

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

## RISING WATERS

### The Causes and Consequences of Flooding in the United States

Hurricane Katrina and the flooding of New Orleans in 2005 confirmed what had been tacitly understood by local policy makers for a long time: that the problem of flooding is getting worse and that this presents a major risk to the health and safety of the American population.

This interdisciplinary book brings together over 5 years of empirical research funded by the National Science Foundation to explore the causes of flooding in the United States and the ways in which local communities can reduce the associated human casualties and property damage. Focusing on the two most vulnerable states in the nation, Texas and Florida, this book investigates factors other than rainfall that determine the degree of flooding, and considers the key role of non-structural techniques and strategies in flood mitigation. The authors present an empirical and multiscale assessment that underlines the critical importance of local planning and development decisions.

Written for advanced students and researchers in hazard mitigation, hydrology, geography, and environmental planning and public policy, this book will also provide policy makers, federal, state, and local government employees, and engineers with important insights into how to make their communities more resilient to the adverse impacts of chronic flooding in the future.

**SAMUEL D. BRODY** is a professor at Texas A&M University in the departments of marine sciences at Galveston and landscape architecture and urban planning at College Station. He holds the George P. Mitchell '40 Chair in Sustainable Coasts and is the Director of the Center for Texas Beaches and Shores. Dr Brody is also a faculty fellow at the Rice University Severe Storm Prediction Education and Evacuation from Disasters Center, the Texas A&M University Hazard Reduction and Recovery Center, and the Texas A&M University Institute for Science, Technology, and Public Policy. His research and teaching focus on coastal environmental planning, environmental dispute resolution, climate change policy, and natural hazards mitigation.

**WESLEY E. HIGHFIELD** is a research scientist at Texas A&M University at Galveston in the department of marine sciences. He is also the Associate Director of the Center for Texas Beaches and Shores. Dr. Highfield conducts research on the effects of wetland alteration on flooding and teaches courses in geographic information systems and biostatistics.

**JUNG EUN KANG** is a research fellow in the Korea Adaptation Center for Climate Change of the Korea Environment Institute. Dr Kang was formerly a postdoctoral research associate at the Hazard Reduction and Recovery Center at Texas A&M University where she conducted research on coastal flooding and natural hazard mitigation in the Gulf of Mexico.

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

# RISING WATERS

The Causes and Consequences of  
Flooding in the United States

SAMUEL D. BRODY

*Texas A&M University at Galveston and College Station*

WESLEY E. HIGHFIELD

*Texas A&M University at Galveston*

JUNG EUN KANG

*Korea Adaptation Center for Climate Change  
of the Korea Environment Institute*



CAMBRIDGE  
UNIVERSITY PRESS

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

CAMBRIDGE UNIVERSITY PRESS  
Cambridge, New York, Melbourne, Madrid, Cape Town,  
Singapore, São Paulo, Delhi, Tokyo, Mexico City

Cambridge University Press  
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

[www.cambridge.org](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9780521193214](http://www.cambridge.org/9780521193214)

© Samuel D. Brody, Wesley E. Highfield, and Jung Eun Kang 2011

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2011

Printed in the United Kingdom at the University Press, Cambridge

*A catalogue record for this publication is available from the British Library*

*Library of Congress Cataloguing in Publication data*

Brody, Samuel David.

Rising waters : the causes and consequences of flooding in the United States /

Samuel D. Brody, Wesley E. Highfield, Jung Eun Kang.

p. cm.

Includes bibliographical references.

ISBN 978-0-521-19321-4 (hardback)

1. Flood control—Government policy—United States. 2. Flood damage—United States.

3. Floods—United States. I. Highfield, Wesley E. II. Kang, Jung Eun. III. Title.

TC423.B68 2011

363.34'930973—dc22

2010052186

ISBN 978-0-521-19321-4 Hardback

The publisher has used its best endeavors to ensure that the URLs for external websites referred to in this book are correct and active at the time of going to press. The publisher has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

