

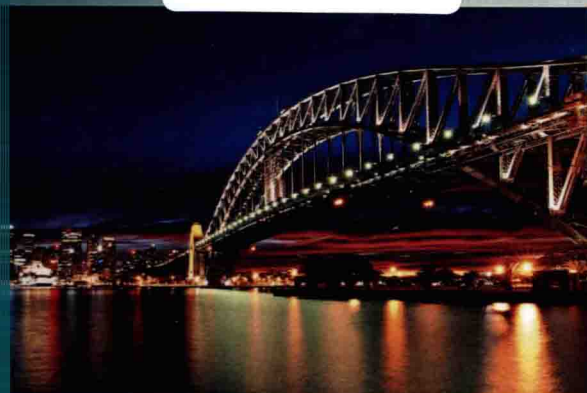
# Climate Change and the Coast

## Building Resilient Communities

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**Bruce C. Glavovic • Mick Kelly  
Robert Kay • Ailbhe Travers**

 **CRC Press**  
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# **Climate Change and the Coast**

**Building Resilient Communities**



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Bruce dedicates this book to Peter and Faith Glavovic  
Mick thanks Sarah for her patience and her sage advice  
Robert dedicates this book to Lizzy Kay  
Ailbhe dedicates this book to Lily

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# Foreword

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Ever since the beginning of the negotiations on the Framework Convention on Climate Change, I have had the privilege of being deeply involved in this fundamental effort of tackling one of the most serious global problems facing us. Climate change is one of the main components of the human impact on the immensely large natural systems that are essential for the long-term survival of our species. We realize that we have entered a new geological epoch, the Anthropocene.

Emissions of greenhouse gases have to be dramatically reduced over the coming decades. However, this is a time-consuming and politically laborious process. Therefore, the negotiations have increasingly had to facilitate adaptation to the negative effects of global warming. Among these consequences, the expected long-term sea-level rise and the increasing risks for climate disasters affecting coastal communities are among the most serious. The editors of this book rightly emphasize that up to 50% of the planet's population live in these zones and that a large number of the megacities are located at or close to the coast. In fact, what we call human civilization and human culture to a large extent developed in these areas of encounter and dynamic transitions.

My native country of Sweden has a long coastline and is at present seriously working on methods to reduce our vulnerability. Conditions are obviously very different in other parts of the world, but, faced with a global problem with so serious consequences for governments at all levels and for individuals in all countries, it is essential that we profit from adaptation practices and experiences in different parts of the world.

The case studies included in this book will be of great interest for all those who will be involved in the needed action to improve resilience to the effects of climate change on the coastal zones. In particular, I am struck by the ambition to provide practical guidance at the community level. As a former negotiator, I believe strongly in the essential role of multilateral agreements to mobilize global action on problems that are eminently global.



But the women and men who face storms, flooding, and destruction at the coastal front line need to be given the practical tools provided by experiences from other parts of the world.

**Bo Kjellen**  
*Stockholm Environment Institute*

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# Preface

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This book is about climate change and the coast. It focuses on our global coastal communities that face the prospect of rising sea levels, changes in the intensity of extreme events such as coastal storms, ocean acidification, and changes in ocean circulation patterns at a time when they are already stressed by existing environmental pressures and adverse social and economic trends. A key theme of the book is the urgent need to ready ourselves to deal with these coming waves of adversity and learn to plan for an uncertain future.

We embarked on this book because there is an urgent need to integrate insights from research and practice in an accessible way so that coastal communities can plan proactively for this future. Our collective academic and professional experience gives us a distinctive advantage for contributing to this goal and hence our collaboration. Bruce draws on his experience as the project manager for the Republic of South Africa's coastal policy formulation process that culminated in the passage of the Integrated Coastal Management Act that has transformed coastal management in that country. For over a decade, based at Massey University in New Zealand, Bruce has conducted research on how to build community resilience and sustainability by exploring the intersection of coastal governance, climate change adaptation, disaster risk reduction, and natural hazards planning. Mick draws on his career as a climate scientist at the University of East Anglia where, among other things, he researched mechanisms of climate change and climate vulnerability. More recently, he has worked with local communities in diverse settings to tackle a range of environmental issues. Educated in the United Kingdom, Rob held an academic position in New Zealand and has since worked for nearly two decades as a consultant to governments, communities, and companies around the world to translate best practices in coastal management and climate change adaptation into local reality. Ailbhe's contribution is grounded in her expertise as a coastal geomorphologist and environmental scientist and over a decade working as a consultant to coastal stakeholders, governments, and communities on a range of coastal management and climate change adaptation matters.

