Gurion University and a Masters in Public Health at the Uniformed Services University of the Health Sciences, Maryland, U.S.A. Served in the IDF Medical Corps; Has published many articles in Health Care Policy and Management and in Disaster Management Journals.

Gertrud Hatvani-Kovacs is an Architect-Engineer and Building Energy Auditor graduated with an MSc degree from the Budapest University of Technology in 2007. Since her graduation she has worked in engineering design and later in the project management of sustainable office building developments. As a LEED AP, she contributed to the design and execution of the first LEED Platinum building in Hungary. She commenced work on her PhD in September 2013. Her research interest includes heat stress resilience and healthy built environment.

David Johnston, PhD is a Senior Scientist at GNS Science, Director of the Joint Centre for Disaster Research at Massey University and a Professor in the School of Psychology at Massey University, New Zealand. He conducts multidisciplinary theoretical and applied research involving physical and social scientists from several organisations and countries. His research focuses on human responses to volcano, tsunami, earthquake and weather warnings, crisis decision-making, and the role of public education and participation in building community resilience.

Melanie Irons, PhD is a Lecturer in the School of Psychological and Clinical Sciences at Charles Darwin University, in the Northern Territory of Australia. Melanie's PhD explored the use of social media by emergent groups after disaster events. Her research focuses on using new technologies to assist community engagement during and after disasters. Melanie has received several Resilient Australia awards from the Australian Government for her work in this field.

Li-ju Jang, PhD is Associate Professor in the Department of Social Work at National Pingtung University of Science and Technology. Her research interests are disaster resilience, community resilience, and post-traumatic growth.

José Kerstholt is senior scientist at TNO, Department of Human behavior and Organizational Innovation, and professor at the University of Twente, Department of Psychology of Conflict, Risk and Safety. Her recent research focusses on community resilience, both at individual and community level, the role of institutions and new forms of collaboration. She is involved in several European projects such as DRIVER, on crisis management, and INSPEC²T on enhancing cooperation between citizens and police. José is member of several national and international working groups, and regularly publishes her research in scientific and trade journals.

Kaori Kitagawa, PhD is a Research Fellow in the Cass School of Education and Communities at the University of East London. Her research interests include disaster education, community resilience, public pedagogy, lifelong learning and comparative

education. Since engaging in an ESRC-funded project, Critical Infrastructure Failure and Mass Population Response (2012–15), she has published papers examining the intersections of the aforementioned fields. She is currently studying the notion of ‘everyday preparedness.’

Vittorio Leone, PhD is an independent researcher, a retired full professor of Silviculture and Forest Fire control at the University of Basilicata, in Italy, and a member of prestigious Italian Academies (A. dei Georgofili, A. Italiana di Scienze Forestali). His main interests are wildfires under the perspective of a complex socio-economic phenomenon, and fire ecology. He is author of more than 180 papers, mainly covering the fields of the analysis and interpretation of wildfire causes.

Dmitry Leykin is a PhD student at the PREPARED Center for Emergency Response Research, the Faculty of Health Sciences, Ben-Gurion University of the Negev. His topics of research include social media analytics, crisis computing, citizen sensing, behavioral text data mining, applied behavioral science, and community resilience. He is focusing on the detection of stress coping profile from social media, as a tool for improved crisis communication.

Colin MacDougall is Professor of Public Health at Flinders University and Honorary Principal Fellow at University of Melbourne. His major interest is exploring how children experience and act on their worlds. He has taught on children’s research in New Zealand; Hamburg and Stendhal in Germany; and in the European Master’s and French Public Health Programs. He co-convenes the Child Health Special Interest Group for the Public Health Association of Australia.

Ljubica Mamula-Seadon, PhD is a founding member and a former president of the Environment Institute of Australia and New Zealand and a founding member of the NZ Risk Management Society. She has contributed to national and operational resilience and disaster management policies in New Zealand and internationally. She is a member and convener of the Cabinet-level multinational resilience policy group from the US, the UK, Sweden, the Netherlands, Germany, Canada, Australia, Singapore, and Japan. She developed and led the Resilience program at the Ministry of Civil Defence & Emergency Management, New Zealand where she was responsible for Resilience, Recovery, Infrastructure, and Welfare program of work.

