

Cities Under Water

A Comparative Evaluation of Ten Cities' Efforts to Manage Floodplain Land Use

by

Raymond J. Burby

Scott A. Bollens

James M. Holloway

Edward J. Kaiser

David Mullan

John R. Sheaffer



Program on Environment and Behavior

Monograph #47

Institute of Behavioral Science

University of Colorado

1988

Prepared with the support of the
National Science Foundation
Washington, DC 20550
NSF Grant Number ECE-8415817

The opinions, findings, conclusions, and recommendations expressed herein are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Copyright 1988

by the

University of Colorado

Institute of Behavioral Science

Library of Congress

Catalog Card No. 88-81241

PREFACE

For a number of years we have been concerned about the effectiveness of communities' efforts to manage areas subject to flooding. Is the nation getting on top of the urban flood problem? Has flood insurance simply added one more incentive to develop flood hazard areas? To the extent that communities are regulating floodplain development, what measures seem to be having a beneficial effect on development patterns and building practices and which are not? Those are some of the questions we address in this monograph. The answers are important, since the nation annually incurs over \$5 billion in flood losses. For almost 20 years, a massive federally initiated effort to reduce those losses has been underway through the Unified National Program for Floodplain Management and its centerpiece, the National Flood Insurance Program. That effort will be successful only if it brings about wise use of flood hazard areas through community floodplain management.

This monograph represents the culmination of a number of studies we've undertaken since 1975 to better understand how states and communities can manage floodplains to achieve hazard mitigation and environmental objectives. The specific idea for it, however, originated at a meeting in 1983 sponsored by the University of Colorado's Natural Hazards Research and Applications Information Center to consider the policy evaluation needs of the Tennessee Valley Authority. At that time, we noted the complementary research interests of the University of North Carolina's Center for Urban and Regional Studies and of Sheaffer and Roland, Inc., and the two groups decided to join forces to undertake an important longitudinal study of floodplain management. The National Science Foundation agreed to fund the study which began in the autumn of 1985.

The chapters of this monograph are a joint product of the six contributing authors. Raymond J. Burby assumed primary responsibility for chapters 1, 4, and 9 and contributed to each of the other chapters. Scott Bollens assumed primary responsibility for chapters 5, 6, and 7 and contributed to chapter 9. James Holway assumed primary responsibility for chapter 8 and contributed to chapters 5, 6, 7, and 9. Edward J. Kaiser contributed to chapters 1, 4, 6, 7, and 9. David Mullan and John R. Sheaffer assumed primary responsibility for chapters 2 and 3 and contributed to chapter 9. We would like to acknowledge the contributions of our colleagues, Dale Whittington and Harvey Goldstein, who helped us formulate the research design for the study reported here.

We are indebted to Sarah Nathe and the staff of the Natural Hazards Research and Application Information Center for editorial assistance and production work on this volume. We also would like to acknowledge the

assistance of Carolyn Jones, Barbara Rodgers, Asta Cooper, and Carroll Carrozza, who provided secretarial and administrative assistance. We owe a debt of gratitude to the local government floodplain management personnel in each of the ten cities we studied who responded graciously to our many requests for information and other assistance, and to the more than 300 floodplain property owners and builders and developers in those cities who responded to our requests for information about their perceptions of flood hazards and their activities in the floodplain. A final note of thanks is due William Anderson of the National Science Foundation, who served as program manager for the grant which funded the research we report here.

Raymond J. Burby
Scott A. Bollens
James M. Holway
Edward J. Kaiser
Chapel Hill, North Carolina
David Mullan
John R. Sheaffer
Wheaton, Illinois

TABLE OF CONTENTS

PREFACE	iii
LIST OF TABLES	viii
LIST OF FIGURES	xi
1 FLOODPLAIN LAND USE MANAGEMENT AND POLICY EVALUATION	1
Introduction	
Local Floodplain Management Programs	
The Need for Evaluation	
The North Carolina Research Program	
The Research Design	
Prospect	
2 TEN CITIES' PROGRAMS TO MANAGE FLOOD HAZARD AREAS	18
Key Program Dimensions and Components	
Overall Strength of the Ten Programs	
Savannah, Georgia	
Cape Girardeau, Missouri	
Toledo, Ohio	
Tulsa, Oklahoma	
Omaha, Nebraska	
Wayne, New Jersey	
Arvada, Colorado	
Fargo, North Dakota	
Scottsdale, Arizona	
Palatine, Illinois	
Variation in Program Strength	
3 THE IMPACTS OF FLOODPLAIN MANAGEMENT	57
Measuring with Counterfactual Scenarios	
Limiting Further Development of the Floodplain	

	Reducing Susceptibility to Flood Damage	
	Population at Risk	
	Protecting Floodplain Natural Values	
	Conclusions	
4	TARGET GROUPS FOR FLOODPLAIN LAND USE MANAGEMENT	84
	The Land Conversion Process	
	Key Decisions	
	Influences on Land Conversion Decisions	
	Surveys of Decision Makers	
5	LANDOWNERS' DECISIONS	95
	The Survey of Owners of Vacant Floodplain Property	
	Land Acquisition and Holding	
	Property Value Expectations	
	Knowledge and Perceptions	
	Attitudes Toward Floodplain Management Policy	
	Policy Implications	
6	BUILDERS' AND DEVELOPERS' DECISIONS	118
	Survey of Builders and Developers	
	Decisions to Buy and Develop Floodplain Property	
	Decisions Regarding Site Design and Construction	
	Awareness and Perceptions of Flood Hazards	
	Attitudes Toward Floodplain Management Policy	
	Policy Implications	
7	CONSUMERS' DECISIONS	137
	Survey of Consumers	
	Home and Commercial Building Purchase Decisions	
	Flood Mitigation Measure Adoption	
	Knowledge and Perceptions of Flood Hazards	
	Attitudes Toward Floodplain Management	
	Policy Implications	

