# DISASTER RESILIENCE

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## An Integrated Approach

*By*

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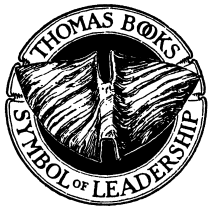


CHARLES C THOMAS • PUBLISHER, LTD.
*Springfield • Illinois • U.S.A.*

*Published and Distributed Throughout the World by*

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

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ISBN 0-398-07663-4 (hard)
ISBN 0-398-07664-2 (paper)

Library of Congress Catalog Card Number: 200644509

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*Printed in the United States of America*
*MM-R-3*

**Library of Congress Cataloging-in-Publication Data**

Paton, Douglas
Disaster resilience : an integrated approach / by Douglas Paton and David Johnston.
p. cm.
Includes bibliographical references and index.
ISBN 0-398-07663-4 – ISBN 0-398-07664-2 (pbk.)
1. Disasters–Social aspects. 2. Natural disasters–Social aspects. 3. Hazardous geographic environments. 4. Risk management. 5. Emergency management. 6. Preparedness. 7. Community organization. 8. Resilience (Personality trait). I. Johnston, David Moore, 1966-II. Title.

HV553.P37 2006
363.34'7–dc22

2006044509

# PREFACE

The Boxing Day 2004 Indian Ocean tsunami and the impact of Hurricane Katrina on New Orleans in 2005 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 organize and sustain community capacities and functions. It would, however, be incorrect to automatically assume that the deficit and loss outcomes that are often the most visible and publicized aspects of these events should be regarded as a fait accompli of exposure to disaster. Rather, deficit and loss outcomes co-exist with a capacity to confront challenging circumstances in ways characterized by adaptation and growth. Recognition of the co-existence of these outcomes opens up new opportunities for managing natural hazard risk. This book discusses how risk can be managed by identifying factors that influence a capacity for co-existence with periodically hazardous, but often beneficial, environmental elements. It identifies values, beliefs, competencies, resources and procedures that societies and their members can utilize to proactively develop a capacity to adapt to adverse natural hazard consequences and sustain societal functions in the face of significant perturbations to the fabric of everyday community life. That is, to make societies and their members resilient.

DOUGLAS PATON
DAVID JOHNSTON

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Trevor Auld is the Emergency Management Officer with the Manawatu District Council in New Zealand. He has extensive experience in developing emergency response policies and plans and in applying them to manage natural hazard processes. The content of the chapter he contributed to draws upon his experience in managing a large flood disaster in 2004.

**JULIA BECKER, B.SC.**

Julia studied both resource management and natural hazards at Waikato University in New Zealand before joining the Institute of Geological and Nuclear Sciences (GNS) in 2000. She has completed studies in social science research, and has undertaken social surveys looking at people's perceptions and awareness of social, environmental and hazard issues. In addition to her work at GNS, Julia spent two years in the U.K. from 2002–2004 working on environmental impact assessment, energy issues and urban development. Currently, she is involved with research into effective planning and policy for natural and environmental hazards in New Zealand.

**PHILIP BUCKLE, B.SC.**

Philip Buckle has extensive experience in planning and managing recovery programs for natural and anthropogenic disasters. He has contributed top policy debates in Australia and the U.K. and has researched and taught in a number of Universities in Australia and the U.K., currently at the Coventry Centre for Disaster Management at Coventry University. He has published numerous papers, guidelines, program documents and books, focusing mainly on recovery, vulnerability assessment and capacity development.

**PETRA T. BÜRGELT, M.A.**

Petra T. Bürgelt is currently conducting her Ph.D. project in which she qualitatively explores the experiences of German migrants to New Zealand and Australia by accompanying them

throughout their migration process. She has also been involved with the design and analysis of several qualitative research projects on modeling preparedness for bushfires (Australia) and identifying indicators of warning effectiveness for tsunami hazards (Washington State Government, U.S.A.). In addition to her publications in this area, Petra is currently completing a book on adaptation and migration. This work is based on her Masters research with German migrants to New Zealand that examined migration within a salutogenic paradigm.

