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THE U.S.- MEXICAN

border
environment:

A road map
to a sustainable 2020

Edited by
Paul Ganster

SCERP Monograph Series, no. 1

Southwest Center for Environmental Research and Policy

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A series edited by Paul Ganster and David J. Pijawka

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The Southwest Center for Environmental Research and Policy (SCERP) is a consortium of U.S. and Mexican universities dedicated to addressing environmental issues of the U.S.-Mexican border region through applied research, outreach, and regional capacity building.

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THE U.S.-MEXICAN BORDER ENVIRONMENT

A Road Map to a Sustainable 2020

Edited by Paul Ganster

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Foreword

This volume, *The U.S.-Mexican Border Environment: A Road Map to a Sustainable 2020*, inaugurates the monograph series of the Southwest Center for Environmental Research and Policy (SCERP). Published by the San Diego State University Press with the cooperation of the Herberger Center for Design Excellence at Arizona State University, this series presents the results of research projects, policy analyses, information systems development, and symposia supported by SCERP.

Since its inception in 1990, the SCERP consortium of Mexican and U.S. universities has carried out some hundred and twenty specific projects that have involved more than two hundred faculty researchers and a like number of advanced graduate students. While the results of this research are available as final project reports on SCERP's web site (www.scerp.org) and in hundreds of articles in the scientific, policy, and environmental management literature, the SCERP Monograph Series makes available research results that are grouped thematically. The series will be distributed widely to stakeholders in the border region as well as to the public policy and scientific communities in Mexico and the United States. The next two volumes of the series, now in progress, will address water and air issues of the U.S.-Mexican border region.

The U.S.-Mexican Border Environment: A Road Map to a Sustainable 2020 brings together background papers and ancillary materials prepared for Border Institute I, held in December 1998. The briefing papers, as presented at Border Institute I and then revised, lay out basic information and analysis about the population, economy, environment, and governance of the border region. They provided the context for discussions of the environmental sustainability of the region over the next twenty years or so. The purpose of Border Institute I was to encourage stakeholders in the region and elsewhere to redirect their focus from immediate and urgent current border environmental issues to the steps that must be taken soon if the region is to arrive at 2020 with a healthy and sustainable environment. SCERP, and its partners in Border Institute I—the U.S. Environmental Protection Agency and the Border Trade Alliance—will convene additional meetings approximately every year to continue the discussion on key aspects of the environmental sustainability of the border region. Each of these institutes will produce a volume for the SCERP Monograph Series.

As general editors of the SCERP Monograph Series, we wish to recognize the efforts of Jennifer Fraser, of Arizona State University's Herberger Center, who

The U.S.-Mexican Border Environment

took charge of copyediting, design, and layout of this inaugural volume. Bertha Hernández, of SDSU's Institute for Regional Studies of the Californias, also provided valuable assistance with copyediting and substantive issues.

Paul Ganster, San Diego State University

David Pijawka, Arizona State University

SCERP Monograph Series General Editors

Acronyms

AIRS	Aerometric Information Retrieval System
APCD	Air Pollution Control District
BECC	Border Environment Cooperation Commission
BEIF	Border Environmental Infrastructure Fund
BLM	Border Liaison Mechanism
BTA	Border Trade Alliance
CEC	Commission for Environmental Cooperation
CFE	Mexican Federal Electricity Commission (Comisión Federal de Electricidad)
CICA	Centro de Información Sobre Contaminación de Aire
CILA	Comisión Internacional de Límites y Aguas
COG	Councils of Government
EPA	U.S. Environmental Protection Agency
GATT	General Agreement on Tariffs and Trade
GNEB	Good Neighbor Environmental Board
GSP	gross state product
IBEP	Integrated Border Environmental Plan
IBWC	International Boundary and Water Commission
IDP	Institutional Development Program
IMF	International Monetary Fund
IMIP	Instituto Municipal de Investigación y Planeación
ISI	Import Substitution Industrialization
JAC	Joint Advisory Committee
LFPR	labor force participation rates
MSAs	Metropolitan Statistical Areas
NAAEC	North American Agreement for Environmental Cooperation
NADBank	North American Development Bank
NAFEC	North American Fund for Environmental Cooperation
NAFTA	North American Free Trade Agreement
OECD	Organization for Economic Cooperation and Development
PROFEPA	Office of the Attorney General for the Environment (Procuraduría Federal de Protección al Ambiente)
SANDAG	San Diego Association of Governments
SCERP	Southwest Center for Environmental Research and Policy
SEMARNAP	Secretaría de Medio Ambiente, Recursos Naturales y Pesca
TNRCC	Texas Natural Resources Conservation Commission

I

Overview—Findings of Border Institute I, The U.S.-Mexican Border Environment: A Road Map to a Sustainable 2020¹

*Paul Ganster, David Pijawka, Paul W. Rasmussen, and
Rick Van Schoik*

SUMMARY

Border Institute I, held late in 1998 in Rio Rico, Arizona, brought together more than fifty community leaders—members of the private sector; representatives of nonprofit organizations; university researchers; and local, state, and federal government officials from the United States and Mexico—to discuss how to ensure the future environmental quality and economic development of the border by the year 2020. The Southwest Center for Environmental Research and Policy (SCERP), the U.S. Environmental Protection Agency (EPA), and the Border Trade Alliance (BTA) were co-sponsors of the Border Institute.

Keynote presentations provided basic current information about the population, economy, environment, and governance of the border region, as well as some projections to 2020. They also raised issues relating to sustainability and transborder cooperation. Discussion groups of Institute participants developed a vision for the border environment of 2020 and outlined approaches for improving environmental and related conditions in the region. Basic features of the border include the following:

Population

Border counties and municipalities now have 10.6 million residents. If migration were to decline significantly, the border would naturally grow by some five million residents by 2020. If current growth rates continue, which is the most

likely scenario, the border will increase by an additional 14 million people and the populations of most twin-city regions will more than double. Most of the population is concentrated in binational twin cities, contributing to significant environmental, economic, and social spillover effects across the international boundary.

Economy

The North American Free Trade Agreement (NAFTA) has brought a major increase in bilateral trade, most of which is carried across the border by trucks. NAFTA, coupled with national and global economic growth, has created more jobs in the border region. However, wages on both sides of the border have remained low and unemployment has remained high for U.S. border cities, with the exception of San Diego. The poorest region of the United States is along the border with Mexico. In economic terms, the U.S. border region continues to decline relative to the border states and the nation as a whole. Increased trade and NAFTA have not brought a fair distribution of wealth to most border residents. The border has experienced economic growth, not economic *development*.

The border is characterized by significant economic differences between the United States and Mexico. Minimum wages are eight to ten times higher and municipal budgets are up to fifty times higher in the United States. These economic asymmetries are not likely to diminish by 2020.

Environment

Currently, the border environment is at risk. The situation will deteriorate significantly in the future if population and economic growth continue at present rates without significant changes in regional development. By 2020, business as usual will bring:

- Greater traffic congestion
- Poorer air quality and attendant human health effects
- Water shortages
- Increasing numbers of endangered and threatened habitats and species
- Hazardous and solid waste disposal crises
- Sewage infrastructure shortfall
- Contaminated beaches and oceans

A Vision for the Border's Environment in 2020

Border Institute participants crafted a two-part vision for 2020 as a goal that all stakeholders in border communities are encouraged to embrace:

- A healthy, sustainable natural environment with an involved binational community, ensuring proper resource management as a basis for a secure and adequate quality of life for all border inhabitants
- A sustainable and responsible border economy that provides all its residents a satisfactory quality of life through enhanced employment, education, and business opportunities

Achieving the Vision

Institute participants identified steps that will lead to achieving this vision. These include:

- Binational solutions for binational problems that have increasing trans-boundary spillover effects
- Transborder coordination of land-use planning
- Border communities must address the issues of smart economic growth and raising standards of living rather than simply expanding the economy
- Communities must focus on long-term issues of growth and environment
- Federal, local, and state agencies must address long-term issues now
- The Border Environment Cooperation Commission, the North American Development Bank, and Border XXI are key institutions that need to be strengthened
- SCERP, EPA, and BTA are committed to continue working with border stakeholders to achieve the vision

INTRODUCTION

The U.S.-Mexican border region is one of the most dynamic in the world, experiencing high population growth rates and substantial economic expansion since the 1940s. This growth was accelerated by the implementation of the North American Free Trade Agreement (NAFTA) in 1994 and, today, border communities face significant problems related to basic infrastructure, economic prosperity, social well-being, and deterioration of the environment. The immediate problems related to the infrastructure and the environment are so overwhelming that border communities and local, federal, state, and international agencies working on the solutions tend to have a very short-term focus. They react to specific problems that currently threaten the quality of life of border residents. Border communities must also begin to anticipate and plan for future needs.

Border Institute I, organized by the Southwest Center for Environmental Research and Policy (SCERP) and the U.S. Environmental Protection Agency (EPA), in collaboration with the Border Trade Alliance (BTA), initiated the

process of determining how to ensure adequate environmental quality for border residents in the future. The target year selected was 2020. The Border Institute was held in Rio Rico, Arizona, December 7–9, 1998, and involved some fifty community leaders; members of the private sector; representatives of non-profit organizations; university researchers; and local, state, and federal government officials from the United States and Mexico. A list of participants is appended at the end of this chapter.

The first part of Border Institute I included presentations by experts on selected topics that were accompanied by free-flowing discussions among participants.² The topics presented were:

- Population and population projections to 2020
- The border economy
- Border growth and the environment
- Planning in the transborder region
- The evolving administrative and institutional framework for border environmental issues

To provide a realistic context for the information provided by the presenters, a tour of the twin-city communities of Nogales, Arizona, and Nogales, Sonora, was included as part of the program. This tour involved on-site briefings regarding border health conditions, border crossing congestion, water supply and treatment, the maquiladora industry, and metropolitan governments.

For the final segment of the Border Institute, participants developed a vision of what the condition of the border and its environment should be in the year 2020. Participants were asked to answer a set of questions about the border's future and to design a scenario for the next 20 years. Participants developed a road map for what border communities should begin doing now in order to achieve a sustainable and healthy environment by 2020. The elements that participants considered in developing a scenario included:

- A vision for the border in 2020
- Actions that will be required to attain the desired conditions by 2020
- Suggestions for roles, responsibilities, and/or agencies to carry out the recommended actions

The recommendations made by participants are summarized at the end of this chapter.

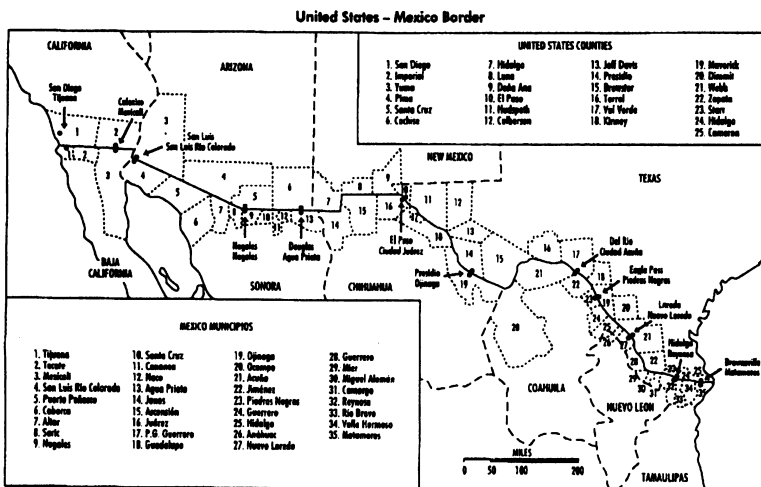
THE POPULATION OF THE BORDER, NOW AND IN 2020

The population of the U.S.-Mexican border region is often described according to the boundaries of U.S. counties and Mexican municipios that are adjacent to the international border. Within these local administrative units, the border's population is largely clustered in urban areas arranged in city pairs along the border. Figure 1 shows the location of the border counties and municipios.

In both the United States and Mexico, historical trends have shown faster growth in the border region than in the nation as a whole. In 1900, one in 18 U.S. residents lived in a border state; by 1995, about one in five U.S. residents lived in a border state. Also in 1990, one Mexican in 10 lived in a border state; by 1995, that figure became one in six.

By 1995, almost 10.6 million people lived in the counties and municipios adjacent to the international boundary, with 5.8 million on the U.S. side and 4.8 million on the Mexican side. In California, Imperial and San Diego counties account for almost half of the U.S. border population. The Baja California municipios of Tijuana, Mexicali, and Tecate accounted for 37 percent of Mexico's 1995 border population, although Ciudad Juárez was the most populated municipio, with slightly over one million residents.

Figure 1: U.S. Counties and Mexican Municipios of the Border



Annual population growth rates increased in Mexican municipios from 3.1 percent during the 1980s to 4.5 percent during the 1990s. In U.S. counties, the annual population growth rate was about 3.0 percent in the 1980s, and slowed to about 2.4 percent in the 1990s. However, there was considerable variation of growth rates along the border. For example, in the early 1990s, San Diego was in a deep recession, job growth disappeared, and migration slowed dramatically. Consequently, the county's population grew less than one percent on an annual basis. During the same period, the population growth rates of Imperial County and many Texas counties accelerated.

The age structure of the population is quite different on the Mexican and U.S. sides of the border. The following population pyramid shows the different age structures of Mexican and U.S. border populations in 1995. The most striking

ing difference is that the Mexican border population is younger than the U.S. border population. This means that the labor force population (age 15 to 64) in Mexico is nearly double that in the United States. This also means that the demographic momentum of Mexican municipios is much greater than that of U.S. counties. In other words, a larger percentage of the Mexican municipio population is younger and includes women who will soon enter their child-bearing years. Thus, there will be a significant natural increase in population on the Mexican side of the border.

Another component of border population growth is migration. Domestic migration to U.S. border counties is related to the economic development of the Sunbelt region. Beginning after World War II, migration has been a significant element of total population growth. In addition, both documented and undocumented international migration (principally from Mexico) has also been important.

Figure 2: Border Region Population Pyramid 1995



Source: Peach and Williams.

Domestic migration has likewise been a key contributor to the high growth rates in Mexican border cities. Mexicans move to the northern border due to the increased economic opportunities on the border compared to elsewhere in Mexico. Many also consider the possibility of crossing the border and working in the United States.

In order to make projections for the future of the border's population, it is necessary to consider both natural growth and migration, along with other fac-

tors. Below are three population projections developed by James Peach and James Williams. All assume that birth rates will remain constant at the 1990 to 1995 rates and that death rates will gradually slow. The lowest projections assume that net migration will be zero after 1995. The medium projections assume that net migration will be 75 percent of the early 1990s level for the 1995–2000 projection, and 50 percent of the early 1990s rate after the year 2000. The high projections assume that there will be no change in migration rates.

Table 1: Border County and Municipio Population Projections

	1995 Population*	2000 Population	2010 Population	2020 Population
High Projections				
Border total	10,585,265	12,376,232	17,144,395	24,099,054
U.S. subtotal	5,827,439	6,535,848	8,304,648	10,671,306
Mexican subtotal	4,757,826	5,840,384	8,839,747	13,427,748
Medium Projections				
Border total	10,585,265	12,145,349	15,397,768	19,460,216
U.S. subtotal	5,827,439	6,438,616	7,604,430	8,957,028
Mexican subtotal	4,757,826	5,706,733	7,793,338	10,503,188
Low Projections				
Border total	10,585,265	11,452,700	13,285,313	15,186,177
U.S. subtotal	5,827,439	6,146,918	6,757,453	7,333,809
Mexican subtotal	4,757,826	5,305,782	6,527,860	7,852,368

*Actual 1995 population.

Source: Peach and Williams.

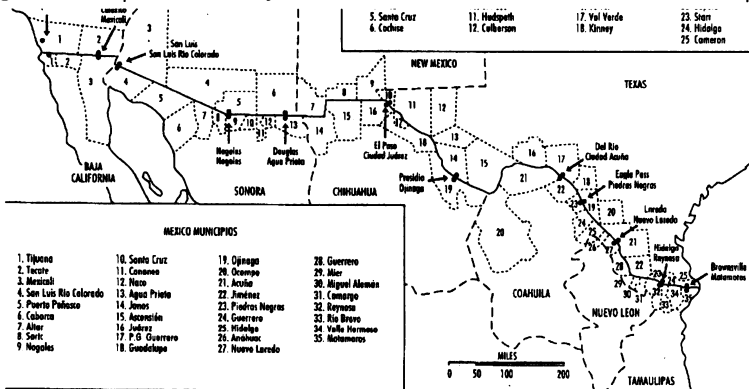
These projections indicate that the border region will experience significant growth in population over the next 20 years, with projected increases of five to twelve million people during the period 2000–2020. One key projection variable is migration. If migration continues at the same rate as in the early 1990s, the border population will double by 2020. If migration were to stop, both sides of the border would continue to grow. The Mexican side would grow at a faster rate, surpassing the U.S. border population by 2020. Given the depressed state of the Mexican economy and its inability to generate large numbers of jobs

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and raise wages, a significant change in Mexican migration to and across the border seems unlikely.

These population trends portend serious problems for border communities in terms of infrastructure deficits, availability of water and energy, and negative environmental impacts on water, air, and natural areas. In a best-case scenario, the border population will increase by only 50 percent by 2020. In a worst-case scenario, it will more than double. Most border communities are not prepared to deal with even the best-case scenario. Population growth poses a key challenge to stakeholders concerned about the environment in the border region.

Figure 3: Population Projections for Border Counties and Municipios



Note: High Projections

Source: Peach and Williams.

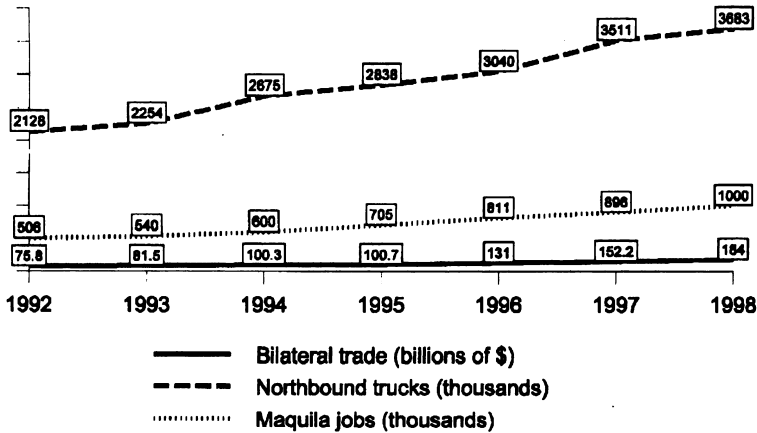
ECONOMY—GROWTH OR DEVELOPMENT?

Although subject to debate, there is a growing consensus that NAFTA has resulted in greater economic growth for Canada, Mexico, and the United States than might otherwise have occurred. However, impacts on regional and economic sectors have varied considerably. Communities along the U.S.-Mexican border have experienced a number of changes, including greater integration of the local twin-city economies, an enormous increase in commerce passing through the border cities, and significant growth of the maquiladora industry. All of this has taken place within the context of the Mexican recession that began with the late 1994 to early 1995 peso crisis from which Mexico has not yet fully recovered.

Border communities, many of which are characterized by low per capita incomes and high unemployment, have embraced rapid economic expansion as

the means to address these problems. However, many communities have ignored the negative social and environmental impacts as well as the medium- and long-term implications of their economic growth policies.

Figure 4: Growth of U.S.-Mexican Bilateral Trade



Source: U.S. Department of Commerce and CIEMEX-WEFA Maquiladora Monitor, November 1998, based on INEGI data.

Most environmental problems within the border region arise from rapid population growth and the lack of public financial resources to meet expanding infrastructure needs. While growth is a problem, it can also be viewed as a resource to meet projected needs. For this to happen, it will be necessary to distinguish economic growth from economic development, between the simple expansion of output and jobs and an increase in prosperity levels.

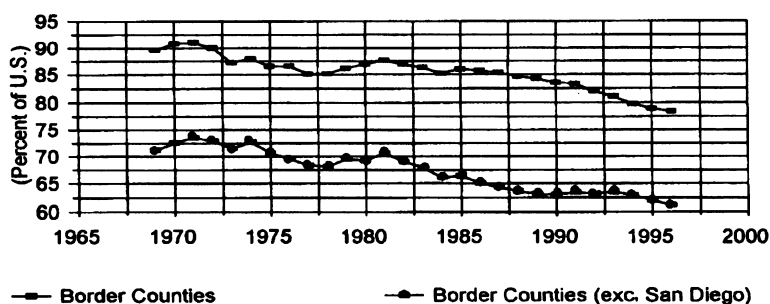
Perhaps the most outstanding economic characteristic of the region is the significant difference in income levels between the United States and Mexico. Minimum wages are approximately eight to ten times higher in the United States than in Mexico. The U.S. per capita gross domestic product (GDP) is about nine times that of Mexico and there is little evidence to suggest that differentials will decrease substantially by the year 2020.

Although Mexican border communities have some of the highest per capita incomes in Mexico, per capita incomes on the U.S. side are below the U.S. average, with the exception of San Diego. Of the 318 Metropolitan Statistical Areas (MSAs) in the United States, the six poorest in terms of per capita income are adjacent to the Mexican border. In 1995, none of the U.S. border counties had a per capita income higher than its respective state. The relative position of the border in the United States has eroded for most of the last three decades in terms of the decline in per capita income as compared to the rest of the nation.

In contrast, the per capita income of the Mexican border region is improving relative to the rest of Mexico.

U.S. border counties also experience higher rates of unemployment than the national average, as employment is concentrated in relatively low-wage industries. Again, San Diego is the exception, considering that its unemployment rate remained consistently below the national and state averages in the late 1990s. Other communities, such as the Imperial Valley in California and Brownsville and El Paso in Texas, have experienced chronic unemployment rates in double digits.

Figure 5: Border Region Per Capita Income as Percent of U.S. Per Capita Income



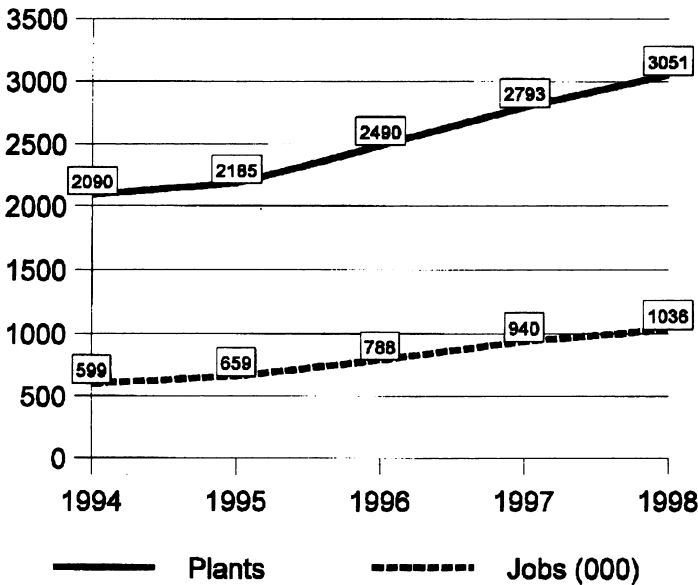
Source: Peach and Williams.

The expansion of the border economy in recent years has created large numbers of new jobs. However, there is a downside to the nature of job creation in border communities. Most of the new jobs created in the border zone in Mexico over the past decade, and particularly since NAFTA, have been in the maquiladora industry. While employment in this industry has risen rapidly, real wages have declined somewhat. The challenge to improve the real wages of maquila workers is clearly recognized by economic development organizations and by the industry itself. The problems associated with low wages in Mexican border cities are compounded by the “dollarized” economy and the very high cost of living.

U.S. border communities have faced a similar challenge with regard to improving real incomes. Regions such as San Diego, which lost high-paying jobs in the defense industry decline of the early 1990s, have added jobs in recovering from the recession. However, many of these new jobs are in entry-level service positions that pay low wages and often do not include health care or other benefits. Most of these workers cannot support families without substantial public assistance through social services, indigent health care, subsidized housing, or other governmental aid. Thus, many of these jobs require a

public subsidy and consume more taxes than they generate. These problems are exacerbated by the relatively high cost of living in U.S. border communities, particularly on the western end of the border.

Figure 6: Growth of Maquiladora Plants and Jobs



Source: CIEMEX-WEFA Maquiladora Monitor, November 1998, based on INEGI data.

Within the globalized economy, more communities are taking a proactive role in fostering economic development at the local, regional, and transborder levels. Most border communities now view their economic future in the context of the transborder region. Through local economic development organizations and government entities on both sides of the border, these communities are working to expand cross-border trade and investment opportunities. The ultimate goal of these efforts is to create jobs in the binational region. Examples include cities of the lower Rio Grande area that have recruited maquilas to locate in adjacent Mexican border cities, joint economic development efforts of the Arizona-Sonora Commission, joint marketing in Asia of the California-Baja California border region as a manufacturing and commerce location, and borderwide efforts to enhance physical infrastructure for trade and commerce led by the Border Trade Alliance. A standard tool employed in economic development efforts is the offering of tax breaks and subsidizing buildings, industrial parks, and infrastructure to companies relocating to the region.

In the effort to create jobs, many communities have not taken into account social or environmental impacts, nor the medium- and long-term implications of their economic development policies. The following considerations and questions have not been systematically incorporated into the efforts to stimulate regional economic activity:

- Do the new economic activities bring higher paying jobs to the communities? By late 1998, some border communities were concerned that they had been bypassed by the benefits of expanded trade and investment brought by NAFTA. For example, El Paso business and civic leaders reported at meetings of the Border Trade Alliance that the local economy experienced a great increase in trade and manufacturing, but failed to add higher value to trade and manufacturing activities. At the same time, this region experienced some negative impacts of free trade, including job displacement and increased traffic congestion. Thus, prosperity driven by NAFTA has been elusive.
- What are the medium- and long-term implications of providing subsidies, tax holidays, and other inducements to companies to locate in the region? For example, do these subsidies reduce the ability of the community to build and maintain infrastructure?
- What is the quality of the jobs created in terms of salaries, wages, and benefits? Will these jobs have a negative or positive impact on the fiscal base of the region? Entry-level positions often require more in government services than they contribute in taxes. Do the new jobs raise the standard of living of the workers and their families?
- What are the environmental consequences of the economic development activities? For example, will the resulting growth have negative impacts on air quality, water availability, traffic congestion, open spaces, or critical habitats? Will the activities simply expand the size of the communities without bringing an improved quality of life and living standard?

As a result of mixed experiences with rapid economic growth, many border communities are beginning to focus more clearly on redirecting economic growth. The new emphasis is on smart growth and economic development that will bring prosperity, protect and improve the environment, raise standards of living, and ensure the same for future generations.

BORDER GROWTH AND THE ENVIRONMENT

Rapid economic growth in border communities is linked to a high rate of population growth and the expansion of urban areas and industry. Economic, population, and urban growth have consumed significant amounts of natural resources. Moreover, they have caused the serious pollution of water, soil, and air resources, and threaten or endanger plant and animal species and important

ecosystems and habitats. All of these trends clearly indicate increasing environmental problems associated with growth and the potential for declining quality of life for border residents.

A key element in the long-term viability of border communities is the environment. Border communities increasingly will need to address environmental problems in order to improve the quality of life now and to ensure liveable environments in the future. Water supply and quality, air quality, and the viability of natural species, habitats, and ecosystems are the most critical areas of concern.

Water Supply

The U.S.-Mexican border region is largely arid. It has limited water supplies for human activities and for the maintenance of important habitats and ecosystems adjacent to rivers, streams, and lakes. Increasing competition among urban, agricultural, industrial, and environmental uses of water is evident at all points along the border.

The two largest transborder communities, San Diego-Tijuana and El Paso-Ciudad Juárez, account for approximately two-thirds of the border's population. Both regions face a precarious future with respect to water supply.

In a typical year, San Diego County imports over 90 percent of its water. Tijuana imports up to 95 percent of its water, depending upon the amount of rainfall captured at Rodríguez Dam. By 2010, this binational region's population will increase from 3.7 to 5.45 million people, with 60 percent living in San Diego and 40 percent in Tijuana. A total of 848,000 acre-feet (an acre-foot is 325,851 gallons or 1,233 cubic meters) of water will be required annually for consumption, with San Diego accounting for 87 percent of water use and Tijuana for 13 percent. The high population growth projection for this region in 2020 is 7.22 million persons. At the projected per capita water-use rates, more than 1.2 million acre-feet will be required for regional use in 2020.

In 1996, approximately 85 percent of San Diego's water came from the Colorado River. However, in future years San Diego will have to rely less on this source as California is forced by other users to reduce its draw on the river. San Diego hopes to meet future needs with transfers of water saved by conservation efforts in the Imperial Valley. Currently, authorities in San Diego and Tijuana are discussing the joint construction of an aqueduct from the Imperial Valley-Mexicali Valley region to bring additional water to the area.

Also in 1996, municipal and industrial per capita water use in the San Diego region was .197 acre-feet. In the year 2010, it is projected to be .196 acre-feet per person, assuming that the water supply is adequate to meet this demand. As indicated below, the maintenance of such a high rate of water usage may not be sustainable. For Tijuana, 1996 per capita water use was .063 acre-feet and the projected use for 2010 is .053 acre-feet per person. The significant difference in

per capita use between Tijuana and San Diego can be partially explained by the greater density of residential areas in Tijuana (19.3 persons per acre) than in San Diego (2.9 persons per acre). In San Diego, for single-family homes and rural areas, outdoor water use may be as high as 60 percent of total residential uses. Thus, an obvious alternative for San Diego and other U.S. border cities is to become more efficient in the use of existing water resources through land-use planning and other mechanisms. Reduced water consumption per capita by San Diegans implies significant changes in lifestyle. In the not-too-distant future, it may not be possible to supply water to users in new housing developments and businesses, nor to maintain the lush, green, urban landscape to which San Diegans are accustomed. Such changes will be difficult and will likely be seen by border residents as a deterioration of quality of life.

The Paso del Norte region consists of the five westernmost counties in Texas, two counties in southern New Mexico that lie along the Rio Grande, and four municipalities in Chihuahua that extend from Ciudad Juárez, down the Rio Grande, to the confluence with the Rio Conchos. The core of this area, Ciudad Juárez, El Paso, and Doña Ana County (Las Cruces), currently has a population of about two million people, which is expected to increase to 2.75 million by 2010 and to about four million by 2020. The regional economy has grown rapidly over the past 15 years. For example, the combined El Paso-Ciudad Juárez region has averaged 5.3 percent annual employment growth since 1983. The expansion of manufacturing has been key in this growth as the agricultural sector has declined.

The supply of water is a critical issue for this rapidly growing region. The El Paso-Ciudad Juárez area depends on the Hueco Bolsón aquifer, but this source is declining in quantity and quality and it is estimated that its potable water will be exhausted by 2030. The response to the growing water demand and finite underground supply has been a shift to using the Rio Grande for urban purposes. This has been reflected in declining agricultural activities and a dramatic reduction in the amount of land cultivated in the surrounding region.

Smaller border communities face similar problems with water supply. For example, Sierra Vista is a community of approximately thirty-five thousand people in southeast Arizona. It is located within the upper San Pedro watershed, which includes parts of Sonora and Arizona. Sierra Vista's rapid growth (from just over three thousand people in 1960) is based on the expansion of the Fort Huachuca military base and the growth of retirement and second homes. Much of this housing development has been the creation of semirural "ranchettes."

The region is characterized by a diverse landscape with natural habitats that are home to thousands of migratory birds; approximately one hundred species of birds breed in the area. In 1988, Congress created the San Pedro Riparian National Conservation Area, recognizing the importance of this natural area that relies on streamflow in the San Pedro River for maintenance of the riparian habitat.

The binational region depends primarily on groundwater for mining, municipal, military, and domestic uses. Extraction exceeds recharge, and, around Sierra Vista, water has been overpumped to the point of creating a cone of depression. In turn, this has negatively affected the riparian areas.

Sierra Vista and the surrounding areas face a very insecure future in terms of water. Present water usage rates are not sustainable and population growth will bring greater demand for water. Competition over water use has created conflicts among local and binational interests, including Mexican ranchers and mining interests, conservationists, Native Americans, land developers, and urban areas.

Water Quality

Surface and groundwater supplies are threatened along the U.S.-Mexican border due to the dumping of raw sewage, agricultural runoff, and industrial and hazardous waste pollution. Such contamination reduces the supply available for human use and often has serious implications for human health, as well as the viability of animals, plants, and ecosystems. All streams and rivers in the border region have suffered deterioration of water quality due to the lack of adequate municipal wastewater collection and treatment systems. The current infrastructure deficit is enormous, and the added demand created by growing populations will be significant. Thus, it is likely that significantly greater levels of financial resources will be required to adequately address water quality issues by 2020.

Air Quality

The quality of the air in the U.S.-Mexican border region is a critical factor in the health and well-being of border residents. Most of the border's 12 million residents are concentrated in urban zones, where most of the air pollution in the border region is generated and where its impacts are most directly felt.

Many border residents are currently exposed to health-threatening levels of air pollution. Ozone, particulate matter (PM10 and PM2.5), carbon monoxide, and sulfur dioxide are among the air pollutants of concern in the border region. Air quality problems are due to emissions from mobile, point, and area sources driven by economic growth in the region. The size of the vehicle fleet in northern Mexico is increasing and many older U.S. cars are available in Mexico. Air quality is impacted since many of these cars do not comply with either U.S. or Mexican auto emission standards. They have been poorly maintained and contain after-market, used, or inappropriate replacement parts. In addition, authorities have been unable to perform adequate planning and design of roadways to allow the free flow and movement of traffic, which likewise contributes to deteriorating air quality.

Another important problem is the large amount of pollution produced by mobile sources at the ports of entry. Large vehicle lines form during peak crossing hours and idling cars and light trucks generate significant quantities of pollutants. This problem is compounded by the poor condition of many of the vehicles' engines. In addition to the tens of millions of passenger vehicles that cross the border each year, there has been a marked increase in the number of heavy-duty trucks that wait in long queues to enter the United States. Most of these trucks burn diesel fuel, a major source of particulate matter that is also carcinogenic.

Industry has grown rapidly in the region, increasing the number of point sources of air pollution. The maquiladora sector and national industry emit large quantities of a variety of pollutants from the combustion of fuels and fugitive emissions from industrial processes. The area is also experiencing additional air pollution from the service and commercial activity that accompanies industrial growth. Power generation plants at several locations in the border region are also significant air pollution sources.

Finally, the rapid urbanization and resulting lack of infrastructure to support such growth has resulted in the creation of large stretches of unpaved roads. Vehicles traveling on these roads contribute significantly to particulate matter in the air, further reducing air quality.

Ambient air quality is checked within the border region by a series of monitoring stations on both sides of the border. Many of these monitors have now been in operation for nearly two years and the data are becoming widely available. Particulate matter is of special concern in the Calexico-Mexicali, El Paso-Ciudad Juárez, and Brownsville-Matamoros regions of the border. Gaseous pollutants, especially ozone and ozone precursors (oxides of nitrogen), are of concern in the San Diego-Tijuana and El Paso-Ciudad Juárez regions.