John McClure, PhD is Professor in Psychology at Victoria University of Wellington. He has published over 60 peer reviewed research papers. He led research funded by the New Zealand Earthquake Commission (EQC) on factors affecting different types of preparedness in businesses and households, and risk judgments about low frequency hazards such as earthquakes. He has examined the effects of different messages on citizen’s fatalism and their beliefs that earthquake damage or climate change can be prevented and how message framing can influence citizens ability to see how actions can influence their safety and increase their resilience.

Simon Moss, PhD is an Associate Professor at Charles Darwin University. His primary research interest concerns how characteristics of organizations and societies, such as inequality of income or leadership, influence the brain functioning—and ultimately the mood, creativity, intuition, engagement, honesty, and altruism—of individuals. To investigate these issues, Simon has published a range of books and articles in the fields of leadership, personality, motivation, integrity, and stress.

Carol Mutch is Associate Professor and Head of School in the School of Critical Studies in Education at The University of Auckland. She has worked as a teacher, teacher educator, policy advisor and academic. Carol has published books, chapters and articles on education policy, curriculum development, research methods, social studies and citizenship education. Her current research focuses on the role of schools in disaster response and recovery following the devastating 2010/2011 Canterbury earthquakes.

Prof. Lahad Mooli, PhD is a senior medical and education psychologist, professor of Psychology and Dramatherpay at Tel Hai College, He is a leader of numerous professional recovery programs after natural and human-made disasters worldwide, a former advisor to Ministries in Israel and abroad, NATO and UNICEF international. He is the author or co-author of 34 books and many articles on the use of integrative approach to treat PTSD and grief, communities under stress, resiliency, and the healing powers of the imagination.

Dr. Ioannis Michaloudis is a visual artist, academic, and a leading researcher in Art & Science. He was the first to research using NASA's nanomaterial silica aerogel in visual arts and design. After receiving a Fulbright Award, in 2001 he undertook post-doctoral research on art and technology at Massachusetts Institute of Technology (MIT). In 2006 he was the first living artist who had a solo exhibit in the Museum of Cycladic Art in Athens, Greece. In 2007 he won the Golden Lighthouse in the XXIV Biennale of Alexandria, Egypt. He is the author of 12 papers and one book chapter.

Hana Morrissey was a senior lecturer at Charles Darwin University. She has extensive military and civilian management experience and has been registered as a pharmacist in Australia since 1991. She has practice certificate in emergency disaster response (University of Queensland) and she is an accredited master-instructor in mental health first aid for adults, youth, work-place and tertiary-education students. Hana served for 20 years in the Australian Regular Army and now moved to the Active Reserve at the rank of Major in 2011.

Peter O'Connor is Professor of Education and Director of the Creativity Research Initiative at the University of Auckland. In 2012 he was named the Griffith University School of Education and Professional Studies Alumnus of the Year for his contributions to social justice and applied theatre

Douglas Paton, PhD is Professor of Psychology and Disaster Risk Reduction at Charles Darwin University in the Northern Territory. He researches all-hazards and cross-cultural aspects of disaster risk reduction.

Etan Pavavalung, an indigenous Paiwanese, was born in Davalan Village, Pingtung County, Taiwan. The name *Etan* inherits from his mother's father; this ancient Paiwan name has its meaning—"brave." *Pavavaljung* is the family which is inherited from his father. Since Typhoon Morakot devastated areas of Taiwan in 2009, Etan created a form of "modern writing" to rebuild everyday tribal aesthetics. He developed the "trace, layer, carve and paint" to create a new style of interpreting and depicting post-disaster dreams and strengths. It is hoped that this style not only presents a new visual art form but impacts how people learn to hear the Earth and its breath, the wind, and to comprehend 'vecik' in life and aesthetics.

P.S.D.V. Prasadarao is Director of the Psychology Clinic, Charles Darwin University, Australia and is a faculty member in the Clinical Psychology program. He is a registered clinical psychologist and a Fellow of the Indian Association of Clinical Psychologists and a member of the New Zealand Association of Clinical Psychologists. His current interests include clinical geropsychology, neuropsychology of older persons, neuroprotective factors of the brain, and the role of culture in health and illness.

Adam Rose is Research Professor in the Price School of Public Policy and Faculty Affiliate of the Center for Risk and Economic Analysis of Terrorism Events (CREATE), University of Southern California, Los Angeles, California. The research contained in this paper was supported by a grant from the U. S. National Science Foundation.