**LYNNE COHEN, PH.D.**

Lynne Cohen is a Senior Lecturer and is Undergraduate Coordinator in the School of Psychology at Edith Cowan University (ECU). She teaches in both the undergraduate and postgraduate psychology programs and has recently been awarded a National Teaching Award by the Australian University Teaching Committee. Her research focuses on issues in higher education and has many publications and presentations on learning and teaching in higher education. She is the current editor of the community psychology journal *Network*. Dr. Cohen is also a community psychologist and researches and teaches in the area of sense of belonging and its relationship to successful outcomes for students.

**ALISON COTTRELL, PH.D.**

Alison Cottrell is with the Centre for Disaster Studies in the School of Tropical Environment Studies and Geography at James Cook University in Townsville, Queensland, Australia. The focus of her research is communities and their relationships with hazards. Perceptions of risk, vulnerability and resilience at the individual, household and community levels are of prime concern. Previous research in hazards has covered issues of women's experiences preparing for flooding and community participation in flood mitigation activities. Current research includes a project with the Bushfire Cooperative Research Centre on understanding the relationships between government policy, planning, service delivery and community responses to bushfires. This research is linked to an assessment of appropriate community-based strategies for enhancing community resilience to hazards in general. Her teaching activities include cultural aspects of environmental issues, disaster studies, community studies and qualitative social research methods.

**JIM COUSINS, B.SC.**

Jim Cousins has been employed with GNS Science and the Physics and Engineering Laboratory (DSIR), New Zealand, since 1973. His research is focused on reducing the vulnerability of peo-

ple, buildings and infrastructure to natural hazards. He has been involved in the modeling of damage and casualties caused by earthquakes, volcanoes, tsunami and post-earthquake fire. For nearly two decades, he has been helping clients from commerce, industry and government bodies understand their risks from earthquakes.

**MICHAEL DOHERTY, B.SC.**

Michael graduated with an Honors Degree in Science from the University of Sydney in 1986, majoring in plant ecology. Working on a wide range of vegetation management projects for Australian State and Federal Agencies he has developed expertise in the ecology of southeastern Australian vegetation communities as well as detailed knowledge of environmental legislation. In addition, he has worked on a variety of consulting projects both locally and overseas. In his current role with CSIRO Sustainable Ecosystems, Michael's research focus is in the dynamics and management of temperate ecosystems, particularly in relation to fire, forestry, and peri-urban expansion.

**CHRIS GREGG, PH.D.**

Chris Gregg is an Assistant Professor of Geology at East Tennessee State University in Johnson City, Tennessee. He received his Ph.D. in Geology and Geophysics from the University of Hawaii and his post-graduate Diploma from the University of Canterbury, New Zealand. He specializes in exploring social cognitive factors that influence community preparedness for geologic hazards (volcanic and tsunami). He is actively working on public understanding of warning signals for tsunami in Hawaii, Thailand, and the coastal US and Puerto Rico. Chris has an extensive background in the U.S.-based environmental industry, which compliments his natural hazards research.

**KATE HILL, M.A.**

Kate Hill is drawing upon her business expertise to conduct doctoral research into business continuity planning. While her contribution to this chapter focuses on large-scale events, the focus of my doctoral work is on the procedures and processes required to ensure continuity during local disruptions.

**BRUCE HOUGHTON, PH.D.**

Bruce Houghton is the Gordon MacDonald Professor in Volcanology at University of Hawaii at Manoa and Hawaiian State Volcanologist and a Fellow of the Royal Society of New Zealand. Previously, he had a career of 25 years as a volcanologist in New Zealand, culminating in the leadership of the scientific response to

the 1995–1996 eruption of Ruapehu volcano. Bruce has published over 150 research papers in international journals and was an editor of the *Encyclopaedia of Volcanoes* in 2000. In his career he has studied active volcanoes in Alaska, Chile, El Salvador, Greece, Hawaii, Iceland, Italy, Germany, Nicaragua, and New Zealand.