It is likely that air quality will continue to deteriorate in the border region over the next 20 years. This is due to the large population increase expected in the region, the long lead times needed to implement any significant pollution reduction programs, the expected increase in the size and age of the vehicle fleet, continuing industrialization, and growth in truck traffic due to increased trade. Unless major efforts are initiated in the near future, border communities will have poorer air quality in the year 2020.

Natural Resources

The expansion of urban areas, the destruction of native habitats through grazing activities or agriculture, the lowering of the water table through excessive pumping, and the impacts of recreation on fragile ecosystems have all had important consequences on the border environment. Efforts have been made to protect certain endangered or valuable species such as the masked bobwhite and the white-winged dove. Nonetheless, it has been difficult for U.S. and Mexican

authorities to establish transborder biosphere reserves to protect habitats of species that live on both sides of the border. In addition, it has not been easy to address transborder impacts on important ecosystems.

There are many examples of threatened natural areas, habitats, and ecosystems along the border where the impacts of economic and population growth have created unsustainable situations. These examples include:

Laguna Madre

The Laguna Madre, located on the Gulf of Mexico, is an important estuarine resource of significant value with diverse aquatic and terrestrial ecosystems, especially on the Mexican side of the border. It is home to endangered bird and mammal populations and is important in the life cycles of a number of commercial species. Principal threats to this resource include the alteration of freshwater sources through dam construction, cattle grazing, uncontrolled harvesting of estuarine and marine species, irregular human settlements, dredging channels to the sea, the possibility of the construction of the intracoastal canal, and biological and chemical pollution.

Rio Grande

The Rio Grande is a complex ecosystem that has been heavily altered by human activities, particularly the construction of major dams and diversion dams to utilize the water for agriculture and urban uses, recreation, and the generation of hydropower. Rio Grande water use is so heavy that at some points the river is reduced to a trickle or is dry, and the quality of the water has been severely degraded. Increased sedimentation from farming and ranching activities, salinization from agricultural return flows, biological contamination through discharge of untreated or poorly treated municipal sewage, chemical and biological contamination through nonpoint source pollution, pesticide contamination from agricultural practices, and heavy metal contamination from mining activities have contributed to the declining quality of Rio Grande water. The impact of development has been devastating on native fish, wildlife, wetlands and riparian habitats, and habitats such as bosques. Despite the intense agricultural development, particularly on the Texas side, some areas of native vegetation remain. These remaining areas are of great value and are the subject of Mexican and U.S. conservation efforts.

The Upper San Pedro Watershed

Located in Arizona and Sonora, this region contains important wetlands and other habitats, such as grasslands. The area is especially significant as a habitat for migrating birds. This area is under stress from cattle grazing, agriculture, urbanization, and mining activities on the Sonoran side of the watershed, and from grazing activities, urban development, and extensive semirural development on the Arizona side. Water quality and supply are key issues in this region.

Tijuana Estuary and Watershed

The Tijuana River National Estuarine Research Reserve is located in the United States at the mouth of the Tijuana watershed, which lies one-third in the United States and two-thirds in Mexico. This watershed includes the urban and industrial core of Tijuana, the City of Tecate, Baja California, and extensive development in San Diego County and Baja California. Important habitats throughout the watershed are threatened by unmanaged development. The estuary is impacted by what occurs in the entire watershed. This includes not only increased freshwater flows, but sewage contamination, chemical contamination, and increased sedimentation.

Bight of the Californias

This nearshore marine zone extends from Point Conception in the north to Cabo Colnett in the south. Much of the population of Southern California and Baja California is located adjacent to the coastline. Human activities have produced significant impacts in the nearshore marine environment through over-exploitation of marine resources, contamination of coastal waters through sewage discharges, treated effluent discharges, and nonpoint source pollution through runoff during storm events. Pollution includes biological elements as well as heavy metals, industrial chemicals, petroleum products, and pesticides.

The degradation of these ecosystems has important economic consequences for border communities. For example, the tourism industry of Southern California is linked to ocean recreation activities. Increased pollution of the ocean produces beach closures, placing direct economic impacts on local communities.

PLANNING FOR THE TRANSBORDER REGION

Transborder cooperation across the U.S.-Mexican border is the result of globalization tendencies in which international boundaries become zones of economic opportunity rather than buffers between nation states. Cross-border activity systems have emerged from such phenomena as cross-border labor, consumer, and housing markets; transnational industrial production complexes; and service economies. Integration and interaction across the international boundary in constricted geographic spaces require enhanced planning of transportation, the environment, and land use. Currently, insufficient policy making and planning is channeled into development of land-use systems along the U.S.-Mexican border. This could severely constrain the positive impact of future infrastructure projects. At the same time, communities and developers often resist the recommendations of planners. A more ordered spatial organization of activities must be constructed in the binational urban regions along the border.

Transborder cooperation in Western Europe may offer some excellent examples that are relevant to the U.S.-Mexican border region. Anchored by the European Community and focused on a common purpose by the expanding

single market, this region has experienced a great increase in transborder planning efforts and projects. Often, these efforts are a mixture of international and national formal agreements combined with informal border-spanning arrangements between local governments and the private sector. Success can be found in the French-Swiss-German area of the Regio Basiliensis on the upper Rhine River and along virtually every internal border of the European Union.

While the European and U.S.-Mexican border contexts are somewhat different, NAFTA now provides more impetus and structure for transborder cooperation in North America. Economic integration along the U.S.-Mexican border, accompanied by exploding populations, increasing urbanization, and marked infrastructure deficits—all shadowed by spillover effects—has been a driving force. At many locations along the border, there are now examples of effective transborder planning and cooperation that ally federal, state, and local governments and the private sector. These provide examples for twin cities that are beginning to grapple with economic, infrastructural, environmental, and other transborder local issues. Included among these are the following:

- Border Liaison Mechanism (BLM) is an umbrella mechanism devised by the U.S. and Mexican federal governments where the local consuls general in twin cities convene government and other actors to address specific issues of local importance. Since those involved represent their respective foreign relations ministries, the direct cross-border interaction of state and local officials is formally sanctioned. The BLM is most advanced in the San Diego-Tijuana region, where working groups deal with issues such as water, criminal justice, ports of entry, and education and culture.
- The Arizona-Sonora Commission is a state-to-state initiative that has successfully worked on joint economic, cultural, and environmental development issues between the two states.
- Private cross-border coalitions, including the Border Trade Alliance, have worked to increase infrastructure funding along the border, as well as administrative reforms such as unified ports of entry management initiatives.
- Local government transborder cooperation can be seen in a number of areas. The joint urban planning effort of Laredo, Texas, and Nuevo Laredo, Tamaulipas, and the binational transportation planning effort under way in the California-Baja California border region are examples. The City of San Diego and the Municipality of Tijuana have also collaborated on a number of specific projects, including solid waste recycling and water reclamation. Along with other partners from local universities, they are working on the development of a binational decision-support geographic information system in the area adjacent to the international boundary to facilitate binational planning for the immediate border area.

- The Joint Advisory Committee is a binational panel of governmental and nongovernmental stakeholders established by the U.S. and Mexican governments to address common air quality problems in the El Paso-Ciudad Juárez-Sunland Park air basin. It developed from binational community action and is a model for potential application elsewhere along the border.

Although these cases indicate progress in binational cooperation and planning, much more remains to be accomplished to help border communities cope with challenges from now until 2020. Other areas that need to be addressed include:

- Close monitoring of demographic and economic indicators
- How decision makers successfully interact across international boundaries and how these lessons can be applied
- Improved land-use planning across the border in transfrontier urban areas
- Specific attention on the planning of border crossings and associated land use
- Addressing issues of prosperity, quality of life, and environment in binational border cooperation and planning
- Centralized and rationalized policy-making and the regionalization of the now fragmented decision-making patterns on both sides of the border

THE INSTITUTIONAL FRAMEWORK

Over the past decade, new institutions have emerged and existing agencies have been reconfigured to address border environmental issues. These include the Border XXI Program, led by the EPA and its Mexican counterpart, the Secretaría de Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP), along with U.S. and Mexican partner agencies; the new institutions created by NAFTA—the Border Environment Cooperation Commission (BECC), the North American Development Bank (NADBank), and the Commission for Environmental Cooperation (CEC); the Good Neighbor Environment Board; and the International Boundary and Water Commission (IBWC).

It is important to note that these institutions are reactive in nature, responding to both specific and general problems and crises. They are not designed to be proactive nor to prevent environmental degradation from unsustainable development practices, although the BECC and NADBank have adopted sustainability criteria for projects approved and funded. The challenge for border communities, Native American tribes, border state governments, and the two federal governments is to move beyond treating the symptoms of the disease to

adopt measures that address its causes and help ensure a sustainable environment for the future.

The basis of environmental cooperation between Mexico and the United States is *The Agreement Between the United States and Mexico for the Protection and Improvement of the Environment in the Border Area*, signed by Presidents Ronald Reagan and Miguel de la Madrid in La Paz, Baja California Sur, in 1983. This agreement established binational workgroups to address border environmental problems with EPA and SEMARNAP as national coordinators.

The Border XXI Program is an innovative binational effort that allows the U.S. and Mexican federal agencies responsible for the shared border environment to work cooperatively toward sustainable development through the protection of human health and environment and the proper management of natural resources. The work of the Border XXI Program is accomplished by nine binational workgroups that publish annual work plans. Border XXI was established with considerable input from the public and border communities, and, gradually, the workgroups are being opened to allow for the participation of more stakeholders from the border communities.

The BECC, headquartered in Ciudad Juárez, is a binational agency that assists local communities and other sponsors in developing and implementing environmental infrastructure projects and certifies projects for funding by NADBank. BECC gives precedence to water supply, wastewater treatment, municipal solid waste, and related projects. It has incorporated sustainable development criteria in its project evaluations and provides considerable technical support to small communities that lack the capabilities to develop complex projects.

NADBank, with headquarters in San Antonio, was capitalized equally by the United States and Mexico to provide \$3 billion in new financing to supplement existing sources of funds and leverage the expanded participation of private capital. In 1997, NADBank was augmented with the creation of the Border Environmental Infrastructure Fund (BEIF) to provide grants for water and wastewater projects. With about \$170 million available, these funds can be used to supplement loan packages to produce low interest rates for poorer communities. NADBank also established the \$4 million Institutional Development Program (IDP), primarily for utility capacity building. NADBank is currently active in 71 projects in 56 communities.

The BECC-NADBank partnership has been slow to bring specific projects to construction. However, they are new binational institutions that had no existing models to follow. They also incorporated significant public participation when designing procedures and programs, a process that considerably prolonged the start-up phase. To date, BECC has certified some 24 projects with a combined cost of nearly \$600 million. NADBank has authorized loans, guarantees, and/or grants totaling \$105 million and has leveraged over \$400 million

in total financing for 14 projects. When completed, the projects will provide benefits to an estimated seven million border residents.

The Good Neighbor Environment Board (GNEB) was created by the Enterprise for the Americas Initiative Act of 1992 to advise the president and Congress on environmental and infrastructure issues and needs within the states contiguous to Mexico. The board has submitted three annual reports and many of its recommendations have been implemented by Border XXI.

The Commission for Environmental Cooperation (CEC) was established as part of the NAFTA process by Canada, Mexico, and the United States. Headquartered in Montreal, the focus of CEC is on conflict resolution, harmonization of environmental laws, and cooperation in the enforcement of current laws. The CEC also reviews submissions from nongovernmental organizations and individuals asserting that a party to NAFTA has failed to effectively enforce its environmental laws. The CEC has also developed a grant program to fund environmental projects proposed by community groups. It has undertaken a number of projects in the border region, including efforts on land-based sources of marine pollution in the California-Baja California border region, the upper San Pedro region, and the San Diego-Tijuana-Rosarito air basin.

The International Boundary and Water Commission (IBWC), along with its Mexican counterpart agency the Comisión Internacional de Límites y Aguas (CILA), was first created in 1889, but was recreated in its modern form by the 1944 water treaty. It addresses issues related to territorial limits, water allocation under the 1944 treaty, wastewater treatment, sanitation, and water quality. The commission has implemented many useful infrastructure projects over the years. Currently, the IBWC is in transition, redefining how it will work with BECC and NADBank and how it will incorporate public participation and sustainable development.

While these border environmental institutions offer significant promise and have accomplished much, they tend to be reactive and do not fully engage many key areas of contemporary border life. Generally, there is a lack of a medium- and long-term vision on the border. Specific areas that require more attention by border environmental institutions include:

- Air pollution
- Water quality
- Pollution from toxic chemicals
- Biodiversity
- Decision making for development
- Planning and land use
- Population growth and its impact
- Transportation
- Housing
- Indigenous peoples

- Involvement of other agencies, including the Bureau of Land Management, which administers some 40 percent of the land on the U.S. side of the border
- Sustainable development

A VISION FOR THE BORDER ENVIRONMENT IN 2020

The discussions at the Border Institute in Rio Rico produced a shared vision for the border environment in 2020. This vision can be summarized as follows:

A healthy sustainable natural environment with an involved binational community, ensuring proper resource management as a basis for a secure and adequate quality of life for all border inhabitants.

It was recognized that the vision for the environment cannot be isolated from other aspects of the border reality, particularly the economy. As a result, an economic vision for the year 2020 was articulated to complement the environmental vision:

A sustainable and responsible border economy that provides all its residents a satisfactory quality of life through enhanced employment, education, and business opportunities.

CONCEPTS AND ELEMENTS UNDERLYING THE VISION STATEMENTS

The two-part vision statements resulted from considerable discussion and a process of consensus building at Border Institute I. There are several important concepts that underlie the vision statements:

1. Planning to improve environmental and economic conditions in the border region will require a binational approach, even at local levels. This will further require new forms of institutional arrangements, partnerships, and decision-making processes.
2. The vision encompasses not only binational social and political arrangements but must be based on effective collaboration among the governmental, private, and public sectors.
3. Based on the demographic projections reported at the Institute and demands anticipated for environmental infrastructure, the vision to be realized will require proactive applications in decision making rather than reactive management systems. Demand-side management approaches must play an important role in this process.

4. Sustainable development implies more than simple growth and demands a balance of environmental and economic development as mutually reinforcing activities. It also implies economic diversification, an educated public, and environmentally responsible growth.
5. Quality of life factors, including health protection, educational opportunities, and equity concerns are critical to the vision of sustainability.
6. Education is a critical factor in attaining a sustainable border environment, including environmental and health education for all sectors of the border population, specialized training for infrastructure, and non-formal education.

RECOMMENDATIONS BY BORDER INSTITUTE I PARTICIPANTS

The following recommendations were proposed by participants in the Institute's discussion sessions. These are not listed in any particular order.

1. Binational capacity building in the area of infrastructure development is a basic requirement to achieve a sustainable border. Emphasis was placed on binational decision making and the equitable distribution of resources. Moreover, it is important to identify short-, mid-, and long-term plans. Capacity building entails more than physical infrastructure projects to meet demands for water supply or hazardous waste treatment. It implies capacity building in the following areas:
 - Institutional—the expansion of binational decision making and innovative institutional arrangements
 - Professional—the enhancement of border Mexican and U.S. professional capacities in science, management, and government
 - Technical—the enhancement of skills in areas of operations and maintenance
2. Financial systems and arrangements must be addressed to meet timely demands for investment and infrastructure projects. Concerns exist about whether current projects meet future needs and can address limited future shortfalls. There is a need to finance high-priority projects, which necessitates the establishment of a financial process that will be responsive to priority needs.
3. The nature of planning in the border region will have to change to meet the extraordinary demands of a rapidly growing border community. The underlying concepts of this new planning approach include:
 - Reactions to current growth pressures along with the development of strategies to manage and direct growth
 - Establishment of strategic objectives for economic development that may include border empowerment zones, diversifi-

- cation of the local economic base, planning and providing incentives for new types of industry (ecotourism), and social responsibilities placed upon industry
- Consideration of issues outside of current administrative structures and formulation of policies at the bioregional level, in air sheds and watersheds. Binational planning, particularly at the local level, must be accompanied by effective institutional organizations that span traditional boundaries
 - Conventional urban planning practices must incorporate “eco-city” principles to ensure sustainable development. This will require substantial public input into plans, growth strategies to reduce pollution, and the consideration of equity issues
4. Economic development should be driven by quality of life objectives. Economic development goals, in addition to increasing the size of the employment base and generating local income, should be accompanied by social goals that reduce income disparities, foster upward mobility in jobs, and provide affordable housing. Participants agreed that in order to be sustainable, the border region must become competitive regionally, nationally, and globally. This could be achieved with carefully developed industrial policies that lead to diversification of the economic base, training and education of the border population, and incentives for global investments.
 5. The region has to develop strategies that promote “regeneration,” including policies aimed at reuse, recycling, and reducing waste, and preventing pollution. Regeneration has to be linked with industrial policy, new business ventures, and binational supply-demand networks. This goal also means support for new environmental firms in the region.
 6. It is imperative that applied environmental research and data analysis be continued and expanded. Research needs to address carrying capacity, alternative low-cost technologies, modeling population to resource demands, and tracking of environmental indicators as warning signals. Moreover, research specifically on institutional and policy issues and environmental behavior has not been well developed for border issues. The vision also includes binational integration of environmental standards, sampling, and analytical methodology.
 7. In the education area, participants recommended significant efforts to increase public awareness of the region’s problems through education, access to higher education locally, and grassroots education, especially in the health area.
 8. The region needs to be recognized as unique in terms of culture, history, peoples, and the physical environment. It is important to view the area as special. There is a need to be sensitive to preserving regional

qualities, to preserve the “sense of place” that has been established. Solutions to border problems will have to be devised through border institutions, cultures, and political will. These approaches will have to be unique to the region.

9. It is important to recognize that there are regional differences along the border and that local areas are unique—El Paso is not Nogales. Solutions and opportunities will be locally based to be effective. Problems are unique and no one planning model will work for the entire region. The region will have to learn how to more effectively transfer knowledge from locale to locale along the border.
10. Institutional issues in cross-border problems will require resolution. For example, different land-use laws result in lack of uniform solutions or partial solutions to problems. Perceptions differ in the two countries on priorities and political approaches to problems. There is a need to experiment with cooperative arrangements based on local initiatives. Currently, substantial coordination efforts exist, but the issue is how to make these more effective.
11. The role of state and local actors has to increase in border policy-making in addition to state-to-state and twin cities binational relations.
12. It will be important to develop long-term projections for the 2020 border environment but there will be significant uncertainties. Therefore, a borderwide monitoring/tracking system of change and consequences needs to be established.
13. One priority must be to promote economic development rather than growth, and local communities should:
 - Create appropriate business climates
 - Work to improve the standard of living
 - Facilitate job creation in well-paying positions
 - Promote binational development collaboration
 - Adopt disincentives and incentives that promote long-term economic sustainability
14. Encourage new economic enterprises linked to the maquiladora industry and create models of collaborative industrial planning—institutional, public-private partnerships, business, and government.

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NOTES

1. A slightly different version of this chapter was published as *The U.S.-Mexican Border Environment: A Road Map to a Sustainable 2020. Report on Border Institute I, Rio Rico, Arizona, December 7-9, 1998*. Southwest Center for Environmental Research and Policy, Border Environmental Research Reports, Number 5, May 1999 (San Diego: Institute for Regional Studies of the Californias, 1999). It may be accessed on the SCERP website: <<http://www.scerp.org>>.
2. This chapter is based on the data and analysis presented in the briefing reports prepared for the Rio Rico Border Institute I: James Peach and James Williams, "Population and Economy on the U.S.-Mexico Border: Past, Present, and Future"; Paul Ganster, Alan Sweedler, and Norris Clement, "Development, Growth, and the Future of the Border Environment"; Mark Spalding, "Addressing Border Environmental Problems Now and in the Future: Border XXI and Related Efforts"; Lawrence A. Herzog, "Cross-Border Planning and Cooperation"; Paul Rasmussen, "Building a Border Road Map to 2020"; and Alan D. Hecht, "Toward a Virtual Border XXI: Meeting the Needs of U.S.-Mexican Border Communities in the Twenty-First Century."

II

Toward a Virtual Border XXI: Meeting the Needs of U.S.-Mexican Border Communities in the Twenty-First Century

Alan D. Hecht

INTRODUCTION

U.S.-Mexican relations have never been easy. In 1910, President Porfirio Díaz lamented, “Poor Mexico! So far from God and so close to the United States.” During the debate on NAFTA, some on both sides of the border would have modified this expression to read, “Poor Mexico—Poor United States! So far from God and so close to each other.”

No two countries enjoy a closer relationship in trade and history. Even before NAFTA, Mexico’s total trade with the United States in 1990 exceeded \$58 billion, making it the United States’ third largest trading partner, behind Canada and Japan. By 1995, trade with Mexico had nearly doubled to \$108 billion. In 1998, trade was closer to \$170 billion.

Although NAFTA has increased economic activity on the border, it has also resulted in increased population growth (on both sides of the border), along with increased demands on natural resources, especially water. Dealing with economic growth and environmental constraints is the challenge of the future. Border Institute I begins a new effort by all stakeholders to help shape the future development of this region.

ENVIRONMENTAL AND SOCIAL INEQUITY ON THE U.S.- MEXICAN BORDER

By most measures, U.S. border communities (defined as communities located within 60 miles of the U.S.-Mexican border) are disadvantaged in relation to U.S. national averages. The following table compares a number of economic

and social indices for the United States as a whole, for the southwestern states, and for U.S. border communities.¹

Table 1: Economic and Social Indices for the United States as a Whole

Index	U.S. Average	Southwest States	Border
Population growth: 1990–1996	6.6%	10%	15%
Per capita income	\$14,420	\$13,505	\$10,648
Unemployment rate	4.8%	5.6%	7.4%
Median household income	\$30,056	\$28,610	\$20,747
Persons in poverty	13.1%	16.7%	25.5%
Persons 25 years and over with high school education	75.2%	75.5%	61.5%
Persons 25 years and over with college education	20.3%	21.1%	12.3%

It is clear from the above data that the economic and educational foundation of the border is weak, and that creative and bold thinking at the grassroots level is going to be necessary to change the pattern in the future. Business as usual in the border region means continued reliance on manufacturing jobs, low wages, low educational standards, increased natural resource use, and a growing, but not prosperous, economy. Eventually, environmental constraints and conflicts between the United States and Mexico will create a binational crisis.

ACHIEVING SUSTAINABLE DEVELOPMENT

The southwestern border region of the United States is on the front line of NAFTA. The ability of communities to shape what this region will look like in the future requires close collaboration among local, state, and federal authorities and with Mexico. Nowhere else in the United States is the future well-being of U.S. citizens so closely related to the economic and social development of Mexico.

Border communities are unique and deserve greater national recognition. To their credit, border communities are beginning to take charge of their future, and, in quiet ways, are beginning to lead the United States on planning for a sustainable America.

The theme of sustainable development is not alien or threatening to many border communities. Instead, there is a growing awareness among border communities of the need to shape the future in ways that address the social inequities, ensure sustained economic growth, and protect the cultural heritage and natural resources for future generations. Sister cities are families, and the fate of a city on one side of the border is intimately tied to the fate of its neighbor on the other side.

The U.S.-Mexican border program, Border XXI, makes a special effort to focus on sustainable development. The mission statement for Border XXI is "To achieve a clean environment, protect public health and natural resources, and encourage sustainable development along the U.S.-Mexico border."

This mission statement is an important road map to the future. Both federal governments are concerned about development on the border and are seeking ways to ensure that this development does not create binational conflicts related to water use, transboundary pollution, hazardous siting, or the transport of goods and waste across the border. The federal perspective is based on application of the Organization for Economic Cooperation and Development (OECD) Pressure-State-Response Model to the border region. The pressures are increased economic development, largely driven by NAFTA; increased population, including some of the fastest growing communities in the United States; stresses on the natural resources, especially water; and the need for binational solutions to the problems associated with rapid growth. The state of the border is reflected in the first binational report on environmental indicators.² The joint response to these conditions, as reflected in the annual binational work plan, which is organized in nine working groups, is to encourage community and state focus on long-term development issues.

While Border XXI identifies sustainability as a long-term goal, it also makes clear that achieving this goal is a shared responsibility among states, local communities, the private sector, and the public. It is up to the states on both sides of the border to take the lead in shaping their own future, while the federal government's role is to help facilitate actions and, specifically, to address transboundary problems that by law and national policy require federal participation.

What some states are doing is a model for the future. For example, the state of Texas has prepared a thoughtful review of the challenges and opportunities on the border. The report of the Texas Comptroller of Public Accounts suggests:³ "Real earning per capita will more than double by 2020. The same forecast suggests that, barring unforeseen changes, the regions standing relative to the rest of the state will still deteriorate during this period."

The Texas study concludes that the border region must have a new economic strategy with emphasis on new industries that enhance opportunities for skilled labor and higher wages, and that protect shared natural resources. The key to an economically viable region is not simply growth but smart growth that is both economically and environmentally sustainable.

BECC AND ENVIRONMENTAL INFRASTRUCTURE

The economic vitality of the border region requires adequate infrastructure support. The BECC and NADBank are key institutions in ensuring that adequate environmental infrastructure is properly designed, financially viable, and con-

tributes to supporting sustainable development in the region. The BECC has incorporated sustainable development criteria for reviewing border infrastructure projects and has initiated a program with EPA funding to assist smaller communities in developing projects.

However, the BECC and NADBank alone are not enough to ensure an economically viable and sustainable border region. As recognized by the Good Neighbor Environmental Board (GNEB), a congressionally mandated advisory committee to Border XXI:⁴

For the past several years, both sides of the border have experienced significant developmental pressures due to industrialization, migration, and population growth. Environmental, health, housing, transportation, and other infrastructure has not kept pace with this development. The interconnection of environment, health, housing, and transportation infrastructure-related problems makes it imperative that infrastructure issues be addressed more comprehensively.

EMPOWERMENT ZONES

The federal government has recognized that this region needs economic help. In 1993, Congress authorized the creation of "empowerment zones" and "enterprise communities" across the nation as tools to stimulate economic development. On December 21, 1994, the Rio Grande Valley became one of three rural empowerment zones. The Rio Grande Valley Corporation has leveraged more than \$95 million for infrastructure projects, jobs and job training, educational services, and the development of health services and facilities.

On April 16, 1997, Vice President Al Gore, at a White House Empowerment Conference, challenged the southwest border region to develop a united and regional approach to economic and community development. What resulted from this challenge is a proposal for the Southwest Border Regional Partnership: a unique consortium of empowerment and enterprise zones designed to achieve, "safe and economically dynamic communities that celebrate the strength of our families, diversity of our culture, and *the preservation of our previous resources for generations to come* [emphasis added]."

The preservation of natural resources for future generations is a common goal of both economic development and environmental protection. Given a common goal, all should work together to ensure that this goal is achieved. What I see evolving is a convergence of federal, state, and local community action whereby economic development, the alleviation of poverty, social improvement, and environmental protection become linked as one.

These relationships can be further cemented through Border Institute I and meetings such as the White House Conference on Sustainable Development

(May 1999) and the Border XXI Conference titled "Road to Detroit." In addition, SEMARNAP is hosting a six-Mexican-state meeting in Reynosa in January 2000 to discuss criticism of sustainable development.

All these events are opportunities for border communities to showcase what they are doing and to learn from each other. We have a powerful collective message for the Presidential Conference on Sustainable Development in Detroit in May 1999. Our collective efforts are aimed at achieving sustainable economic growth on the border, and to:

- Improve environmental conditions
- Strengthen local capacity
- Raise the standard of living and improve education
- Recognize the diversity of people and protect cultural heritage
- Eliminate transboundary conflicts

We propose to achieve the above by promoting community-led activities to shape future growth, by developing stronger partnerships between federal agencies and between federal and states authorities, and by creating new partnerships with the private sector.

PRIVATE SECTOR

The private sector is an important element of economic growth on the border and a necessary partner in achieving sustainable development. The GNEB stated in its 1998 Annual Report, "We emphasize that greater industry involvement is needed in addressing issues related to border economic development, conducting research, applying technologies, and augmenting government resources for infrastructure and training."

Present Border XXI efforts with the private sector are focused on promoting clean production and pollution prevention in the maquiladora sector. Extensive bilateral training and technical assistance programs have been organized at the federal and state level. Efforts by the state of Texas, in cooperation with PRO-FEPA in Mexico, have resulted in significant pollution reduction and cost saving to the participating maquiladora facilities on the Texas border. The participating facilities have reported annual reductions of four to five million gallons of wastewater, over 70,000 tons of hazardous waste, and over 47,700 tons of nonhazardous waste, as well as a reduction in electricity use of over eight million kilowatt hours.

Beyond the maquiladora sector, the private sector in total must be involved in long-range planning for the border. The EPA and the U.S.-Mexico Chamber of Commerce are working on developing a set of sustainable development principles to help guide future development in the border area and throughout the United States and Mexico.

Behind the state of principles, the private sector must be an active partner in new technology, development, new industry planning, and industrial manage-

ment. In this case, SCERP and related academic institutions have a key role to play. I look to this meeting as one opportunity to help define a research and technical agenda that contributes to achieving sustainable development.

BORDER 2000

While my focus remains on environmental protection and needed infrastructure to support a healthy and safe environment, I see our work as intimately related to economic and social development on the border. The EPA's GNEB has given us a broad challenge: "Border XXI should continue to expand coverage and integrate additional issue areas, become over time, the umbrella process for defining an overall sustainable development strategy for the region, linking binational efforts and coordinating public and private programs and resources."⁵

This is a broad goal and a major challenge, achievable only if supported at the grassroots level. As a first step toward this objective, I propose the creation of a Virtual Border XXI in which our work on the environment, economic development, and social improvements are all linked. This Virtual Border XXI is a common meeting ground of ideas and information, which will feed a growing partnership of development and environmental protection at all levels of government. A common website for all our activities would be a useful first step.

I believe we all share the same long-term goal for the U.S.-Mexican border. There is strength in our different institutional perspectives. It is apparent to me that progress on the border will require two things: close federal, state, and local cooperation, and effective U.S.-Mexican bilateral programs. Border XXI has gone a long way to help Mexico address these programs through greater transparency, public participation, and strategic planning. Mexico should be viewed as an active partner in our common quest for sustainable development on the border.

Our goal for the future should be "Mexico and the United States—so close to each other and so close to God."

NOTES

1. From Roland S. Arriola, University of Texas, Pan American, Edinburg, Texas.
2. *U.S.-Mexico Border Environmental Indicators 1997: Report from Border XXI*. EPA Publication 909-R-98-007. (Washington, D.C.: GPO, 1997).
3. John Sharp. *Bordering the Future: Challenges and Opportunities in the Texas Border Region*, (Austin: Comptroller of Public Accounts, 1998).
4. Good Neighbor Environmental Board Annual Report, July 1998.
5. Good Neighbor Environmental Board Annual Report, July 1998.

III

Goals for Border Institute I

Paul W. Rasmussen

OPENING COMMENTS¹

The group of experts assembled here at Rio Rico, Arizona, represent the major “stakeholders” and decision makers along the U.S.-Mexican border. Included in this group are representatives from U.S. Congressional offices; federal agencies, particularly the U.S. EPA; state government; local government; tribal governments; the business community; binational organizations; environmental and other nongovernmental organizations; and the academic community, including both U.S. and Mexican universities. This group represents some of the most knowledgeable experts on the growth, development, and natural environment along our joint border.

The goal for this conference is to help define a vision for the border region for the year 2020. In defining that vision this conference will be developing a road map for the border’s long-term future. In listening to the presentations on population growth, economic characteristics and trends, environmental conditions, challenges to the region’s natural resources, transborder planning, and the current and potential institutional frameworks for decision making, it is very important to frame our questions and discussions around the future challenges and future opportunities confronting this key region.

As we will discuss in the days ahead, there is a wide range of decisions being made within the border region on a daily basis that affect the lives of many thousands of people. These decisions are made by governmental officials, business managers, and a variety of involved and concerned organizations and individuals living within this dramatic, yet potentially threatened environment. The challenge for these meetings is to think of this decision making in sustainable terms. Obviously, both public and private decision making must go forward on a continuing basis. As the prepared papers at this conference will note, short-term decisions can, and do, have mid- and long-term consequences. This group of researchers and officials must begin to help fashion a border vision that will

assist both American and Mexican officials, at all levels, to consider the economic and environmental consequences of their future decisions.

ECONOMIC GROWTH WITH A SUSTAINABLE ENVIRONMENT

What is meant by the term “sustainable development”? The major components for achieving economic growth with a sustainable environment was outlined by the President’s Council on Sustainable Development, which published the Task Force Report “Sustainable Communities” in the fall of 1997. The report noted that for development to be sustainable, it must satisfy five criteria:

- Long-Term Impacts and Consequences—Sustainable development requires the use of a long-term horizon for decision making in which society pursues long-term aspirations rather than simply making short-term, reactive responses to problems.
- Interdependence—Sustainable development recognizes the interdependence of economic, environmental, and social well-being.
- Participation—Sustainable development depends on decision making that is inclusive and participatory, recognizing the input of various stakeholders.
- Equity—Sustainable development promotes equity between generations and among different groups in society.
- Proactive Prevention—Sustainable development is anticipatory. It promotes efforts to prevent problems as the first course of action.

INSTITUTE GOALS

The major goal of Border Institute I is to use these five criteria to assist this group of invited experts to think in terms of both “what is” and “what could be” over the next 20 years. The results of each workgroup’s discussions and decisions must be based on the pragmatic reality of “what is,” but ennobled by an ability to plan for a future of “what could be.”

The conclusions and recommendations reached at this Institute will be used to inform and assist decision makers along the border to take actions that help to strengthen the region’s economy, improve and protect the environment, and strive to achieve social justice and equity. We need to start today to help define a vision for the border in the year 2020 that is worthy of the best thinking and highest ideals that this distinguished group of experts can bring to these proceedings.

NOTES

1. These comments were prepared as opening remarks on the goals for the Border Institute I and as an introduction to a paper that was used as a discussion guide for the Institute’s breakout group meetings.

IV

Population and Economic Dynamics on the U.S.-Mexican Border: Past, Present, and Future

James Peach and James Williams

The U.S.-Mexican border region is fascinating from a demographic perspective for several reasons. First, there are large concentrations of people living in the region who would not be there if the border did not exist. Second, historically, demographic forces have been very pronounced and more extreme along the border than in nonborder areas of both the United States and Mexico. Third, demographic interaction between the countries occurs in the context of extensive cultural, political, social, and economic transborder interdependence. Fourth, demographic change in the region mirrors large-scale forces such as globalization and economic trends not only in the two countries but worldwide. Finally, the consequences of population growth and rising densities in a region troubled by resource constraints create environmental problems uniquely exacerbated by the political boundary between the two countries.