## Contents

<i>Preface</i>	page vii
<i>Acknowledgments</i>	viii
<i>Abbreviations</i>	ix
1 Introduction: rising waters	1
<b>Part I The consequences of floods</b>	9
2 Rising cost of floods in the United States	11
3 Impacts of flooding in coastal Texas and Florida	31
4 National and state flood policy mitigation in the United States	56
<b>Part II Planning decisions and flood attenuation</b>	69
5 Identifying the factors influencing flooding and flood damage	71
6 The role of wetlands: federal policies, losses, and floods	88
7 Mitigation strategies and reduction of flood damages	103
8 Other factors influencing flooding and flood damage	130
<b>Part III What are we learning?</b>	139
9 Policy learning for local flood mitigation	141
10 Local case studies in Texas and Florida	157
<b>Part IV Policy implications and recommendations</b>	171
11 Flood policy recommendations	173
12 Conclusions	181
<i>References</i>	183
<i>Index</i>	194

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

---

## Preface

The information contained within this book was originally based on a National Science Foundation CAREER award to study the relationship between wetland alteration and coastal watershed flooding. Over the past six years, as dozens of colleagues, graduate and undergraduate students, and postdocs participated in the research, the scope of the project broadened to take on a more comprehensive look at flooding, flood impacts, and their policy implications. By bringing together multiple datasets and analyses, we aim to provide the reader with an evidence-based understanding of the degree to which flooding affects people's lives and the opportunities available to mitigate flooding impacts. To that end, we combine concepts, case studies, and statistical models to construct an overall vision of how to mitigate flood problems in the future. We focus our empirical study on Texas and Florida, but hope the findings and lessons learned throughout these pages can inform those based in other places.

While this book is scholarly in nature, it contains information useful to a broad audience, from those working in federal, state, and local government offices, to residents who have experienced flooding in their communities. Readers who do not wish to be overly burdened with understanding statistical procedures and relationships may skip to the summary sections at the end of each chapter, or to the policy recommendations presented at the conclusion of the book. Most of all, we hope that the material we present offers insight into the causes, consequences, and policy implications associated with floods in the United States.

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

## Acknowledgments

This book is based on research supported in part by the U.S. National Science Foundation Grant No. CMS-0346673 to Texas A&M University, the U.S. Environmental Protection Agency STAR Grant No. FP-91661001, and the Houston Endowment. The findings and opinions reported are those of the authors and are not necessarily endorsed by the funding organizations or those who provided assistance with various aspects of the study.

We would like to thank the many research assistants, postdocs, and faculty who have contributed to various aspects of the research contained in this book. These include: Himanshu Grover, Hyung-Cheal Ru, Sarah Bernhardt, Laura Spanel-Weber, Sammy Zahran, Praveen Maghelal, Zhenghong Tang, Anita Hollman, Beth Larkin, Amanda Jaloway, Walter M. Peacock, Scott Burleigh, Linda Salzar, and Ching-Yu Chou. Without their time and input this research could have never been accomplished. We are all indebted to Jennifer Feagins for her laudable organizational skills, attention to detail, and ability to bring this work together in its final form.

We also thank our colleagues and mentors for their encouragement and advice. Appreciation goes to Walter G. Peacock, Michael Lindell, Phil Berke, Dennis Wenger, Phil Bedient, Shannon Van Zandt, Arnold Vedlitz, Bill Merrell, and Bill Seitz. Special thanks go to our editors Ruth Schemmer and Linda Brody who made the forthcoming pages so much more readable.

Finally, and most importantly, we want to thank our friends and family for their constant patience, love, and support for all of our scholarly endeavors.

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

## Abbreviations

ACE	Army Corps of Engineers
ASFPM	Association of State Floodplain Managers
CBD	central business district
CBO	Congressional Budget Office
CRS	community rating system
CSTS	cross-sectional time-series
CWA	Clean Water Act
DCA	Department of Community Affairs
(the) District	Harris County Flood Control District
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	flood insurance rate map
FMA	Flood Mitigation Assistance (Program)
GAO	Government Accountability Office
GIS	geographic information systems
HGMP	Hazard Grant Mitigation Program
HUD	Housing and Urban Development
ICC	increased cost of compliance
NCDC	National Climatic Data Center
NESDIS	National Environmental Data and Information Service
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NSF	National Science Foundation
NWS	National Weather Service
PDM	Pre-Disaster Mitigation (Program)
RFC	Repetitive Flood Claims (Program)

Cambridge University Press

978-0-521-19321-4 - Rising Waters: The Causes and Consequences of Flooding in the United States

Samuel D. Brody, Wesley E. Highfield and Jung Eun Kang

Frontmatter

[More information](#)

---

x

*List of abbreviations*

SHELDUS	Spatial Hazard Events and Losses Database for the United States
SFHA	special flood hazard area
SRL	Severe Repetitive Loss (Program)
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Service