Jane E. Rovins, PhD, MPH, CEM is CEO of Disaster Reduction & Resilience (DRR) Solutions, Ltd (Hong Kong) and a Senior Lecturer at Massey University (New Zealand). She was the inaugural Executive Director of Integrated Research on Disaster Risk (IRDR) Programme (China). She has worked for the United States Federal Emergency Management Agency (FEMA) and was inducted into the International Women in Emergency Management Hall of Fame. She cochairs the World Meteorological Organization (WMO) Working Group on Societal and Economic Research Applications (SERA).

Kamaljit K. Sangha, PhD researches in the trans-disciplinary field of Ecological Economics at Charles Darwin University, Australia. Her research interests include exploring the importance of natural systems for the wellbeing of local and Indigenous people and assessing the value of ecosystem services/benefits from natural resources. She is author of a book 'Ways to live in harmony with nature' which outlines how we can comprehend the importance of Mother nature' services and benefits in our daily living and can contribute for the better management of our natural resources.

Dr. Robert O. Schneider is a Professor of Public Administration at the University of North Carolina – Pembroke where he is also the Director of the Masters in Public Administration Program. His research and published work in the field of emergency management focuses on hazard mitigation planning and techniques, emergency management ethics, and emergency management policy. The author of many peer reviewed articles, he is also the author of two recently published books (*Managing the Climate Crisis: Assessing Our Risks, Options and Prospects* and *Emergency Management And Sustainability: Defining a Profession*).

Dr. Cheney Shreve, PhD is an independent scientific consultant, educator, and volunteer with the Gender and Disaster Network (<http://www.gdnonline.org>). Having recently completed a post as a Senior Researcher for the TACTIC Project (tools, methods, and training for communities and societies to better prepare for a crisis; <https://www.tacticproject.eu/>) at Northumbria University, she is continuing her research at the nexus of gender, environment, and disasters at home in Seattle.

Bevlyne Sithole is a founding executive director for the Aboriginal Research Practitioners' Network (ARNPNet) in the Northern Territory Australia and works with four traditional owners from Arnhem land who are directors of the network. She is on the Collaborative Evaluation Research and Planning (CERP) Panel of the Department of the Prime Minister and Cabinet, Australia. Her primary interest is creating ideal spaces for Aboriginal people in remote areas to actively participate and contribute to the knowledge economy and developing grassroots capacity to conduct participatory research and planning.

Isabelle Skinner, PhD, is a Professor at Charles Darwin University, Australia. Her research focuses on evidence-based interventions that improve life for people in rural and remote communities. Her research and consultancy work includes: community needs analyses; working with communities to co-design services to meet their needs such as telehealth and mhealth services. Her recent work with Tasmania Fire Service was to co-design and conduct the evaluation for the Bushfire-ready Neighbourhoods program in rural Tasmania, Australia.

Nitin Srivastava, PhD is a Consultant for Nikken Sekkei Research Institute (NSRI), Tokyo, Japan. He has wide understanding of the housing, urban, and development policies. He has also coordinated with both government and nongovernment organizations (NGOs) to create a balance in the solutions. His research interests include urban and regional planning, urban-rural linkages, urban resilience, and development policies.

Yingying Sun, PhD is a Research Fellow of the Japan Society for the Promotion of Science. Her research interests include tsunami risk reduction, disaster education and urban disaster prevention planning in villages in Japan that are at risk of experiencing large-scale tsunami in the event of a megathrust earthquake in the Nankai trough. She developed a new approach to developing skills for tsunami evacuation, called the “single-person drill.”

Steve Sutton completed an honours degree in archaeology in 1985. He subsequently worked for governments in northern Australia, including being involved in managing bushfire and cyclone hazards in the Northern Territory of Australia. Steve has interests in archaeology, anthropology, and psychology and is studying for a PhD at Charles Darwin University on cross-cultural aspects of disaster risk reduction.

Fantina Tedim is an assistant professor at the Geography Department, Faculty of Arts, University of Porto (Portugal) and a University Fellow at Charles Darwin University (Australia). Her interests include vulnerability assessment and management, risk communication, and resilience. Her most recent achievement is the project *FI-REXTR-Prevent and prepare society for extreme fire events: The challenge of seeing the “forest” and not just the “trees”* (2016–2019) which will develop and implements a new model of wildfire risk reduction.