The focus of this paper is on past and projected population trends and patterns. Selected economic statistics are included to help provide a context for understanding the causes and the consequences of demographic changes. However, a full understanding of border demographics is hardly so limited since the border is a rich and complicated tapestry that appeals to researchers from all of the social sciences. Border scholars, and border research in general, are by their nature multidisciplinary.

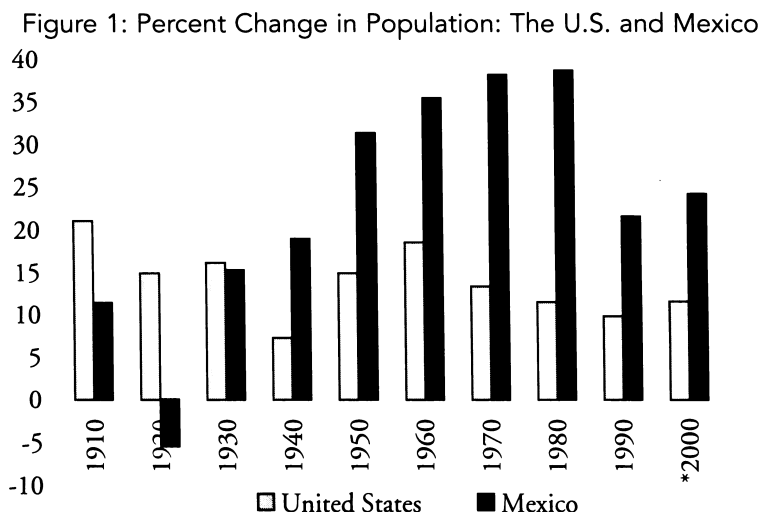
HISTORICAL TRENDS AND PATTERNS

The National Context

Between 1900 and 1995, the U.S. population grew from about 75 million to about 260 million persons, or by roughly three and a half times. During the

same period of time, Mexico's population increased six-fold from about 15 million to 91 million persons. With little inflow of migrants, it is obvious that birth rates have been much higher in Mexico during this century than they have in the United States, and have more than offset migration from Mexico to the United States. While not widely known in the United States, demographers have keenly followed rapid reductions in Mexican birth rates after 1970, and while still higher than U.S. birth rates, the differential has narrowed remarkably.

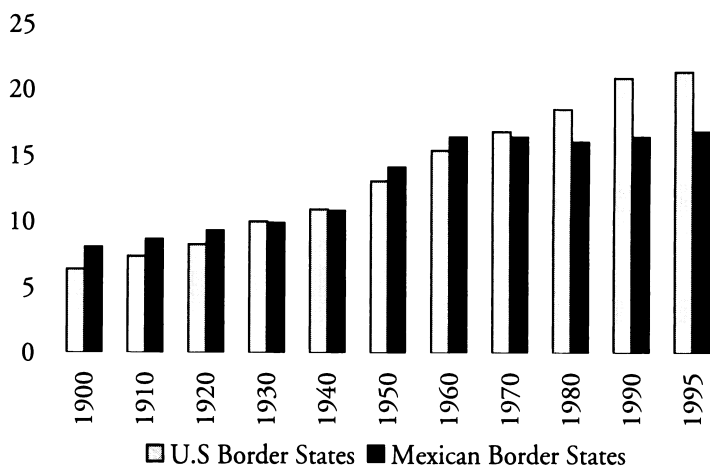
Figure 1 shows the percent change in population for each decade with the 1990 to 1995 data extrapolated to a 10-year period. Clearly, twentieth-century population growth rates in both countries varied considerably over the years. In the United States, the fastest growth in total population is associated with the pre-Depression era and with the baby boom era. In Mexico, growth rates increased each decade from the 1920s to the 1970s, following the staggering loss of population that Mexico experienced during the Revolution decade of 1910 to 1920. The decline in birth rates in Mexico shows up clearly as Mexican population growth rates, while still higher than in the United States, slowed to nearly half their previous levels during the 1980s and 1990s.



The Border States

The four U.S. border states (California, Arizona, New Mexico, and Texas) had a combined population in 1995 of 56.2 million persons, which was nearly four times larger than the 15.2 million persons in the six Mexican border states (Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas). Border state population growth rates for both the U.S. and Mexican sides of the

Figure 2: Border State Population as Percent of National Population



border have varied considerably from state to state and from decade to decade, but have generally been higher than national growth rates, especially since World War II.

Figure 2 shows the border state population as a percent of the national population for the period 1900 to 1995. The data document a rather remarkable transformation, particularly in the United States. In 1900, only one U.S. resident in 18 lived in a border state. By 1995, about one in five U.S. residents lived in border states. As measured by gross state product (GSP), a similar proportion of the nation's output is produced in the four border states. The figures are similar, though somewhat less dramatic for Mexico, with one Mexican in 10 living in a border state in 1900 and one in six by 1995. The presence of the border has influenced these population changes more in Mexico than in the United States. In the United States, a lot of the growth in border states in the past few decades has been associated with "Sunbelt" growth, both in terms of population and employment. A significant portion of the U.S. border state population lives in cities well away from the border. In Mexico, however, the border has been the reason for much of the growth as Mexican policies have encouraged, for various reasons over the years, development of population and employment along the northern "frontier."

Border Counties and Municipios

There is no consensus on a definition of the geographic area called "the border region," and, indeed, there is no scientific way to arrive at a definition. Figure 3 shows the study region, which concentrates on the 25 U.S. counties and 38

The U.S.-Mexican Border Environment

Mexican municipios (roughly county equivalents) that are geographically adjacent to the U.S.-Mexican border.

Figure 3: U.S.-Mexico Border Region

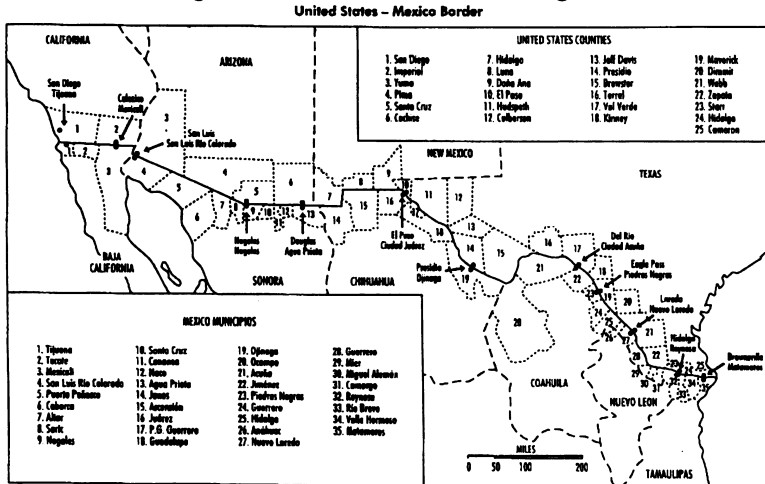


Table 1 provides the population of border counties and municipios summed to state and national totals. The full details of 1980 to 1995 population figures for each county and municipio are provided in Appendix B, Table B1.1, and Table B1.2.

Table 1: Population Adjacent to the Border, 1980 to 1995

Area	1980	1990	1995
Border Total	6,976,694	9,103,319	10,585,265
U.S. Subtotal	4,009,151	5,213,774	5,827,439
California	1,953,956	2,607,319	2,767,796
Arizona	728,142	914,919	1,038,156
New Mexico	117,974	159,578	188,841
Texas	1,209,079	1,531,958	1,832,646
Mexico Subtotal	2,967,543	3,889,545	4,757,826
Baja California	1,002,459	1,400,873	1,750,172
Sonora	312,079	394,712	469,804
Chihuahua	635,490	869,951	1,086,559
Coahuila	151,623	191,135	238,288
Nuevo León	16,475	17,312	18,276
Tamaulipas	849,417	1,015,562	1,194,727

By 1995, almost 10.6 million persons lived adjacent to the U.S.-Mexican border, with about 5.8 million on the U.S. side and slightly less than 4.8 million on the Mexican side. In 1980, there were about seven million persons adja-

cent to the border and four million of these were on the U.S. side. San Diego County dominates the population total for the U.S. side of the border with 2.6 million persons and combined with Imperial County, California, contains almost half of the U.S. border population. Ciudad Juárez, adjacent to El Paso, Texas, continues to be the most populous Mexican municipio along the border; although by 1995, Tijuana (with just less than a million persons) was only barely smaller than Ciudad Juárez (with slightly over a million persons), according to the Mexican mid-decade census (see appendix tables for detailed figures).

Figures 4 and 5 show the average annual growth rates for border counties and municipios summed to state levels for the 1980s and 1990s. The full details of these rates are provided in Appendix B, Table B2.1, and Table B2.2. On the

Figure 4: Mexico Border Region Average Annual Growth Rates

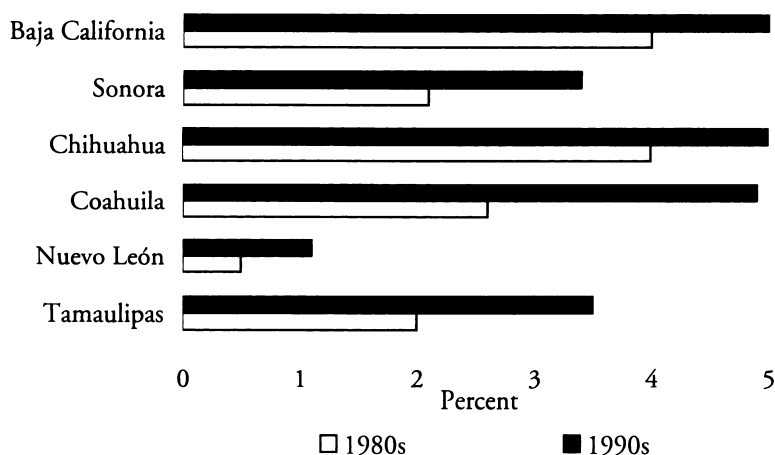
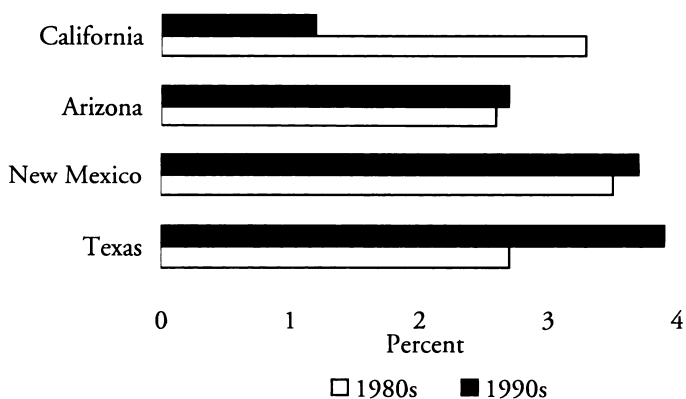


Figure 5: U.S. Border Region Average Annual Growth Rates



Mexican side, there has been a pronounced acceleration in population growth since the 1980s. Border municipios overall went from 3.1 percent average annual growth in the 1980s to 4.5 percent average annual growth in the 1990s, with an acceleration occurring in every Mexican state. However, examination of the appendices reveals considerable variation across municipios. On the U.S. side of the border (Figure 5), a somewhat different picture emerges. Population growth slowed overall from 3 percent average annual to about 2.4 percent in the 1990s. But the variability of growth rates along the border, which is detailed in the appendices, is rather remarkable. In California, for example, San Diego County accounts for nearly half of the U.S. border population. Difficult economic times in San Diego in the early 1990s produced a dramatic slowdown of migration to the area. Conversely, Imperial County, adjacent to San Diego, showed dramatic acceleration in population growth. Arizona and New Mexico growth rates were relatively stable, while population growth in Texas border counties accelerated during this time.

ECONOMIC TRENDS

The border region population trends just described occur within an unusual, if not unique, economic context. The current discussion will be limited to border region income levels and labor market conditions. Three themes will be apparent: (1) the heterogeneity of border region economic conditions; (2) the sensitivity of the border economy to national economic events in both the United States and Mexico; and (3) the interaction of border region economic and demographic variables.

Income

The border region is where two nations of vastly different income levels and economic structures meet. Depending on the peso-dollar exchange rate, U.S. per capita GDP is eight or nine times Mexico's per capita GDP. There is little evidence to suggest that U.S.-Mexican income differentials will decrease substantially by the year 2020. In most parts of the border region, the binational income differentials are visibly obvious to even the most casual observers.

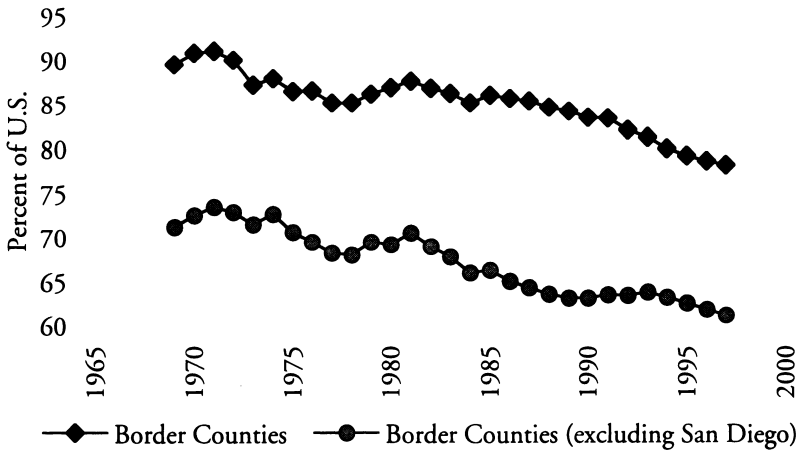
Per capita income levels on the U.S. side of the border are below the national average, except in San Diego. Indeed, of the nation's 318 Metropolitan Statistical Areas (MSAs), the six poorest in terms of per capita income are adjacent to the Mexican border, and many of the Texas border counties are among the poorest in the nation. In 1995, none of the border counties had a per capita income higher than its respective state.

Per capita income in the U.S. border counties in 1995 was 79.2 percent of the national average, and if San Diego is removed from the list, that figure drops to 61.9 percent. Despite considerable change in the economic structure

of the border region in recent years, convergence of border region and national per capita income levels is not yet occurring. Indeed, Figure 6 indicates that per capita income levels in the border region have been declining relative to the nation for most of the last three decades.

There are numerous explanations for the relatively low per capita income on the U.S. side of the border. For example, unemployment rates are generally higher than the national average and employment is concentrated in relatively low wage industries. Demographic variables are also important to an understanding of low border region incomes. First, border region population growth rates are high and population is, of course, the denominator in the calculation of per capita income. Second, the U.S. portion of the border region has a lower median age than the nation and a relatively large number of young persons means a smaller portion of the population is of working age. As young people enter the labor force, they do so initially at relatively low wages compared to workers with many years of labor market experience. Education differentials are also striking and could explain a large part of the income and unemployment gaps.

Figure 6: Border Region Per Capita Income as Percent of U.S. Per Capita Income



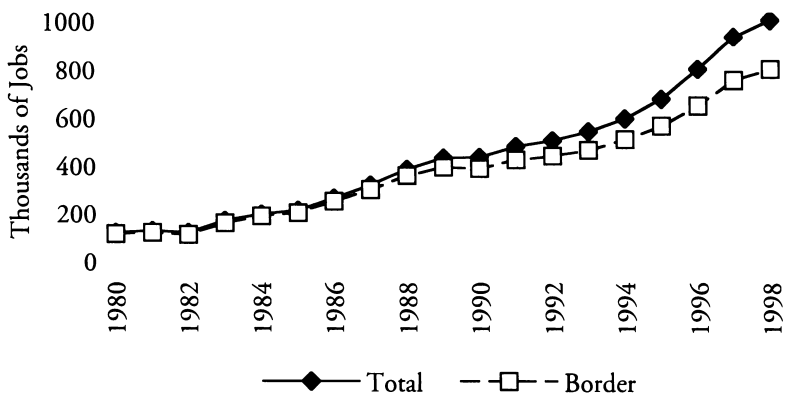
The Border Region Labor Force: Employment and Unemployment

In 1995, there were 132 million persons in the U.S. labor force and 28 million of those were in border state labor markets. Mexico's labor force contained 36 million persons and 7.2 million in its six northern border states. The labor force in the U.S. border counties was 2.6 million, only slightly more than the 2.6 million persons in the border municipios labor force.

The size of the labor force is determined by two factors: labor force participation rates (LFPR) and the age-sex distribution of the population. LFPRs in both the United States and Mexico are relatively low for teenagers, reach a peak for those aged 25–35, and then gradually decline for those approaching retirement. Men have higher LFPRs than women in both nations in all age groups. LFPRs for men in the United States have been declining, while those for women have been increasing. LFPRs for women in Mexico also have been increasing over the last two or three decades, but the decline in male LFPRs in Mexico is not nearly as sharp as in the United States. Border municipio LFPRs are generally higher among all age groups than those for Mexico as a whole, while LFPRs in the U.S. border counties are generally lower than elsewhere in the nation.

One of the most important developments in border region labor markets has been the growth of the maquiladora industry. The maquiladora (in-bond) industry began in the late 1960s after the Johnson administration abolished the Bracero Program, which allowed temporary Mexican workers into the United States. The maquiladora industry was designed to take advantage of certain provisions of the U.S. tariff code that permitted U.S. firms to export unassembled products for assembly abroad. The assembled product is then imported into the United States, but duties are paid only on the value added abroad during the assembly process. Maquiladora employment growth accelerated during the 1990s and, as shown in Figure 7, this has been especially so since 1994. In early 1998, more than two thousand maquila plants employed slightly more than one million workers in Mexico. The largest share of maquiladora employment is located in Mexico's six northern border states, but this share has fallen from 95 percent in 1980 to 81 percent in 1998. Approximately 20 percent of total employment in the Mexican border states is in the maquila plants, and this figure is much higher in some of the border cities.

Figure 7: Maquiladora Employment—Total and Border States

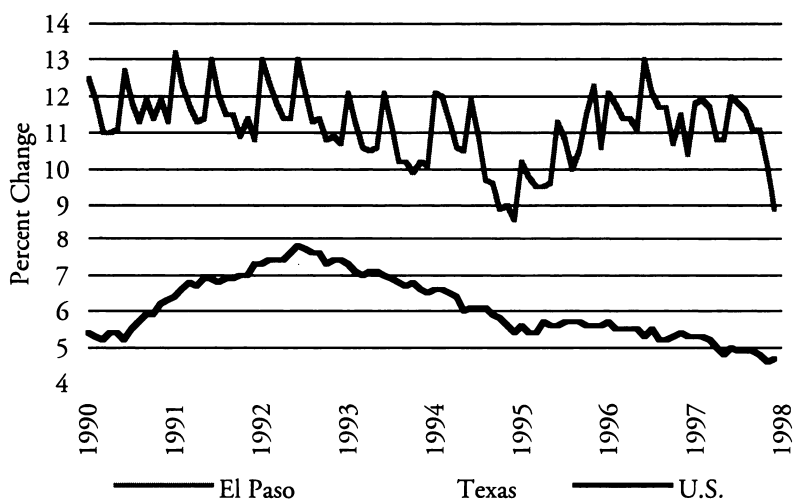


The maquiladora industry played an important role in mitigating the effects of Mexico's most recent economic crisis in the border region. After the crisis began with a sharp and generally unexpected devaluation of the peso in late December 1994, nearly every sector and region of the Mexican economy suffered large employment declines. Maquiladora industry employment, however, continued to increase. In December 1995, maquiladora employment was 13.5 percent higher than in December 1994. By early 1998, maquiladora employment had increased by nearly two-thirds since December 1994. Undoubtedly, the impact of the devaluations on the border region would have been much greater without a healthy maquiladora industry.

It is worthwhile to examine the maquiladora industry in a broader context. After three decades of growth, the maquiladora industry now employs one million workers, a figure that is slightly less than the annual increase in Mexico's labor force. Even with a generous employment multiplier, Mexico needs a new maquiladora industry every two or three years just to maintain its current level of unemployment.

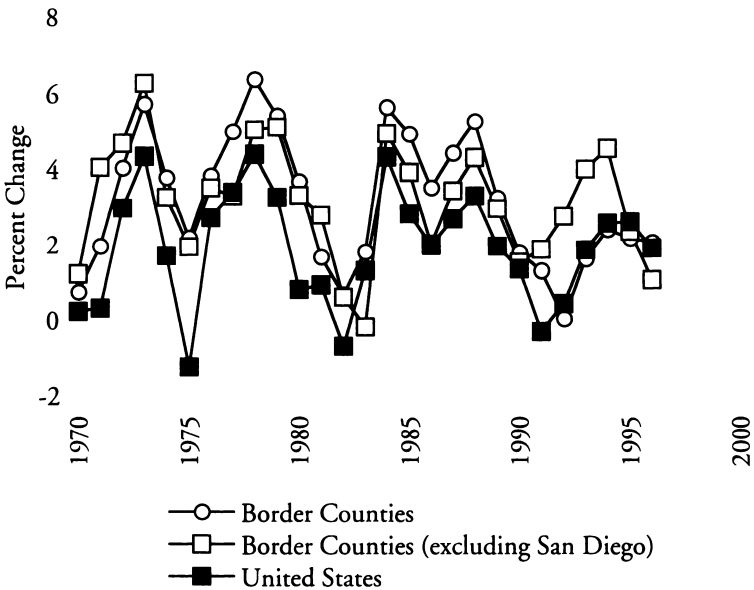
On the U.S. side of the border, unemployment rates are generally higher and more variable in border counties than in the border states or the nation. Figure 8 displays the unemployment rate for El Paso, Texas, over the last decade. This figure shows a typical pattern among border region MSAs. Among the border MSAs, only San Diego has had an unemployment rate consistently below the national (and state) average in the 1990s. At the other end of the border, Brownsville, Texas, has not had unemployment rates below double digits during the 1990s. Similar unemployment patterns have prevailed in the border region for several decades.

Figure 8: Unemployment Rates—U.S., Texas, and El Paso



Despite high unemployment rates in the border region, total employment in the U.S. border counties has been growing at a faster rate than in the nation. Figure 9 displays the annual percent change in employment for the border counties, the border counties excluding San Diego, and the nation. In addition to high employment growth rates, Figure 9 also dramatically illustrates the sensitivity of border region employment to national employment trends.

Figure 9: Percent Change in Employment



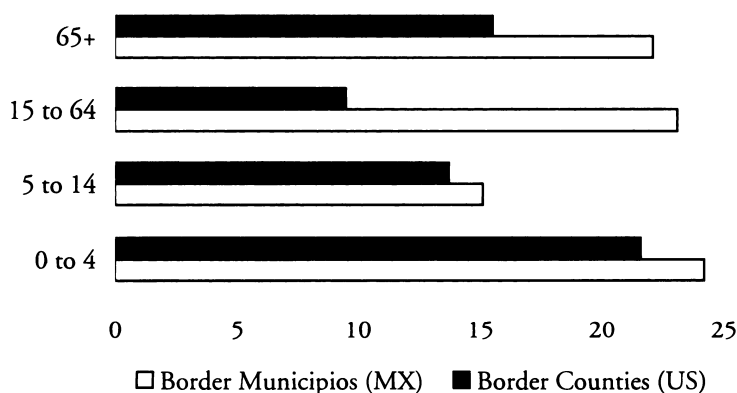
Another notable trend in border region employment is substantial change in the structure of employment by industry. Historically, government employment at all levels has been a major proportion of total employment in the border region. However, in the border region, as in the nation, government employment as a percent of total employment has declined in recent decades. Government employment accounted for more than 35 percent of total border region employment in the early 1970s, but this figure decreased to about 20 percent by the mid-1990s. Manufacturing employment in the border region has remained relatively constant as a percent of total employment for more than two decades, despite a decreasing national manufacturing share of total employment. In some border MSAs, such as El Paso, manufacturing employment has increased dramatically as a percent of total employment. Because both government employment and manufacturing employment are relatively high-wage industries, these trends will have important implications for border region per capita income.

The historical data, both for population and economic indicators, underscore the considerable variability in trends along the U.S.-Mexican border and argue for caution in making sweeping generalizations. California, for example, is a very different “border environment” than is Texas, and while the border is a fact of life for the people who live along its 2,000-mile expanse, its meaning and impact varies in different areas.

THE IMPORTANCE OF AGE STRUCTURE

Demographers, economists, sociologists, and social scientists in general are keenly aware of the importance of the age structure of a population, for it at least partially determines, among many things, future population growth potential, the size of the labor force, per capita income patterns, and the demand for educational facilities, medical services, and much more. Percent change in population by age for the early 1990s is shown in Figure 10. In both the U.S. counties and in the Mexican municipios along the border, the most rapid increase in population in the early 1990s was among the 0–4 age group. In short, the border areas showed substantial births and probably notable immigration of young children. At labor force ages, 15–64, there was a striking contrast between the U.S. and Mexican sides of the border. In Mexico, the percentage change in labor force age population was more than double the U.S. figure.

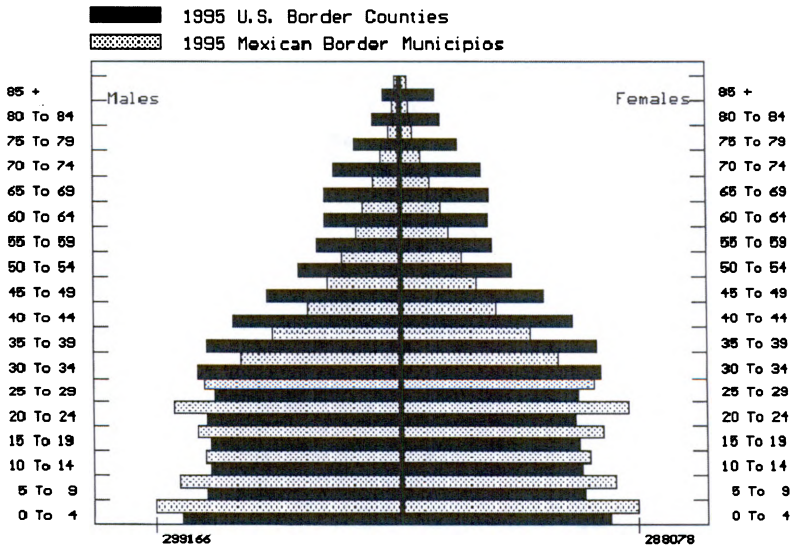
Figure 10: Percent Change by Age



A population pyramid is a common graphic device that shows age composition and Figure 11 provides the pyramids for the U.S. and Mexican sides of the border in 1995. The contrasting age distributions reveal that Mexican municipios have considerably more demographic momentum than U.S. counties. Demographic momentum is a phrase meaning capacity for future growth even

if fertility rates and migration were at low levels. Examining Figure 11, it is apparent that there is a younger age distribution in Mexico than in the United States, and today's young people will be tomorrow's parents. Put another way, the supply of future mothers has already been born and it is simply a matter of the time it takes them to reach their childbearing years. If the number of potential mothers increases, then births would increase in the future even if fertility rates were constant.

Figure 11: Border Region Population Pyramid 1995



Analyses of population dynamics along the border suggest some demographically important patterns that condition forecasts about the future. First, Mexican municipios have shown strong natural increase; the excess of births over deaths, and levels of natural increase have traditionally been greater on the Mexican side than the U.S. side of the border. But levels of natural increase in the U.S. border region, while generally lower than the Mexican side, have been higher than the U.S. average. Historically, added to this strong natural increase is the fact of an age distribution, especially on the Mexican side of the border, that favors future natural increase. And, finally, there is the migration factor. The border municipios have attracted migrants from elsewhere in Mexico adding to the overall growth rate.

On the U.S. side of the border, trends have been a bit different. U.S. border counties have, in fact, grown from migration, but that migration growth tends

to be the result of immigration, not migration from elsewhere in the United States. For example, in 1997 (the most recent year of U.S. data), 20,176 individuals migrated to San Diego from abroad, while 4,196 San Diegans left the area and moved elsewhere within the United States. Similarly, El Paso gained about 11,632 immigrants during that year, and lost almost eight thousand persons to other U.S. destinations. This pattern is widespread on the U.S. side of the border. So, the U.S. border grows from natural increase and immigration, with immigration sufficient to more than offset the tendency for the border counties to lose population to other areas of the United States. Should the flow of immigration stop, growth rates would drop dramatically, although natural increase would continue for some time. However, should a border area become a domestic-migration magnet, like Las Vegas, Nevada, growth rates would accelerate remarkably.

PROJECTING FUTURE POPULATION ON THE BORDER

Detailed methodology for the population projections is provided in Appendix A. As a brief introduction to the results, it is useful to understand that the projections are done by a method known as “cohort-component” and are based upon conditions in the 1990 to 1995 period. The method makes independent calculations for 36 age-sex groupings (cohorts) for each county and municipio, and projects births, deaths, and migration (components) separately for each cohort. The projection periods available are at five-year intervals. This methodology is designed to be “doable” for both sides of the border so that a consistent methodology is applied to the United States as well as Mexico. This makes the projections unusual, since, of the many population projections that can be found, none are known that apply consistent methods along, and on both sides, of the border.

Three alternative sets of projections have been prepared. These sets share the same forecast assumptions about natural increase components. Birth rates are held constant at 1990–1995 levels. Deaths rates trend downward slowly, consistent with available national forecasts. The sets differ in their migration assumptions. In the set labeled “high,” the migration rates that were experienced in the 1990–1995 period are allowed to continue in the future. The “low” set is in marked contrast to the high series as the intent was to document the growth potential of natural increase in the absence of any migration. Thus, the low series sets migration at zero in all areas beginning immediately after 1995. Finally, an intermediate result that is labeled “medium” was produced, and in it migration rates were reduced to 75 percent of the early 1990s levels for the 1995 to 2000 projection. Then migration was again reduced to 50 percent of the early 1990s rates for all projection cycles after the year 2000.

BORDER POPULATION IN 2020

High Series: No Change in Migration Rates

Table 2 provides the state-level sums for border counties and municipios under the high series assumption of continued migration rates as were experienced during 1990 to 1995. The full details are available in Appendix B, Table B3.1, and Table B3.2.

Table 2: High Series—Population Adjacent to the Border, 2000–2020

Area	2000	2010	2020
Border Total	12,376,232	17,144,395	24,099,054
U.S. Subtotal	6,535,848	8,304,648	10,671,306
California	2,941,502	3,355,351	3,889,001
Arizona	1,176,231	1,500,926	1,897,829
New Mexico	224,221	311,794	425,737
Texas	2,193,894	3,136,577	4,458,739
Mexico Subtotal	5,840,384	8,839,747	13,427,748
Baja California	2,188,899	3,424,592	5,343,687
Sonora	563,156	818,840	1,217,468
Chihuahua	1,356,211	2,111,144	3,272,890
Coahuila	301,256	493,352	834,135
Nuevo Leon	19,465	22,072	24,569
Tamaulipas	1,411,397	1,969,747	2,734,972

A simple continuation of demographic patterns of the early 1990s, trends not unusual in the history of most of the border region, will mean tremendous population growth in the next 25 years. The border population would grow from about 10.6 million in 1995 to more than 24 million persons by 2020. On the Mexican side of the border the population would grow from 4.8 million to almost 13.5 million, while the U.S. side would not even double in size.

On the U.S. side of the border, to continue recent trends to 2020 would imply significant population growth, especially for Texas, which is projected to more than double in border population. On the Mexican side, these projections show that today's metropolitan centers along the border would become very large cities, especially in Baja California, Chihuahua, and Tamaulipas.

Can this happen? One approach to this question is to consider the demographic issues. Migration patterns are truly a key concern. A slowdown in migration to border areas has two impacts. First, of course, the direct effect of migration is reduced. However, with a lot of migration to the border that includes women of childbearing ages and children, the migration patterns of the past have contributed to future births. Consequently, if migration declined there would be this secondary impact that would reduce growth rates. But, how

might migration patterns change? On the Mexican side of the border, so long as the northern frontier is a major source of jobs and remains relatively wealthy in the eyes of Mexicans elsewhere in the country, then migration would likely continue, as long as there is a "supply" of potential migrants from elsewhere in Mexico.

It should be noted that Mexican national projections show slower population growth in the next century, reflecting the late twentieth-century fertility decline. Some of the current migration from Mexico to its border with the United States is certainly a stepping stone for migration to the United States, legal or undocumented. On the one hand, should the United States further control immigration, either legal or undocumented or both, then immigration levels would be reduced, and immigration contributes substantially to U.S. border population growth. On the other hand, it should also be noted that border areas show outmigration to other areas of the United States. It is not known if these are immigrants traveling on after a few years, or long-term residents leaving the area. If these outmigrants to other parts of the country are indeed recent immigrants, then reduced immigration to the United States would probably diminish the outflow to other parts of the country from border counties, dampening the impact of lessened immigration on the balance of growth.

And just how does one control growth? Not well along the border, seems to be the answer. When responding to these numbers, some individuals in the El Paso area noted that there simply is not enough water to sustain the recent growth patterns. Yet there is little evidence that the price of residential water in Arizona, for example, has discouraged people from moving long distances to be in the area. It is also politically unpopular for elected officials to constrain employment growth along the border, a region desperate for new and better jobs. Hence, it is unlikely that these officials, when faced with a choice, will not vigorously pursue water resources to meet demand one way or another. Finally, it must be remembered that along the border considerable growth is generated by people who are born, grow up, and live out their lives in the area. It would be difficult to tell these people that there is not enough water for them to live where they were born.

Age Composition in 2020 for the High Series

Figure 12 presents the population pyramids for the border counties and municipios summed to national totals for 2020 under the assumption of no change in migration patterns. The age distribution of the Mexican side of the border would continue to host a considerably younger population than the U.S. side. In absolute numbers, U.S. totals would exceed Mexican totals only at the highest ages. A continuation of recent migration patterns ensures further population growth as the Mexican pyramid retains a high degree of demographic momentum.

Figure 12: Border Region Population Pyramid 2020 (High Series)

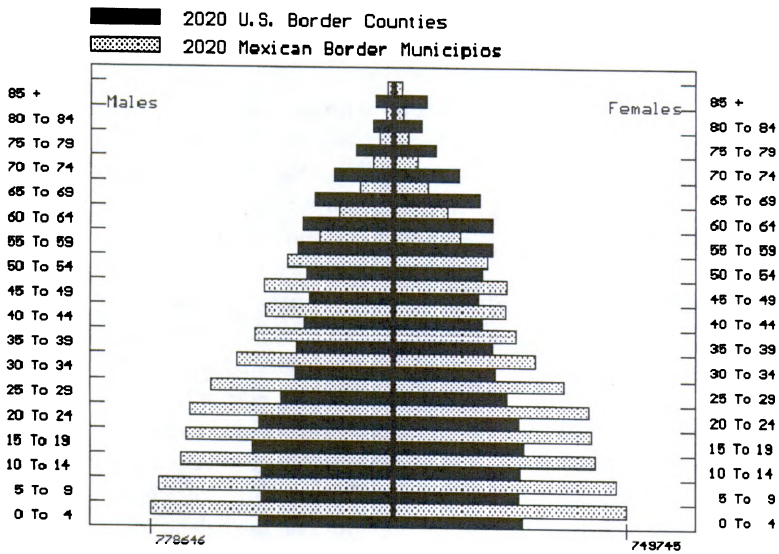


Figure 13: Border Region Population Pyramid 2020 (Medium Series)



Medium Series: Migration Trended in Half

Again, summary data are presented in Table 3 and detailed data are provided in Appendix B, Table B4.1, and Table B4.2.

