

# **Springer Series on Environmental Management**

---

**Robert S. DeSanto, Series Editor**



Soil erosion, an agricultural disaster, Locust Grove, Sherman County, Oregon (Frank M. Roadman, USDA–Soil Conservation Service photograph).

Harold D. Foster

# **Disaster Planning**

The Preservation of Life and Property

With 48 Figures



Springer-Verlag  
New York Heidelberg Berlin

**Harold D. Foster**  
University of Victoria  
P.O. Box 1700  
Victoria, British Columbia  
Canada V8W 2Y2

*According to German legend the Lorelei lured sailors to  
their deaths on the Rhine rocks. This book is dedicated to a  
Lorelei who, despite her name, has helped me avoid many a  
disaster.*

Library of Congress Cataloging in Publication Data  
Foster, Harold D  
Disaster planning.

(Springer series on environmental management)

Bibliography: p.

Includes index.

1. Disaster relief—Planning. I. Title.

II. Series.

HV553.F64 363.3'48 80-18910

The use of general descriptive names, trade names, trademarks, etc. in this publication, even if the former are not especially identified, is not to be taken as a sign that such names, as understood by the Trade Marks and Merchandise Marks Act, may accordingly be used freely by anyone.

All rights reserved.

No part of this book may be translated or reproduced in any form without written permission from Springer-Verlag.

© 1980 by Springer-Verlag New York Inc.

Softcover reprint of the hardcover 1st edition 1980

9 8 7 6 5 4 3 2 1

ISBN-13:978-1-4612-6095-0 e-ISBN-13:978-1-4612-6093-6

DOI: 10.1007/978-1-4612-6093-6

## **Series Preface**

This series is dedicated to serving the growing community of scholars and practitioners concerned with the principles and applications of environmental management. Each volume will be a thorough treatment of a specific topic of importance for proper management practices. A fundamental objective of these books is to help the reader discern and implement man's stewardship of our environment and the world's renewable resources. For we must strive to understand the relationship between man and nature, act to bring harmony to it and nurture an environment that is both stable and productive.

These objectives have often eluded us because the pursuit of other individual and societal goals has diverted us from a course of living in balance with the environment. At times, therefore, the environmental manager may have to exert restrictive control, which is usually best applied to man, not nature. Attempts to alter or harness nature have often failed or backfired, as exemplified by the results of imprudent use of herbicides, fertilizers, water and other agents.

Each book in this series will shed light on the fundamental and applied aspects of environmental management. It is hoped that each will help solve a practical and serious environmental problem.

Robert S. DeSanto  
East Lyme, Connecticut

# Preface

The daily newspapers record a never-ending series of disasters. From epidemics to invasions, each headline is accompanied by graphic descriptions of death, suffering, and destruction. Nevertheless, many communities tend to ignore the risks to life and property posed by the ever-increasing hazard spectrum. Others make token efforts at preparedness, accepting the possibility of local disaster and designing a plan to deal with its aftermath. A few, more enlightened municipalities have begun to recognize that every decision has an impact on risk, and therefore on the probability of disaster. This book is written to encourage more local authorities, institutions, and organizations to accept their responsibility to increase safety through such comprehensive risk management.

There will be those no doubt who, after reading this volume, will exclaim, "the price of safety is too high." There are few goals that are worth satisfying at the expense of community destruction or dramatic increases in deaths and illnesses. In response to such criticism it should be pointed out that in urban communities the staff, equipment, and information already may be available to implement many of the stages of the disaster mitigation model presented in this volume. What is often needed is a redefinition of roles, change in emphasis, and a commitment to achieve safety goals. In many cases procedures and practices may be made less hazardous by changes that are not necessarily more expensive. Similarly, if through the implementation of a safety plan, death, illness, and destruction are reduced, other community programs will become less financially demanding. Where additional assistance is required to meet safety goals, this may often be provided at minimal cost by senior levels of government, or by college and university departments. For example, postdisaster plans, designed to speed recovery if destruction should occur, can be prepared as training exercises for urban geographers, planners, and architects.

The situation is more complicated in rural areas, where resources and expertise are generally limited. Since safety is everyone's concern it should also be each individual's responsibility. For this reason, local officials might actively seek assistance from various community groups on a volunteer basis.

Some of the concepts in this volume are my own and I take full responsibility for them. The large majority, however, have been gleaned from the published works of the small army of dedicated individuals who attempt to reduce the suffering of others by an analysis of the causes and consequences of disaster. To all such colleagues I owe a considerable in-

tellectual debt. Their names are listed in the bibliographies following each chapter.

I am also pleased to acknowledge the encouragement of Dr. Robert S. DeSanto, who first suggested I write such a book. Mrs. E. Lowther has been of great assistance in her continuing role as the world's best typist. Lorelei, my wife, has been invaluable as both proofreader and constructive critic. I should also like to acknowledge the drafting and graphic skills of Mr. Ian Norie, Mr. Ole Heggen, and Mr. Ken Quan, which have added greatly to the quality of the final product.

Harold D. Foster  
University of Victoria  
Victoria, B.C.

# Contents

<i>Series Preface</i>	v
<i>Preface</i>	vii
<b>1. Introduction</b>	<b>1</b>
References	4
<b>2. Risk and Comprehensive Planning</b>	<b>5</b>
Risk and the Comprehensive Plan	5
The Development of a Community Safety Plan	7
Safety Goals and Objectives	9
Potential Strategies	21
Criteria for Evaluating Alternative Strategies	25
Constraints and Strategy Adoption	27
Safety Programs	34
Safety Plan	34
Hindsight Review	35
References	40
<b>3. Development and the Spatial Distribution of Risk</b>	<b>43</b>
Hazard Microzonation	43
Data Collection	46
Scale	62
Single Hazard–One Purpose Mapping	63
Single Hazard–Multiple Purpose Mapping	64
Multiple Hazard–Multiple Purpose Mapping	68
Acceptable Risk	78
Enforcing Unacceptable Risk Standards	86
Opposition to Microzonation	88
References	90
<b>4. Safety by Design</b>	<b>96</b>
Structural Integrity	97
Operational Compatibility	102
Fail-Safe Design	104
Forgiving Environment for Failures	107
Emergency Evacuation	113
Security	116
Conclusions	121
References	122
<b>5. Predicting and Preventing Disaster</b>	<b>124</b>
Disaster Simulation Models	125
Scenarios	146



Delphi Technique	150
Game Simulations	154
Gaming: An Overview	159
Field Exercises	161
Conclusion	165
References	165
<b>6. Disaster Warning Systems</b>	<b>170</b>
The Nature of Warning Systems	170
Recognition of Danger	173
Designing the Warning System	174
Installation and Operation	184
Education of the User Group and Modification of the Infrastructure	186
Testing the System	188
Modification after Testing	189
Detection of Threat	190
Collation and Evaluation	191
The Decision to Warn	193
Transmission of Warning Messages	196
Interpretation of Warning Messages and Action by Recipients	202
Feedback to Issuers of Warnings	203
Transmission of Further Warning Messages	206
Issuing of All-Clear Messages	206
Hindsight Review	207
Testing the Revised System	208
References	208
<b>7. Disaster Plans</b>	<b>212</b>
The Case for Preparation	212
The Content of a Disaster Plan	213
References	234
<b>8. Construction and Reconstruction</b>	<b>235</b>
The Recovery Process	237
Related Problems	240
In Conclusion	253
References	253
<i>Index</i>	<i>255</i>