John M. Violanti, PhD is a Full Research Professor in the Department of Epidemiology and Environmental Health, School of Public Health and Health Professions, University at Buffalo and a member of the University at Buffalo graduate faculty. He is a police veteran, serving with the New York State Police for 23 years as a trooper, criminal investigator, and later as a coordinator of the Psychological Assistance Program (EAP) for the State Police. He has authored over 100 peer-reviewed articles on police stress and PTSD, police mortality, and suicide. He has also published 18 books on police stress, psychological trauma, resilience, and suicide.

Kerstin Zander is Senior Research Fellow at Charles Darwin University. She holds a PhD in Environmental and Resource Economics from University of Bonn. Since 2007 she lives and works in Australia, mainly on the nexus between people and nature. One of her main research interest is the economics of climate change and the socio-economic dimension of adaptation, particularly to rising temperatures.

PREFACE

Events such as the December 26th 2004 Indian Ocean tsunami, Hurricane Katrina in 2005, and the Japanese earthquake and tsunami in 2011 have provided unfortunate reminders of the susceptibility of many communities to devastating losses from natural hazards. These events provided graphic illustrations of how extreme hazard events adversely impact on people, affect communities, and disrupt the community and societal mechanisms that serve to organise and sustain community capacities and functions. While societies and citizens are powerless to prevent the occurrence of, for example, the seismic, volcanic, and tsunami activity that arises from plate tectonics, there is much they can do to mitigate their risk and to understand and manage the consequences they could experience should disaster occur. The construct that has come to epitomize how this is done is resilience.

This book describes resilience in terms of how interdependence between societies, citizens and environment creates a need to develop policies, plans knowledge, competencies, relationships that progressively support the development of strategies that facilitate the ability of societies and citizens to co-exist with an environment that presents opportunities and amenities, but also challenge and change. If the recommendations, resources, and practices contained in this volume can be developed in sustainable ways, estimates of community capability to anticipate, cope with, adapt to, recover from, and learn and develop from natural hazard events will increase substantially, as will confidence in the planning and policies that define societal responsibility and the actions they stimulate to develop resilience in societies and citizens who must co-exist with generally beneficial, but periodically hazardous environmental processes.

Douglas Paton
David Johnston

CONTENTS

	<i>Page</i>
<i>Preface</i>	xiii
CHAPTER 1–CO-EXISTING WITH NATURAL HAZARDS AND THEIR CONSEQUENCES	3
<i>Douglas Paton</i>	
Introduction	3
Responding to Challenge and Change	4
Co-existing with a Hazardous Natural Environment	4
Resilience as Co-Existence	6
Co-existence in Practice	7
Co-existing with a Hazardous Environment	9
Evolving Hazard-Scapes	10
Societies and Citizens: Coping and Adapting	11
The Building Blocks of a Resilient Society	13
References	16
CHAPTER 2–URBAN RESILIENCE: THE NEED FOR A NEW CONTEXT IN SOUTH ASIA	18
<i>Nitin Srivastava</i>	
Introduction	18
Background: The Concept of Urban Resilience and The Evolution of Its Purview	19
Urban Resilience	19
Evolution of the Concept of Urban Resilience in Asia	21
Symbiosis of Urban and Rural Areas	22
Urban-Rural Linkages	23
Urban-Rural Linkages and Climate-Related Hazards	23
Urban-rural linkages and their usability in a Climate-sensitive future	25

Provision for utilization of regional natural resources	27
Regional Growth	27
Poverty reduction through employment generation	27
Disaster Management	28
Conclusion	28
References	29
CHAPTER 3–LIFELINES AND URBAN RESILIENCE.	33
<i>David Johnston, Julia Becker and Jim Cousins</i>	
Introduction	33
Case Study 1: Impacts of Volcanic Ash Falls from the 1995-1996 Eruptions of Ruapehu	34
Case Study 2: Impacts of Flooding on Gas Supplies in February, 2004.	36
Case Study 3: Impacts of a Moderate Earthquake–1987 Edgecumbe, New Zealand	37
Case Study 4: Impacts of the 1931 Hawke's Bay	41
Assessing Lifeline Vulnerability	45
Methodology	48
At Risk Components	48
Analysis Process	50
Mitigation Measures	51
The Contribution of Lifelines Studies to Urban Resilience	53
References	53
CHAPTER 4–CONSTRUCTION OF AN ECONOMIC RESILIENCE INDEX	55
<i>Adam Rose</i>	
Introduction	55
Defining Economic Resilience	56
An Operational Metric	59
Economic Theory Underpinnings.	61
Production Functions	61
Resilience in a Production Function Context	63
Empirical Measurement of Resilience.	64
Cost-Effectiveness	66
Cost-Benefit Analysis of Resilience.	68
Construction of a Resilience Index	72
Calculation Steps	72