Reducing migration rates by half diminishes projected population growth along the border through 2020 by about 4.5 million persons, with a new total along the border of about 19.5 million persons, up from 10.6 million in 1995. Therefore, even a sweeping and substantial reduction in migration would not eliminate the growth prospects for the future as the border population would almost double in the next 25 years from the beginning of the projection.

Table 3: Medium Series—Border Population, 2000–2020

Area	2000	2010	2020
Border Total	12,125,349	15,397,769	19,460,216
U.S. Subtotal	6,438,616	7,604,430	8,957,026
California	2,932,628	3,263,538	3,622,559
Arizona	1,150,557	1,339,554	1,542,858
New Mexico	217,834	269,187	328,292
Texas	2,137,597	2,732,151	3,463,317
Mexico Subtotal	5,686,733	7,793,339	10,503,187
Baja California	2,129,078	2,957,489	4,043,896
Sonora	533,897	742,290	988,882
Chihuahua	1,320,454	1,833,626	2,507,297
Coahuila	293,081	420,266	601,216
Nuevo Leon	19,637	22,998	26,586
Tamaulipas	1,390,586	1,816,670	2,335,310

Low Series: Zero Migration from 1995 Onward

Figure 13 is a graphic representation of the expected population growth along the border under the assumption that net migration becomes zero in 1995, an unlikely assumption, but illustrative nonetheless. Under this draconian scenario, all growth is produced from the balance of births and deaths; yet the total border population would still grow by almost five million persons, or about 50 percent, by the year 2020. About 3.1 million of this growth will occur on the Mexican side of the border, reflecting its relatively greater demographic momentum. Appendix B, Table B5.1, and Table B5.2 contain the detailed results for counties and municipios. Along the entire border, only tiny Jeff Davis County in Texas would be projected to experience population decline from 2,067 persons to 2,021 persons between 1995 and 2020.

Figure 14: Border Region Population Pyramid 2020 (Low Series)



SUMMARY AND IMPLICATIONS

Evaluation of demographic and economic information on the U.S.-Mexican border is a matter of perspective. From the U.S. national view, the U.S. side of the border, (excepting San Diego) is a Third World region with high unemployment, low wages, low educational levels, and relatively rapid population growth fueled by both birth rates and migration from across the border. From the perspective of U.S. border residents gazing across to the Mexican side, the view is of uncontrolled and unconstrained population growth and a host of serious infrastructure problems including water, sewer, roads, schools, hospitals, and environmental concerns. However, if one were to look at the Mexican side of the border from the perspective of much of Mexico, it is a place of opportunity with booming employment growth and rapid urbanization, adjacent to U.S. shopping and entertainment. No wonder Mexicans continue to move to the border, joining a population already growing due to relatively high birth rates. It is no wonder that some come to the United States, since it is just a step forward in the chain of migration patterns, joining a culturally and ethnically similar land one political boundary away. This pattern might be stopped, supposing the border could truly be closed. But the fact for planning is that these patterns have a long history and there is no reason to expect some sudden change.

Projecting population is not difficult as a mathematical exercise, and evaluation of these projections is a matter of evaluating the various assumptions. The border population will grow even in the absence of migration, and certainly the resources and the environment will be strained further. Population growth of 50 percent along the border by 2020 is—short of war or natural disaster or some incredible unforeseen change in patterns of birth and death—a certainty. Modern death rates are low, and birth rates are simply higher than the very low rates in the general U.S. population. Mexican birth rates have already dropped considerably, but scepticism about major further reductions is appropriate. The figure of 50 percent increase in population requires one to imagine no further migration to the region, and certainly the post-1995 data available indicates that this is not happening.

Should migration patterns maintain themselves for another 25 years, the impacts are nothing short of astounding. Imagine El Paso (Texas), Ciudad Juárez (Chihuahua), and Las Cruces (New Mexico) as a single metropolitan center of almost six million persons. Local officials who have seen these projections respond simply that “there is not enough water,” a problem that is of concern along many miles of the U.S. border with Mexico. But, shutting off the flow of people is not an easy task and most often local governments scramble to meet already unmet demands for services, and so it would seem prudent to plan for substantial population growth on the border, and the attendant growing pains.

If one sides with Adam Smith in thinking the growth of population is the measure of the wealth of nations, then there is little cause for concern. However, a more realistic view of history, evaluating the current situation, and projecting future scenarios leaves reason for concern, for this is not a bright and shining region, at least by the standards of much of the United States. Where will the employment growth come from and will it continue to be of marginal wage levels? Where will water, sewage treatment, and other resources come from, and, particularly, what will be the source of capital for major infrastructure additions in the future? It remains to be seen whether these problems will be noted at the respective federal levels or left to state and local governments, with attendant expectations about their capacities to cope.

APPENDIX A

Projection Methodology

The population projections have been prepared using cohort-component methodology, which means that births, deaths, and migration components are projected separately for each of the 18 age groups (0–4 through 85 and over) for males and females separately (the cohorts). The projection methodology requires use of detailed age and sex information from each country in 1990 and 1995. Both countries conducted censuses in 1990. In 1995, Mexico conducted a census while the U.S. Census Bureau published detailed population estimates, by age and sex, for all U.S. counties for 1995. The Mexican census system, unlike the United States, reported persons for whom age is unknown. In the 1990 and 1995 Mexican data series used to prepare the projections, “unknown age” persons were allocated to age groups 20 and over according to a procedure recommended in the international demographics literature.

An important feature of the projections is that the same methodology has been used for both counties and municipios. However, this means that the methodology must be workable for both sides of the border and so some technical compromises must be made. Thus, for example, demographers prefer to project births using detailed age-specific fertility rates. Such rates are not uniformly available along the U.S.-Mexican border, thus, another method was mandated that would be uniformly applicable. The projection methods require only two census period counts or estimates, by age and sex, and survival rate information. The projection intervals are five years at a time.

Birth Projection

In each county and municipio the ratio of children 0–4 years of age divided by the population of women at ages 15–49, the childbearing years, is calculated. These child-woman ratios from 1995 are held constant through the year 2020 in all three series (low, medium, and high), and are applied to the projected future population of women at the childbearing ages after calculating deaths and migration during the projection period. The ratios produce “births” over the five-year projection interval, and thus produce 0–4 year-olds at the end of the projection interval.

Death Projection

For the United States, Census Bureau projections of survival rates and life expectancy rates by age and sex available in published documents have been used. These U.S.-level projections of mortality rates trend slowly downward over the entire period to 2020. For Mexico, United Nations information on

Mexican life expectancy rates, and survival rates by age and sex corresponding to various levels of life expectancy rates have been used. The Mexican death rates for males and females trend downward only to the year 2000 and then are assumed to remain constant at that level into the future. This assumption has more to do with technical constraints of available information than a real forecast, and the projections would probably be slightly low as a result of likely continuing improvements in reducing mortality after 2000 in Mexico. But, in projections, deaths are usually not a major source of error, at least in areas experiencing substantial migration and strong demographic momentum as does the border region.

Migration Projection

Migration rates are produced first for the period from 1990 to 1995 using a procedure known as “residual estimation.” The technique can be easily illustrated. Imagine a county or municipio that had 1,000 males aged 10–14 years in 1990. Application of the survival rate previously discussed would yield an expected count of 992 males aged 15–19 years in 1995 in the absence of migration. Should the 1995 data show 1,100 males at ages 15–19, the residual estimate of net migration (the balance of in- and outflows) for this cohort would be 108 migrants coming into the area, and the rate would be 108 divided by the initial population of 1,000 males ages 10–14. This calculation is done for all age-sex groupings, with special procedures needed to handle the 85 and over population. Also, the “births” discussed earlier are not subject to migration directly, although, since the “mothers” are subject to migration, the child-woman ratio technique will reflect the parental migration patterns.

This residual estimation technique is sensitive to problems of undercount when one period has substantially more or less undercount than the second period. Using the aforementioned migration example, some of the presumed 108 migrants that were estimated may simply be people who were not counted in 1990 but were captured by the 1995 figures. Correcting such a count differential would be a major undertaking and perhaps not even possible for the entire border region.

Three projection series have been prepared and they differ only with respect to the migration assumptions.

High projection series

While labeled “high,” this set simply assumes a continuation of the migration rates by age and sex which were experienced in each county and municipio in the 1990 to 1995 period. The baseline for judging the results is to consider whether the trends in the early 1990s would continue through 2020. In some areas, migration rates were very high and, indeed, by 2020 the population consequences are profound. The combined El Paso, Ciudad Juárez, and Las Cruces

metropolitan area would grow to nearly six million persons, which raises questions about whether or not such rates can possibly continue. However, San Diego in the early 1990s was in a slump, and current evidence suggests that the period between 1990 and 1995 is too conservative for forecasting the future.

Medium projection series

The migration assumption for this series is that migration rates fall to 75 percent of the 1990–1995 levels during the period between 1995 and 2000 and continue to fall to 50 percent in 2000 and beyond. Thus, the rates trend toward zero from either positive or negative levels, and level off at half of the 1990–1995 rates from 2000 onward.

Low projection series

The low series is not a forecast but demonstrates an important point after calculating the results. In the low series, migration rates were set to zero immediately after 1995. While hardly realistic, the value of such a series is that all projected population growth in the future comes solely from the difference between births and deaths, and the results demonstrate that the border region will continue to grow even if there is no migration growth.

APPENDIX B

Table B1.1: Total Population—U.S. Border Region

Area	1980	1990	1995
San Diego	1,861,846	2,498,016	2,626,714
Imperial	92,110	109,303	141,082
California (subtotal)	1,953,956	2,607,319	2,767,796
Yuma	90,554	120,739	136,088
Pima	531,443	666,880	755,273
Santa Cruz	20,459	29,676	36,372
Cochise	85,686	97,624	110,423
Arizona (subtotal)	728,142	914,919	1,038,156
Hidalgo	6,049	5,958	6,262
Luna	15,585	18,110	22,578
Doña Ana	96,340	135,510	160,001
New Mexico (subtotal)	117,974	159,578	188,841
El Paso	479,899	591,610	678,629
Culberson	3,315	3,407	3,231
Hudspeth	2,728	2,915	3,143
Jeff Davis	1,647	1,946	2,067
Presidio	5,188	6,637	7,806
Brewster	7,573	8,681	9,074
Terrell	1,595	1,410	1,314
Val Verde	35,910	38,721	42,485
Kinney	2,279	3,119	3,371
Maverick	31,398	36,378	45,219
Dimmitt	11,367	10,433	10,501
Webb	99,258	133,239	172,386
Zapata	6,628	9,279	10,876
Starr	27,266	40,518	52,214
Hidalgo	283,229	383,545	482,461
Cameron	209,727	260,120	307,869
Texas (subtotal)	1,209,007	1,531,958	1,832,646
Border Region Total	4,009,079	5,213,774	5,827,439

Source: U.S. Department of Commerce 1983; 1993; and 1998.

Note: Tables B3.2–B5.2 components may not add to totals due to rounding.

The U.S.-Mexican Border Environment

Table B1.2: Total Population—Mexican Border Region

Area	1980	1990	1995
Tijuana	461,256	747,379	991,593
Tecate	30,540	51,556	62,546
Mexicali	510,663	601,938	696,033
Baja California (subtotal)	1,002,459	1,400,873	1,750,172
San Luis Río Colorado	92,791	110,531	133,141
Puerto Peñasco-P.E. Calles	26,754	36,353	37,491
Caborca	50,453	59,159	64,511
Altar	6,027	6,457	7,120
Saric	2,250	2,109	2,265
Nogales	68,075	107,937	133,489
Santa Cruz	1,587	1,472	1,399
Cananea	25,323	26,932	29,256
Naco	4,441	4,643	4,901
Agua Prieta	34,378	39,119	56,231
Sonora (subtotal)	312,079	394,712	469,804
Janos	8,904	10,896	10,772
Ascensión	11,985	16,360	19,646
Juárez	567,369	798,500	1,011,787
Guadalupe	7,774	8,439	8,941
Praxedis G. Guerrero	8,874	9,053	9,580
Ojinaga	26,420	23,909	23,509
Manuel Benavides	4,164	2,794	2,324
Chihuahua (subtotal)	635,490	869,951	1,086,559
Ocampo	9,000	7,853	7,485
Acuña	41,947	56,335	81,528
Jiménez	8,636	8,254	9,280
Piedras Negras	80,291	98,184	116,147
Nava	8,684	16,916	20,444
Guerrero	2,314	2,373	2,135
Hidalgo	751	1,220	1,269
Coahuila (subtotal)	151,623	191,135	238,288
Anáhuac	16,475	17,312	18,276
Nuevo León (subtotal)	16,475	17,312	18,276
Nuevo Laredo	203,285	219,465	275,060
Guerrero	4,191	4,510	3,972
Mier	6,382	6,242	6,240
Miguel Alemán	19,600	21,323	22,366
Camargo	16,014	15,042	15,265
Gustavo Díaz Ordaz	17,830	17,704	15,632
Reynosa	211,411	282,666	337,052
Río Bravo	83,523	94,010	100,370
Valle Hermoso	48,342	51,305	55,284
Matamoros	238,839	303,295	363,486
Tamaulipas (subtotal)	849,417	1,015,562	1,194,727
Border Region Total	2,967,543	3,889,545	4,757,826

Source: INEGI 1998.

Table B2.1: Percent Change in Population—U.S. Border Region

Area	1980–1990	1990–1995	Implied 1990–2000
San Diego	34.2	5.2	10.3
Imperial	18.7	29.1	58.1
California (subtotal)	33.4	6.2	12.3
Yuma	33.3	12.7	25.4
Pima	25.5	13.3	26.5
Santa Cruz	45.1	22.6	45.1
Cochise	13.9	13.1	26.2
Arizona (subtotal)	25.7	13.5	26.9
Hidalgo	-1.5	5.1	10.2
Luna	16.2	24.7	49.3
Doña Ana	40.7	18.1	36.1
New Mexico (subtotal)	35.3	18.3	36.7
El Paso	23.3	14.7	29.4
Culberson	2.8	-5.2	-10.3
Hudspeth	6.9	7.8	15.6
Jeff Davis	18.2	6.2	12.4
Presidio	27.9	17.6	35.2
Brewster	14.6	4.5	9.1
Terrell	-11.6	-6.8	-13.6
Val Verde	7.8	9.7	19.4
Kinney	36.9	8.1	16.2
Maverick	15.9	24.3	48.6
Dimmitt	-8.2	0.7	1.3
Webb	34.2	29.4	58.8
Zapata	40.0	17.2	34.4
Starr	48.6	28.9	57.7
Hidalgo	35.4	25.8	51.6
Cameron	24.0	18.4	36.7
Texas (subtotal)	26.7	19.6	39.3
Border Region Totals	30.0	11.8	23.5

Source: Author calculations from Table B1.1.

The U.S.-Mexican Border Environment

Table B2.2: Percent Change in Population—Mexican Border Region

Area	1980–1990	1990–1995	Implied 1990–2000
Tijuana	62.0	32.7	65.4
Tecate	68.8	21.3	42.6
Mexicali	17.9	15.6	31.3
Baja California (subtotal)	39.7	24.9	49.9
San Luis Río Colorado	19.1	20.5	40.9
Puerto Peñasco-P.E. Calles	35.9	3.1	6.3
Caborca	17.3	9.0	18.1
Altar	7.1	10.3	20.5
Saric	-6.3	7.4	14.8
Nogales	58.6	23.7	47.3
Santa Cruz	-7.2	-5.0	-9.9
Cananea	6.4	8.6	17.3
Naco	4.5	5.6	11.1
Agua Prieta	13.8	43.7	87.5
Sonora (subtotal)	26.5	19.0	38.0
Janos	22.4	-1.1	-2.3
Ascensión	36.5	20.1	40.2
Juárez	40.7	26.7	53.4
Guadalupe	8.6	5.9	11.9
Praxedis G. Guerrero	2.0	5.8	11.6
Ojinaga	-9.5	-1.7	-3.3
Manuel Benavides	-32.9	-16.8	-33.6
Chihuahua (subtotal)	36.9	24.9	49.8
Ocampo	-12.7	-4.7	-9.4
Acuña	34.3	44.7	89.4
Jiménez	-4.4	12.4	24.9
Piedras Negras	22.3	18.3	36.6
Nava	94.8	20.9	41.7
Guerrero	2.5	-10.0	-20.1
Hidalgo	62.5	4.0	8.0
Coahuila (subtotal)	26.1	24.7	49.3
Anáhuac	5.1	5.6	11.1
Nuevo León (subtotal)	5.1	5.6	11.1
Nuevo Laredo	8.0	25.3	50.7
Guerrero	7.6	-11.9	-23.9
Mier	-2.2	0.0	-0.1
Miguel Alemán	8.8	4.9	9.8
Camargo	-6.1	1.5	3.0
Gustavo Díaz Ordaz	-0.7	-11.7	-23.4
Reynosa	33.7	19.2	38.5
Río Bravo	12.6	6.8	13.5
Valle Hermoso	6.1	7.8	15.5
Matamoros	27.0	19.8	39.7
Tamaulipas (subtotal)	19.6	17.6	35.3
Border Region Total	31.1	22.3	44.6

Source: Author calculations from Table B1.2.

Table B3.1: High Case Population Projections—U.S. Border Region

Area	1990	1995	2000	2005	2010	2015	2020
San Diego	2,498,016	2,626,714	2,758,849	2,899,162	3,052,314	3,219,316	3,397,223
Imperial	109,303	141,082	182,653	235,810	303,037	386,605	491,778
California (subtotal)	2,607,319	2,767,796	2,943,502	3,136,977	3,357,361	3,607,936	3,891,021
Yuma	120,739	136,088	153,545	173,266	195,798	221,101	248,855
Pima	666,880	755,273	853,313	961,035	1,080,285	1,211,816	1,354,571
Santa Cruz	29,767	36,372	44,465	54,226	66,035	79,908	96,271
Cochise	97,624	110,423	124,908	141,010	158,808	177,881	198,132
Arizona (subtotal)	915,010	1,038,156	1,176,231	1,329,537	1,500,926	1,690,706	1,897,829
Hidalgo	5,958	6,262	6,546	6,816	7,074	7,291	7,472
Luna	18,110	22,578	28,143	35,028	43,584	54,017	66,562
Doña Ana	135,510	160,001	189,532	223,295	261,136	304,067	351,703
New Mexico (subtotal)	159,578	188,841	224,221	265,139	311,794	365,375	425,737
El Paso	591,610	678,629	777,144	886,178	1,008,637	1,142,289	1,287,217
Culberson	3,407	3,231	3,058	2,869	2,682	2,484	2,284
Hudspeth	2,915	3,143	3,428	3,716	4,030	4,308	4,590
Jeff Davis	1,946	2,067	2,196	2,322	2,459	2,577	2,690
Presidio	6,637	7,806	9,165	10,720	12,501	14,479	16,705
Brewster	8,681	9,074	9,501	9,894	10,285	10,704	11,021
Terrell	1,410	1,314	1,243	1,159	1,077	987	901
Val Verde	38,721	42,485	46,762	51,255	55,879	60,436	65,007
Kinney	3,119	3,371	3,656	4,006	4,393	4,813	5,211
Maverick	36,378	45,219	56,001	68,984	84,963	103,744	126,041
Dimmitt	10,433	10,501	10,552	10,568	10,545	10,450	10,316
Webb	133,239	172,386	222,100	284,506	363,458	461,623	583,653
Zapata	9,279	10,876	12,716	14,836	17,298	20,163	23,473

Table B3.1—Continued

Starr	40,518	52,214	67,149	85,846	109,311	138,006	173,279
Hidalgo	383,545	482,461	605,449	756,457	944,917	1,175,720	1,457,516
Cameron	260,120	307,869	363,774	428,335	504,142	590,558	688,835
Texas (subtotal)	1,531,958	1,832,646	2,193,894	2,621,651	3,136,577	3,743,341	4,458,739
Border Region Total	5,213,865	5,827,439	6,535,849	7,351,298	8,304,648	9,405,344	10,671,307

Source: 1990 and 1995 data are from U.S. Department of Commerce 1993; 1998. Author calculations for remaining years.

Table B3.2 High Case Population Projections—Mexican Border Region

Area	1990	1995	2000	2005	2010	2015	2020
Tijuana	747,379	991,593	1,309,634	1,722,050	2,255,833	2,942,466	3,822,116
Tecate	51,556	62,546	75,942	91,990	111,022	133,397	159,547
Mexicali	601,938	696,033	803,323	924,214	1,057,737	1,203,207	1,362,024
Baja California (subtotal)	1,400,873	1,750,172	2,188,899	2,738,254	3,424,592	4,279,070	5,343,687
San Luis Río Colorado	110,531	133,141	160,205	192,307	229,645	272,560	321,701
Puerto Peñasco-P.E. Calles	36,353	37,491	38,818	40,082	41,123	41,927	42,430
Caborca	59,159	64,511	70,693	77,340	84,135	91,073	98,065
Altair	6,457	7,120	7,877	8,700	9,569	10,470	11,366
Saric	2,109	2,265	2,479	2,703	2,924	3,136	3,343
Nogales	107,937	133,489	164,070	199,919	243,667	297,446	362,203
Santa Cruz	1,472	1,399	1,365	1,328	1,280	1,228	1,164
Cananea	26,932	29,256	31,865	34,519	37,305	40,155	43,103
Naco	4,643	4,901	5,174	5,439	5,682	5,907	6,084
Agua Prieta	39,119	56,231	80,610	114,998	163,510	231,825	328,009
Sonora (subtotal)	394,712	469,804	563,156	677,335	818,840	995,727	1,217,468

Table 3.2—Continued

Janos	10,896	10,772	10,767	10,755	10,706	10,569	10,384
Ascensión	16,360	19,646	23,765	28,763	34,592	41,305	49,062
Juárez	798,500	1,011,787	1,276,573	1,606,143	2,019,075	2,532,379	3,166,092
Praxedis G. Guerrero	8,439	8,941	9,548	10,156	10,757	11,308	11,764
Guadalupe	9,053	9,580	10,199	10,839	11,451	12,027	12,521
Ojinaga	23,909	23,509	23,391	23,350	23,170	22,778	22,163
Manuel Benavides	2,794	2,324	1,968	1,671	1,393	1,134	904
Chihuahua (subtotal)	869,951	1,086,559	1,356,211	1,691,677	2,111,144	2,631,500	3,272,890
Ocampo	7,853	7,485	7,234	7,041	6,842	6,658	6,482
Acuña	56,335	81,528	117,619	168,508	241,466	345,635	492,484
Jiménez	8,254	9,280	10,507	11,847	13,354	14,969	16,672
Piedras Negras	98,184	116,147	137,764	163,009	192,069	225,209	262,996
Nava	16,916	20,444	24,840	30,158	36,435	43,730	52,355
Guerrero	2,373	2,135	1,950	1,775	1,611	1,448	1,303
Hidalgo	1,220	1,269	1,342	1,444	1,575	1,699	1,843
Coahuila (subtotal)	191,135	238,288	301,256	383,782	493,352	639,348	834,135
Anáhuac	17,312	18,276	19,465	20,760	22,072	23,356	24,596
Nuevo León (subtotal)	17,312	18,276	19,465	20,760	22,072	23,356	24,596
Nuevo Laredo	219,465	275,060	344,501	430,210	536,784	667,796	828,248
Guerrero	4,510	3,972	3,680	3,468	3,339	3,247	3,145
Mier	6,242	6,240	6,349	6,444	6,582	6,778	6,977
Miguel Alemán	21,323	22,366	23,484	24,635	25,812	27,006	28,183
Camargo	15,042	15,265	15,561	15,850	16,075	16,230	16,302
Gustavo Díaz Ordaz	17,704	15,632	13,878	12,291	10,827	9,477	8,246
Reynosa	282,666	337,052	402,039	477,464	563,994	662,465	774,085
Río Bravo	94,010	100,370	107,428	114,875	122,296	129,348	135,912

Table B3.2—Continued

Valle Hermoso	51,305	55,284	59,785	64,623	69,635	74,665	79,658
Matamoros	303,295	363,486	434,692	517,763	614,403	726,256	854,216
Tamaulipas (subtotal)	1,015,562	1,194,727	1,411,397	1,667,623	1,969,747	2,323,268	2,734,972
Border Region Total	3,889,545	4,757,826	5,840,384	7,179,431	8,839,745	10,892,271	13,427,750

Source: INEGI 1998 and author calculations.

Table B4.1: Medium Case Population Projections—U.S. Border Region

Area	1990	1995	2000	2005	2010	2015	2020
San Diego	2,498,016	2,626,714	2,757,874	2,888,839	3,022,391	3,157,483	3,294,769
Imperial	109,303	141,082	174,754	205,716	241,147	281,382	327,790
California (subtotal)	2,607,319	2,767,796	2,932,628	3,094,555	3,263,538	3,438,865	3,622,559
Yuma	120,739	136,088	150,728	163,637	177,577	192,464	208,348
Pima	666,880	755,273	834,499	898,079	963,864	1,031,440	1,100,276
Santa Cruz	29,676	36,372	43,065	49,155	55,982	63,475	71,796
Cochise	97,624	110,423	122,265	132,056	142,131	152,233	162,438
Arizona (subtotal)	914,919	1,038,156	1,150,557	1,242,927	1,339,554	1,439,612	1,542,858
Hidalgo	5,958	6,262	6,546	6,817	7,086	7,340	7,588
Luna	18,110	22,578	26,845	30,273	34,060	38,266	43,005
Dofia Ana	135,510	160,001	184,443	205,629	228,041	252,084	277,699
New Mexico (subtotal)	159,578	188,841	217,834	242,719	269,187	297,690	328,292
El Paso	591,610	678,629	764,480	842,796	926,121	1,012,755	1,103,065
Culberson	3,407	3,231	3,162	3,172	3,169	3,147	3,114
Hudspeth	2,915	3,143	3,402	3,642	3,903	4,147	4,402
Jeff Davis	1,946	2,067	2,164	2,225	2,286	2,339	2,392

Table B4.1—Continued

Presidio	6,637	7,806	8,907	9,835	10,843	11,924	13,121
Brewster	8,681	9,074	9,444	9,737	10,050	10,379	10,664
Terrell	1,410	1,314	1,268	1,251	1,239	1,218	1,200
Val Verde	38,721	42,485	46,412	50,048	53,713	57,398	61,208
Kinney	3,119	3,371	3,598	3,787	3,974	4,167	4,359
Maverick	36,378	45,219	54,225	62,527	71,998	82,555	94,495
Dimmitt	10,433	10,501	10,704	11,011	11,300	11,586	11,890
Webb	133,239	172,386	213,437	252,025	296,827	348,144	407,110
Zapata	9,279	10,876	12,434	13,846	15,408	17,169	19,165
Starr	40,518	52,214	64,597	76,255	89,708	105,025	122,659
Hidalgo	383,545	482,461	584,161	678,076	786,011	909,170	1,050,166
Cameron	260,120	307,869	355,202	398,148	445,601	497,419	554,307
Texas (subtotal)	1,531,958	1,832,646	2,137,597	2,418,381	2,732,151	3,078,542	3,463,317
Border Region Total	5,213,774	5,827,439	6,438,616	6,998,582	7,604,430	8,254,709	8,957,028

Source: U.S. Department of Commerce 1993; 1998; and author calculations.

Table B4.2: Medium Case Population—Mexican Border Region

Area	1990	1995	2000	2005	2010	2015	2020
Tijuana	747,379	991,593	1,260,121	1,532,687	1,855,867	2,235,062	2,676,672
Tecate	51,556	62,546	74,513	86,875	100,938	116,703	134,271
Mexicali	601,938	696,033	794,444	893,876	1,000,684	1,113,609	1,232,953
Baja California (subtotal)	1,400,873	1,750,172	2,129,078	2,513,438	2,957,489	3,465,374	4,043,896
San Luis Río Colorado	110,531	133,141	157,276	181,842	209,237	239,390	272,448
Puerto Peñasco-P.E. Calles	36,353	37,491	39,527	42,268	44,909	47,455	49,851
Caborca	59,159	64,511	70,926	78,059	85,413	92,993	100,756

Table B4.2—Continued

Altar	6,457	7,120	7,878	8,706	9,590	10,515	11,464
Saric	2,109	2,265	2,493	2,706	3,045	3,338	3,635
Nogales	107,937	133,489	160,834	188,531	220,591	257,669	299,598
Santa Cruz	1,472	1,399	1,418	1,483	1,542	1,598	1,647
Cananea	26,932	29,256	31,928	34,754	37,721	40,796	43,991
Naco	4,643	4,901	5,261	5,727	6,202	6,682	7,139
Agua Prieta	39,119	56,231	76,356	97,511	124,040	157,126	198,353
Sonora (subtotal)	394,712	469,804	553,897	641,641	742,290	857,562	988,882
Janos	10,896	10,772	11,140	11,883	12,623	13,341	14,085
Ascensión	16,360	19,646	23,368	27,332	31,771	36,726	42,314
Juárez	798,500	1,011,787	1,239,922	1,470,185	1,738,020	2,045,334	2,395,024
Praxedis G. Guerrero	8,439	8,941	9,641	10,446	11,271	12,092	12,891
Guadalupe	9,053	9,580	10,318	11,219	12,149	13,091	14,011
Ojinaga	23,909	23,509	23,957	24,957	25,857	26,630	27,275
Manuel Benavides	2,794	2,324	2,108	2,030	1,935	1,820	1,697
Chihuahua (subtotal)	869,951	1,086,559	1,320,454	1,558,052	1,833,626	2,149,034	2,507,297
Ocampo	7,853	7,485	7,550	7,979	8,416	8,882	9,389
Acuña	56,335	81,528	111,347	142,616	182,340	232,393	294,604
Jiménez	8,254	9,280	10,458	11,693	13,058	14,524	16,081
Piedras Negras	98,184	116,147	135,850	156,263	179,006	204,052	231,580
Nava	16,916	20,444	24,479	28,852	33,820	39,386	45,722
Guerrero	2,373	2,135	2,039	2,028	2,011	1,983	1,954
Hidalgo	1,220	1,269	1,358	1,482	1,615	1,747	1,886
Coahuila (subtotal)	191,135	238,288	293,081	350,913	420,266	502,968	601,216
Anáhuac	17,312	18,276	19,637	21,283	22,998	24,761	26,586
Nuevo León (subtotal)	17,312	18,276	19,637	21,283	22,998	24,761	26,586

Table B4.2—Continued

Nuevo Laredo	219,465	275,060	334,955	395,023	464,575	543,880	633,770
Guerrero	4,510	3,972	3,851	3,923	4,025	4,135	4,249
Mier	6,242	6,240	6,453	6,767	7,110	7,483	7,863
Miguel Alemán	21,323	22,366	23,795	25,617	27,521	29,475	31,458
Camargo	15,042	15,265	15,819	16,637	17,432	18,205	18,946
Gustavo Díaz Ordaz	17,704	15,632	14,642	14,382	14,061	13,685	13,265
Reynosa	282,666	337,052	394,864	452,628	515,993	584,684	658,403
Río Bravo	94,010	100,370	108,390	117,870	127,636	137,449	147,230
Valle Hermoso	51,305	55,284	60,082	65,558	71,302	77,209	83,235
Matamoros	303,295	363,486	427,735	493,483	567,015	648,366	736,891
Tamaulipas (subtotal)	1,015,562	1,194,727	1,390,586	1,591,888	1,816,670	2,064,571	2,335,310
Border Region Total	3,889,545	4,757,826	5,706,733	6,677,212	7,793,338	9,064,272	10,503,188

Source: INEGI 1998 and author calculations.

Table B5.1: Low Case Population Projections—U.S. Border Region

Area	1990	1995	2000	2005	2010	2015	2020
San Diego	2,498,016	2,626,714	2,754,949	2,876,121	2,990,908	3,094,817	3,191,225
Imperial	109,303	141,082	151,059	161,360	171,743	182,171	193,276
California (subtotal)	2,607,319	2,767,796	2,906,008	3,037,481	3,162,651	3,275,988	3,384,501
Yuma	120,739	136,088	142,278	148,467	154,728	161,113	167,945
Pima	666,880	755,273	778,058	798,149	815,649	830,061	842,722
Santa Cruz	29,676	36,372	38,864	41,301	43,726	46,138	48,691

Table B5.1—Continued

Cochise	97,624	110,423	114,336	117,905	121,076	123,851	126,508
Arizona (subtotal)	914,919	1,038,156	1,073,536	1,105,822	1,135,179	1,161,163	1,185,866
Hidalgo	5,958	6,262	6,546	6,833	7,115	7,398	7,704
Luna	18,110	22,578	22,951	23,304	23,716	24,232	24,939
Dofia Ana	135,510	160,001	169,176	178,055	186,650	194,832	202,965
New Mexico (subtotal)	159,578	188,841	198,673	208,192	217,481	226,462	235,608
El Paso	591,610	678,629	726,491	773,077	818,720	862,738	906,332
Culberson	3,407	3,231	3,473	3,704	3,933	4,167	4,414
Hudspeth	2,915	3,143	3,322	3,508	3,692	3,878	4,061
Jeff Davis	1,946	2,067	2,069	2,065	2,052	2,035	2,021
Presidio	6,637	7,806	8,134	8,475	8,825	9,206	9,630
Brewster	8,681	9,074	9,270	9,442	9,591	9,724	9,853
Terrell	1,410	1,314	1,344	1,375	1,402	1,426	1,452
Val Verde	38,721	42,485	45,359	48,154	51,013	53,945	56,949
Kinney	3,119	3,371	3,424	3,462	3,495	3,532	3,589
Maverick	36,378	45,219	48,897	52,639	56,431	60,408	64,706
Dimmitt	10,433	10,501	11,159	11,828	12,521	13,251	14,047
Webb	133,239	172,386	187,445	202,846	219,021	235,774	253,445
Zapata	9,279	10,876	11,589	12,328	13,153	14,102	15,191
Starr	40,518	52,214	56,942	61,819	66,945	72,324	78,043
Hidalgo	383,545	482,461	520,296	558,636	598,196	639,572	683,960
Cameron	260,120	307,869	329,487	351,150	373,150	395,906	420,140
Texas (subtotal)	1,531,958	1,832,646	1,968,701	2,104,508	2,242,140	2,381,988	2,527,833
Border Region Total	5,213,774	5,827,439	6,146,918	6,456,003	6,757,453	7,046,600	7,333,809

Source: U.S. Department of Commerce 1993; 1998; and author calculations.