Our aim is to provide insight on learning to live with climate change through practical guidance for coastal communities. We draw from current theory and first-hand experience to show how to reduce vulnerability to climate change impacts and build adaptive capacity and resilience. This practical advice is based on consideration of a series of stories from real-world communities in diverse coastal settings from around the globe. These stories reveal the nature of climate change and explore the complex set of challenges and opportunities it poses for different coastal communities. We are privileged to have highly regarded specialists from different fields share their perspectives with us based on their first-hand experience. This ensemble of stories enables us to provide up-to-date, grounded insights about how to overcome the barriers and unlock the opportunities facing coastal communities in this era of climate change.

Our book is intended for a diverse audience. It will be of particular interest to professionals working in the public and private sectors of coastal communities, including coastal planners and managers, consultants, and scientists, as well as those who work for a range of international bodies. It provides practical guidance for coastal decision-makers, including elected and appointed government officials, business leaders, and leaders of non-governmental and community-based organizations. The book will be relevant to students and scholars in fields ranging from environmental science to geography, planning, development studies, politics, public administration, policy analysis, emergency management, and emerging interdisciplinary fields such as sustainability studies and adaptive management. It will be of special interest to people in coastal communities who are searching for innovative and practical ways to achieve more sustainable outcomes, especially those elected or appointed to make community decisions and those that advise them.

**Bruce C. Glavovic**  
*Massey University*

**P. Mick Kelly**  
*Tanelorn Associates*

**Robert Kay**  
*Coastal Zone Management Ltd*

**Ailbhe Travers**  
*Coastal Geomorphologist*

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# Acknowledgments

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Many people and organizations contributed to and supported us in developing and finalizing this book. We especially appreciate the invaluable contributions of all those who wrote case studies. Contributing authors generously shared their knowledge and experience with us and helped to develop a fresh perspective on how coastal communities might tackle the challenge of adapting to a changing climate.

We would like to especially thank Katharine Moody for working closely with authors to finalize the chapters and for her valuable contribution in the technical editing of the manuscript.

We gratefully acknowledge a financial contribution by the Land Oceans Interactions in the Coastal Zone (LOICZ) program that enabled us to meet in Perth to distil the essence of the case studies and develop the reflexive adaptation approach outlined in the concluding chapter.

Bruce would like to thank Massey University and his Head of School in particular for supporting the research that underpins his contributions to this book, including financial support to employ Katharine to assist with technical editing and undertake replacement teaching. He would also like to thank the Earthquake Commission for support and funding research that he conducted and is presented in this book.



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## Editors

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**Bruce C. Glavovic** holds the EQC Chair in Natural Hazards Planning at Massey University, New Zealand. His research explores the role of governance and land-use planning in building resilient and sustainable communities. He has over 25 years of experience in academia, private consulting, and government, mainly in the Republic of South Africa, the United States, and New Zealand. He is currently vice-chair of the Land–Ocean Interactions in the Coastal Zone (LOICZ) Scientific Steering Committee. He is coeditor of *Adapting to Climate Change: Lessons from Natural Hazards Planning* (2014, Springer), and a contributing author to Working Group II’s chapter on Australasia in the IPCC’s 5th Assessment Report.

**Mick Kelly** is a consultant with Tanelorn Associates based in New Zealand’s winterless north. Having retired from the Climatic Research Unit at the University of East Anglia in the United Kingdom, where he specialized in research on mechanisms of climate change and climate vulnerability, he now manages 69 acres of regenerating bush and is committed to community-based science projects.

**Robert Kay** is principal consultant of Coastal Zone Management Pty (Ltd) and of Adaptive Futures, Claremont, Australia, two niche consulting companies advising governments, communities, and companies worldwide on the challenges posed by climate change impacts. Dr. Kay has 25 years of experience in climate change impact assessment, coastal zone management and planning through work in government, consulting, and academic sectors. He holds a position of Visiting Adjunct Professor at the Sustainability Research Center at the University of the Sunshine Coast, Australia. He has an Honours degree in Geology (Wales) and a PhD in Environmental Science (East Anglia, UK).