**PETER HUGHES, M.A.**

Peter Hughes teaches Media Studies at La Trobe University, Melbourne, Australia. His main areas of research and publication are in the fields of documentary film and television, and new cultural technologies. He is author, with Ina Bertrand, of Media research methods: Institutions, texts, audiences (published by Palgrave, Basingstoke, New York, 2005) and is currently engaged (with Peter White and Erez Cohen) on research into Media and Bushfires through the Bushfire CRC.

**LI-JU JANG, PH.D.**

Li-ju is an assistant professor in the School of Medical Sociology and Social Work at Chung Shan Medical University, Taiwan. She holds a doctorate from the University of Denver in Social Work. Her interest areas are human response to natural disaster, disaster resilience, and posttraumatic growth. Her focus has been on the effects of cultural factors on resilience and posttraumatic growth. Li-ju also supervises a group of voluntary outreach workers whom themselves were the survivors of the 921 Earthquake. Those survivors now reach out to people in need. Their roles have changed from service receivers to helpers.

**DAVID JOHNSTON, PH.D.**

David Johnston has been employed with the Institute of Geological and Nuclear Sciences, New Zealand since 1993, and his research is focused on reducing the vulnerability of society, economy, and infrastructure to hazards. He has been involved in developing integrated risk management strategies for many different hazard events, using techniques such as scenario development, mitigation planning and community education programs. He is also interested in assessing social and economic impacts of natural and environmental hazard events. David has had long-term relationship with a wide number of end-users through his research, consulting, and outreach activities.

**GAIL KELLY, PH.D.**

Gail's research focuses on understanding community change processes and strategies (initially in the context of forest industry restructuring). She has published a Social Impact Assessment on

the plantation industry, and led a conflict resolution process investigating aerial spraying of commercial eucalypt plantations. Gail currently leads the Sustainable Urbanization research stream within the Resource Futures Program at CSIRO Sustainable Ecosystems. Her current areas of focus include understanding the social dimensions of community resilience and developing linkages between quality of life and biophysical measures of sustainability in coastal regions.

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David King is an Associate Professor of Geography in the School of Tropical Environment Studies and Geography at James Cook University, and is both Director of the Centre for Disaster Studies, and the Centre for Tropical Urban and Regional Planning. He has worked in North Queensland for 15 years and was formerly at the University of Papua, New Guinea. His research specializes in social impact and evaluation in such areas as planning, natural hazard vulnerability and resilience, disaster mitigation and recovery, as well as the social impact of mining projects, third-world development, and census analysis.

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Walter LaMendola is Professor at the Graduate School of Social Work, University of Denver, Denver, Colorado, U.S.A. He teaches social theory as well as research courses in the PhD and Master of Social Work program. His scholarly interests have ranged across issues that involve the use and application of information and communication technologies in human services, particularly when they are directed toward, or otherwise involve themselves in the everyday life of people experiencing social problems, such as mental illness. He has recently completed a multi-year study of the effects of technology mediation on learning outcomes and resilience among children living in public housing.

**JOHN MCCLURE, PH.D.**

John McClure is Associate Professor of Psychology at Victoria University of Wellington. His research relating to disasters focuses on reducing people's fatalism about hazards such as earthquakes and on clarifying people's biases in the risk judgments about these hazards. He has examined the way that people's attributions for damage following earthquakes mediates their fatalism. People who attribute the damage solely to the force of the earthquake are more fatalistic than people who attribute the damage in part to the design of the damaged buildings. He has also clarified why people have a tendency to underestimate the risk from harmful low-frequency events.

**MOIRA O'CONNOR, PH.D.**

Moira O'Connor is a senior lecturer in the School of Psychology at Edith Cowan University, Western Australia. Moira teaches community psychology, environmental psychology and applied social psychology, as well as qualitative research methods. Her research interests include sense of place and the importance of place to people's psychological well-being; psychosocial aspects of living with cancer; psychological aspects of palliative care; women's health, particularly during life transitions; parenting and domestic violence and women's safety. What ties these research interests together is an interest in people's stories and experiences and a focus on health and well-being. Moira's involvement in community responses to natural disasters comes from an interest in sense of community and sense of place in rural Australia.