Table B5.2: Low Case Population Projections—Mexican Border Region

Area	1990	1995	2000	2005	2010	2015	2020
Tijuana	747,379	991,593	1,111,582	1,242,042	1,380,392	1,524,365	1,671,328
Tecate	51,556	62,546	70,226	78,682	87,770	97,438	107,606
Mexicali	601,938	696,033	767,809	845,071	924,613	1,006,003	1,088,659
Baja California (subtotal)	1,400,873	1,750,172	1,949,617	2,165,795	2,392,775	2,627,806	2,867,593
San Luis Río Colorado	110,531	133,141	148,489	165,333	183,050	201,626	220,955
Puerto Peñasco-P.E. Calles	36,353	37,491	41,654	46,185	50,856	55,723	60,790
Caborca	59,159	64,511	71,625	79,374	87,399	95,748	104,417
Altair	6,457	7,120	7,882	8,734	9,649	10,632	11,673
Saric	2,109	2,265	2,533	2,851	3,195	3,564	3,954
Nogales	107,937	133,489	151,127	170,097	190,683	212,650	235,480
Santa Cruz	1,472	1,399	1,576	1,767	1,978	2,208	2,462
Cananea	26,932	29,256	32,117	35,145	38,292	41,583	45,029
Naco	4,643	4,901	5,521	6,230	6,992	7,805	8,648
Agua Prieta	39,119	56,231	63,594	71,769	80,565	89,997	100,042
Sonora (subtotal)	394,712	469,804	526,118	587,485	652,659	721,536	793,450
Janos	10,896	10,772	12,259	13,984	15,902	18,062	20,529
Ascensión	16,360	19,646	22,178	25,063	28,112	31,415	35,004
Juárez	798,500	1,011,787	1,129,968	1,258,069	1,393,175	1,533,470	1,676,142
Praxedis G. Guerrero	8,439	8,941	9,919	10,992	12,138	13,357	14,649
Guadalupe	9,053	9,580	10,675	11,893	13,200	14,586	16,055
Ojinaga	23,909	23,509	25,656	27,954	30,313	32,767	35,336
Manuel Benavides	2,794	2,324	2,529	2,750	2,986	3,234	3,497
Chihuahua (subtotal)	869,951	1,086,559	1,213,184	1,350,705	1,495,826	1,646,891	1,801,212
Ocampo	7,853	7,485	8,498	9,692	11,005	12,495	14,184
Acuña	56,335	81,528	92,530	104,521	117,676	131,859	146,798

Table 5.2—Continued

Jiménez	8,254	9,280	10,314	11,451	12,683	14,013	15,439
Piedras Negras	98,184	116,147	130,108	145,367	161,647	178,909	197,117
Nava	16,916	20,444	23,393	26,734	30,345	34,245	38,489
Guerrero	2,373	2,135	2,303	2,493	2,689	2,894	3,107
Hidalgo	1,220	1,269	1,408	1,567	1,728	1,905	2,102
Coahuila (subtotal)	191,135	238,288	268,554	301,825	337,773	376,320	417,236
Andhuac	17,312	18,276	20,151	22,226	24,433	26,784	29,328
Nuevo León (subtotal)	17,312	18,276	20,151	22,226	24,433	26,784	29,328
Nuevo Laredo	219,465	275,060	306,317	339,923	375,265	412,221	450,103
Guerrero	4,510	3,972	4,364	4,799	5,276	5,787	6,338
Mier	6,242	6,240	6,765	7,330	7,916	8,531	9,170
Miguel Alemán	21,323	22,366	24,730	27,319	30,066	32,961	35,976
Camargo	15,042	15,265	16,593	18,034	19,531	21,122	22,781
Gustavo Díaz Ordaz	17,704	15,632	16,934	18,306	19,704	21,140	22,602
Reynosa	282,666	337,052	373,340	412,247	452,720	494,081	535,293
Río Bravo	94,010	100,370	111,277	123,201	135,783	148,977	162,750
Valle Hermoso	51,305	55,284	60,973	67,235	73,820	80,732	87,952
Matamoros	303,295	363,486	406,865	454,099	504,315	556,922	610,587
Tamaulipas (subtotal)	1,015,562	1,194,727	1,328,158	1,472,493	1,624,396	1,782,474	1,943,552
Border Region Total	3,889,545	4,757,826	5,305,782	5,900,532	6,527,860	7,181,811	7,852,368

Source: INEGI 1998 and author calculations.

V

Development, Growth, and the Future of the Border Environment

Paul Ganster, Alan Sweedler, and Norris Clement

SUMMARY OF ISSUES, PROBLEMS, AND RECOMMENDATIONS *Issues and Problems*

The U.S.-Mexican border currently has a population of 12 million and will likely double by the year 2020, with most of this growth taking place in the urban regions on both sides of the border. Accompanying this large growth in population will be a sizable increase in cross-border trade and other regional economic activity. The population and trade growth will place significant stress on water and energy resources, transportation infrastructure, and essential social services. It could also have serious environmental consequences for the health and quality of life of border residents. For example, at the present time, all surface waters in the border region are fully allocated by international treaties and domestic agreements. In addition, groundwater deposits are very limited and overused in many regions. Air quality is also a serious problem for many border residents, particularly the high levels of ozone and particulate matter found in the urban regions along the border. Another serious problem is the lack of adequate transportation infrastructure needed to assure the steady flow of goods within the border region. Inadequate roads and highways and poor border crossing facilities result in long delays at the border and heavy congestion in the border region, all contributing to degrading air quality. Finally, much of the historic economic expansion in the border region has not brought economic development, with increasing real wages, standard of living, or prosperity. This has been a limiting factor on the fiscal base of many border communities, compromising their ability to address environmental and infrastructure problems.

Recommendations

Although most of the environmental issues in the border region arise from rapid population growth and the lack of financial resources to meet the needs of the population, this growth can also be viewed as a resource to meet projected needs. For this to happen, it will be necessary to distinguish economic growth from economic development. In the effort to create jobs, many communities have not taken into account social and environmental impacts, nor the medium- and long-term implications of their economic development policies. By and large, the following considerations should be systematically incorporated into the efforts to stimulate regional economic development:

- Do the new economic activities bring higher paying jobs to the communities and will the quality of the jobs have a positive impact on the fiscal base of the region?
- What are the medium- and long-term implications of providing subsidies, tax holidays, and other inducements to companies to locate in the region? For example, do these subsidies reduce the ability of the community to build and maintain infrastructure?
- What are the environmental consequences of the economic development activities? For example, will the resulting growth have negative impacts on air quality, water availability, traffic congestion, open spaces, and important habitats? Will the activities simply expand the size of the communities without bringing an improved quality of life and living standard?

Specific recommendations related to improving air and water quality in the border region include:

- Maintaining and expanding the system of air monitoring stations in the border region.
- Developing an inspection and maintenance program for vehicles (private and commercial) in the border region.
- Developing clean energy projects that take into account impacts of energy use on the air and water resources in the region.
- Investing in technologies and processes that put a premium on water conservation in all sectors (residential, commercial, and industrial).
- Providing technical assistance to border communities to enable them to compete for NADBank financing by working closely with the BECC.

INTRODUCTION

This paper discusses the relationship between economic and demographic growth and the environment in the U.S.-Mexican border region. In the first two sections, the historical factors that have shaped current economic and demographic patterns in the border region and what is now being done to

change those patterns, are reviewed. The third section focuses on those aspects of the environment that have suffered the most as a result of economic and demographic patterns. In the final section, some of the indicators that have proved valuable in monitoring a region's environmental health are examined.

ECONOMIC GROWTH AND DEVELOPMENT IN MEXICO AND THE BORDER REGION

Historical Trends

For over a century, the U.S. economy has been the main driver of urban expansion on the Mexican side of the border. From the Mexican-American War of 1848 until just a few decades ago, Mexico considered the large desert area of its northern states as a barrier to further U.S. expansionism and focused on the economic development of the central part of the country. As the U.S. economy grew and prospered during the late nineteenth and early twentieth centuries, the vast differences in total and per capita income between the two countries grew. As a result, Mexico's northern regions, originally sparsely settled, became more populated in response to the opportunities related mainly to U.S. economic growth.

This symbiotic growth on the Mexican side of the boundary accelerated after World War II with the growth of the U.S. Southwest. There, migration of both capital and population intensified the growth of border twin cities, the urban areas characterized by high population growth rates, rapid expansion of the service sector, and increasing cross-border integration. Some twin cities (e.g., El Paso and Ciudad Juárez), because of their immediate proximity to each other, developed strong and visible commercial, cultural, and social linkages, while in others (e.g., San Diego and Tijuana) these linkages were not so strong nor visible, but present nevertheless. Consequently, the economic health of most Mexican border cities has become intimately intertwined with the performance of the U.S. economy generally and the neighboring U.S. state economy specifically. In fact, it is common to hear the saying in Mexico, and especially in the northern border region, that "when the U.S. economy sneezes, the Mexican economy catches pneumonia." The relationship between business cycles in the United States and Mexico has long been recognized by economists and policy-makers in both countries.

The development of the economy of Mexico's northern border region has been conditioned by many factors, not just the U.S. economy. It is important to note that the Mexican national economy has evolved a great deal over the last half century. While Mexico did experience a long period of economic growth in the late nineteenth and early twentieth centuries, the Mexican Revolution (1910–1917) wiped out most of the gains of the earlier period. It was not until the 1930s that Mexico was able to focus on economic development once again.

World War II provided Mexican industry an opportunity to develop while U.S. corporations, which supplied a good part of Mexico's manufactured products, were busy supplying the needs of U.S. troops in Europe and Asia. After World War II, Mexico adopted a strategy of Import Substitution Industrialization (ISI) that focused on high tariffs and government incentives to industrialize a country which, at that time, was a full century behind the United States in terms of economic development. As a result of that strategy, Mexico enjoyed relatively high rates of economic growth (6 percent per year) and low rates of inflation (3 percent) during the 1950–1970 period. Mexico did attain a modest level of industrialization during that period, but beginning in the early 1970s, the ISI strategy began to falter. Inflation started rising and commercial bank loans from developed countries were incurred in order to sustain growth.

During the 1977–1981 period, Mexico's economy boomed as its oil exports grew and world prices soared. However, in 1982, when interest rates skyrocketed and a global recession and plummeting oil prices converged, Mexico was forced to declare a moratorium on its debt service payments. The value of the peso fell dramatically and inflation rose to record levels. The U.S. government and the International Monetary Fund came to Mexico's rescue with emergency loans, but in return demanded that Mexico stabilize its economy through tight monetary and fiscal policies and reform its economy along market-oriented lines. Stabilization was necessary in order to reduce inflation and, consequently, the need for further reductions. It also meant that employment and living standards were reduced and the economy oscillated between low and negative growth for more than a decade.

Since 1982, Mexico has undergone a profound revolution in its economic development strategy. In less than two decades, protection and regulation of the domestic economy were reduced, state-owned firms were privatized, and the economy was opened to foreign investment and free trade with its North American partners. This new development strategy, frequently referred to as neo-liberalism, seeks development through expanded exports, an expanded role for market mechanisms, and a new, more selective role for government. While these revolutionary changes have important implications for the border region, there are other border-related factors that must also be discussed.

The Maquiladora: From the Bracero Program to Industrialization

A key factor in the economic development of the U.S. Southwest and the border region was the integration of Mexican labor. One of the great deficiencies of Mexico's development strategies in the post-World War II period has been the inability of the economy to employ the rapidly expanding labor force. Population growth rates prior to the introduction of family planning measures in the mid-1970s hovered above three percent per year and subsequently have fall-

en to around two percent. Nevertheless, it is estimated that currently Mexico's economy must grow at a rate of six percent per year simply to absorb the new entrants into the labor market. Thus, while open (urban) unemployment is usually estimated at less than 10 percent, the rate of underemployment (i.e., people involuntarily working part-time) is estimated to be more than 40 percent. Thus, at any point in time, approximately half of the labor force is either un- or underemployed. This situation has, over the last several decades, led to the integration of a growing proportion of the Mexican labor force into the U.S. economy; first through the Bracero Program and then through the Border Industrialization Program.

The Bracero Program was first implemented in 1942 in response to the wartime labor shortage in the United States. The Mexican and the U.S. governments agreed to a guest worker program to allow temporary contract of Mexican laborers to work in the United States, initially in agriculture, but later in other sectors. The program was extended beyond the wartime emergency and was finally terminated in 1964. Nonetheless, driven by poverty and lack of jobs in Mexico and attracted by employment opportunities and higher wages in the United States, the flow of Mexican labor northward has continued to the present time in the form of illegal migration. The movement of Mexican migrants into the United States has profoundly affected border communities and today constitutes a key issue for the border region.¹

Simultaneously, as many Mexicans acquired visas for work in the United States, and as many border Mexicans acquired U.S. citizenship, a significant group of commuter workers developed along the entire border region. Living in the Mexican twin city and commuting to work in the United States, these workers are an important regional economic force. They constitute approximately eight percent of the economically active population in Mexico's border cities and account for a disproportionate share of personal income in Mexican border cities because of the higher wages earned in the United States. For example, in the San Diego-Tijuana region in the late 1980s, there were probably more than forty thousand men and women who crossed daily to work in the United States, and presently this figure may be as high as sixty thousand.² The total income of this group of commuters is at least several times larger than the income of the 135,000 or so workers in Tijuana's maquiladora industry.³ Paid in dollars, these individuals benefit from devaluations of the peso and account for important retail purchases in the United States. Often, earners of low wages in the United States, these commuters are middle class by Mexican standards. They often live in Mexico not only for cultural preferences, but also for lower housing and living costs. In addition to providing high quality and low cost labor, these workers benefit the U.S. border cities in another way. San Diego has a serious shortage of affordable housing and in the case of the commuter workers and a growing number of U.S.-born citizens, Mexico meets that basic infrastructure need.⁴

Border Industrialization Program—The Maquiladora Industry

Mexico, fearing significant unemployment as the Bracero Program ended and guest workers returned from the United States, established the Border Industrialization Program in 1965. Designed to generate jobs in Mexican border cities through establishment of assembly plants, or maquiladoras, the program initially enjoyed only modest success.⁵ However, beginning in 1984, stimulated by simplified regulations and lower wages brought by the devalued peso, the industry has achieved double-digit increases in employment each year.

The importance of the maquiladora industry to the border region should not be underestimated. On the Mexican side of the international boundary, the industry stimulated significant job creation and produced a group of managers and technical personnel in an industry that has become competitive on a world level at prevailing wages. Since other areas of Mexican industry were not globally competitive, the maquiladora industry, through job creation and investment, has helped the northern border become one of the most economically dynamic regions of Mexico, even during the severe economic downturns of the mid-1980s and mid-1990s. Ironically, however, the maquiladora industry owes much of its success and rapid growth to the weakness of Mexico's national economy since the early 1990s. Labor costs in dollar terms have been kept low by successive peso devaluations, thereby attracting investment that would otherwise have gone to low wage areas in Asia and the Caribbean. Nevertheless, the weakness of the Mexican economy can be blamed for the huge infrastructure deficit that characterizes those border cities where maquiladora growth has been the fastest. Tijuana, for example, throughout the 1980s and 1990s, has experienced population growth rates of well over six percent per year due to its ability to provide jobs for migrants who come from the interior of the country. However, most resources for infrastructure expenditure must come from the federal government, which for the last 15 years has been intent on reducing expenditures and raising taxes. Consequently, as needs in the border regions have grown with the increasing population, the ability of the federal government to provide social and physical infrastructure has diminished.

Informal Border Transactions

For decades, the most visible element of border economic integration from the perspective of the U.S. border communities was through retail—and some wholesale—purchases made by Mexicans shoppers on the U.S. side of the border. The unrecorded purchases are usually referred to as informal border transactions. Much of Mexico's northern border has been a free zone since the 1930s. This status recognized the northern economy's isolation from the Mexican national economy and its close linkages to the U.S. economy. This policy,

which continues currently, acknowledges that enforcement of customs regulations by Mexico at the international boundary was futile. Thus, many Mexican shoppers crossed to the United States where price, variety, and quality of goods were perceived to be better than in Mexico. Many U.S. border communities reported significant negative impacts with the peso devaluations of 1976, 1982, and 1994–1995 that decreased the value of the peso versus the dollar and created recessions, making it difficult for many Mexicans to continue to cross into the United States to shop.⁶

Unfortunately, the regional economies of border twin cities are not well understood due to inadequate data and the complexity of the cross-border economic linkages. There are also significant differences along the border. For example, the regional economy of San Diego is at least ten times larger than that of Tijuana. The Mexico connection accounts for no more than five percent of San Diego's employment, whereas Tijuana's U.S. economic linkages account for more than half of its employment.⁷ In the El Paso-Ciudad Juárez region, the relationship is less asymmetrical and in some areas, the larger Mexican city dominates the U.S. twin city, as in the case of Mexicali and Calexico or Nogales, Sonora, and Nogales, Arizona. Consequently, one must be cautious when generalizing for the entire border region.

The expansion of the maquiladora industry in the early 1980s coincided with a decline in Mexican retail purchases, which, in turn, triggered new cross-border collaboration. Many local officials in U.S. border communities, noting the positive economic impact on their own economies from the establishment of maquiladoras in adjacent Mexican cities, began to actively recruit U.S. and other companies to relocate to the Mexican side of the border. For the first time, many business and political leaders, as well as members of the general public in U.S. border communities, became aware of the symbiotic relationship with their Mexican neighbors. Beginning in the mid-1980s, U.S. border communities began to see significant opportunities in expanded economic relations with Mexico. This was especially true in the smaller U.S. border communities, particularly along the lower Rio Grande in Texas where regional economies were narrowly based on agriculture and Mexican retail purchases.⁸ These communities viewed maquiladoras as an opportunity to broaden the regional economic base. This change in mentality led to strong support in border communities for the North American Free Trade Agreement that took effect January 1, 1994. It also culminated in enhanced border interactions in areas of life other than those strictly related to trade and commerce, pushing U.S. and Mexican border communities toward cooperation on many fronts.

Border Economic Growth and NAFTA

The changes in Mexico's economic policy initiated under the presidency of Miguel de la Madrid (1982–1988) and continued under Carlos Salinas de Gor-

tari (1988–1994) have significantly altered the economic relations between the United States and Mexico. Mexico's decision to enter the GATT (General Agreement on Tariffs and Trade) in 1986 resulted in the elimination of import licenses and reduction of tariffs, providing much greater access for U.S. exporters to Mexican markets. Additional changes in Mexico's trade, investment, real estate, and maquiladora laws and regulations followed and these liberalizing measures produced a significant increase in U.S.-Mexican trade. Since most bilateral trade moved goods by land, trade-related activities boomed in border cities. At the same time, infrastructure in the border cities, including customs facilities, ports of entry, and roads became saturated.

While it is likely that the overall economic impact of NAFTA has been greater economic growth for Canada, Mexico, and the United States than otherwise might have occurred, the regional impacts have varied considerably. Border communities have experienced a number of effects, including greater integration of the regional transborder economies, a huge increase in commerce passing through the border cities, and a significant growth of the maquiladora industry.

The expansion of the border economy has created large numbers of new jobs. The maquiladora industry is a case in point. However, there is a downside to the nature of job creation in border communities. Most of the new jobs created over the past decade, and particularly since NAFTA, have been in entry-level service positions or in the maquiladora industry. While employment in the maquiladora industry has risen rapidly, real wages have not increased and have actually declined somewhat. Thus, the industry has failed to improve standards of living for most of its workers. The challenge of improving the real wages of maquila workers is clearly recognized by economic development organizations and by the maquiladora industry itself. The problems of low maquila wages and other wages in Mexican border cities are compounded by the "dollarized" Mexican border economy and the very high cost of living.

U.S. border communities have also faced a similar problem with improving real incomes. Regions such as San Diego that lost high paying jobs related to the defense industry decline during the early 1990s have added new jobs in the recovery from the recession. However, many of the new jobs are in entry-level service positions that pay low wages and often do not include health care and other benefits. Most of these jobs cannot support families without substantial public assistance through social services, indigent health care, subsidized housing, or other governmental assistance. Thus, many of these positions actually require a public subsidy and consume more taxes than they generate. All these problems are exacerbated by the relatively high cost of living in U.S. border towns, particularly on the western end of the border.

Economic Growth Versus Economic Development

Within the globalized economy, more communities and regions are beginning to take a proactive role in fostering economic development at the local and regional level. Border communities now view their economic regions as the entire transborder region of the twin cities and surrounding areas, and through local economic development organizations and governments they have worked to expand trade and investment opportunities. The ultimate goal of these efforts is to create jobs in their communities. Examples include cities of the lower Rio Grande area working to bring maquilas to cities across the border, joint economic development efforts of the Arizona-Sonora Commission, joint marketing in Asia of the California-Baja California border region as a manufacturing and commerce location,⁹ and border-wide efforts to enhance physical infrastructure for trade and commerce led by the Border Trade Alliance. A standard tool employed by communities in economic development efforts has been to recruit companies to locate in the region by offering tax breaks, subsidized buildings and industrial parks, infrastructure subsidies, and so forth.

In the efforts to create jobs, many communities have not taken into account the social and environmental impacts nor the medium- and long-term implications of their economic development policies.¹⁰ By and large, the following considerations and questions have not been systematically incorporated into the efforts to stimulate regional economic growth:

- Do the new economic activities bring higher paying jobs to the communities? By 1998, many border communities were concerned that they had been left out of the benefits of expanded trade and investment brought by NAFTA. Simply put, regions such as El Paso-Ciudad Juárez had experienced a great increase in trade and manufacturing, but had failed to add higher value to the trade and manufacturing activities. At the same time, this region experienced some negative impacts of free trade, including job displacement and increased traffic congestion.¹¹ Thus, prosperity driven by NAFTA has been elusive.
- What are the medium- and long-term implications of providing subsidies, tax holidays, and other inducements to companies to locate in the region? For example, do these subsidies reduce the ability of the community to build and maintain infrastructure?
- What is the quality of the jobs created in terms of salaries, wages, and benefits? Will these jobs have a negative impact (and require social services) or a positive impact on the fiscal base of the region? Entry level positions often require more in government services than they contribute in taxes. Do the new jobs raise the standard of living?

- What are the environmental consequences of the economic development activities? For example, will the resulting growth have negative impacts on air quality, water availability, traffic congestion, open spaces, and important habitats? Will the activities simply expand the size of the communities without bringing an improved quality of life and living standard?

Future Scenarios

The aforementioned considerations suggest that communities that continue efforts to create jobs indiscriminately without regard to improving the level of real wages face negative impacts in the medium and long term. These negative impacts will be seen in saturated infrastructure, negative environmental impacts, accelerated growth, increasing poverty, and declining quality of life. Business as usual will most likely bring growth and economic expansion without qualitative improvement in quality of life and prosperity.

These considerations suggest that additional elements should be incorporated into the thinking of communities engaged in economic development activities. The challenge for border communities, then, is to implement policies that will bring economic development, protect and improve the environment, and improve the quality of life in border communities.

POPULATION GROWTH

The reasons for the flow of people from central and southern Mexico to the northern border and across into the United States are related to push factors in Mexico and pull factors in the United States. Mexican development and social policy in modern times, and especially since the 1940s, focused little attention on a more equitable distribution of income and wealth and largely ignored services in the rural areas and small towns of Mexico.¹² The population explosion that hit Mexico beginning in the 1940s first produced internal migration to the cities in search of employment and access to services. Then, the flows turned northward in search of work, following paths established by generations of Mexican migrant workers, including legal guest workers who had worked in the United States as *braceros* from World War II until 1964, when the program ended. The boom of the war years and subsequent postwar economic growth and urban development of the Southwest (the Sunbelt) acted as a strong magnet for Mexicans for whom adequate employment in their native regions was not possible.

There is a clear link between economic conditions and population growth in border communities. Economic growth in U.S. border cities encourages immigration, both domestic and foreign. Recession in U.S. border communities reduces domestic in-migration and has a dampening effect on international in-

migration. Recession in central and southern Mexico encourages out-migration to Mexico's northern border cities and into the United States.

The populations of both the Mexican and the U.S. border zones have, over the long run, exceeded natural growth rates. Migration is the most important factor shaping the demographic picture of the binational border region. For example, Tijuana's population grew 6.9 percent between 1987 and 1988; 1.9 percent of the growth was natural increase and 5 percent was the result of immigration. During the same period, Ciudad Juárez saw a 1.8 percent natural increase and a 7.5 percent increase from migration.¹³ In 1980, 48.9 percent of the population of the border counties and municipalities consisted of migrants. Of the 48.9 percent, 8.4 percent were from a foreign country. The 1980 population of the Mexican border municipalities was 31.8 percent migrants, while the figure for the U.S. border counties was 58.2 percent. Eleven percent of the migrants in the Mexican border municipalities were foreign-born, while the figure was a much larger 20 percent for the U.S. border counties.¹⁴

The relationship between economic growth and population increase in border communities can clearly be seen in the recent history of San Diego. It should be noted that approximately 40 percent of the border's population resides in the San Diego-Tijuana border zone. In the early 1990s, San Diego's economy went through a deep recession, provoked largely by the convergence of a national recession with downsizing of the defense industry after the end of the Cold War. During this period, migration out of the region increased, migration into the region decreased, and the region's population grew at an average rate of 1.8 percent per year. This contrasts with a yearly average growth of 3.0 percent in the 1980s.¹⁵ In 1996, the economy began to rebound, and in that year 20,500 jobs were created. In that same year, the county's population grew by 42,300, an increase of 1.6 percent, which was a significant change from the previous year's population increase of 0.9 percent.¹⁶ In one year, the time required for the San Diego population to double decreased from nearly 77 years to 43 years. As the San Diego economy continued to improve throughout 1997, the rate of population growth continued to increase. In 1997, San Diego County's population increased by 68,500 people, an annual rate of 2.5 percent, implying a doubling time of 27.6 years.¹⁷ Thus, in a few short years, the improving San Diego economy caused the population growth rate to double. The relationship between economic cycles and rapid, often unpredictable, population growth presents a challenge to many other border communities in their efforts to plan for future infrastructure requirements.

THE NATURAL RESOURCE BASE, ENVIRONMENTAL CONDITIONS, AND BORDER GROWTH

The U.S.-Mexican border region is largely arid, with limited water supplies for human activities and for maintenance of the viability of important habitats

along rivers, streams, and elsewhere. Everywhere along the border, concentrated and rapid urban growth and economic activities including ranching, mining, recreation and tourism, and other pursuits have polluted the environment and have stressed the natural resource base of the region. The section that follows will discuss especially critical aspects of the environment and natural resources of the border and will be illustrated with a few examples.

Water Supply and Demand

Economic growth, including industrial activities, irrigated agriculture, urban expansion, and population growth, has created a huge demand for water in the border region. All surface waters in the border region are fully allocated by international treaties and domestic agreements, and groundwater deposits are very limited and overused in many regions. One alternative for the long-term water supply for border communities is water reclamation, combined with conservation. However, this involves significant capital costs for infrastructure and major energy costs for reclamation and pumping. Recently, attention has turned to an examination of developing water markets to permit transfer of water from agriculture to urban uses. In the case of California, only five percent of agricultural water would have to be transferred to urban uses to assure an adequate supply for the foreseeable future. Participating in transboundary water markets might be a viable alternative for some Mexican border cities in order to avoid huge infrastructure costs. Not all areas of the border have this option available and continued growth will be possible only through conservation accompanied by radical changes in consumption practices and water reuse. It is clear that most of the population centers of the border do not at present have a secure water supply that will carry them to the year 2020.

Tijuana-San Diego

San Diego County and Tijuana account for approximately 40 percent of the population of the border region. In a typical year, San Diego County imports over 90 percent of its water and Tijuana imports up to 95 percent of its water, depending upon the amount of rainfall captured at Rodríguez Reservoir.¹⁸ By 2010, the binational region's population will increase from 3.7 to 5.45 million people, with 60 percent living in San Diego and 40 percent in Tijuana. A total of 848,000 acre feet (an acre-foot is 325,851 gallons or 1,233 cubic meters) of water will be required at that time for annual consumption, with San Diego accounting for 87 percent of water use and Tijuana for 13 percent. In 1996, approximately 85 percent of San Diego's water came from its allotment of California's share of Colorado River water. In future years, San Diego will have to rely less on this source as California is forced by other Colorado water users to reduce its draw on the Colorado River.¹⁹ San Diego hopes to meet future needs with transfers of water saved by conservation efforts from the Imperial Valley.

Although the source of this water is the Colorado River, it would be from the Imperial Valley's agricultural allotment. Currently, authorities in San Diego and Tijuana are discussing joint construction of an aqueduct from the Imperial Valley-Mexicali Valley region to bring additional water to the area.²⁰

In 1996, municipal and industrial per-capita water use in the San Diego region was .197 acre-feet. In the year 2010, it is projected to be approximately .196 acre-feet per person. For Tijuana, 1996 per-capita water use was .063 acre-feet and the projected use for 2010 is approximately .053 acre-feet per person. The significant difference in per capita use between Tijuana and San Diego can be partly explained by the greater density of residential areas in Tijuana (19.3 persons per acre) than in San Diego (2.9 people per acre). In San Diego, for single-family homes and rural areas, outdoor water use may be as high as 60 percent of total residential uses.²¹ Thus, an obvious alternative for San Diego and other U.S. border cities is to become more efficient in use of existing water resources through land-use planning and other mechanisms. Such change will be difficult and will likely be seen by U.S. border residents as a deterioration of the quality of life.

Related water supply problems for the San Diego-Tijuana region include an inadequate storage system and a system of aqueducts from the north and east that is vulnerable to natural hazards such as earthquakes. In order to expand the supply of local water, in recent years there has been a significant effort to enhance water reclamation in the region. At present, there is some capacity for water reuse in the region. There is a small water reuse facility in Tijuana known as Ecoparque that could supply a limited amount of water for irrigation of green areas. There are also reclamation projects in Escondido and Del Mar in San Diego County. The most ambitious reclamation project is the construction of a seven-million-gallon per day reclamation plant adjacent to the International Waste Water Treatment Plant located next to the international border.²² The reclaimed water will be marketed in the south San Diego area and in Tijuana for landscape irrigation, industrial uses, and groundwater recharge. It should be noted that water reuse schemes for domestic purposes in San Diego have encountered significant local political opposition and the enmity of the largest regional newspaper. Labeled as "tap to toilet" by its foes, water reuse for domestic purposes faces some difficulties in the political arena. The willingness of border populations to accept innovation regarding water use is problematic and is a challenge that local leaders must face between now and 2020.

While water authorities in the San Diego-Tijuana region are planning for future needs, the task is enormous and greatly exacerbated by rapid population growth. The increase of imports from outside the region will require expensive infrastructure and may not be possible at all. It is likely that conservation and reuse will be employed widely, resulting in higher prices for users. Reduced water consumption per capita by San Diegans implies significant changes in lifestyle. In the not-too-distant future, it may not be possible to supply water to

users in new housing developments and businesses, nor to maintain the lush, green urban landscape that San Diegans are accustomed to.

Sierra Vista

Sierra Vista is a community of about 35,000 people in southeast Arizona in the Upper San Pedro watershed that includes parts of Sonora and Arizona.²³ Sierra Vista's rapid growth from just over 3,000 people in 1960 is based on the expansion of the military base of Fort Huachuca, retirement homes, and second homes. Much of the housing development is extensive with the creation of semirural "ranchettes."

The region is characterized by a diverse landscape with natural habitats that are home to thousands of migratory birds, and approximately one hundred species of birds use the area as a breeding site. In 1988, Congress created the San Pedro Riparian National Conservation Area, recognizing the importance of this natural area. This area relies on streamflow in the San Pedro River for maintenance of the riparian habitat.

The binational region depends primarily on pumping groundwater for mining, municipal, military, and domestic uses. Extraction exceeds recharge, and around Sierra Vista water has been overpumped to the point of creating a cone of depression. In turn, this has negatively affected the riparian areas.

Sierra Vista and the surrounding area face a very insecure future in terms of water. The present water usage rates are not sustainable and population growth will bring greater demand for water. Competition over water use has created conflicts among local and binational interests, including Mexican ranching and mining interests, conservationists, the Gila Indians, land developers, and others.

El Paso-Ciudad Juárez

The Paso del Norte region consists of the five westernmost counties of Texas, two counties in southern New Mexico that lie along the Rio Grande, and four municipalities in Chihuahua that extend from Ciudad Juárez down the Rio Grande to the confluence with the Rio Conchos. The core of this area, Ciudad Juárez, El Paso, and Doña Ana County (with the city of Las Cruces), currently has a population of about two million persons, which is expected to rise to 2.75 million by 2010 and to about four million by 2020.²⁴ This projection assumes an annual growth rate of 2.6 percent, which is a doubling time of 27 years. The regional economy has grown rapidly over the past decade and a half. For example the combined El Paso-Ciudad Juárez has averaged 5.3 percent annual employment growth since 1983. Growth of manufacturing has been a key to that growth as the agricultural sector has declined.

The supply of water is a critical issue in this rapidly growing region. The El Paso-Ciudad Juárez area depends on the Hueco Bolsón aquifer, although this source is declining in quantity and quality, and it is estimated that potable water

from this source will be exhausted by 2030. The response to the growing water demand and finite underground supply has been to shift to surface supplies from the Rio Grande for urban purposes. This, of course, has been reflected in declining agricultural activities in the region and a dramatic reduction in the amount of land cultivated. Ciudad Juárez does not have access to the Rio Grande surface waters, so its future supply depends totally on underground sources.

Air Quality

The quality of the air in the U.S.-Mexican border region is a critical factor in the health and well-being of border residents. Most of the border's 12 million residents are concentrated in urban zones, which is where most of the air pollution in the border region is generated and where its impacts are most directly felt. This section discusses what is currently known about the ambient air quality in the border region, the sources of emissions to the atmosphere, programs that deal with air quality, future trends, and recommendations to improve air quality in the region.

Issues and Problems

Many border residents are currently exposed to health-threatening levels of air pollution. Ozone, particulate matter, carbon monoxide, and sulfur dioxide are among some of the air pollutants of concern in the border region. Air quality problems are due to emissions from mobile, point, and area sources driven by economic growth in the region. The size of the vehicle fleet in northern Mexico is increasing and many older U.S. cars are available in Mexico. This impacts air quality as a large portion of these cars do not comply with either U.S. or Mexican auto emission standards because they have been poorly maintained and contain after-market, used, or inappropriate replacement parts. In addition, authorities have been unable to perform adequate planning and design of roadways to allow the free flow of traffic, which likewise contributes to the deterioration of air quality.

Another important problem is the large amount of pollution produced by mobile sources at the border crossings, since large vehicle lines form during peak crossing hours. The problem is compounded by the poor condition of the vehicles and the extended idling times required to cross into U.S. cities. This produces noticeable air pollution at the border crossings. In addition to the tens of millions of passenger vehicles that cross the border each year, there has been a marked increase in the number of heavy-duty trucks now waiting in long queues to enter the United States. The vast majority of these trucks burn diesel fuel, which is a major source of toxic particulate matter.