Conclusion	76
References	77
CHAPTER 5–BUSINESS CONTINUITY IN DISASTER CONTEXTS	79
<i>Douglas Paton and John McClure</i>	
Introduction	79
Integrating Resilient Practices into Business Activity	80
The Goals of Planning: Preventing Loss Versus Facilitating Survival	81
Linking Business Continuity Planning and Business Resilience.	83
Developing Continuity Plans and Strategies	84
Implementation	84
BCM: Management Responsibilities.	85
BCM: Implications for Organizational Culture and Change	86
Implementing BCM: Staff Competencies	87
Selection and Training	87
Organizational Implications	89
Business and Community Resilience.	90
References	91
CHAPTER 6–HAZARD MITIGATION: A PRIORITY FOR SUSTAINABLE COMMUNITIES.	94
<i>Robert O. Schneider</i>	
Introduction	94
Sustainability: A Necessary Linkage	95
From the Old to The New to the Past Back to the Future	99
Principles and Techniques of Sustainable Hazard Mitigation.	106
Conclusion	110
References	112
CHAPTER 7–HAZARD READINESS AND RESILIENCE	114
<i>Douglas Paton, José Kerstholt and Isabelle Skinner</i>	
Introduction	114
Readiness and DRR	115
Readiness and its Precursors	116
Anticipating Hazardous Circumstances	118
Cognitive Biases: Unrealistic Optimism and Risk Compensation	118

Personalizing Risk	119
Readiness Theories	122
Family and Community Influences.	124
Relationships Between People and Agencies	126
Facilitating Hazard Readiness: Bushfire Ready Neighborhoods	129
Future Work	131
Affect and DRR Outcomes.	131
Readiness: A Developmental Process.	132
Predictors of Functional Readiness Categories.	133
Conclusion	134
References	135
CHAPTER 8—CHILD CITIZENSHIP IN DISASTER RISK AND AFFECTED ENVIRONMENTS	138
<i>Lisa Gibbs, C. MacDougall, C. Mutch and P. O'Connor</i>	
Introduction	138
Representations of Childhood.	139
Applications in Disaster Contexts	140
Citizenship in Action	142
Citizenship in Action Case Studies	143
The Child-at-Risk	145
The Developing Child.	148
Critical Citizens	150
The Politics of Disaster Response and Recovery in Christchurch	152
Conclusion	154
References	155
CHAPTER 9—NEW INSIGHTS INTO OLD AGE AND RESILIENCY FROM A COMMUNITY PERSPECTIVE	158
<i>Odeya Cohen, Diklah Geva, Mooli Lahad, Arkady Bolotin, Dima Leykin, Avishay Goldberg and Limor Aharonson-Daniel</i>	
Introduction	158
Materials and Methods	160
Results.	161
Discussion.	166
Conclusion	170
References	171

CHAPTER 10—GENDER AND DISASTER RESILIENCE.....	175
<i>Cheney Shreve, Belinda Davis and Maureen Fordham</i>	
Introduction	175
Background.....	176
Situating Gender and Disaster Scholarship within the Mainstream Disasters Discourse.....	177
Recent Disaster Paradigms: Vulnerability and Resilience.....	177
Three Waves of Gender and Disaster Scholarship	178
First Wave: 1980s.....	179
Second Wave: 1990s	179
Third Wave: 2000s-Present.....	180
Gender and Disaster Resilience.....	182
Less Discussed Components of Resilience	184
Rethinking Participation	185
Linking Vulnerability and Resilience	187
Conclusions: Resilience Building	188
References	189
CHAPTER 11—SOCIAL MEDIA AND EMERGENT GROUPS: THE IMPACT OF HIGH FUNCTIONALITY ON COMMUNITY RESILIENCE.....	194
<i>Melanie Irons and Douglas Paton</i>	
Introduction	194
Resilience	195
Case Study	197
Robustness, Rapidity and Redundancy	198
Robustness.....	198
Rapidity	199
Redundancy.....	199
Community Resilience as a Set of Networked Adaptive Capacities.....	201
Economic Development	201
Social Capital.....	202
Information and Communication	203
Community Competence	205
Conclusion	208
References	208