**DOUGLAS PATON, PH.D.**

Douglas Paton is a Professor at the University of Tasmania. He researches community resilience to natural hazards. This work involves working with communities susceptible to seismic, volcanic, bushfire, tsunami and flooding hazards. He recently served on a NATO working party on resilience to terrorism and was the Australian delegate to the UNESCO Education for Natural Disaster Preparedness in the Asia-Pacific program. He has published some 170 papers and chapters and 12 books on resilience and vulnerability to disaster and traumatic events. He is chief psychological advisor to the Cities on Volcanoes Commission (IAVCEI), editor of the *Australasian Journal of Disaster and Trauma Studies,* and is on the Editorial Board of *Disaster Prevention and Management.*

**JULIE ANN POOLEY, PH.D.**

Dr. Julie Ann Pooley is a Senior Lecturer in the School of Psychology at Edith Cowan University since 1991. She is involved in teaching in both the undergraduate and postgraduate psychology programs and has recently been awarded a National Teaching Award by the Australian University Teaching Committee. Her current research is focusing on communities facing natural disasters, through which she is trying to determine what enables communities to become resilient to impending threats. She is also interested in the area of environmental education and attitudes towards the environment.

**ADAM ROSE, PH.D.**

Adam Rose is Professor of Energy, Environmental, and Regional Economics in the Department of Geography at The Pennsylvania State University where he researches the economics of natural and

man-made hazards, and the economics of climate change. He recently served as a lead researcher on a report to the U.S. Congress evaluating the net benefits of FEMA hazard mitigation grants and on a National Research Council study on the benefits of advanced seismic monitoring. He is a faculty affiliate of the DHS Center for Risk and Economic Analysis of Terrorism Events and of the NSF Multidisciplinary Center for Earthquake Engineering Research, where his work emphasizes resilience to natural disasters and terrorism at the levels of the individual business, market, and regional economy. Professor Rose is the co-author or co-editor of ten books, published by Oxford and Johns Hopkins University Press among others, and has published 70 refereed articles. He serves on the editorial boards of several journals, as well as on the advisory boards of several research units at Penn State. He has served as the American Economic Association Representative to the American Association for the Advancement of Science and currently serves on the Board of Directors of the American Association of Geographers Energy and Environment Specialty Group. He is also the recipient of a Woodrow Wilson Fellowship, an East-West Center Fellowship, an Earthquake Engineering Research Institute Special Recognition Award, and the American Planning Association Outstanding Program Planning Honor Award.

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Professor Robert O. Schneider is currently serving as Acting Associate Vice Chancellor for International Programs at the University of North Carolina at Pembroke (UNCP). He has previously served as Department Chair and Professor in the Department of Political Science and Public Administration at UNCP. Dr. Schneider's research includes published work in hazard mitigation, the ethical dimensions of emergency management, and emergency management policy. He has also worked on several (local and national) curriculum development projects in emergency management.

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Leigh Smith is an Associate Professor in the School of Psychology at Curtin University of Technology, Perth, Western Australia. His fields of expertise include research design and analysis, measurement, and disaster research. He also has research interests in cognitive development and psych-motor development. He is currently the program leader for the Organizational Psychology stream within the School of Psychology.

**PETER B. WHITE, M.A.**

Peter B. White teaches Media Studies at La Trobe University in Melbourne, Australia. His main area of teaching and research deals with the social and regulatory implications of new media. Recent work with Naomi Rosh White examines the role of new media such as mobile phones, SMS, and internet-based communications in the lives of tourists. He is currently engaged (with Peter Hughes and Erez Cohen) on research into media and bushfires through the Bushfire CRC.