With respect to point sources of air pollution, industrialization has accelerated the negative impacts with the increased location of industrial operations in

the border zone. In combination, the maquiladora sector and national industry emit large quantities of a variety of pollutants from the combustion of fuel and fugitive emissions from industrial processes. The area is experiencing additional air pollution from service and commercial activity that accompanies industrial growth.

Finally, the rapid urbanization and resulting lack of infrastructure to support growth has resulted in the creation of large stretches of unpaved roads that contribute significantly to particulate matter in the air, further reducing air quality.

The important issues related to improving air quality in the border region can be grouped into at least three categories:

- What are the sources of air pollution?
- What information exists, and what is needed to determine ambient air quality in the border region?
- What can realistically be done to reduce pollutant emissions to the atmosphere, given the economic realities of the region?

Sources of Air Pollution

Ambient Air Quality

Ambient air quality is monitored within the border region by a series of monitoring stations on both sides of the border. The monitoring stations on the U.S. side are usually operated and maintained by the state or local air pollution control agency. For example, in San Diego County, the San Diego Air Pollution Control District carries out this work; for Imperial County, monitoring responsibility falls to the Imperial County Air Pollution Control District (APCD); and in Texas, the Texas Natural Resources Conservation Commission (TNRCC) operates the system. Data from these monitoring stations are quality assured and quality controlled (QA/QC) by the responsible agency and the U.S. EPA. The actual data are stored on the USEPA's mainframe computer system located in Research Triangle Park, North Carolina, in the Aerometric Information Retrieval System data base, known as AIRS.

Until recently, little or no data were available for Mexican cities along the border. Within the last few years, however, a system of monitoring stations has been installed as a result of a cooperative effort by the USEPA and SEMARNAP. Many of these monitors have now been in operation for nearly two years and the data are now becoming widely available. The monitors on the Mexican side of the border are, in most cases, identical to those on the U.S. side, and all data are processed through the AIRS system, ensuring appropriate QA/QC. It is thus possible to compare data from the United States and Mexico with a high degree of confidence. The data presented in this section are all derived from these monitors and have all been verified by AIRS. Only monitors reported in AIRS and located within approximately 100 kilometers (62 miles) of the U.S.-

Mexican border are included. State agencies have reviewed the data submitted to AIRS, including the data presented here, to assure data quality.

Most of the monitoring stations are situated in the urban regions of San Diego-Tijuana, Imperial-Mexicali Valley, El Paso-Ciudad Juárez region, and in the Ambos Nogales area of the Arizona-Sonora border. In the near future, monitors will be added for Tecate, Baja California, and a number of other border cities. Monitoring stations are located in the following regions:

- San Diego, California-Tijuana, Baja California Area
- Imperial Valley, California-Mexicali, Baja California-Yuma, Arizona Area
- Ambos Nogales-Tucson-Douglas, Arizona Area
- Ciudad Juárez, Chihuahua-El Paso, Texas-Las Cruces, New Mexico Area
- Portions of the Lower Rio Grande/Rio Bravo Valley

Ambient air quality data from these stations can be obtained directly from AIRS. Summary data are available from a website known as CICA, derived from the Spanish name for the website: Centro de Información Sobre Contaminación de Aire.²⁵

The pollutants measured by the monitoring stations in the border zone include the criteria pollutants listed below:

- Particulate Matter 10 micrometers or less in diameter (PM10)
- Lead (Pb)
- Sulfur Oxides (SO_x)—measured as SO₂
- Nitrogen Oxides (NO_x)—measured as NO₂
- Ozone (O₃)
- Carbon Monoxide (CO)

Data are also provided for a large number of noncriteria pollutants (including air toxics).

San Diego-Tijuana Region

The San Diego-Tijuana-Rosarito border region has a population of about four million. The 200-km binational border zone extends north to include all of San Diego County and as far south as the city of Ensenada in Baja California. There are currently 16 ambient air monitoring stations in the binational region, 12 in San Diego County, three in Tijuana, and one in Rosarito. The monitoring stations in Mexico have been in operation for about three years.

Over the past decade, the air quality of San Diego has improved significantly. Since 1991, no Stage 1 smog alerts have been recorded in the County of San Diego.²⁶ The number of health advisory episodes has been declining. In 1991 and 1992 there were six, in 1993 there were five, in 1994 there was one, and in 1995 there were three. In 1996, no health advisories were recorded.

This improved air quality is the result of reformulated fuels, enhanced air pollution control equipment on mobile sources, and better control of point

sources. At the same time, decreased economic activity and population growth rates in San Diego due to the recession of the early 1990s had a beneficial effect on the region's air quality.

Although less is known about the air quality of Tijuana, data are now becoming available as a result of the air monitoring stations. Generally speaking, the gaseous pollutants of ozone, oxides of nitrogen, and, to a lesser extent, carbon monoxide were observed to exceed Mexican legal limits on a number of occasions. The monitoring data for 1996 and 1997 reveal significant exceedences for ozone recorded by the monitors in Tijuana, particularly for sites downtown, and, to a lesser extent, for sites located west and south of the city on the coast. Ozone, and its precursors, oxides of nitrogen and volatile organic compounds, are issues that need to be addressed in this region.

Prevailing winds in the region are generally from north to south, although southerly winds are observed on occasion. Some preliminary data suggest there may be some pollutant transport from north to south, but much more work is needed for this to be confirmed. Despite the poorer air quality in Tijuana, there are little or no data to indicate pollutant transport from south to north, except on an intermittent basis. In fact, the mixing of pollutants in the region from both sides of the border may be considerably more complex than just northerly or southerly transport, and appears to involve westerly winds as well. Clearly, more data are needed regarding ground and upper-level wind patterns in the region.

An important source of air pollution in Tijuana results from an older vehicle fleet, largely without air pollution control equipment and in a poor state of repair. At the end of 1995, some 212,031 automobiles and 88,403 light and heavy-duty trucks were registered in Tijuana.²⁷ Many of the older automobiles and light-duty trucks were purchased as used vehicles in Southern California. In other words, California exports its older, more polluting vehicles to Mexico.

Pollution from point sources, particularly from the Rosarito thermoelectric plant, which burns fuel oil with a relatively high sulfur content, as well as many businesses and manufacturing facilities that use volatile solvents, contribute to the pollution load in the region. With regard to the Rosarito power plant, recently signed agreements—if carried out—will provide natural gas to the plant as well as other areas in Tijuana. This should significantly help reduce emissions from the plant and greatly improve air quality in the whole binational region.

One source of ambient air pollution that impacts both Tijuana and San Diego is that of the border crossings, both commercial and noncommercial. Long lines of idling vehicles waiting to cross the border produce significant amounts of pollutants. Although waiting times in the noncommercial lanes have been reduced to approximately 20 minutes, the air pollution generated not only produces unhealthy working conditions for personnel employed at the border, but affects the health of residents of the San Diego communities of San Ysidro and Otay Mesa, as well as Tijuana residents who live close to the border.

This problem will increase as transborder vehicular traffic and the regions of San Diego close to the international border are built out and have greater numbers of residents.

In addition to the waiting times at the border crossings, there are a number of vehicles that cross into San Diego each day from Tijuana. It is difficult to estimate the impact of this transborder traffic on the ambient air quality of San Diego. Some 50,000 passenger vehicles cross into San Diego each day from Tijuana. If 65 percent of these vehicles are Mexican (the portion of persons entering San Diego from Mexico who are Mexican), then 32,500 vehicles on San Diego streets each day are Mexican. This is equivalent to 1.5 percent of the total passenger vehicles registered in San Diego County (1,200,000, 1996 estimate). It is likely that the Mexican vehicles produce much higher levels of pollutants than the San Diego vehicles, so it is possible that all Mexican vehicles contribute some 2–3 percent of the vehicular air pollution in San Diego County on any day.

Currently, there is no effective vehicular pollution control program in Tijuana. The responsibility for vehicular pollution control is being transferred to the Municipality of Tijuana from federal and state entities as part of an ongoing process of environmental administrative decentralization in Mexico. The laws and regulations for this are now being drafted and approved. Once that process is completed, resources are to be assigned to the municipality for monitoring and compliance purposes. The development of the human and physical infrastructure will be a slow process for the municipality and it is unlikely that effective programs will be in place until two or three years in the future.

Tijuana municipal authorities are very concerned about the effects of air pollution on human health and are beginning to design public outreach programs in preparation for future programs for vehicle inspection and maintenance. In the fall of 1997, the Universidad Autónoma de Baja California, with the support of San Diego State University, initiated a public outreach campaign in Tijuana regarding air pollution and vehicles. Experiences elsewhere along the border and in Mexico suggest that public awareness campaigns are an effective and necessary first step leading to successful vehicular emissions control programs.²⁸ This and similar outreach programs will also have a beneficial impact on Spanish-speaking residents of San Diego. This suggests that in the future it would be appropriate for San Diego and Tijuana to cooperate on these initiatives.

Preliminary data suggest that air quality is poorer in the Mexican border cities compared to cities located on the U.S. side of the boundary. Particulate matter is of special concern in the Calexico-Mexicali, El Paso-Ciudad Juárez, and Brownsville-Matamoros regions of the border. Gaseous pollutants, especially ozone and ozone precursors (oxides of nitrogen), are of concern in the San Diego-Tijuana region.

It is likely that air quality will continue to deteriorate in the border region over the next 20 years. This is due to the large population increase expected in the region, the long lead times to implement any significant pollution reduction programs, the expected increase in the vehicle fleet, and the continued industrialization and growth in truck traffic due to increased trade. Unless major efforts are initiated in the near future, border communities will have poorer air quality in the year 2020 than at present.

*Energy Use and Resources in the U.S.-Mexican Border Region*²⁹

The 1983 La Paz Agreement between the United States and Mexico defined the border region as a zone stretching 100 km on both sides of the international boundary. For the purpose of discussing the energy sector and environmentally related issues, such as air pollution, this definition is not particularly meaningful. Energy and transportation systems cannot be localized to within a narrow region, and the cities in the border area all have important linkages to other regions throughout the United States, Mexico, and Canada. Air and water flows also do not respect national boundaries or politically created barriers. Therefore, although the term border region is used, energy-related programs and facilities located anywhere in a broad area of the southwestern United States or northern Mexico are included in the discussion.

California-Baja California Region

The energy resources available in the border region vary considerably throughout the border area. The California-Baja California portion of the border, in which almost 50 percent of the total border population is located, is poor in energy resources. The outstanding characteristic of energy use in this portion of the border region is the almost total dependence on energy resources from outside the region. With the notable exception of the geothermal fields located south of Mexicali, virtually all of the energy consumed in the region originates in distant regions. These imported energy resources are in the form of petroleum products (gasoline, diesel, jet fuel, liquefied petroleum, and fuel oil), natural gas, uranium, and imported electricity. Approximately \$3 billion per year leaves the San Diego economy to pay for this energy. All of Baja California's transportation, industrial, and residential fuels must be transported long distances from refineries located far to the south in Mexico. Moreover, the electric power grid in Baja California is not connected to the main Mexican power system. The state has no natural gas pipeline system, although Mexicali recently has been connected to the U.S. gas distribution network and a similar connection is being developed for Tijuana and Rosarito.

Total installed electrical power generating capacity in Baja California is 1.4 GW, compared to 2.5 GW in San Diego. San Diego does not meet its electric

demand by in-region generation and must import nearly 60 percent of its electricity from outside the region. Baja California, by contrast, has until recently not only been able to meet its own needs, but had a surplus available for export to California. This situation has changed and now Baja California must import electricity from California. Per capita electric consumption in San Diego is much greater than in Baja California. Residents on the U.S. side of the border use 3.5 times more electricity per capita than people living in Baja California. Per capita consumption of electricity in Baja California will very likely increase as industrialization and urbanization continue to expand.

The fuels used for electric generation in Baja California are oil (44%), geothermal (44%), and diesel (12%). This power is generated mostly in two large plants, one near Rosarito, which uses oil, and the other at Cerro Prieto, near Mexicali, which uses geothermal heat. Several smaller plants in Tijuana, Mexicali, and Ensenada utilize diesel.

The salient features of the energy sector in this section of the binational region are the lack of indigenous or nearby energy resources for San Diego, Imperial County, and Baja California; the relatively high cost of electricity in San Diego; the isolation of the Baja California power grid from the rest of Mexico; the absence of a natural gas pipeline system in Baja California; and the growing demand for energy resulting from the increasing industrialization and population in northern Mexico. These facts also provide a basis for developing increased cooperation in the energy field between California and Baja California as well as other regions in Mexico and the southwestern United States.

Texas-Mexico Border Region

The energy situation in the Texas-Mexico border region is quite different from the California-Baja California area. Texas is the world's sixth largest energy consumer and produces one-fourth of all natural gas produced in the United States and one-fifth of all U.S. oil. Texas consumes three times as much energy per capita as the U.S. average, compared to California which consumes less than the national average. In Texas, natural gas powers 96 percent of the power plants in the border region, with the remainder being Rio Grande hydroelectric plants.

Almost 15 percent of the total Mexican installed capacity for power generation is located in the four Mexican states bordering Texas. Coal (41.2%) and fuel oil/natural gas (50%) fuel the eight generating plants in these states.

Some of the major energy related issues in the Texas-Mexico border region are centered around the need to provide more and better electric services. Texas relies on natural gas (60.1%) and coal (20.2%) for most of its electricity, while Mexican states bordering Texas rely on coal and fuel oil—much of which has a high sulfur content. Electricity consumption is increasing faster than population growth in both Texas and Mexico. Electricity consumption in the Mexican states that border Texas is projected to increase six to eight percent annually

over the next few years. If this growth rate is realized, electricity consumption would double in these states in just 11.7 to 8.75 years, respectively.

The four Mexican states that border Texas—Nuevo León, Chihuahua, Tamaulipas, and Coahuila—have 4.6 GW of installed capacity at eight generating stations. The Texas counties in the border region have 13 power plants, but with an installed capacity of only 1.6 GW. Natural gas fuels 96 percent of this capacity, with most of the remainder being hydroelectric power from the Rio Grande.

As in the western portion of the border, the demand for electric power has increased faster on the Mexican side of the border than on the U.S. side, as the region has grown economically and in population. This increasing use of electricity is an essential part of modernization. Areas currently underserved or unserved by electric power will seek access to electricity. This demand can be met in a more sustainable fashion through the use of renewable energy resources, increased energy efficiency, and demand-side management programs.

Infrastructure issues play a large role in meeting future electric demand in the region. There are eight electrical interconnections that cross the Texas-Mexico border, compared to only two across the California-Baja California border. Due to limited transmission capabilities, these are “normally open” connections, some used only for emergencies. Active connections could have a negative impact on the reliability and management of both systems. If substantial exchange of electricity is needed on these transmission systems, some infrastructure improvement would be required. Electric power exchange across the border would require the existence of sufficient demand, price advantages, and regulatory means, as well as appropriate interconnections.

SUMMARY OF ENERGY ISSUES IN THE U.S.-MEXICAN BORDER REGION

The rapid population growth, urbanization, and industrialization noted earlier have created an increasing demand for energy services, particularly electricity, in northern Mexico. The Mexican Federal Electric Commission (CFE) estimates that demand for electric services will increase at an annual rate of 5.7 percent between 1996 and 2005 for northern Mexico, compared to 4.7 percent for the country as a whole. An additional 5,608 MW of installed capacity in northern Mexico will be required to meet the demand. This will constitute a significant investment in energy-related infrastructure and human resource development. Unless careful consideration is given to the types of energy resources used and the technologies employed to meet future energy needs, air and water quality could be further degraded in the border region with negative consequences for human health. Thus, programs need to be developed that can meet the expected need for energy services in the next 10 years, but at the same time, minimize the environmental impacts of increased energy use. By utilizing a mix

of appropriate fuels, modern generating technologies, and energy efficiency programs, it should be possible to achieve this end.

Natural Resources

The impressive growth and development of the borderlands over the past decades have produced significant negative impacts on the native flora and fauna and ecosystems of the region. Expansion of urban areas, destruction of native habitats through grazing activities or agriculture, lowering the water table through excessive pumping of water deposits, and impacts of recreation on fragile ecosystems have all had important consequences on the border region. While efforts have been made to protect certain endangered species such as the masked bobwhite and the white-winged dove, it has been difficult for U.S. and Mexican authorities to establish transborder biosphere reserves to protect habitats of species that live on both sides of the border.³⁰ In addition, it has not been easy to address transborder impacts on important ecosystems.

The degradation of these ecosystems have important economic consequences for border communities. For example, the tourism industry of Southern California is linked to ocean recreation activities. Increased pollution of the ocean produces beach closures by the local health authorities with direct economic impacts on the communities affected.

Species and habitats are under stress in many areas along the border as the result of human activities. Some of the hot spots include the following:

Bight of the Californias

This nearshore marine zone extends from Point Conception in the north to Cabo Colnett in the south. Much of the population of Southern California is located adjacent to the coastline, and human activities have produced significant impacts in the nearshore marine environment through overexploitation of marine resources, contamination of coastal waters through sewage discharges, treated effluent discharges, and nonpoint source pollution through runoff during storm events. Pollution includes biological elements as well as heavy metals, industrial chemicals, petroleum products, and pesticides.

Tijuana Estuary and Watershed

The Tijuana River National Estuarine Research Reserve is located in the United States at the mouth of the Tijuana watershed that lies one-third in the United States and two-thirds in Mexico. It includes the urban and industrial core of Tijuana, the City of Tecate, Baja California, and extensive development in the watershed on the U.S. and Mexican portions. Important habitats throughout the watershed are threatened by unmanaged development. The estuary is impacted by what occurs in the entire watershed. This includes not only increased fresh water flows, but sewage contamination, chemical contamination, and increased sedimentation.

The Upper San Pedro Watershed

Located in Arizona and Sonora, this region contains important wetlands and other habitats, such as grasslands. The area is especially significant as a habitat for migrating birds. The area is under stress from cattle grazing, agriculture, urbanization, and mining activities on the Sonoran side of the watershed and from grazing activities, urban development, and extensive semi-rural development in the Arizona portion of the region. Water quality and supply are key issues here.

Rio Grande

The Rio Grande is a complex ecosystem that has been heavily altered by human activities, particularly the construction of major dams and diversion dams to utilize the water for agriculture and urban uses, for recreation, and for the generation of hydropower.³¹ Not only is the Rio Grande water use so heavy that at some points the river is reduced to a trickle, but the quality of the water has been severely degraded. Increased sedimentation from farming and ranching activities, salinization from agricultural return flows, biological contamination through discharge of untreated or poorly treated municipal sewage, chemical and biological contamination through nonpoint source pollution, pesticide contamination from agricultural practices, and heavy metal contamination from mining activities all have contributed to the declining quality of the Rio Grande water. The impact of the development has been devastating on native fish, wildlife, wetlands and riparian habitats, and habitats such as the bosques. Despite the intense agricultural development, particularly on the Texas side, some areas of native vegetation remain. These remaining areas are of great value and are the subject of Mexican and U.S. conservation efforts.

Laguna Madre

The Laguna Madre, particularly on the Mexican side of the border at the Gulf of Mexico coast, is an important estuarine resource of significant value with diverse aquatic and terrestrial ecosystems.³² It is home to endangered bird and mammal populations. The principal threats to this resource include alteration of freshwater sources through dam construction, cattle grazing, uncontrolled harvesting of fish species, irregular human settlements, dredging channels to the sea, the possibility of the construction of the intracoastal canal, and biological and chemical pollution.

ENVIRONMENTAL INDICATORS AND THE FUTURE OF THE BORDER

One of the difficulties in discussing the environment is the lack of a clear and understandable method for measuring change in the quality of the environment. In order to plan for the future, border communities must have some way

of assessing the state of the environment in their regions and determining the effects of urbanization, economic growth, and population growth on the environment. Perhaps the most promising approach is the development of environmental indicators for the border region. Related efforts include development of quality of life measures and sustainability criteria.

Environmental Indicators

A joint project of the EPA and SEMARNAP has produced the United States-Mexico Border Environmental Indicators 1997, an effort that employed the nine workgroups of Border XXI to create indicators to assess the condition of the border environment and progress in addressing problem areas.³³ This is the most comprehensive work to date for development of indicators for the border region.

Some regions of the borders have begun similar work for their own areas. For example, the San Diego Association of Governments (SANDAG) incorporated quality of life elements in the Regional Growth Management Strategy that it adopted in January 1993.³⁴ The Regional Growth Management Strategy was developed in response to Proposition C, "Regional Planning and Growth Control Measure," passed by San Diego voters in November of 1998. A central part of the strategy is that actions should be aimed at preserving or improving the quality of life in the region. It focused on specific areas such as clean air, water quality and supply, hazardous and solid waste reduction, traffic congestion reduction, adequate housing, protection of open and sensitive lands, adequate public infrastructure, and maintenance of a prosperous economy. The strategy establishes a framework for all of the region's local governments (18 cities and the county of San Diego) to cooperate to meet the objectives outlined in the plan. Since the adoption of the strategy, SANDAG has moved forward with specific action plans on issues such as water quality³⁵ and has established a system for local agencies and governments to produce self-certification reports on progress toward meeting the goals of the Regional Growth Management Strategy.³⁶ It is perhaps too soon to evaluate the effectiveness of this effort. Also, it is not clear how much of this strategy is relevant to Tijuana. Although Tijuana shares the same natural environment with San Diego, its social, political, and economic contexts are quite different.

An Environmental Checklist

It is possible to identify a number of elements from the environmental indicator, sustainability, and growth management strategies that can serve as a checklist in order to determine the state of the environment in different regions along the border and to measure progress in the future. Such a checklist should also

be useful for making estimates regarding environmental quality to the year 2020.

This discussion needs to be prefaced with a cautionary note that there are many significant gaps in information regarding the border environment. This is due to lack of basic monitoring, as can be seen in the incomplete coverage of air monitoring stations along the border. It is also due to difficulties in accessing available information that is understandable and useful. A joint project by San Diego State University in partnership with the EPA and SEMARNAP has produced a website that is designed to facilitate access to border environmental information that is available on the Internet. This website, Border EcoWeb, is a good place to begin the search for required information. The address is <www.borderecoweb.sdsu.edu>.

Air Quality

Mexico and the United States have similar ambient air quality standards for pollutants that can be measured by air monitoring stations. These standards indicate acceptable limits of specific pollutants and when those limits are exceeded (exceedances), there are clear negative impacts on human health. For some border communities, this information can be obtained to provide an accurate picture of the local air quality and potential health effects. In other areas, where no continuous monitoring stations are functioning, sporadic sampling may be used for rough estimates of air quality. The following measures or air pollutants can be used to assess air quality for border communities: ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter (PM10), and lead.

Transportation Infrastructure

Since the roads, highways, and ports of entry of a community are directly related to issues such as traffic congestion and air pollution, the relevant infrastructure should be considered.

Water Quality

Is potable water of acceptable quality? Usual measures for potable water quality include the presence of disease-causing organisms, chemical contaminants, and total suspended solids (including salts).

Water Quantity

Is there sufficient water of an acceptable quality available to serve human needs and to sustain a sound economy? Are water conservation and reuse efforts adequate?

Water Infrastructure

What percentage of the community is served by treated potable water, sewage collection, and sewage treatment services? Since transborder sewage flows

impact the entire binational region, the twin cities should be considered as one community.

Solid Waste

Is there adequate collection, disposal, and recycling? Recycling should be a coordinated binational activity.

Hazardous Waste

Is proper disposal and recycling taking place? Is infrastructure adequate? Are pollution prevention efforts sufficient?

Emergency Response

Are plans, equipment, and trained personnel available? Binational capability should be developed.

Environmental Health

Are there health problems related to environmental conditions? This includes diseases related to air pollution, pesticide exposure, gastrointestinal diseases related to contaminated water, exposure to chemicals and heavy metals in industry or other sources, and so forth. Many of these risk factors are transboundary in nature.

Natural Resources

Is there adequate protection of threatened and endangered species and habitats in the region? This is an important area of transboundary cooperation.

Natural Disasters

Is the community vulnerable to natural disasters including earthquakes, floods, droughts, and wildfires? The risks associated with these are directly associated with human activity. For example, increased urbanization, agricultural and grazing activities, mining, and alteration of native vegetation significantly increases storm water runoff and risk of flooding. Human activities often change regional climate conditions and induce desertification. Long-term changes in climate and weather patterns are linked to human activities; how will these changes impact local communities?

Economic Development

The rate and nature of economic expansion have a profound effect on the environment through increased pollution, impacts on natural areas, environmental health considerations, and so forth. The nature of the economic expansion is critical, for economic growth without development might not reduce poverty or bring prosperity. Simple economic expansion might not enhance the tax base

sufficiently to provide necessary infrastructure and other measures to mitigate environmental problems.

By considering the topics on this checklist, it is possible to develop a rough assessment of the state of the environment at the community level. By projecting those elements into the future to 2020 in a context of either continued economic expansion or economic growth, it is possible to identify aspects of the environment that will need attention in order to avoid severe environmental effects in the future.

NOTES

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2. Lawrence A. Herzog, “Border Commuter Workers and Transfrontier Metropolitan Structures along the United States-Mexico Border,” *Journal of Borderlands Studies* 5, (Fall 1990): 120.
3. Serge Rey, Paul Ganster, Gustavo del Castillo, Juan Alvarez, Ken Shellhammer, Alan Sweedler, and Norris Clement, “The San Diego-Tijuana Region,” in *Integrating Cities and Regions: NAFTA and the Caribbean Face Globalization*, ed. James W. Wilkie and Clint E. Smith. (Guadalajara: Universidad de Guadalajara, 1999).
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This represents a major challenge to the industry, and, given current conditions, it is one not easily remedied. As noted below, most Mexican firms have still not attained a global level of competitiveness in terms of price and quality. Thus, most components are imported, either from the United States or from Asia. However, beginning in 1984, stimulated by simplified regulations and lower wages brought by the devalued peso, the industry has achieved double-digit increase in employment each year.

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8. Jerry R. Ladman, "The U.S. Border Regional Economy: Interdependence, Growth and Prospects for Change," in *Views across the Border*, ed Stanley R. Ross and Jerry R. Ladman, 2nd ed. (Tempe: Latin American Center, Arizona State University, forthcoming). Of course, the maquila-generated employment benefitted Mexican border cities' economies as well. Salvador Mendoza Higuera et al., "Tijuana: Short-Term Growth and Long-Term Development," in *San Diego-Tijuana in Transition: A Regional Analysis*, ed. Norris C. Clement and Eduardo Zepeda Miramontes (San Diego: Institute for Regional Studies of the Californias, San Diego State University, 1993), 57–64.
9. See the promotional materials published by the Tijuana Economic Development Corporation, *Tijuana-San Diego, the Pacific Rim's Gateway to NAFTA. Book of Facts* [1998?].
10. "Quality of Life and Economic Development in the Arizona-Sonora Region" (August 15, 1996), a project in cooperation with the Arizona-Sonora Commission by Northern Arizona University and the Instituto Tecnológico y de Estudios Superiores de Monterrey that was part of the Strategic Economic Development Vision for the Arizona-Sonora Region explores some of these same issues.
11. "Jobs Outlook Improving," *El Paso Times*, 28 October 1998. This editorial points out that El Paso had lost some ten thousand jobs as a result of free trade, but that the region is beginning to create new jobs. A key element is producing a higher skilled work force through training programs.
12. The special issue of *Frontera Norte* titled *La pobreza: Aspectos teóricos, metodológicos y empíricos* (Tijuana: El Colegio de la Frontera Norte, 1994) has a number of articles that deal with income distribution in Mexico.
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VI

Addressing Border Environmental Problems Now and in the Future: Border XXI and Related Efforts

Mark Spalding

INTRODUCTION

The purpose of this paper is to bring Border Institute I participants up to date on past and current federal and binational efforts to address the environmental problems along the U.S.-Mexican border.¹ It also intends to set the stage for discussions regarding current and emerging border environmental problems and future infrastructure, institutional, and other needs. The geographical focus of the paper is the border region and the analysis is largely regarding federal institutions. However, every attempt has been made to note the role of small, rural communities as well as large cities. The role of Indian tribes is also discussed when appropriate and when data are available. The paper also provides basic information and analysis necessary to understand the environmental implications of growth in the transborder region in the context of the border environmental institutions developed to date. The paper raises concerns about the long-term sustainability of present growth trends in the border region and the ability of these institutions to address these growth trends.

The negotiation of NAFTA is what brought environmental issues in the border area to the forefront of public attention. Because an understanding of the relationship between trade and environmental issues is central to problem solving in the border area, this paper will first present an overview of the relationship between trade liberalization and environmental protection. It will then briefly summarize the political, social, and economic context of the border area, and then identify existing and emerging environmental problems in the region. With this backdrop, the paper will then describe and assess the various environmental institutions operating in the border area, providing an overview of

Border XXI, describing the process that has emerged for identifying and addressing border environmental problems, and assessing the progress made to date. Potential improvements to the effectiveness of the Border XXI Program, particularly in terms of local and state collaboration, will be examined. The role and results of BECC and NADBank will be detailed, including adoption of sustainability criteria by BECC for project certification. The efforts of the Good Neighbor Environment Board (GNEB), the Commission for Environmental Cooperation (CEC), and the IBWC regarding border environment will be discussed.

The basic problem presented by all of these border environmental institutions is their reactive nature. They are not designed to be proactive and prevent environmental degradation from unsustainable development. Unless they are radically redesigned or supplemented with a much broader planning and regulatory enforcement structure, they will never do more than treat the symptoms of the disease.

OVERVIEW OF THE RELATIONSHIP BETWEEN TRADE LIBERALIZATION AND THE ENVIRONMENTAL PROTECTION POLICIES

The debate between environmentalists and trade liberalization proponents has usually been framed by two questions: How does trade liberalization harm the environment? and How do environmental protection measures interfere with trade liberalization? Few have asked, "Is it possible to promote trade liberalization while maintaining or increasing the level of environmental protection?" Seemingly, the only two paths have been to keep trade and environmental agreements separate, or to completely integrate them into a whole system. To keep them separate would suggest the need for conflict resolution between them, while integrating them would suggest that conflict avoidance was the correct solution.

There are many aspects of trade liberalization that must be reconciled with environmental goals. Table 1 is an incomplete list of the direct or indirect environmental effects of trade liberalization that should be understood or addressed in order to maintain or increase the level of environmental protection.

Separation

Historically, at the global level, trade and environmental issues have been kept separate. A remarkable number of stand-alone multilateral environmental agreements were successfully negotiated during the eight years it took to complete the negotiations of the Uruguay round of the General Agreement on Tariffs and Trade (GATT).² Separating trade and environmental issues may be the

Table 1: Does Trade Liberalization Improve Environmental Quality?

Pros	Cons
Free Trade = greater efficiency = economic growth = greater tax revenues = greater environmental protection	Free Trade = economic growth and greater need for fossil fuels for transportation = increased pollution and consumption of natural resources
Free trade reduces poverty, which reduces harm to the environment.	Free trade fosters economic growth, which increases consumption, which causes environmental harm.
Free trade permits the dissemination of environmentally superior goods beyond their home market.	Free trade permits dissemination of environmentally-harmful products.
Economies of scale may lower the price of environmentally sound goods and thus expand their market.	Economies of scale may lower the price of environmentally harmful goods. This "magnifier" effect may also allow these goods to have the upper hand due to current market share.
Factors other than environmental regulation dictate the location of investment and industry. On average, compliance with environmental regulations amounts to one percent of overhead thus indicating other cost factors are more important to location decisions.	"Dirty" industries will migrate. "Pollution havens" will be created to attract them. This will put downward pressure on environmental standards everywhere.
	Degradation on a global scale. Expanded trade creates an incentive for production of globally polluting goods (collective action problem).
	Degradation of the "commons" or "public goods." Expanded trade creates an incentive for the overuse of common property resources (collective action problem).
Free trade eliminates subsidies, which distort trade flows and environmental policy.	Free trade creates incentives for increased production of export commodity crops.
Most MNCs bring their environmental "best practices" with them.	Some "dirty technology" is exported when it becomes obsolete or can no longer comply with domestic environmental regulations.

Table 1—*Continued*

Free trade eliminates nontariff barriers to trade including protectionistic measures disguised as environmental standards.	Free trade causes a loss of sovereignty. Trade goals trump environmental principles, undercutting communities' rights to make their own environmental regulatory decisions.
Free trade helps move societies to use economic measures instead of regulations (e.g., the "polluter pays principle" and "cost internalization").	
	The movement toward freer trade will make it harder to adopt optimal environmental standards.

Source: Mark Spalding, "Trade and the Environment in Latin America." Lecture given at San Diego State University, 1996.

right answer because trade and environment regimes are very different in nature. One traditional argument is that separation allows individual nations to first address poverty and income distribution so that there is sufficient widespread wealth to pay for environmental protection and cleanup. While this ignores extremely important opportunities to avoid mistakes of the past through technology transfers, it is nonetheless valid for some nations. Further, when moving toward economic integration, dealing with the economic issues first gives the more developed countries greater credibility. They can show they are not dictating standards or laws to less developed nations and, as trust and capacity are built, they will enable cooperation on environmental issues.

While this may be very satisfying from the standpoint of addressing environmental issues, it does not resolve the potential for conflicts between trade agreements and the international environmental conventions, nor conflicts between the trade agreements and domestic environmental laws. As trade agreements go beyond merely reducing or eliminating border tariffs on goods to addressing nontariff barriers to trade, it can be expected that there will be conflict with environmental policies. Meanwhile, environmental policy is simultaneously moving beyond compelling the "end of pipe" cleanup of pollution to addressing pollution prevention as well as examining production and process methods. In some cases, these new approaches to environmental policy fall into the current international definition of a nontariff barrier to trade, hence the conflict.

In addition, there are problems with the approach of negotiating separate trade and environmental agreements, which stem from the more broad membership of trade accords than environmental agreements. This incongruent

membership is the result of a perceived or real fear that participation in international environmental agreements will limit international competitiveness.

Linkage

A few multilateral environmental agreements (MEAs) directly link trade with environmental protections by banning trade in environmentally harmful materials or endangered species. In addition, NAFTA, and to a much lesser extent the Uruguay round of the GATT, acknowledge the direct linkage of trade and environmental issues in other ways by integrating environmental provisions into the body of the trade agreement, which either alter the design of the liberalization process or expose some of the trade provisions to environmental scrutiny. Linkage can take two forms: the integration of environmental provisions into a trade agreement, or through the negotiation of parallel environmental agreements that are both supportive of and dependent upon the trade agreement negotiated alongside them.

North American Economic Integration: An Approach to the Trade-Environment Conflict

It is possible to look to the NAFTA trade agreement and its two environmental side agreements to discern some solutions to regional environmental problems and a resolution to the question of how to liberalize trade while simultaneously improving environmental performance. Some of North America's negotiated solutions could form the basis for hemispheric or global trade negotiations, even if they are taken on seriatim. In the alternative, if we continue to address trade and environmental issues separately, there will inevitably be a conflict between the two key policy areas, which will require resolution.