CHAPTER 12—ART AND DISASTER RESILIENCE: PERSPECTIVES FROM THE VISUAL AND PERFORMING ARTS	212
<i>Douglas Paton, Ioannis Michaloudis, Etan Pavavalung, Kirby Clark, Petra Buergelt, Li-ju Jang and Grace Kuo</i>	
Introduction	212
The Sky’s Catastrophe	213
Labored Breathing at Another Foothill: The Roles of Visual Arts in the Post-Morakot Reconstruction	218
The Connections Between My Art Creations and Tribal Culture	218
Interactions with Nature (Natural Environment)	219
The Connections Between Art Creations and Tribal Disaster Response and Recovery	219
Helping Tribal fellowmen Reconnect with Indigenous Culture Through Art Creations	222
Australian Aboriginal Songlines	223
Music, Song and DRR	226
Coping	227
Sharing Knowledge	228
Sharing Experience	229
Conclusions and Future Work	231
References	233
 CHAPTER 13—COPING WITH AND ADAPTING TO NATURAL HAZARD CONSEQUENCES: CROSS-CULTURAL PERSPECTIVES.	236
<i>Douglas Paton, Li-ju Jang, Kaori Kitagawa, Ljubica Mamula-Seadon and Yingying Sun</i>	
Introduction	236
Cross-Cultural Assessment of the Community Engagement Theory	237
Cross-Cultural Perspectives on Disaster Response What People had to Respond To.	240
Coping with and Adapting to Hazard Consequences.	242
New Zealand	242
Taiwan	243
Future Directions and Conclusions	250
References	252

CHAPTER 14—RELIGIOUS PRACTICES AND COMMUNITY RESILIENCE	255
<i>Steve Sutton</i>	
Introduction	255
Traditional and Proposed Interactions Between Religion and Disasters	255
How Religions Might Provide Models for Developing Risk Communication Programs	258
Case Study: Silkwood Subdivision	260
Conclusion	264
References	264
CHAPTER 15—LIVING WITH WIDDIJITH – PROTOCOLS FOR BUILDING COMMUNITY RESILIENCE IN REMOTE COMMUNITIES IN NORTHERN AUSTRALIA	268
<i>Bevlyne Sithole with H. Hmalan Hunter-Xenie and H. Cherry Daniels, Grace Daniels, Kesley Daniels, Antony Daniels, Geraldine Daniels, Debra Daniels, Howard Turner, Cherry Anne Daniels, Tammy Daniels, Patrina Thomas, David Thomas (Ngukurr Community Based Research Team) and Dean Yibarbuk, Otto Bulmaniya Champion, Serina Namarnyilk, Evelyne Narorroga, Otto Dann, Kingswood Dirdi, Gwen Nayilibibj, Christine Brown (Gunbalanya Community Based Research Team)</i>	
Introduction	268
Remote Communities in Northern Australia	270
Facing Up to the Reality of Community Resilience	271
Who Should Build Community Resilience?	273
Community Ideas on Building Resilient Communities	276
Discussion	284
Conclusion	285
References	287
CHAPTER 16—LIVING IN HARMONY WITH OUR ENVIRONMENT: A PARADIGM SHIFT	289
<i>P. T. Buergelt, D. Paton, B. Sithole, K. Sangha, P.S.D.V Prasadarao, L. Champion, & J. Champion</i>	
Introduction	289
Living in Disharmony with Nature: Source of Disasters	291
Living in Harmony with Nature: Source of Well-being and Adaptive Capacities	292

