



# DIVIDED WATERS

Bridging the U.S.-Mexico Border

Helen Ingram, Nancy K. Laney, and David M. Gillilan

# Divided Waters

---

Bridging the U.S.-Mexico Border

Helen Ingram, Nancy K. Laney, and David M. Gillilan

The University of Arizona Press Tucson

The University of Arizona Press

Copyright © 1995

The Arizona Board of Regents

All Rights Reserved

⊗ This book is printed on acid-free, archival-quality paper.  
Manufactured in the United States of America

00 99 98 97 96 95 6 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Ingram, Helen M., 1937—

Divided waters : bridging the U.S.-Mexico border / Helen Ingram,  
Nancy K. Laney, and David M. Gillilan.

p. cm.

Includes bibliographical references and index.

ISBN 0-8165-1513-1 (cloth).—ISBN 0-8165-1564-6 (paper)

1. Water rights—United States. 2. Water rights—Mexico.

3. Water-supply—Arizona—Nogales. 4. Water-supply—Mexico—  
Nogales (Sonora) 5. United States—Boundaries—Mexico.

6. Mexico—Boundaries—United States. I. Laney, Nancy K. II. Gillilan,  
David M., 1960— . III. Title.

HD1694.A3 1995

333.91'00972'1—dc20 95-13626

CIP

## Divided Waters

*To Rosalva Gallardo, who was herself a bridge across the border.*

## Acknowledgments

This book is the capstone of a binational research project that began in 1989. The project was sponsored by the Ford Foundation and conducted at the Udall Center of the University of Arizona. By 1994 the project had produced more than 175 documents, including published and unpublished papers and conference presentations. Consequently, this book reflects not just the work of the authors but also the cumulative knowledge and insights provided by the many individuals involved in the project. As a binational enterprise, the book draws heavily on the knowledge and expertise provided by the Mexican counterparts of the Udall Center: El Colegio de La Frontera Norte (COLEF) and the Instituto Tecnológico de Sonora. Roberto Sánchez and Francisco Lara at COLEF were important sources of information and perspectives on water management in Mexico.

The interdisciplinary research team coordinated by the Udall Center is the source of the broad expertise that informs this book. Simon Inge, Tod Rasmussen, and Jim de Cook developed much of the hydrological information on which Chapter 3 is based. Stuart Marsh consulted on the GIS maps. Irasema Coronado provided much of the social and historical data in Chapters 2 and 4. Melinda Laituri, Barbara Morehouse, Shelby Tisdale, Brad Cloud, David White, Vera Pavlakovich, Gary Hansen, Greg Saxe, and Ron Sokota, among others, produced crucial background documents. Other individuals, especially Dick Kamp and John Audley, provided important ideas at key junctures.

Large team efforts seldom succeed without a maestro to orchestrate the blending together of the many parts. Our maestro was Robert Varady, who also doubled as a careful reader and critic. Among

Varady's most important accomplishments was the recruitment of Lenard Milich, whose enormous talent for editing and manuscript preparation are evidenced on every page. Although the authors hold Milich blameless for any faults in this book, they gratefully share full credit for turning a simple report into a real book.

## Contents

List of Acronyms ix

List of Figures xi

Acknowledgments xiii

### **Chapter 1 Global Trends and Border Consequences 3**

Multiplying Borders 3

The Greening of the Globe 9

Global Economic Integration 15

The Grass Roots: Demand for Local Participation and Control 19

Policy Design for the Future 22

The Global Problem in Microcosm 25

### **Chapter 2 Shared Encounters: Ambos Nogales 28**

The Origins 29

Patterns of Growth 33

Interdependent Economies 38

The Border Culture 46

### **Chapter 3 The Troubled Waters of Ambos Nogales 50**

Natural Water Resources 50

Water Resources Systems 58

Water Quality 98

### **Chapter 4 Divided Neighbors 104**

Four Families 105

Socioeconomic Dividing Lines 110

Perceptions and Attitudes about Water 116

Social and Economic Linkages Across the Border 129



Transboundary Linkages: The View from Nogales, Arizona	134
Differing Perceptions of Water Issues in Nogales, Arizona	137