For the NAFTA parties, there are many difficulties in reconciling the U.S. legal system's confrontational style and Mexico's conflict avoidance and cooperation style. Current environmental decision making in North America is led by the United States, but incorporates some unique elements from the Canadian and Mexican systems. While the United States and Canada have "command and control" oriented systems in which regulatory schemes with strict directives and fines for noncompliance and nonattainment predominate, Canada has experimented more with financial or tax incentives for environmental compliance. Mexico has more of a "pollution prevention" approach, with some command and control elements added. Until very recently, Mexico has had almost no economic incentives for environmental compliance. All three countries have varying levels of enforcement and success in dealing with pollution and natural resources issues. As a result of the injection of environmental protection issues into the debate over NAFTA, during the last five years the three nations have embarked upon a joint effort to deal with environmental issues. Included in

this rather young collaboration are environmental protections that are integrated directly into the NAFTA trade agreement, and the creation of three new institutions to deal with environmental problems.

In an interesting way, concern over international competition was the major motivation behind the environmental components of NAFTA. The perception that Mexico would have an unfair trade advantage from lax environmental enforcement became the vehicle for the inclusion of environmental protections in the agreement.

As early as May 1991, the Bush administration announced (in what became known as the "May 1st Commitments") that the U.S. Trade Representative (USTR) would review U.S.-Mexican environmental issues and that NAFTA would be negotiated in a way that would protect U.S. federal and state environmental laws and regulations as well as certain international environmental agreements. Most of the U.S. government reports issued as a result of the USTR review asserted that while Mexico had severe environmental problems, it had good laws. All that Mexico needed was greater efforts in the enforcement area, since its current efforts were hampered by a general lack of resources, which would be provided when NAFTA's impact on the Mexican economy was felt. The problem was that the answer was circular and did not deal with the potential environmental impacts of NAFTA's trade and investment liberalization. Instead, the trade negotiators relied upon the argument of some economists that as income rises so does the concern for and spending on environmental issues. Thus, as shown in Table 2, the environmental provisions within NAFTA are important, but not extensive.

The NAFTA regime also has two parallel agreements dedicated to environmental issues. During the 1992 U.S. presidential campaign, there remained a question of whether then-candidate Clinton would support NAFTA or not. In

Table 2: Environmental Provisions of NAFTA

NAFTA is the first trade agreement that contains provisions to deal with the environmental issues that arise in the context of trade relations and disputes:	
1.	NAFTA protects certain multilateral environmental agreements from trade challenge (art. 104).
2.	NAFTA prohibits reducing environmental standards to attract investment (arts. 104, 906[2], and 1114).
3.	NAFTA sets general, multilateral rules on Sanitary and Phytosanitary Measures (SPSs) and other Standards Related Measures (SRMs) (arts. 712, 902, and 904).
4.	NAFTA promotes the upward harmonization of environmental policies and standards (arts. 713, 714, 905, and 906).
5.	NAFTA provides for improved consideration of environmental issues in its trade dispute resolution procedures (arts. 723 and 914).

a speech at the University of North Carolina, he announced that he would support it, but only if substantial protections for the environment and labor were incorporated into the agreement. When it became clear that no one wanted to reopen the NAFTA negotiations, the decision was made to use parallel or side agreements. Ultimately, because support for NAFTA was very low, negotiators were forced to seriously consider environmental issues to gain more votes in Congress. As a result, as outlined in Table 3, three new environmentally focused institutions were created.

Most importantly, a close reading of the two side agreements shows that environmental protection is secondary to trade interests. One goal of trade liberalization is to create a level playing field in which competition can be made more pure. Thus, there is an emphasis, even in these side agreements, on harmonization of environmental laws, cooperation among NAFTA parties, resolution of accusations of lax enforcement, and provision for environmental infrastructure to support the trade structures. Only the Border Environment Cooperation Commission (BECC) and the North American Development Bank (NAD-Bank) agreement deals with cleaning up the environmental damage caused by pre-existing border free trade and industrial zones. In other words, this may be the only part of the NAFTA regime that addresses the environment directly rather than as an element of trade policy.

Table 3: The New NAFTA Environmental Institutions

The three new NAFTA environmental institutions are the Commission for Environmental Cooperation (a trilateral body), the Border Environment Cooperation Commission, and the North American Development Bank (the latter are U.S.-Mexico bilateral institutions)	
1.	The Commission for Environmental Cooperation (CEC) is headquartered in Montréal, Québec, Canada. The focus of the CEC is conflict resolution, the harmonization of environmental laws to avoid conflicts, and cooperation in the enforcement of current laws. The CEC will also review submissions from nongovernmental organizations and individuals who assert that a party to NAFTA is failing to effectively enforce its environmental laws.
2.	The Border Environment Cooperation Commission (BECC), with headquarters in Ciudad Juárez, Chihuahua, Mexico, assists local communities and other sponsors in developing and implementing environmental infrastructure projects, and certifies projects for North American Development Bank financing.
3.	The North American Development Bank (NADBank), with headquarters in San Antonio, Texas, is capitalized in equal shares by the United States and Mexico to provide \$3 billion in new financing to supplement existing sources of funds and leverage the expanded participation of private capital.

POLITICAL, SOCIAL, AND ECONOMIC CONTEXTS OF THE BORDER REGION

The U.S.-Mexican border is a unique place with distinctive legal, cultural, political, and structural systems on each side of the border, and it is often interestingly at odds with the federal governments of each nation. Regardless, there are clearly shared ecosystem problems.

Political and Administrative Context

The border area includes two countries that speak two different languages and that have two different legal and political systems. In addition, there are few direct governmental and administrative counterparts across the border. One of the reasons for this is the fact that Mexico is highly centralized. However, four U.S. and six Mexican states meet at the border, and there are numerous Indian tribes with their own governing bodies and their own political and legal systems. As well, there are many local, urban, and rural communities; industrial areas; and protected natural areas. The border zone, as defined in the La Paz Agreement, does not follow the shape of watersheds or ecosystems. In fact, the border itself divides many watersheds, ecosystems, and migratory species corridors.

Cooperation is increasing at the federal and local levels and in the private and NGO sectors; recently, state-to-state cooperation has also been improving. Mexico has begun to delegate some authority to states, which, in turn, have begun to address border environmental issues jointly with their neighbors to the north. The states have been increasingly included in broader border efforts such as the Border XXI workgroups.³ Border Indian tribes were the last governmental entities to be included in border environmental protection and restoration efforts; however, the focus on their needs and their participation is now increasing.

Population and Poverty

The border area suffers from the impact of immigration patterns that reflect the gap between the developed and the developing world. As a result, the border region constitutes the most rapidly growing region of North America (its population in 1960 was one million; today, it is over 12 million). And, although growth rate numbers are highly politicized, it is expected that they will double by the year 2010. Due to this growth, border communities find it impossible to keep up with growth and to provide adequate infrastructure.

A large percentage of the population—particularly south of the border—lives in poverty (alongside great wealth) and because of the well-established linkage between poverty and environmental degradation there is clear reason for alarm.

Population growth combined with the poverty problem and the lack of government enforcement have produced squatter housing on hillsides, in parks, and in designated conservation areas. For example, the San Diego-Tijuana region is one of the fastest growing urban areas in the world. The combined population in the region is well over three million and Tijuana alone has an estimated population of between one and two million. The municipal authorities in Tijuana admit to being behind in the provision of basic infrastructure such as water supply and sewerage by over 75 percent. At a projected growth rate of over 6 percent per year, it can be expected that the population will double by 2010.

Economic Characteristics

The border region still faces significant economic challenges: city and state governments on both sides of the border (but especially in Mexico) often lack the basic resources and information needed to address environmental issues; there is an increasing gap between the rich and the poor; there has been significant job creation in the maquiladora and other industry for a number of decades; and with NAFTA, the economic linkages across the border have grown and intensified.

With the exception of San Diego, economic conditions in the United States get worse as one gets closer to the border: unemployment rates increase and income levels decrease. And, although many in the United States may find it surprising, Northern Mexico is among the wealthiest regions of Mexico. What is apparent is this region's extremely poor income distribution. However, the greatest contrast is often from one side of the border to the other. It is also important to note that all Indian tribes were left out of NAFTA and its side agreements.

ENVIRONMENTAL PROBLEMS IN THE BORDER REGION

There are many environmental problems to be addressed in the border region, including air, water, and land-based pollution; overconsumption of water and other natural resources; deforestation; loss of biodiversity; and increasing trade and exploitation of endemic species. While some problems are localized, many, if not most, are transboundary in nature. The main causes are interlinked. With the growth of urban populations and domestic manufacturing and associated activities, and with the expansion of the maquiladora industry, there has been a great increase in industrial waste and pollutants. Table 4 reviews a summary of the problems more specifically.

Clearly, the environmental conditions in the U.S.-Mexican border region are worse now than they were when NAFTA started. This is partly because the three NAFTA environmental institutions have not yet had sufficient time to

remedy the environmental problems. And, while they have been gearing up, staffing up, and writing their policies and procedures, the environment has continued to deteriorate. In the future, more of the same can be expected. Things are going to get far worse before they get any better. While not necessarily applicable to every location, Table 4 lists a number of the crucial environmental issues that constitute the border region's needs. All these needs are obviously interrelated, and yet the mandates of the NAFTA environmental institutions do not address them all.

In the border region, ultimately fundamental structural problems must be addressed. Activities are carried out with unsustainable assumptions and trends built into the economic structure, such as ever-expanding consumption, or lack

Table 4: Environmental Problems

Environmental Categories	Border Specifics
Water Quantity	Communities and states fight over the scarce water supplies and other natural resources. At current growth and consumption rates, the water supply for many border communities is expected to be exhausted in 20 to 30 years. Groundwater is significantly contaminated, aquifers are being depleted, and the supply of fresh water cannot meet demand. There is a lack of proper water conservation, reclamation, and prioritization of uses. There has been a history of excessive and ill-planned diversion/diminution of natural water flows.
Water Quality	Many rivers have become contaminated. There is a related great (and increasing) need for municipal wastewater and industrial pretreatment. There are some U.S. failures to upgrade and maintain wastewater treatment systems. Meanwhile, the Mexican side has struggled for over fifty years to provide sewage collection and treatment facilities for its exploding urban population. There is extensive urban runoff, nonpoint pollution, as well as runoff from the use of agricultural chemicals and pesticides. As a result of irrigation, many water sources are showing increased salinity. There has been extensive dumping of heavy metals and toxic chemicals in water.
Other Waste Problems (land-based pollution)	There has been extensive dumping of heavy metals and toxic chemicals on land. Only a portion of this waste is disposed of properly. There

Table 4—*Continued*

	has been lax enforcement of Mexican environmental laws regarding dumping. There are increased conflicts regarding the siting of nuclear waste dumps (e.g., Sierra Blanca). There is evidence of illegal dumping on Indian reservations. There are increased conflicts regarding siting of dumps, waste treatment, or other operations in minority neighborhoods. There are missed opportunities for recycling of maquiladora waste and byproducts.
Air pollution	Air quality is being harmed by power generation in Mexico that does not use state-of-the-art production methods. Long distance transport of air pollution. The management of the El Paso-Ciudad Juárez airshed basin has become crucial. There has been lax enforcement of Mexican environmental laws regarding air pollution. Air pollution is partly the result of deforestation.
Climate Change Induced Problems	Increasing inland droughts, particularly in the southwestern United States and northwestern Mexico. There is an increase in violent coastal storms with greater precipitation. Need for crop changes, to compensate for precipitation increases or decreases according to area climate changes. Impact on forests and other terrestrial natural resources. Impact on ocean fisheries—warmer water affects migration patterns. Policy problem due to broad ignorance resulting in recalcitrance.⁴
Ecosystem/Habitat Destruction	There has been extensive alteration of natural systems, including the coastal habitat and the diversion of rivers. Improper attention has been paid to the location and size of ports of entry. There has been construction in alluvial areas. There is serious urban sprawl in many communities. Forestry firms are moving into Mexico from Canada and the United States to avoid barriers to timber production. Risk of loss of Mexico's remaining forests. Significant areas of the United States are already deforested. Deforestation causes loss of habitat for birds and other

Table 4—*Continued*

	restrial species; soil erosion, causing siltation of streams (with recent endangered species listing of salmon as a result); and air pollution due to loss of carbon sinks. Habitat destruction causes in-migration and immigration and political instability. There has been overuse of the environment as a sink for pollutants—uncontrolled dumping on land, in rivers, and into the surf—resulting in habitat deterioration.
Threats to Biodiversity	The United States and Mexico are host to many endangered plants and animals.⁵ There has been little funding in Mexico to administer natural protected areas.⁶ There has been lax protection of already designated conservation areas.⁷ There are conflicts over protection of shared migratory species and their habitats. The border region contains many parks, which may need protection from encroachment by urban sprawl.⁸ There are serious binational and tribal issues to be addressed concerning the Salton Sea and the ecosystem health of the lower Colorado basin and the upper Gulf of California. There is increased use of hormonal disrupters for pest control. There is evidence of bioaccumulation of toxins in plants and animals. The introduction of monoculture crops increases catastrophic failure risks.

of political will to reverse perverse subsidies.⁹ There is an almost complete lack of long-range planning, certainly a complete lack of ecosystem planning, and very little watershed analysis and management. Among other consequences, there is the risk of political instability through a failure to address degradation of fragile ecosystems, as happened in Chiapas.

Contemporary activities in the border region include new construction of endless housing developments, paving over habitats; constructing new highways with limited attention paid to public transportation or to urban sprawl; and initiating new economic developments that are added without regard to the future, to the impact on natural resources, or to the cumulative impact on human health. Finally, developers, prevented from undertaking some new projects in the United States, are now expanding their building and paving to Mexico (which had previously been somewhat protected by limitations on foreign investment and especially by land ownership restrictions for foreigners along

the coastlines and in the border region). All this development occurs amid shortfalls in financing for environmental infrastructure.

ENVIRONMENTAL PROGRAMS AND INSTITUTIONS

International Boundary and Water Commission (IBWC)

With antecedents in the 1889 International Boundary Commission, which was given some responsibilities regarding water in the 1930s, the IBWC—known as the Comisión Internacional de Límites y Aguas (CILA) in Mexico—was established by the 1944 Water Treaty. It is the principal binational agency with authority over territorial limits, water allocation, wastewater treatment, sanitation, and water quality. Its chief activities involve planning, construction, and operation of several wastewater treatment plants on both sides of the border.

The institutional arrangement just described has been questioned by many border scholars and activists who criticize the IBWC for its inability to act as an independent border institution, and for the lack of transparency in its decision-making processes. The IBWC is infamous for being an old-fashioned, engineering driven institution that focuses on large, capital-intensive brick and mortar projects. The IBWC has also been criticized for being too slow and too bureaucratic and for being a nonpublic oriented institution. To make matters worse, the IBWC's many proposals for border projects have frequently not been given funding in Washington D.C. or Mexico City. For example, despite the pressures on existing wastewater treatment systems from growing population, the IBWC only added 15 or 16 new wastewater treatment facilities in the past 53 years (depending on how you count its Rio Grande management projects).

With regard to border environmental infrastructure, the IBWC has completed a number of projects in its over fifty-year history. An examination of the total list of IBWC projects, however, reveals that only a few constitute real environmental infrastructure. If items such as bridges and the various flood control projects are eliminated from the list, then there are not many truly environmental infrastructure projects. Obviously, IBWC cannot be blamed for this. It has other duties in its portfolio, and its recommendations for infrastructure have not always been followed by Congress. In addition to water quality and sewerage/sanitation, the IBWC portfolio includes nonenvironmental tasks such as boundary settlement and maintenance; water gauging, monitoring, and apportionment; and water storage and flood control. Evidently, some of these tasks may relate to the environment in direct and indirect ways. As some examples of the IBWC's work, 15 joint international projects are listed in Table 5.

Fortunately, the slow movement of the IBWC and its lack of focus on environmental infrastructure are changing. To show this, Table 6 lists the two projects of the "quick fixes" program (Minute No. 294) worth \$14 million. Also, Minute No. 294 contemplates an additional five projects through the year 2001.

In the future, the IBWC/CILA will either take the lead, exercising its unused authority; or it will move into a strong support role. Its support role might make the best use of its qualities and resources, which include its engineering capabilities and its role in crafting the form of binational agreements known as minutes. The IBWC/CILA can be expected to take a more active role in water resource management including regional water planning for surface and groundwater. This might include leadership in promoting the negotiation of a groundwater treaty.

In order to advance in addressing border environmental needs, there must be a greater clarification of the IBWC/CILA role in relation to the BECC-NAD-Bank institutions. The IBWC/CILA must adopt its own policies related to sustainable development and public participation that are consistent with those of the BECC. In this way, sustainability of border environmental infrastructure projects will be increased regardless of who builds them. To help accomplish this, the IBWC/CILA need to hire new engineers who are well grounded in alternative technologies and cost reduction methodologies such as value engineering. The IBWC/CILA need to become more binational in their operations. One of the dramatic steps taken with the BECC-NADBank institutions was to make them wholly binational with bilingual, bicultural staffs.

Table 5: IBWC/CILA International Joint Projects

Location	Project Type	Comment
San Diego, California	Wastewater infrastructure to handle sewage from Tijuana	Minute No. 283
Tijuana, Baja California	Channelization of the transboundary Tijuana River	Minute No. 258. Unfortunately, it is now known that this and other flood control measures tend to speed flow and do harm downriver.
Mexicali, Baja California	Facility planning for the New River Project	Minute No. 294
Calexico, California	Delivery of water to Mexico in compliance with salinity standards	1944 Water Treaty
Yuma, Arizona	Flood control and boundary river stabilization	1944 and 1970 Treaties
Nogales, Sonora, and Nogales, Arizona	Binational wastewater treatment facility	Minute No. 276

Table 5—Continued

El Paso, Texas and Ciudad Juárez, Chihuahua	Delivery of Rio Grande waters for use in the Juárez valley, and construction of the American Canal extension to improve Rio Grande water conveyance	Convention of 1906. Associated channelization in 1936.
Ciudad Juárez, Chihuahua	Bridge of the Americas replacement	Minute No. 290 and the Chamizal Treaty of 1963. Not an environmental infrastructure project
Rio Grande	River channelization and boundary rectification	Convention of 1933
Rio Grande	River channelization to resolve boundary dispute	1970 Boundary Treaty
Rio Grande	Hydrographic program for measuring and accounting for national ownership of waters	1944 Water Treaty
Del Rio, Texas	Amistad Dam and Reservoir to enhance utilization and control of binational waters	1944 Water Treaty
Nuevo Laredo, Tamaulipas	Binational wastewater treatment plant	Minute No. 279
Rio Grande	Falcon Dam and Reservoir to enhance utilization and control of binational waters	1944 Water Treaty
Lower Rio Grande	Flood Control Project	1944 Water Treaty

Source: IBWC, "Two Countries, Their Borders and Their Waters" (IBWC: El Paso, 1996), 5–6.

Table 6: IBWC/CILA Quick Fix Project Examples

Location	Project Type	Comment
Mexicali, Baja California	Water quality improvement for the New River	Completed December 1998 for \$12.80 million
Nogales, Arizona, and Nogales, Sonora	Water quality improvement for the Nogales Arroyo	Completed in early 1999 for \$2.10 million

The 1983 La Paz Agreement

The Agreement Between the United States and Mexico for the Protection and Improvement of the Environment in the Border Area, signed by Presidents Ronald Reagan and Miguel de la Madrid in 1983, established a framework for cooperation on specific environmental pollution problems. The U.S. EPA and Mexico's SEMARNAP act as the national coordinators of efforts to find and implement solutions to border environmental problems, in particular to prevent, reduce, and eliminate sources of air, water, and land pollution. Formal workgroups, comprised of federally appointed governmental and academic experts, target their policy recommendations toward water, air, contingency planning and emergency response, hazardous waste, enforcement cooperation, and pollution prevention.¹⁰ These workgroups have had varying degrees of success. For the most part, they are not sufficiently transparent, participatory, intermedia, or interdisciplinary in focus. Because the La Paz Agreement lacks any formal avenue into national policies, critics see it as more symbolic than practical. Despite its informal nature, the La Paz Agreement is regarded as the basis for binational cooperation on a variety of regional environmental issues.

Integrated Border Environment Plan (IBEP) 1992–1994

The IBEP was the first binational federal initiative created under the assumption that increased trade liberalization would create additional stress for the environment and human health along the border. The plan was released in February 1992, amid the environmental politics of the NAFTA negotiations. It proposed strengthening enforcement of environmental laws, increased cooperative planning, completion or expansion of wastewater treatment facilities, and the development of a computer tracking system on the transboundary movement of hazardous wastes. But because the IBEP lacked any implementation plan or resource commitment, it was widely criticized as nothing more than a plan to plan. There was also the concern that the plan's policies were dictated by the federal capitals, rather than by the border region. Despite these criticisms, a recent study of the IBEP indicates many of its programs and activities have proceeded and proved useful for the border communities.¹¹

Good Neighbor Environmental Board

The Good Neighbor Environmental Board was created by the Enterprise for the American Initiative Act of 1992 to advise the president and Congress concerning environmental and infrastructure issues and needs within the states contiguous to Mexico. The Act requires that board membership include representatives from appropriate U.S. government agencies; from the governments of Arizona, California, New Mexico, and Texas; and from private organizations,

including community development, academic, health, environmental, and other nongovernmental entities with expertise on environmental and infrastructure problems along the southwest border. At present, there is also one tribal representative on the board. A Presidential Executive Order delegates implementation authority to the U.S. Environmental Protection Agency. The board has a goal to meet three times annually at locations along the U.S.-Mexican border, and has met 11 times at various border locations since its inception.

The board has submitted a total of three annual reports and while the Border XXI workgroups and other border institutions have implemented many of its recommendations, it is not well known within the federal legislature. To be more successful, the board needs to assert its role as an advisor to the executive and legislative branches of government, urging each of them to take a more holistic approach to border environmental issues and to target the most long-term solutions possible.

NAFTA

It is probably too early to tell what NAFTA's impact on border environmental infrastructure, or border infrastructure in general, will be. However, it is clearly going to have a significant impact on pollution from manufacturing, energy, and transportation sectors. NAFTA is the first trade agreement that contains provisions to deal with environmental issues that arise in the context of trade relations and disputes:

The text of the agreement includes explicit references to environmental and health standards and goals. The preamble contains a commitment to sustainable development and to the preservation and protection of the environment, and specific provisions appear in four chapters: sanitary and phytosanitary measures (Chapter 7b), measures related to standards (Chapter 9), investments (Chapter 11), and settlement of disputes (Chapter 20). In brief, the purpose of these provisions is to ensure (a) the integrity of the signatories' internal systems of environmental regulations, (b) the implementation of efforts tending to improve standards, (c) the ecologically sensitive settlement of disputes related to environmental measures, (d) the protection of the trade provisions of international agreements, and (e) the avoidance of external investments that could allow the creation of pollution havens.¹²

Border XXI

The Border XXI Program is an innovative binational effort that brings together the diverse U.S. and Mexican federal entities responsible for the shared border environment to work cooperatively toward sustainable development through protection of human health and the environment and proper management of natural resources in both countries. It is the follow-up program to the IBEP.

Regardless of where they originate, border environmental problems significantly impact communities and ecosystems on both sides of the border. Border XXI respects the sovereign rights of the United States and Mexico to manage their own resources according to their own policies, ensuring that such activities do not cause damage to the environment of the neighboring country.

The principal goal of Border XXI is to promote sustainable development in the border region by seeking a balance among social and economic factors and environmental protection in border communities and natural areas. The central strategy of Border XXI consists of three components: public involvement; decentralization of environmental management through state and local capacity building; and improved communication and cooperation among federal, state, tribal, and local government agencies. Given this goal and the central strategy, Border XXI, a product of significant public input, defines five-year objectives for the border environment and describes mechanisms for fulfilling those objectives. The success of Border XXI is contingent upon broad-based binational participation by federal, state, and local governments; Indian tribes; international institutions; academic, nongovernmental organizations; the private sector; and border citizens and communities.

Nine binational Border XXI workgroups implement the program by integrating the efforts of participating entities and defining specific projects to meet Border XXI objectives. Each workgroup operates under the guidance of a U.S. and Mexican co-chairperson. The workgroups ensure effective coordination of bilateral efforts by bringing together federal agencies from both countries with interests in a given issue.

There are a number of projects being carried out under the umbrellas of each of the nine workgroups (the projects are listed in the 1998 Implementation Plans). The following is one project in which there has been significant local input and feedback to governmental officials.

Joint Advisory Committee

The Joint Advisory Committee is a panel of governmental and nongovernmental stakeholders. The committee is to advise and provide recommendations to the Air Workgroup, which is devising a binational strategy to improve air quality in the El Paso, Ciudad Juárez, and Sunland Park air basin under Annex V of the La Paz Agreement.

The JAC has made a series of recommendations to the Air Workgroup to reduce emissions throughout the air shed. The Joint Advisory Committee also acts as a liaison among federal agencies, state agencies, and the community to develop solutions to pernicious air quality problems.

The JAC has recommended that the Air Workgroup take actions on oxygenated fuel, vehicle inspection and maintenance programs, and the use of supplemental environmental projects. The JAC has held five meetings to date, and is now drafting a strategic plan to guide the activities of the JAC in selecting recommendations for the Air Workgroup. The Air Workgroup, in designing a comprehensive air quality improvement plan, would also use the strategic plan.

Because Border XXI is the result of the La Paz Agreement, which was signed by the president of each country in 1983, it is likely that Border XXI or a similar successor will continue to exist in some form to serve as a coordinating mechanism for the two countries. As Border XXI continues to emphasize transparency to the public as well as to tribal, state, and local governments, there will be more participation by those governments and from nongovernmental organizations and the private sector in the workgroup process. This, most likely, will mean a lengthier decision-making process. If decentralization continues in Mexico so that the Mexican state and local governments have greater decision-making capability, there will be more state-to-state collaboration on local regional projects. Collaboration between Baja California and California in the area of wastewater treatment and water supply already exists. The federal governments will need to learn to play a different role in this decision-making paradigm.

To make Border XXI function well, there must be a commitment to greater resources from all sectors of government (i.e., federal, tribal, state, and local) as well as greater coordination among these levels of government. All concerned need to work toward the increased participation by the private sector. Those involved in Border XXI should do more to plan ahead and become proactive. Unlike BECC-NADBank or IBWC, which build infrastructure, the Border XXI workgroups can provide some long-term vision for the border. They are not required to be reactive and should not fall into that trap. In this way, they may achieve greater incorporation of sustainable development policies in planning and implementing border region projects.

The Border Environment Cooperation Commission and the North American Development Bank

The debate over NAFTA worked to bring further attention to North American environmental problems. The seriousness of the U.S.-Mexican border region's environmental crisis, coupled with concerns about increasing environmental degradation under the NAFTA, pointed to the need for immediate action to

address the situation. Thus, in November 1993, the governments of Mexico and the United States formally agreed on institutional arrangements to assist communities on both sides of the border in coordinating and carrying out environmental infrastructure projects.¹³ This agreement furthers the goals of the environmental side agreement to promote growth along the border while reducing negative environmental impacts.

In the November 1993 agreement, the governments established two separate institutions:

- The Border Environment Cooperation Commission (BECC) with headquarters in Ciudad Juárez, Chihuahua, to assist local communities and other sponsors in developing and implementing environmental infrastructure projects, and to certify projects for North American Development Bank financing. BECC is augmented by \$10 million in grant funds from EPA for its Project Development Assistance Program (PDAP).
- The North American Development Bank (NADBank) with headquarters in San Antonio, Texas, capitalized in equal shares by the United States and Mexico, to provide \$3 billion in new financing to supplement existing sources of funds and leverage the expanded participation of private capital.¹⁴ The NADBank was augmented in 1997 by the creation of the Border Environmental Infrastructure Fund (BEIF), which can provide grants for water and wastewater projects. The BEIF started with about \$170 million available, much of which has now been allocated to projects. The NADBank has also established an Institutional Development Program (IDP) primarily for utility capacity building.¹⁵ IDP has \$4 million available to give as grants. NADBank made its first BEIF grant recommendations in March 1998, and IDP is currently active in 71 projects in 56 communities.¹⁶

The BECC and the NADBank must work with states and local communities, private investors, and nongovernmental organizations in developing effective solutions to environmental problems in the border region, giving preference to projects involving water pollution prevention, wastewater treatment, municipal solid waste disposal, and related projects. In other words, the BECC and NADBank structures are intended to provide public goods. Those affected by the construction of these projects are often the poorest border communities that must function without these basic services. It has been established over and over again that public works, such as those proposed to be financed by the NADBank, are exactly the type of infrastructure that helps to reduce poverty. The NADBank is supposed to provide these public goods with few grants, as it is primarily a self-supporting lending institution.

The BECC-NADBank structure shatters many precedents. It is a balanced structure, with equal financial support from, and equal votes for, the United

States and Mexico. The BECC-NADBank represents the first instance of the United States sharing equal decision-making and spending power. The United States has normally maintained an upper hand in development banks by tying its larger contributions to equally larger voting rights.

By design, these entities are balanced, evenhanded, binational, and equal membership organizations and, by promise, they will have sufficient funding to meet their mandates. Those who worked on the creation of the NAFTA environmental institutions were concerned that they would not repeat the mistakes of the past. First, the BECC was made separate to avoid being driven by financial considerations only. Second, the NADBank was limited to only financing projects certified by the BECC to assure that only sustainable development projects were financed. Sustainable development concepts require that “[d]evelopment today must not undermine the development of present and future generations.”¹⁷ This means that BECC-NADBank projects must not adversely harm the environment or local culture. At the same time, the projects must improve the quality of life for those living on the border.¹⁸

The BECC has a binational board of directors with 10 members, five from each country, and decision-making procedures structured to ensure that the views of states, local communities, and members of the public are taken into account. Unfortunately, Indian tribes are not represented on this board. The commission is required to consult with an advisory council of 18 members, nine from each country. A general manager, a deputy general manager, other officers, and a small staff manage the BECC. The number of employees is about eighteen. Each country contributes an equal share of the operating budget of the commission.

There are two levels for the role of civil society in the BECC-NADBank structure, including NGOs: first, in the creation of the institutions and, second, in the implementation of the institutions. The BECC-NADBank agreement was negotiated in a very short time frame. The Clinton administration called upon a small number of national environmental groups to help it design a way to pay for the environmental clean up along the border and thus quiet a few more critics of the NAFTA. The original concept for the NADBank can be found in the work of Raul Hinojosa and Carlos Melcher, who had proposed such a bank for broad-based economic development focused on the integration of the economies of the three NAFTA countries. To a certain degree, the environmental community hijacked this concept and redirected it to finance the construction of badly needed environmental infrastructure along the border. Some of the original concept can still be seen in the so-called “domestic window” of the NADBank, which will make use of 10 percent of its funds to provide adjustment compensation to communities adversely impacted by the trade agreement.

During the implementation phase, the BECC has established procedures for public participation, including written notice of the opportunity to comment

on general guidelines and on applications for certification of projects. The BECC's and the NADBank's annual reports have been made available to the public. The BECC board of directors holds public meetings each quarter. Interestingly, during the implementation phase the larger national environmental groups that were instrumental in creating the institutions have been replaced by more local environmental and development-oriented NGOs and individuals for whom issues related to the border are the primary focus. Only an informed public can effectively participate in public consultations. Thus, education is key and should be pursued vigorously on both sides of the border.

The NADBank was not designed with community outreach in mind. It lacks the structure and mission to accomplish this. In part because of this design, it relies upon the BECC's public consultation process.

In the BECC's area of responsibility, there should be community outreach at three key levels. First, the project proponent (e.g., a public utility) should consult the public in reaching a needs assessment before developing a project. One element of the environmental assessment process involves public access to information and participation in a meaningful way to consider alternatives before development decisions proceed. Second, the BECC's required public steering committees should be involved in design consultation, solutions evaluations, and the development of a true local, public outreach program. Third, there should be, through the BECC's public meetings, a broader public consultation of border-wide interests. This process should offset any local tunnel vision, or unfair results. This third level should also promote alternative solutions and technologies.

The NADBank needs to think in terms of transparent decision making in order to improve and maintain its credibility. In addition, public consultation is important to the NADBank's role in regard to its programs and policies. The NADBank should consult the public as it develops any new policies and programs or makes any key decisions in which the public has a vital interest. This is especially true of any distribution decisions regarding grant funds administered by the NADBank such as its IDP and BEIF funds. However, public consultation may also come into play in post-BECC certification communications. For example, the public should be consulted when a project has to be changed if financing viability depends upon it (the NADBank would probably need to take responsibility for this if the change falls short of a redesign that would trigger a new BECC certification review).

Through these mechanisms the BECC-NADBank institutions have fostered greater cooperation, increased public participation, hastened democratic processes (particularly in Mexico), developed sustainable development criteria, promoted value engineering, created a volunteer high-level sustainable development program, and, together with SCERP, are about to undertake a border-wide needs assessment.

The BECC evaluates and certifies environmental infrastructure projects according to certain criteria. To be certified by the board of directors, project sponsors must comply with general standards in several areas, including: (1) environment and human health, (2) technical feasibility, (3) financial feasibility, (4) community participation, and (5) sustainable development. These criteria are described in Table 7 in more detail.

Table 7: BECC Certification Criteria

Criteria	Brief Description of Requirements
Human Health and Environment	- human health and environmental need - environmental assessment - compliance with applicable environmental and cultural resource laws
Technical	- appropriate technology - operation and maintenance plan - compliance with applicable design regulations and standards
Financial and Project Management	- financial feasibility - fee/rate models - sound project management
Community Participation	comprehensive community participation plan, including steering committee and public meetings to guarantee local community support
Sustainable Development	- compliance with principles of sustainable development - institutional and human capacity building - natural resource conservation - community development

Source: BECC News, June 1997, 4.

Note: For more detailed information regarding these descriptions and requirements see <<http://www.cocof.org>>.

These criteria, if strictly applied, will ensure real, long-term solutions to many environmental problems in the border region. Meanwhile, NADBank has issued its fundamental documents, including its Loan and Guaranty Policies and Operational Procedures.

Over one hundred projects have been submitted to the BECC for consideration. Of these, approximately thirty percent do not qualify because they are not in the border zone, or do not fall within the BECC-NADBank's three programmatic areas. Other qualified project proposals are not yet ready for certification because they require additional technical assistance to meet both BECC and NADBank standards.

To date, 24 projects have been certified with a combined estimated cost of nearly \$600 million dollars. The NADBank has authorized loans, guarantees, and/or grants totaling \$105 million and has leveraged over \$400 million in total financing for 15 projects. Fourteen of these projects are under construction, and one has been completed. When complete, these projects will provide at least some benefit to an estimated seven million border residents—approximately sixty percent of the border's population.

Some analysts have suggested that Mexico is not getting its fair share of the benefit, given its 50 percent support of the BECC-NADBank institutions. At 13, the U.S. has more projects certified, which are worth more money (\$365.9 million) than does Mexico, with 11 projects costing \$234.1 million. Some information about the projects of the BECC-NADBank is listed in Table 8.