8	THE MARKET EFFECTS OF FLOODPLAIN LAND USE MANAGEMENT	153
	Determinants of Land Value and Development	
	Lessons from Previous Research	
	Methods Used to Examine the Land Market	
	The Value of Vacant Land	
	Development	
	Policy Implications	
9	LESSONS LEARNED AND SUGGESTIONS FOR FLOODPLAIN LAND USE MANAGEMENT POLICY	176
	Important Findings	
	Benefits and Costs of Floodplain Land Use Management	
	Conclusions	
	REFERENCES	197
	APPENDICES	
A	Measurement of Floodplain Program Components and Dimensions	214
B	Coding of Independent Variables Used to Study Land Values and the Likelihood of Development	218
C	Questionnaires Used for Surveys of Owners of Vacant Land, Builders and Developers, Consumers	225
D	Land Parcel Characteristics	246

LIST OF TABLES

2-1	Factors Associated with the Adoption of Strong Floodplain Management Programs	55
3-1	Residential Building Permits Issued in Ten Cities, 1976-1985	61
3-2	Projected Increase in Floodplain Dwellings without Floodplain Management vs. Dwellings Actually Built, 1976-1985	63
3-3	Nonresidential Building Permits Issued in Ten Cities, 1976-1985	66
3-4	Comparison of Projected Increase in Floodplain Nonresidential Acreage without Floodplain Management with Actual New Nonresidential Acreage, 1976-1985	68
3-5	Change in Total Average Annual Private and Public Flood Loss Potential, 1976-1985	72
3-6	Comparison of Projected Increase in Average Annual Flood Losses without Floodplain Management with Losses with Floodplain Management, 1976-1985	73
3-7	Change in Flood Insurance Policies in Effect in Ten Communities, 1976-1985	76
3-8	Change in Proportion of Floodplain Dwellings Covered by Flood Insurance, 1976-1985	77
3-9	Comparison of Projected Floodplain Population without Floodplain Management with Actual Population with Floodplain Management, 1985	79

3-10	Comparison of Projected Floodplain Open Space without Floodplain Management with Actual Open Space with Floodplain Management, 1985	81
5-1	Factors Associated with Motives for Purchasing Vacant Land in the Floodplain	100
5-2	Factors Associated with Motives for Holding Vacant Land in the Floodplain	104
5-3	Association of Perceived Odds of Property Flooding and Previous Flooding Experience with Motives for Holding Property	106
5-4	Motives for Holding Floodplain Land and Acquisition of Property Before or After City Joined National Flood Insurance Program	108
5-5	Effect of Availability of Flood-Free Sites on Investment Holding for Parcels Acquired After City Joined National Flood Insurance Program	108
5-6	Factors Associated with Property Value Expectations Over the Next Five Years	109
5-7	Landowners' Attitudes about Responsibility for Dealing with Flood Hazards	113
5-8	Landowners' Evaluations of Specific Measures to Deal with Flood Problems	115
6-1	Factors Associated with Builders' and Developers' Perceptions of Floodplain Land	121
6-2	Association between Strength of Local Floodplain Program and Perceived Profitability and Developability of Floodplain	125
6-3	Association of Floodplain Program Strength and Mean City Growth Rate and Median Housing Value	125

6-4	Mitigation Measures Incorporated into Floodplain Projects	127
6-5	Factors Associated with Adoption of Hazard Mitigation Measures	128
6-6	Comparison of Builders' and Developers' Attitudes about Responsibility for Dealing with Flood Hazards with Those of Landowners	133
6-7	Comparison of Builders' and Developers' Evaluations of Specific Measures to Deal with Flood Problems with Those of Landowners	135
7-1	Factors Associated with Frequency of On-Site Mitigation and Political Action by Consumers	143
7-2	Characteristics of Property Owners Who Took Political Action	146
7-3	Comparison of Consumers' Attitudes about Responsibility for Dealing with Flood Hazards with Those of Landowners	149
7-4	Comparison of Consumers' Evaluations of Specific Measures to Deal with Flood Problems with Those of Landowners	151
8-1	Sample of Parcels Studied	164
8-2	List of Variables	166
8-3	Regression of Land Value on Control and Policy Variables for Vacant Land Zoned for Residential Use	168
8-4	Logistic Regression of Development Status on Control and Policy Variables for All Parcels	173
9-1	Benefits and Costs of Floodplain Management in Ten Cities	188

LIST OF FIGURES

1-1	Overview of Research Design	13
1-2	Location of the Ten Case-Study Communities	16
2-1	Relative Strength of Ten Cities' Floodplain Management Programs	21
2-2	Map of Savannah, Georgia	24
2-3	Map of Cape Girardeau, Missouri	27
2-4	Map of Toledo, Ohio	30
2-5	Map of Tulsa, Oklahoma	33
2-6	Map of Omaha, Nebraska	37
2-7	Map of Wayne Township, New Jersey	40
2-8	Map of Arvada, Colorado	44
2-9	Map of Fargo, North Dakota	47
2-10	Map of Scottsdale, Arizona	50
2-11	Map of Palatine, Illinois	53