## **Chapter 5 Stranded Communities and Failed Crossings 146**

Who Is Responsible for Sewage in Nogales Wash?	147
Lessons from Nogales	160
The Mexican Perspective	165
Differing Perceptions of Public Health and Environmental Issues	166
Changing Times in Mexican Water Regulation	167
The Path toward Decentralization and Shared Goals	178
The IBWC: Hope for the Future or Outdated Institution?	180
The La Paz Agreement: Adequate Basis for Binational Action?	194
Ambos Nogales and the EPA	197
An Evaluation of the EPA and SEDESOL as Binational Actors	200

## **Chapter 6 Reinventing the Border: A Framework for Transboundary Water Management 203**

Global Forces Revisited	203
Borders: Maelstroms or Bridges?	205
Border Links	216
Bridging Borders through Improved Institutional Design	220
Criteria for Successful Border Institutions	222

## **Appendix A Implementation of the Border Environment Cooperation Commission and the North American Development Bank 231**

## **Appendix B Proposal for a U.S.-Mexico International Boundary Environmental Commission: A Binational U.S.-Mexico Border Environmental Management Institution 234**

Notes	243
Bibliography	252
Index	258

## Acronyms

ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AGMA	Arizona Groundwater Management Act (1980)
AMA	Active Management Area
AMCHAM	American Chamber of Commerce in Mexico
BECC	Border Environmental Cooperation Commission
BEP	Border Ecology Project
BIP	Border Industrialization Program
CILA	Comisión Internacional de Límites y Aguas (International Boundary and Water Commission)
CNA	Comisión Nacional del Agua (National Water Commission)
COAPAES	Comisión de Agua Potable y Alcantarillado del Estado de Sonora (State of Sonora Potable Water and Sewerage Commission)
COLEF	El Colegio de la Frontera Norte (College of the Northern Border)
EPA	U.S. Environmental Protection Agency
GIS	Geographical Information System
IBEP	Integrated Environmental Plan for the Mexico-U.S. Border Area
IBWC	International Boundary and Water Commission
INEGI	Instituto Nacional de Estadística, Geografía e Informática (National Institute for Statistics, Geography, and Information)
NAFTA	North American Free Trade Agreement
NGO	Nongovernmental organization
NIWUTF	Nogales International Waste Water Treatment Facility
NPDES	National Pollution Discharge Elimination System
NWD	Nogales, Ariz., Water Department
PCE	Perchloroethylene (tetrachloroethylene)
PRI	Partido Revolucionario Institucional (Institutional Revolutionary party)
SARH	Secretaría de Agricultura y Recursos Hidráulicos (Ministry of Agriculture and Water Resources)

x Acronyms

SEDESOL	Secretaría de Desarrollo Social (Ministry for Social Development)
SEDUE	Secretaría de Desarrollo Urbano y Ecología (Ministry for Urban Development and Ecology)
SIF	Sistema de Información Fronteriza (Border Information System)
TCE	Trichloroethylene
VOC	Volatile organic compound
WPA	Work Projects Administration

## Figures

- 1.1 The border region on either side of the U.S.-Mexico boundary 7
- 1.2 A state of emergency declared by the City of San Diego on September 7, 1993 13
- 1.3 Aerial map of Ambos Nogales 26
- 2.1 Population growth in Ambos Nogales, 1930–1990, and estimates for Nogales, Son., through 2012 35
- 2.2 Fruits and vegetables passing through the Port of Nogales, 1987–1992 40
- 2.3 Employed population in Nogales, Son., 1990 42
- 2.4 Estimated number of maquila employees in Nogales, Son., 1990 43
- 2.5 Labor costs in Mexican factories as a percentage of total U.S. labor costs for manufacturing 44
- 3.1 The upper Santa Cruz River and upper Río Magdalena (Los Alisos) watersheds 51
- 3.2 Climate of Nogales, Ariz. 52
- 3.3 Nogales, Son., water supply wellfields, July 1993 71
- 3.4 The price of household water in Ambos Nogales 82
- 3.5 Social inequity in access to water in Ambos Nogales 83
- 3.6 Effluent release from the NIWWTF to the Santa Cruz River 95
- 4.1 Zones supplied with potable water by pipas; and the percentage of residents without access to water supply or sewer systems 117
- 4.2 Number of hours per day during which inhabitants of Nogales, Son., receive water through the COAPAES system 118
- 4.3 Percentage of residents of Nogales, Son., who believe that contaminated water may adversely affect their health 119
- 4.4 Residents' perceptions of water quality in Nogales, Ariz. 126
- 4.5 Residents' perceptions of the degree of seriousness of water contamination in Nogales, Ariz. 127
- 4.6 Increased purchases of bottled water in response to perceptions of worsening water quality in Nogales, Ariz. 128
- 4.7 Household income diversity by language preference, Nogales, Ariz. 135