Living in Harmony: Requires Individual and Collective Adaptive Capacities	293
Indigenous People: Knowledges, Sensitivities and Practices for Living in Harmony	294
Fire	298
Living in Harmony with Nature: Socio-Economic Benefits	301
Conclusion	302
References	304
CHAPTER 17—RESPONDING TO CRITICAL INCIDENTS AND DISASTERS: FACILITATING RESILIENCE IN HIGH RISK PROFESSIONS	308
<i>Douglas Paton, Simon Moss, John Violanti, Jezamine De Leon and Hana Morrissey</i>	
Introduction	308
What Do Officers Need to be Resilient To?	309
Empowerment	310
Critical Incidents, Incident Interpretation and Adaptation	313
Empowerment Schema and Resilience.	314
Person-Level Sources.	314
Trust	315
Team Cohesion and Support	316
Senior Officers	317
Resilience, Organizational Learning and Organizational Culture	318
Multi-agency Operating Environments: Implications for Resilience	319
Family	320
Conclusions	321
References	322
CHAPTER 18—GOVERNANCE FOR RESILIENCE.	327
<i>Ljubica Mamula-Seadon</i>	
Introduction	327
Resilience and Governance—Basic Concepts	328
Advent of Resilience in Risk Management	329
Governance for Resilience.	331
Governance for Resilience—the New Zealand Experience	332
Governance for Resilience—Challenges and the Way Forward	336
Conclusion	341
References	342

CHAPTER 19—RESILIENCE TO HEAT WAVES: A FRAME- WORK FOR RESEARCH, POLICY AND PRACTICE	344
<i>Kerstin K. Zander, Gertrud Hatvani-Kovacs and Stephen T. Garnett</i>	
Introduction	344
The Livelihood Framework	345
Natural Capital	346
Built/Physical Capital	348
Human Capital	350
Social Capital	351
Financial/Economic Capital	352
Discussion	354
Conclusion	355
References	356
CHAPTER 20—ENHANCING RESILIENCE TO WILDFIRE DISASTERS: FROM THE “WAR AGAINST FIRE” TO “COEXIST WITH FIRE”	362
<i>Fantina Tedim and Vittorio Leone</i>	
Introduction	362
The Paradigm Shift from The “War Against Fire” to “Coexist with Fire”	363
The “War Against Fire” Paradigm: a SWOT Analysis	363
“Coexist with Fire”: a New Paradigm	364
Enhancing Resilience in Wildfire Risk Management: Problems, and Challenges	370
Problems and Challenges	370
An Operational Wildfire Resilience Framework	372
The Fire Smart Territory: An Innovative Strategy of “Coexist with Fire”	373
Fire Smart Territory: The Concept	373
Conclusion	376
Acknowledgements	377
References	377
CHAPTER 21—A WICKED PROBLEM: MAKING DRR AND CCA WORK FOR RESILIENCE.	384
<i>Jane Rovins</i>	
Introduction	384
International Agreements	385

Sendai Framework for Disaster Risk Reduction 2015–2030	286
Sustainable Development Goals	387
Why Is This So Complicated?	387
Indonesian Fires	387
Solutions	388
References	389
CHAPTER 22—DISASTER RISK REDUCTION AND DISASTER RESILIENCE: PROGRESS AND CHALLENGES	391
<i>Douglas Paton</i>	
Introduction	391
Reflection	392
Invitation	393
Resilience and Community Development	394
Strengths and Vulnerabilities	396
Changes in Adaptive Resource Availability	398
Experience	400
Resilience: An Integrated Approach	401
Conclusion	402
References	403
<i>Index</i>	405

DISASTER RESILIENCE

Chapter 1

CO-EXISTING WITH NATURAL HAZARDS AND THEIR CONSEQUENCES

DOUGLAS PATON

*Keep my words positive, because my words become behaviors.
Keep my behaviors positive, because my behaviors become habits.
Keep my habits positive, because my habits become my values.
Keep my values positive, because they become my destiny.*

Mahatma Gandhi

INTRODUCTION

Fifty-thousand years ago, it has been estimated that there were some 5,000 humans on planet earth. The intervening millennia have seen this grow (and exponentially over the past 100 or so years) to over seven billion. During this time, humans have colonized every corner of the globe (except Antarctica) and demonstrated their capacity to cope with, adapt to and recover from many threats and challenging circumstances, including natural disasters, famine, flood, pestilence, disease and climate change, along the way (e.g., Burton, Diringer & Smith, 2006). As climate change looms as a significant threat to all humanity, and at a time of considerable political and social reluctance to accept the need to respond to this challenge, it is perhaps ironic that the human capacity to adapt and change may be due to that very phenomenon.