# CONTENTS

# DISASTER RESILIENCE

# Chapter 1

# DISASTER RESILIENCE: BUILDING CAPACITY TO CO-EXIST 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

A long history of development in locations which has resulted in increased societal susceptibility to experiencing adverse impacts from interaction with natural processes, such as volcanic, wildfire, storm, flooding, tsunami and seismic events, has stimulated interest in understanding how to manage the associated risk. This is no easy task. Objectively, societal risk from natural hazards is constantly increasing. Even if the probability and intensity of hazard activity remain constant, continuing population growth and economic and infrastructure development results in a concomitant increase in the potential magnitude and significance of loss and disruption associated with hazard activity, and consequently, risk. In this book, the focus is on managing risk through influencing the consequences of hazard exposure. It does

so by identifying factors that influence a capacity for co-existence with periodically hazardous, but often beneficial, environmental elements. This involves developing a capability to sustain societal processes should disaster occur through the proactive development of a capacity to adapt or adjust to the consequences of hazard activity.

The most effective strategy for achieving this outcome is planning to avoid development in areas susceptible to hazard impacts (Burby, Deyle, Godschalk, & Olshansky, 2000). While this approach must retain a prominent position in the battery of hazard mitigation strategies, particularly with regard to decisions about future development in areas susceptible to hazard activity and post-disaster rebuilding, it does not cater for all circumstances.

Much economic, infrastructure and social development has already occurred in areas susceptible to disruption and loss from hazard activity. For example, in her review of research from United States Geological Survey and Smithsonian Institute sources, Mayell (2002) describes how there are some 457 volcanoes with cities that house one million or more people within 100km of them. Depending on prevailing meteorological conditions, whose distribution cannot be planned for, hazards such as volcanic ash may find them. The city of Auckland, New Zealand is built on a volcanic field, the location of whose future eruptions cannot be predicted. It is difficult to plan where future development should occur if the location and distribution of future hazard activity cannot be specified in advance. While many of these cities have, so far, been spared a need to confront significant hazard events, others have. Experience of hazard activity is not, however, necessarily a disincentive for societal development.

For example, some 3.75 million people live in Naples, which has a history of experiencing adverse consequences over several millennia as a result of its proximity (within 30km) to Vesuvious. Popcate´petal, which has erupted 15 times in the past 400 years, is located 60km from Mexico City and its 20 million inhabitants (Mayell, 2002). The cities of San Francisco (U.S.) and Wellington (New Zealand), to name but a few, are built on active fault lines that have been active in historical times. These cities thus remain susceptible to experiencing considerable devastation from future seismic activity. Even if a decision to halt future development was made, a need to develop a capability to confront the consequences of hazard activity is an important component in any plan designed to facilitate a societal capacity to co-exist with the

potentially hazardous elements of its environment.

## Co-existing With a Hazardous Environment

As the opening quote alludes, this starts from hazard issues being the subject of community discourse that supports choosing to develop adaptive capacity. It also involves ensuring that the choices that reflect the substance of this discourse are translated into beliefs and behaviors that, over time, become established within the fabric of society. When such values are established, societies and their members lay the foundation for a destiny that includes a capacity for their sustained co-existence with a hazardous environment.

That developing a capacity for co-existence with natural hazards is feasible, is evident from observation of communities that face regular exposure to hazard activity. For example, because it receives ashfall and ballistic debris on some 113 days/year from its proximity to Sakurajima volcano, the town of Kagoshima in Japan has developed building codes, ash removal practices and community attitudes and preparedness to facilitate continuity of societal functions during periodic volcanic episodes (Johnston, 2004). That is, when a need to confront hazard consequences prevails, adaptive mechanisms can be established within the fabric of a society.

In locations characterized by less frequent hazard activity, however, a more challenging risk management environment faces the emergency planner. If they are to rise to this challenge, emergency management planners need knowledge of the characteristics and processes that underpin a capacity to adapt to hazard consequences and they need to develop strategies to instill these into the fabric of communities at risk. Furthermore, they have to do so in the context of evolving hazard-scapes.

The hazards that communities will face will change over time. For example, growth of residential development in the peri-urban environment has increased risk from wildfire hazards. Changes in land use patterns (e.g., farming, land clearance, industrial development) have increased environmental degradation. Change is also emanating from factors such as global warming. This may result in areas which have previously enjoyed relatively benign relationships with their environment experiencing risk from new sources. Clearly, understanding the hazards that represent the source of adaptive pressures is an important