**Ailbhe Travers** is a coastal geomorphologist with over 10 years of experience in environmental studies, focusing specifically on the coastal realm. She holds an Honours in Environmental Science (University of Ulster) and a PhD in Geography and Environmental Systems Engineering at the University of Western Australia.

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# Contributors

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**Derek Armitage** is an Associate Professor with the Department of Environment and Resource Studies, University of Waterloo, Ontario, Canada. His research interests center on the human dimensions of environmental change and the formation of adaptive, multilevel governance systems, with a primary focus on coastal, marine, and freshwater aquatic contexts.

**Scott Baum** is a Professor at Griffith University, Brisbane, Queensland, Australia. He is trained in economics and sociology and researches the conditions impacting on communities and their residents including climate change. He has published across many areas including climate change adaptation, community disadvantage, and labor market analysis.

**Marcus Bussey** is a researcher and futurist with the Sustainability Research Centre, University of the Sunshine Coast, Queensland, Australia. He is currently a Visiting Fellow at Nanyang Technology University, Singapore, with the Centre of Excellence in National Security.

**Gillian Cambers** is a coastal scientist who has worked for island governments and international organizations in the Caribbean, Indian Ocean, and Pacific regions. Recently, she led the Pacific Climate Change Science Program and is also Director of the Sandwatch Program.

**R.W. (Bill) Carter** is an Associate Director of the Sustainability Research Centre, University of the Sunshine Coast, Queensland, Australia. His research focuses on evaluation of resilience of communities and institutions to change, especially in the context of tourism and natural resource management.

**Ralph Chapman** is Environmental Studies Director, Victoria University of Wellington, Wellington, New Zealand. His research focuses on climate change policy. He has worked with the NZ Environment Ministry, NZ Treasury, UK Treasury, and OECD. He has degrees in engineering, public policy, and economics.



**Darryl Low Choy** is Professor of Environmental and Landscape Planning at Griffith University, Brisbane, Queensland, Australia. His current research is focused on values-led planning and indigenous landscape values, peri-urbanization and landscape resilience, and climate change adaptation and postdisaster planning for human settlements.

**Florence Crick** is a Research Fellow in the Urban Research Program at Griffith University, Brisbane, Queensland, Australia. She has previously worked as a project coordinator at the National Climate Change Adaptation Research Facility, Queensland, Australia, and as a climate change adaptation consultant at the OECD, France.

**Luke Dalton** is an environmental engineer in the Water Corporation of Western Australia, Stirling, Australia. Since graduating in 2009, he has worked on both environmental management and civil construction projects in Australia and abroad. He holds an Honours degree in Environmental Engineering from RMIT University, Victoria, Australia.

**Carmen Elrick-Barr** is an environmental scientist with over eight years of experience in environmental management and research. Over this time, she has delivered climate change adaptation programs, projects, and policies in Australasia, the Pacific, and Africa.

**Timoteo Caetano Ferreira** is a retired Professor from the University of Trás-os-Montes and Alto Douro (UTAD), Vila Real, Portugal and since 2006 he has been collaborating as International Consultant and Chief Technical Adviser with a number of United Nations Organizations including WMO, UNIDO, UNDP, and UNEP. Tim acted as the International Project Development Specialist in the Mozambique LDCF project development process.

**Annie George** is Chief Executive Officer of BEDROC (Building and Enabling Disaster Resilience of Coastal Communities), an NGO based out of Nagapattinam, Tamil Nadu, India. Previously, she was CEO of the NGO Coordination Resource Centre, Nagapattinam, Tamil Nadu, India, that coordinated recovery activities after the 2004 tsunami.

**Mónica Gómez-Erache** is a researcher at the School of Sciences, Universidad de la República (UdelaR), Montevideo, Uruguay, and senior advisor for the Climate Change Office of the Uruguayan Environment Ministry, Uruguay. Previously, she was the coordinator of the EcoPlata Program on integrated coastal zone management.

**Vivien Gornitz** is a geologist and special research scientist with the Columbia University Center for Climate Systems Research and NASA GISS, New York. Her research examines recent and Holocene global sea-level change and extreme climate events in the NY Metro Region.