xii Figures

- 4.8 Residents of Nogales, Ariz., who transport water to friends or relatives in Sonora 136
- 4.9 Goods and services purchased in Nogales, Son., by Nogales, Ariz., residents 137
- 4.10 Nogales, Ariz., residents' perceptions of NWD water quality 138
- 4.11 Nogales, Ariz., residents' perceptions of water contamination 138
- 4.12 Nogales, Ariz., residents' political actions in response to water problems 140
- 4.13 Nogales, Ariz., residents' perceptions of the level of government most responsible for water policy 141
- 4.14 "National" versus "binational" orientations of Rio Rico and Nogales, Ariz., residents 143
- 5.1 Environmental themes in Ambos Nogales newspapers 167
- 5.2 Sources of information for articles on the environment in Ambos Nogales newspapers 168

## Divided Waters



# Global Trends and Border Consequences

---

## Multiplying Borders

Our shrinking planet hosts a growing number of nations. Along with the rapid political reconfigurations of the 1990s, new boundaries are proliferating like lines on a fractured mirror. At the same time, the distances between nations are being narrowed through migration, travel, communications, and trade. The collapse of communism in the Soviet Union and eastern Europe and the virtual disintegration of several African states have been accompanied by drastic changes in the political landscape. New, often ethnically based nations are in the process of inventing themselves and securing their borders. Between late 1991 and mid-1993, the dissolution of two great heterogeneous federations, the Soviet Union and Yugoslavia, into many ethnic republics, as well as the amicable separation of Czechoslovakia, expanded the number of international boundaries by 46 (Udall and Varady, 1993).<sup>1</sup> By their very nature, borders create stress and contradictions, and the increasing number of borders is cause for concern. Where the peripheries of nations come together, experience suggests that both problems and possibilities exist.

Boundaries are legal constructs invented by humans to serve a variety of important purposes. Political control cannot be asserted without setting a boundary inside of which a regime governs. Rights cannot exist unless a boundary separates those who have rights from those who do not. Formerly united peoples divide as a way of resolving disputes resulting from irreconcilable interests, allowing each new nation to go its own way. Less internal conflict may exist when borders are drawn to include people with common interests or to exclude those with different backgrounds and points of view.

Boundaries can be flashpoints over issues that neighbors have in common, such as environmental pollution. Natural resources are



especially likely to present problems because of their increasing scarcity and value. Further, national boundaries often intersect the boundaries of natural systems, and actions taken by one nation that affect the atmosphere, oceans, airsheds, watersheds, aquifers, wildlife migration corridors, and other shared resources are bound to affect the interests of other nations.

What should be optimally treated as a unified whole is managed instead through different and often conflicting regimes. Boundaries fragment legal and political power, with the result that there is no single jurisdiction with the power to make and enforce decisions. Throughout Eurasia, for example, the number of trustees of threatened resources such as the Black, Aral, and Caspian Seas and the Danube River has multiplied severalfold. What were once difficult internal problems for the Soviet Union and its eastern European sister states have become even more complex international issues.<sup>2</sup> There are other costs associated with drawing boundary lines as well. Drawing boundaries has the effect of marginalizing the things closest to the line, designating them as remote from the core. The breakdown of law and order and the decline of civilizing influences are often associated with frontier regions. It is no accident that from the time the Akkadian Empire constructed a wall of fortresses known as the Repeller of the Amorites almost 4,050 years ago (H. Weiss et al., 1993), powerful interests have fortified themselves against change by building walls and arming outposts along borders.

But if boundaries can separate, they can also connect. They can bridge differences and bring divergent interests and attitudes closer together, functioning as points of contact and cooperation where greater diversity and opportunity for innovation exist. Frontiers are often testing grounds that illustrate the vulnerability of a system and the advantages of change. The Berlin Wall, after all, represented a desperate act by a threatened regime, and the permeability of the border leading to the dismantling of the wall signaled the regime's end. Boundaries, more than other places, provide the geographic context for challenging established ideas. Possibilities expand at the frontier. At their best, borders are places where conventional approaches are questioned; stereotypes dissolve in the face of reality, and new understanding emerges. A boundary region that shares and combines the