Slezak (2015) reviewed evidence suggesting that it was environmental change, rather than a specific environment, that drove human evolution. The research Slezak reviewed suggests that in environments in which substantial climatic shifts occurred every 10,000 to 20,000 years (over a period of a few million years), humans with a capacity to change and adapt to these dynamic conditions would have been selected for. While the work discussed by Slezak remains tentative, it is possible to speculate that the legacy of such

experiences has been a capacity to adapt to environmental change in modern humans that underpins the beliefs, behaviors and relationships encapsulated in contemporary understanding of “resilience.” One thing is for certain, a need to be responsive and adaptive to environmental challenge and change is a capability that is becoming increasingly important for people, communities and societies.

Responding to Challenge and Change

A prominent reason why being responsive and adaptive to environmental challenge and change is important derives from the growing risk societies and citizens the world over face from the action of natural processes, such as volcanic, wildfire, storm, flooding, tsunami and seismic phenomena. Given the dynamic and complex nature of the characteristics and behaviors of these phenomena (Gregg & Houghton, 2006), it is not surprising that effectively managing the risk they pose is not a straightforward task.

Objectively, societal risk from natural hazards is constantly increasing. Even if the probability and intensity of the activity of the natural phenomena that create the hazards societies and citizens will encounter remain constant, factors such as continuing population growth and economic and infrastructure development in at-risk areas, are making incremental contributions to the potential magnitude and significance of the loss and disruption societies and citizens experience when disasters occur.

It is not possible for societies and citizens to directly influence the natural sources of the hazards (e.g., the seismic, volcanic and tsunami activity that arises from plate tectonics) they face. There is, however, much they can do to mitigate their risk and to understand and manage the consequences they could experience should disaster occur. The construct that has come to epitomize how this is done is resilience. This book explores how adding an environmental co-existence perspective can assist understanding the multifaced and dynamic nature of resilience. First, it is pertinent to ask why placing emphasis on environmental co-existence can complement and contribute to understanding risk management in general and resilience in particular.

Co-existing with a Hazardous Natural Environment

Decisions regarding the location of societal development have often reflected the association between geological and other natural processes and the resources and amenities (e.g., fertile soils, natural harbours, navigable rivers that serve as commercial highways, forests and wood products, water supplies, coastal and mountain scenery etc.) they create for societies and

citizens. The fact that the activities societies and citizens engage in to secure beneficial outcomes from their environment (e.g., where and how they build cities, develop economies through environmental resource use, harvesting forests, develop on flood plains, etc. –see Chapter 2) contribute to their ever-growing risk provides the fundamental rationale for including a co-existence perspective in how resilience is conceptualized. A co-existence framework may facilitate resilience by reconciling societal development goals with the concomitant need to manage risks emanating from the environmental context in which development is situated. There are precedents to adopting this kind of think to frame risk management.

A conceptualization which seeks to balance development with the proactive management of the challenges environmental processes present to societies and citizens is consistent with the original definition of risk. Dake (1992) discussed how the term risk originally defined a process of accounting for the *gains* and the *losses* that arise in circumstances in which chance influences outcomes. This way of thinking about risk, as a combination of gains and losses, echoes the meaning inherent in the Chinese symbol for crisis. By defining it as a mix of a ‘danger’ and an ‘opportunity,’ a crisis is represented as an event from which both losses and gains can ensue. Which outcome occurs, gain or loss or the balance between them, is something that is amenable to human intervention. The application of the concept of resilience is intended to tip the balance in favour of gains and development.

If the reality of being faced with potential gains (from environmental situation and characteristics) and potential losses (when the action of environmental processes turn hazardous) can be anticipated, societies and citizens can take steps to minimize potential losses and optimize the attainment of environmental gains. If transferred to a societal risk management setting, a co-existence framework thus affords opportunities for risk management to contribute to reconciling the benefits of sustainable societal development with the management of the periodic hazard activity that occurs when nature presents societies and citizens with its more malevolent side (Paton, 2000; Tobin, 1999). Pulling these various threads together, this book describes resilience in terms of how interdependence between societies, citizens and environment creates a need to develop policies, plans knowledge, competencies, and relationships that progressively support the development of strategies that facilitate the ability of societies and citizens to co-exist with an environment that presents opportunities and amenities, but also challenge and change.