Table 8: BECC-NADBank Border Environmental Infrastructure Project Status

Location	Project Type	Cost
Completed		
Tamaulipas (FINSA)	Wastewater Treatment Certified 1/18/96	\$1 million
In Construction		
Mercedes, Texas	Water and Wastewater Expansion Certified 11/9/96	\$4.1 million
El Paso County, Texas	Self-Help Septic Tank System Certified 7/18/96	\$213,000
El Paso, Texas	Wastewater Reclamation Certified 11/15/95	\$11.7 million
Alton, Texas	Wastewater collection Certified 6/18/97	\$14.8 million
Douglas, Arizona	Water and Wastewater Upgrade Certified 1/18/96	\$2 million
Brawley, California	Water Treatment Plant Certified 9/28/95	\$25 million
Nogales, Sonora	Water Supply (Phase I) Certified 1/18/96	\$39 million
Agua Prieta, Sonora	Municipal Sanitary Landfill Certified 11/9/96	\$1.9 million
Naco, Sonora	Water and Wastewater Certified 4/30/96	\$1.03 million
Mexicali, Baja California	Wastewater Treatment Certified 12/5/97	\$50.4 million
Cd. Juárez, Chihuahua	Wastewater Treatment Plants Certified 9/30/97	\$30 million
San Diego, California	South Bay Reclamation Plant Certified 6/18/97	\$99.6 million

Table 8—Continued

Donna, Texas	Water and Wastewater Project Certified 6/24/98	\$21.2 million
El Paso, Texas	Water and Sewage System for the Lower Valley Water District Certified 6/24/98	\$98.3 million
Construction Not Started		
Somerton, Arizona	Wastewater Treatment Certified 11/9/96	\$1.5 million
Tijuana, Baja California	Parallel Conveyance System and Rehabilitation of Wastewater Treatment Plant Certified 6/18/97	\$18 million
Tijuana, Baja California	Ecoparque Certified 6/18/97	\$170,000
El Paso, Texas	Water Treatment Expansion Certified 12/5/97	\$37.8 million
Reynosa, Tamaulipas	Comprehensive Sanitation Certified 3/31/98	\$82.9 million
Del Rio, Texas* *construction start date was delayed by severe flooding	Water Treatment Certified 3/31/98	\$40.2 million
Puerto Peñasco, Sonora	Sanitary Landfill Certified 11/9/96	\$1.7 million
Calexico, California	Potable Water Project Certified 6/24/98	\$11.3 million
Projects To Be Redefined		
Ensenada, Baja California	Wastewater Treatment Certified 9/28/95	\$8 million

The BECC and the NADBank need to do more to plan ahead. They can use their entry into communities to promote planning, to reduce perverse subsidies, and to have the private sector become more involved. The BECC and the NADBank need to work to eliminate the unproductive competition among the states for money by easing the bureaucratic process without compromising project criteria standards. The ultimate barrier to the success of these institutions is financial. The reasonable estimates for border environmental infrastructure costs in the three areas of the BECC-NADBank mandate are between \$8 and \$10 billion. At best, the NADBank can only leverage \$1 to \$2 billion. More grant funds for project design, capacity building, planning, and so forth, are crucial.

The North American Commission for Environmental Cooperation

The Commission for Environmental Cooperation (CEC) was formed as part of the NAFTA package that sought to liberalize trade in North America while simultaneously providing some minimal protections for labor and the environment. The CEC is thus an international organization whose members are Canada, Mexico, and the United States. Specifically, the CEC was created in 1994 under the North American Agreement for Environmental Cooperation (NAAEC) to address regional environmental concerns, help prevent potential trade and environmental conflicts, and to promote the effective enforcement of environmental law. The agreement complements the environmental provisions established in NAFTA, and the work of the CEC can be divided into five main areas:

1. Protecting human health and the environment
2. Enforcement cooperation and law
3. Environmental conservation
4. Environment, trade, and economy
5. Information and public outreach

The stated goal of the Clinton administration in calling for an environmental side agreement was to make sure that the economic growth of the United States, Canada, and Mexico, as a result of the NAFTA, would not come at the expense of the environment. The focus of the environmental side agreement is on conflict resolution, the harmonization of environmental laws to avoid conflicts, and cooperation in the enforcement of current laws. The agreement also provides for the maintenance of a separate independent body to “watchdog” the environmental law enforcement of the parties. For these reasons, the side agreement will have a significant effect on health and environmental issues in North America.

The CEC is governed by three commissioners. Its secretariat staff carries out the work program of the CEC. This staff also provides technical, administrative, and operational support for the commission and its related committees. The legal staff of the secretariat reviews submissions from nongovernmental organizations and individuals that assert a party to NAFTA is failing to effectively enforce its environmental laws. Finally, the commission is supported by a 15-member Joint Public Advisory Committee (JPAC).¹⁹ The CEC is thus unique in that it contemplates the United States yielding a significant leadership role in place of a consensus-based decision-making structure at the commission, the secretariat, and the JPAC levels—even for dispute resolutions.

Despite the name of the commission, its “cooperation” role is not given great focus in the side agreement, nor did advocates of the creation of the institution put as much stock in this aspect of its functions as they put into the more litigious functions contemplated by the dispute resolution, citizen petition, and

access to justice provisions. Simply stated, the CEC has a cooperative function, that includes face-to-face communications with the three environmental ministers, and tripartite cooperation on the dissemination of information on environmental protection issues, transboundary environmental harm, and natural resources accounting methods.²⁰

The CEC works toward harmonization of U.S., Mexican, and Canadian environmental laws.²¹ From the standpoint of trade liberalization proponents, this function of the CEC was key. It was to be the means to achieve a level playing field by which trade could be made most easy. Some industrialists went so far as to say that they did not fear stringent environmental laws as long as they were uniform. Without the CEC seeking to harmonize environmental actions, no single country within North America was likely to go ahead on a unilateral basis.

For 1998 through 2001, the CEC has adopted "A Shared Agenda for Action," which sets a strategic focus for the commission. It includes two main focus areas. The first is to pursue environmental sustainability in open markets. Under this area, "the Commission will work to promote trade in environmentally friendly goods and services and explore the linkages between environment, economy and trade. In addition, the Commission will strengthen its ongoing

Table 9: Environmental Dispute Resolution, Enforcement, and Sanctions

It was the areas of dispute resolution, enforcement of environmental laws, and sanctions for noncompliance with the side agreement into which the major environmental groups (which in the end supported NAFTA) poured their resources. Lead by the Natural Resources Defense Council and the Environmental Defense Fund, two organizations heavily staffed with lawyers, these aspects of the side agreement got the most concerted attention.

- **Government vs. government.** Formal government-to-government disputes regarding lax enforcement of environmental laws and regulations will be resolved through the CEC. Two of the three NAFTA parties must agree to accuse a third party of lax enforcement. The commission will impanel environmental experts to hear each party's arguments. These experts may conduct hearings similar to the trade dispute resolution procedures in the main trade agreement.²² This is a groundbreaking development in international law to create a formal mechanism for dispute resolution of purely environmental matters. Historically, few environmental regimes have been designed for purposes of dispute resolution.²³ An even more important international law accomplishment is the inclusion of international sanctions or "snap backs" on trade agreement benefits for the punishment of lax enforcement. According to some analysts, the conflict resolution mechanisms are too limited because they are

Table 9—Continued

reached after too many standing and evidentiary hurdles, as well as nonpublic votes by the Commission. However, unlike many other international dispute resolution mechanisms, the CEC dispute resolution process has deadlines for submissions of pleadings and evidence that ensure a relatively short time frame for the resolution of disputes (by international standards).
Private party vs. government. The CEC can also investigate and attempt to resolve complaints of nonenforcement of environmental laws (i.e., the governments will be held accountable for enforcement).²⁴ Citizens, nongovernmental organizations (NGOs), businesses, and governmental entities can prompt such CEC investigations.²⁵ To reach this groundbreaking development in international law, the negotiators overcame some, but not all, sovereignty concerns. The CEC has no subpoena or police powers to conduct its investigations and must rely on the parties and the public for information. In addition, two of the three NAFTA parties have to agree that a factual record of an investigation should be prepared, and then after the secretariat prepares the record, a two-thirds vote by the council is again required to make it public. This second vote and its potential to limit the CEC's transparency is a rather critical flaw, which, if exercised, would undermine the institution's credibility.
Guarantees for access to justice: private party vs. private party actions. Relying on the tremendous success of third-party litigation in the United States to address pollution problems and natural resources preservation, the environmental groups working with the Clinton administration in drafting the side agreement suggested language requiring the NAFTA parties to guarantee citizen suit rights, and guarantee access to reasonable remedies for environmental harm. The language is intended to ensure a domestic right of action for those who can show an injury from a failure to enforce environmental laws.²⁶

analytical and cooperative efforts in environmental standards, enforcement, compliance and performance.”²⁷ Second, the three environmental ministers directed that the CEC staff “address issues regarding the shared stewardship of the North American environment, including identifying the relationships between emerging economic and environmental trends, protecting human and ecosystem health, and sustaining the biodiversity on the continent.”²⁸ In addition, within the framework of the Kyoto Protocol, the CEC will work with the three nations and the private sector to develop North American opportunities for the Clean Development Mechanism.

The CEC has undertaken a number of border-related activities. Under its Article 13 investigation report authority, the CEC has undertaken to look at the San Pedro River watershed uses and sources of contamination. Its conservation

program's Bight of the Californias project will test the CEC's ability to promote binational clean up of nonpoint and point sources of marine pollution and habitat modification in the coastal area near San Diego and Tijuana. The CEC has also been actively involved in the development of a transboundary Environmental Impact Assessment (EIA) agreement. At present, with the exception of BECC-NADBank projects, there is no requirement for a binational impact assessment. This has led to such famous border disputes as Carbon I and Carbon II and Sierra Blanca. As an upcoming exercise using the CEC's dispute resolution procedures for a border issue, the San Diego-based Environmental Health Coalition recently brought an Article 14, "Public Submission," regarding the abandoned Metales y Derivados battery recycling facility in Tijuana.

As the result of the resignation of its first general director, the CEC is in a management transition. Significant changes are under consideration to fix management problems. It would be most advisable for the CEC to work toward a structure that increases its independence and thus its credibility. In this way, it can improve its relevance. The CEC should augment its otherwise excellent studies with more applied actions in communities. This might be accomplished by an increase in funding for North American Fund for Environmental Cooperation (NAFEC).

Table 10: Independent Review of the CEC

An Independent Review Committee appointed in 1997 by the three environment ministers has presented its report on the operations and effectiveness of the North American Agreement on Environmental Cooperation. The review revealed opportunities for improvement, as well as some notable accomplishments achieved by the commission, such as:	
•	Developing regional action plans for the reduction and elimination of widespread and persistent pollutants (including DDT, PCBs, chlordane, and mercury) to protect public health and the environment.
•	Providing the public with important regional environmental information. This includes pollutant emissions data shown on a regional basis in the CEC's annual Taking Stock Report, and an on-line comprehensive summary of the environmental law of the three NAFTA partners.
•	Sharing scientific information on biodiversity among the three parties.
•	Identifying the cause of waterfowl mortality in the Silva Reservoir in the state of Guanajuato, Mexico, and providing capacity building and planning activities that have assisted the state and federal government in rehabilitation of this important wildlife area.
•	Establishing an elaborate process of public participation through the JPAC and national advisory committees, as well as public meetings at the council sessions, and with working groups.

Table 10—Continued

• Working with the three governments to help develop an open and transparent means of conducting transboundary environmental impact assessments for government projects that may adversely affect the environment of a neighboring NAFTA country.
• Promoting cooperation among the environmental enforcement agencies of the three countries by exchanging information on current policies and practices, and by conducting several capacity building and training exercises.
• Implementing the innovative public submission procedure empowering citizens to allege that a party to NAFTA is failing to effectively enforce its environmental laws.

Source: CEC Council Joint Communiqué, Fifth Regular Session of Council, Mérida, Mexico, 26 June 1998.

CONCLUSION AND RECOMMENDATIONS

The size of border programs and, thus, the success of these institutions, depend on the politics of trade, of the White House, and of Congress. The border environmental institutions are valuable and offer varying states of promise. However, it should be clear from this reading that they are reactive to problems and are not proactive or preventative in their approaches. Perhaps worse than being reactive, the designs to date either ignore or only indirectly address development decision making, planning/land use, population growth/control, biodiversity, pollution from toxic chemicals, transportation, housing, and indigenous peoples.

The bottom line is that much has been accomplished with the establishment of these institutions. Unfortunately, they are reactive, their relationships to each other are not well defined, they do not address all of the many border environmental problems, and they are still under-funded relative to the needs of the region, given five decades of uncontrolled growth and development.

NOTES

1. Parts of this paper contain excerpts and adaptations from the following prior papers: Mark Spalding, "Border Water Issues: Merging the Californias" (paper prepared for the conference "California Water Policy VIII: Alchemy, Anarchy or Accountability," Los Angeles, Calif., October 22, 1998); Mark Spalding, "Lessons of NAFTA for APEC," *Journal of Environment and Development* 6, no. 3 (1997): 252–75; and Mark Spalding, "Things Are Going To Get Far Worse Before They Get Any Better: Environmental Issues Associated With U.S.-Mexican Economic Integration" (paper prepared for a conference titled "Mexico and the United States in the Next Decade" cosponsored by the Center for U.S.-

Mexican Studies and the Pacific Council on International Policy, La Jolla, Calif., May 11, 1998). In addition, the author wishes to acknowledge the excellent editorial advice provided by Marta Burg.

2. Among the resulting environmental agreements were the Vienna Convention, the Montreal Protocol, the Basel Convention, the Bamako Convention, and the Wellington Protocol. Also during this time, the United Nations Conference on Environment and Development (the Earth Summit) took place and produced the Rio Declaration, Agenda 21, the Convention on Climate Change, and the Convention on Biological Diversity. The Earth Summit also led to the establishment of the Global Environment Facility.

3. California's former Governor Wilson had slightly poorer relations with Mexico and Mexican states due to his support for certain propositions and his stance against affirmative action, both of which were viewed as anti-Mexican. The state of New Mexico has also been reluctant to participate in Border XXI.

4. Mexico will not respond to climate change until the United States does. It may take serious consequences before a policy response is generated. Fortunately, industry and public opinion is turning in a positive direction. The insurance industry is particularly advanced on this issue and this should drive change.

5. For example, San Diego County has more than two hundred species of plants and animals listed or proposed to be listed by federal or state governments as endangered, threatened, or rare. In fact, there are more plants and animals threatened with extinction in San Diego than in any other part of the United States. San Diego is developing a Multi-Species Conservation Plan with the involvement of all stakeholders, which, if it works, may prove to be a model for other locations in the country. Most of these same plants and animals exist in Baja California as well.

6. Twelve countries contain 70 percent of the world's biological diversity; of these, Mexico ranks fourth in the world after Indonesia, Brazil, and Colombia. It boasts more than 10 percent of the world's birds, more than 10 percent of the world's mammals, and more than 10 percent of the world's plants. Furthermore, 32 percent of Mexico's terrestrial vertebrates and 40 to 50 percent of her plant species are endemic. This biological richness results from great habitat variation and diverse ecological regions, complex topography, climate, geology, and geographical location. Ecosystems range from deserts to rain forests and mangrove swamps. Ten presidential decrees issued this century have created 374 protected areas in Mexico. As a result, nearly 60 percent of the country falls under some form of protection. Unfortunately, many of these decrees disregarded local interests and even disregarded then-existing conditions of development. (The World Conservation Monitoring Centre, 1997. <<http://www.wcmc.org.uk/>>.)

7. For example, illegal sheep hunting in the mountains and over-fishing in the Gulf of California.

8. For example, the adjacent parks near Big Bend (one U.S. and three Mexican) and those in the Sonoran Desert—Piñacate, Organ Pipe, as well as the Cleveland National Forest in California.
9. Improper incentives used in the blind search for economic growth, e.g., water-use fee waivers and other counter-productive subsidies.
10. The workgroups produced five annexes of cooperation on the following areas of environmental pollution: (1) sanitation problems in the San Diego-Tijuana area, (2) hazardous materials spills, (3) transboundary shipments of hazardous substances, (4) air pollution by copper smelters on the Arizona-Sonora border, and (5) air pollution in urban centers on the border.
11. Karen Riveles, "Analysis of the Environmental Plan for the Mexican-U.S. Border Area First Stage: 1992-1994," Institute for Regional Studies of the Californias (unpublished manuscript, summer 1996, copy on file with author).
12. Gordon MacDonald, J. Daniel Nielson, and Marc A. Stern, eds., *Latin American Environmental Policy in International Perspective* (Boulder, Colo: Westview Press 1997), 122.
13. "Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Establishment of a Border Environment Cooperation Commission and a North American Development Bank," 32 I.L.M. 1545, 1993.
14. Mexico and the United States will each contribute half of the \$450 million in paid-in capital and half of the \$2.55 billion in callable capital. It has been estimated that leveraging these moneys could produce \$10 to \$20 billion for environmental and social adjustment projects.
15. In a parallel move, the EPA has also provided \$17 million in direct grants to tribes for this same purpose.
16. Per Victor Miramontes, personal communication.
17. This definition of sustainable development is from the World Conference on Environment and Development of 1987 (see the *Brundtland Report: World Commission on Environment and Development: Our Common Future* [Oxford: Oxford University Press, 1987]) and was reaffirmed and made part of the Rio Declaration on Environment and Development. It has been incorporated into the NAFTA regime by inclusion in the preamble of the environmental side agreement and by inclusion in the sustainable development criteria for certification of BECC-NADBank projects.
18. Neither the Inter-American Development Bank nor the World Bank started out with the express goal of "sustainability," and thus focused on capital intensive projects, which in many cases were detrimental to the environment.
19. The JPAC has played a significant role in the implementation of the CEC. It has been the key point for much of the public input into the CEC. In addition, the members of the committee have worked very hard to reflect a North

American identity by thinking of themselves as representing the continent as a whole rather than their home nations.

20. "North American Agreement on Environmental Cooperation Between the Government of Canada, the Government of the United Mexican States and the Government of the United States of America, 1993." Articles 10, 12–13. Available at <<http://www.cec.org/english/resources/agreement/index.cfm?format=2>>.

21. "North American Agreement," 1993 art. 3.

22. "North American Agreement," 1993 arts. 22–36.

23. Konrad Von Moltke, *International Environmental Management: Trade Regimes and Sustainability* (International Institute for Sustainable Development, 1994), 49.

24. "North American Agreement," 1993, art. 5.

25. "North American Agreement," 1993, arts. 13–5.

26. "North American Agreement," 1993, art. 6.

27. CEC Council Joint Communiqué, Fifth Regular Session of Council, Mérida, Mexico, 26 June 1998.

28. CEC Council Joint Communiqué, Fifth Regular Session of Council, Mérida, Mexico, 26 June 1998.

VII

Cross-Border Planning and Cooperation

Lawrence A. Herzog

INTRODUCTION

This essay addresses the idea of transborder planning and cooperation by reviewing a sample of existing programs of cooperation along the Mexican-U.S. border, as well as more recent institutions created to address the region. The early portions of the report provide background for the idea of transborder cooperation by outlining the evolution of the idea.

Prior to the middle of the twentieth century, international boundaries were viewed as buffer zones between nation states, defended edges to be fortified with military infrastructure, but were carefully avoided as places of production, development, and settlement. Indeed, most of the great cities of the world remained purposefully lodged in their nations' interiors, far from the uncertainties of the international boundary. Since 1950, the scale of national defense has shifted away from land boundaries. Meanwhile, new technologies have led to the globalization of markets, communication, and transportation, and have profoundly changed the way nations organize their territory and understand the ecosystem. As the twentieth century comes to a close, the world, territorially speaking, is very different. International boundaries now pose enormous new opportunities for resource development, production, and urban growth. These opportunities also carry vast new responsibilities for managing ecosystems that transcend international boundaries.

One prototype of global urban space in the next century is what can be called the "transfrontier metropolis."¹ Since the dawn of the nation-state in the nineteenth century, cities have been understood as physical places that lie within the boundaries of one sovereign nation. Yet the late twentieth century marks a new global geography, where city-regions housing millions of inhabitants sprawl across international boundaries, most notably in Western Europe and North America. Important European, transfrontier, urban agglomerations with populations ranging between 300,000 and one million inhabitants include Basel-

Mulhouse-Freiburg (Swiss-French-German border); Maastricht-Aachen-Liege (Dutch-German-Belgian border); the Geneva metropolitan area (Swiss-French border); and the Strasbourg metropolitan area (French-German border). In North America, one finds transfrontier urban regions housing between 250,000 and four million people along the Canadian-U.S. border at Vancouver-Victoria-Seattle, Detroit-Windsor, and Toronto-Hamilton-Buffalo; and on the Mexican-U.S. border at Tijuana-San Diego, Ciudad Juárez-El Paso, Mexicali-Calexico and El Centro, Nuevo Laredo-Laredo, Reynosa-McAllen, and Matamoros-Brownsville.

Transfrontier metropolitan regions typically consist of two or more settlement core areas located around an international boundary. Over time, these settlement centers have fused together to form a single ecological and functional city-region.

THE MEXICAN-U.S. TRANSFRONTIER METROPOLIS

Probably the most vivid example of transfrontier urban space is found along the border between Mexico and the United States. Today, more than 12 million people live in transfrontier metropolitan regions that blanket the 2,000-mile boundary from Matamoros-Brownsville to Tijuana-San Diego. Citizens on either side of the boundary are increasingly drawn together into a web of north-south relations, where the Third World vs. First World and developing vs. developed dichotomies are cast aside as urban neighbors become part of a common transnational living and working space. The largest Mexican-U.S. transfrontier urbanized regions include Tijuana-San Diego (estimated population, 4.5 million), Ciudad Juárez-El Paso (2.5 million), Mexicali-Imperial Valley (1.5 million), Reynosa-McAllen (0.8 million), Matamoros-Brownsville (0.7 million), and Nuevo Laredo-Laredo (0.5 million). These transfrontier urban regions exist in a state of ecological and functional overlap, manifest in the form of a set of overlapping activity systems and ecosystems that tie twin cities together. These systems can be outlined as follows:

TRANSFRONTIER ACTIVITY SYSTEMS

Activity systems are the daily functional systems that define the geography of the transborder urban economies.

Transfrontier Labor Markets

Nearly 300,000 workers legally travel across the border, from the Mexican to the U.S. side of a transfrontier metropolis, to work in the United States on a daily or weekly basis. Countless thousands of others cross illegally with a border resident card (that permits Mexican border residents to cross into the Unit-

ed States for nonwork purposes, but which is frequently used illegally to get to work). The creation of a class of legal international commuter workers within the transfrontier urban region can be traced to a 1963 Supreme Court decision (Texas State AFL-CIO v. Kennedy) in which the courts ruled that anyone in possession of an alien resident card (lawfully permitted permanent residence in the United States) could live outside the borders of the country as long as he or she continued to work within the United States. In effect, the Court recognized that Mexican border cities could serve as “bedroom communities” for legally immigrated Mexican workers in the United States.

Transfrontier Consumer Markets

More than six billion dollars in commercial transactions occur annually across the Mexican-U.S. border, while several hundred million border crossings take place each year, primarily between the partners that form the transnational metropoli. Clearly, this is the most densely populated and heavily used border region in the world. Consumers constitute the most active group of legal border crossers, and are perhaps the primary population that ties together the two sides of the Mexican-U.S. transfrontier metropolis. The North American Free Trade Agreement (NAFTA), with its emphasis on opening borders and increasing economic integration, will heighten the unification of settlements that defines transfrontier cities. Consumers constitute a complex web of flows north and south across the border. Their circulation patterns can be predicted based on comparative advantages of products on either side of the frontier: U.S. consumers travel south to purchase prescription drugs, bottled beverages, furniture, foods, arts and crafts, medical and dental services, car repairs, and entertainment; Mexican consumers travel north for manufactured goods—clothing, electronic goods, refrigerators, washing machines, automobiles, auto parts, and so forth.²

Transfrontier Services

Since the 1920s, Mexican border cities have defined themselves partly as recreational places for U.S. border region residents and visitors. In the 1920s, prohibition of alcohol and gambling in the United States served as a powerful catalyst to the formation of a new Mexican industry—border tourism. By the second half of the 1920s, tourism infrastructure became the defining feature of the architecture of Mexican border towns. So too, the landscape of Mexican border cities began to transform itself in ways that would attract more American consumers. This legacy has endured to the end of the twentieth century. Tourism continues to be a vital generator of revenue in the border region. For Mexico as a nation, tourism is the third largest source of national income, after oil and manufacturing.

Transfrontier Production/Global Factories

Much has been said and written about “offshore” manufacturing, where multinational corporations relocate their assembly work to cheap labor enclaves in places like Hong Kong, Singapore, South Korea, Taiwan, and Haiti. Since 1965, Mexico has been an important participant in this emerging trend toward the globalization of the factory. Most of the global factories in Mexico are located in the transfrontier cities. A cheap labor enclave on the Mexican side of the border (in Spanish, called a *maquiladora*) is linked to a headquarter office and warehouse on the U.S. side of the border, creating within the larger fabric of the transfrontier metropolis a “twin plant” system of U.S. investors/managers and Mexican assemblers. These global factories are very profitable for both sides. Mexicans charge dollarized rents and gain wages for a growing army of industrial workers (one million at last count), while U.S. (and other foreign) companies save millions of dollars in labor costs. This sector brings an estimated three billion dollars of annual income to Mexico.

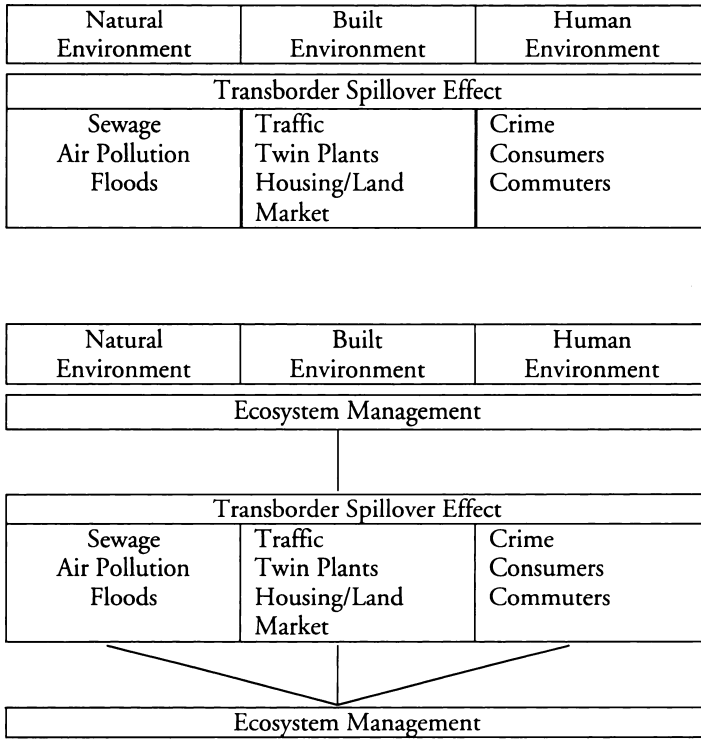
Transnational Housing and Land Markets

Urban dwellers in the transfrontier metropoli consume not only goods and services on both sides of the boundary, but housing and land as well. NAFTA is spurring the purchase/lease of land by global investors along the border, particularly in the Baja California region, where plans for international resorts, hotel complexes, commercial development, and luxury housing are abundant. Baja California already has the second largest enclave of expatriate American homeowners (the largest lies in the Guadalajara region), with some 15,000–20,000 Americans residing in homes along the Baja California coast. Meanwhile, increasing numbers of Mexican immigrants, as they legitimize their work and immigration status, are purchasing homes on the U.S. side of the border. Some members of a family may live on the U.S. side, while others remain on the Mexican side. The hard edge of political demarcation—the physical boundary line—begins to blur. The larger transfrontier region becomes the true urban life space of the border dweller, a more precise spatial construct for defining the experience of binational urban families.

THE TRANSFRONTIER ECOSYSTEM

The activity systems discussed earlier are the behavioral links that sit within the larger transfrontier ecosystem that defines each transfrontier metropolis. Such a model can be illustrated below. This model, of course, simplifies a much more complex ecosystem of feedback loops and overlapping environments. However, it is useful for the purposes of understanding ecosystem management, which, in the model, is a function of three controls over transborder spillover effects—

Table 1: Transborder Urban Ecosystem Model



those in built environment, the natural environment, and the human environment. Thus, it can be seen that the natural environment cannot stand alone—it must be regulated in concert with the design of the built environment, and with the regulation of human behavior. Due to the changing nature of boundaries late in the twentieth century, it becomes clear that any change in the built environment or in human behavior on one side of the international border may have immediate spillover consequences on the other side. Thus “ecosystem management” along the border becomes an inherently international process, and requires new and innovative forms of cooperation and planning. Further, as Table 1 suggests, the mediating force between the natural and human (politics, government) environment is the built environment. Thus, from the perspective of cross-border policy-making, more attention needs to be directed toward managing the built environment along the Mexican-U.S. border.

CROSS-BORDER PLANNING AND COOPERATION IN THE TRANSFRONTIER METROPOLIS.

An empirical examination of recent border region infrastructure projects is presented in Table 2, which lists projects by category (transport, land use, environment), region, project type, and lead actors. These data were gathered over a two-month period from first-hand interviews, public documents, internet websites, and library archival sources. Table 2 does not represent a comprehensive list of all border region projects, but rather an approximation of the scope of projects in the planning stages, under construction, or recently completed. Several observations can be made about these data: (1) The lead actors range from local, state, and national political jurisdictions to private companies, quasi-public economic development agencies, NGOs, and cross-border coalitions—there is no single formula for political administration of border projects; (2) large cities like Tijuana-San Diego are developing more cross-border projects than smaller ones; (3) transportation and environmental projects dominate the landscape at this point. Transport projects like roads, airports, and rail lines are seen as positive assets to accompany cross-border economic development in the spirit of NAFTA. Environmental projects address immediate infrastructure needs to cities and towns with resource management problems. The “glue” that ties together the environment and the economy is land use—literally the form and functioning of urban regions, and this is the category of project development that is least coordinated on a binational basis. Clearly, one of the missions for the twenty-first century will be to better balance ecology and economy through land-use planning.

THE CHALLENGE OF COOPERATION

One of the more difficult elements in cross-border planning for development lies in the area of institutional cooperation. Most experts divide institutional cooperation into two prototypical models: formal and informal. Formal cooperation involves agreements between national states in the form of treaties, presidential meetings with memoranda of agreement, or interparliamentary negotiations. Formal accords can lead to permanent cross-border institutions, including decision-making bodies either with jurisdictionary or advisory status. Informal accords include regular meetings among local and higher government authorities, as well as nonbinding agreements to cooperate on local matters ranging from criminal justice to pollution control and from firefighting to traffic management.

Table 2: Recent U.S.-Mexican Border Region Infrastructure Projects
(planned, in progress, or completed)

Location	Category	Project	Lead Actor(s)
San Diego-Tijuana	Transport	Twin Ports/airport	City of San Diego
		Ports of entry, Otay Mesa	County of San Diego
		San Diego-Arizona Eastern Rail Line	Metropolitan Transit Development Bd. (MTDB)
		Virginia Ave. Border Crossing, San Ysidro	U.S. and Mexican federal governments
		Intermodal Transport Facility Freeway Rts. 905, 125	California Department of Transportation (CALTRANS)
		Widening Otay Mesa Rd.	City of San Diego
		Tijuana Light Rail Transit	Mun. of Tijuana
		Tijuana 2000, peripheral hwy. Ring	SAHOPE
		International Ave.: Circulation plan for border crossing	Mun. of Tijuana
		Road improvements	Mun. of Tijuana
	Land use	International Gateway, mixed use development	Land Grant Development (private) with City of San Diego
		Tijuana pedestrian space development at border crossing	Mun. of Tijuana
	Environment	Wastewater treatment plant	National Development Bank (NADBank-BECC)
		Ecoparque expansion	NADBank
		Southbay border wastewater	City of San Diego
		Treatment plant, San Diego Border Power Plant	Pacific Gas and Electric (private)
Tecate-Tecate	Transport	Expand/realign border crossing	General Services Admin. (federal)
		Rt. 94 expansion	CALTRANS
	Land use	Rezone rural land for urban development near border crossing	County of San Diego
Calexico-Mexicali	Transport	New port of entry	GSA, Imperial County, Mexican government
		Bridge, All American Canal	Imperial County
	Environment	New River cleanup	Imperial County, U.S. Congress
		Salton Sea reclamation, Imperial County, California	U.S. Bureau of Reclamation, Salton Sea Authority
		Wastewater treatment plant, Mexicali	NADBank
	Land use	Redesign border crossing	City of Calexico

Table 2—Continued

Yuma-San Luis Río Colorado	Transport	New border crossing at San Luis Río Colorado	Mun. of San Luis Río Colorado, City of Yuma, State of Arizona
		Access road to I-8	City of Yuma, Arizona Highway Department
		Airport expansion; foreign trade zone	City of Yuma
	Land use	Revitalization/redevelopment of downtown Yuma	City of Yuma
		San Luis Río Colorado, mixed use commercial/residential development	Mathews Group (private)
		Unified port management (pilot project)	Arizona-Mexico Commission, U.S. and Mexican federal governments
		Rail line	Private
		New commercial port	Arizona-Mexico commission
	Environment	Ambos Nogales Water Resource Project	City of Nogales, Arizona, City of Nogales, Sonora
		Water supply and wastewater treatment, Naco, Sonora	NADBank-BECC, City of Naco, Sonora
Columbus, New Mexico-Palomas, Chihuahua	Environment	Wastewater treatment/groundwater protection	State of New Mexico, City of Columbus, New Mexico
	Land use	Expansion of downtown Columbus, National Historic Landmark	City of Columbus, New Mexico
El Paso-Ciudad Juárez	Transport	Replacement of Cordova International Bridge of the Americas	International Boundary and Water Commission (IBWC)
	Environment	C. Juárez Wastewater Treatment Plant	Banobras, NADBank, Mun. of Ciudad Juárez
		Wastewater treatment plant, El Paso colonias	NADBank
		Air quality monitoring systems	City of El Paso, Mun. of Ciudad Juárez, Texas Natural Resource Conservation Commission, EPA
Eagle Pass-Piedras Negras	Transport	Second international bridge, international airport, Hwy. 57/I-35	Middle Rio Grande Development Council, U.S. Department of Transportation
	Land use/housing	Colonias improvement	Bank of America, USDA, Housing Assistance Council
Dos Laredos	Land use	Joint Urban Land Use Plan	City of Laredo
	Environment	Joint Environment Management Plan	City of Laredo, Mun. of N. Laredo, EPA-Border XXI

Table 2—*Continued*

McAllen-Reynosa	Transport	Expansion of International Bridge	McAllen Bridge Board, City of McAllen
	Environment	Wastewater treatment plant	USDA, Texas Water Development Bd., NADBank-BECC
	Land use	Reynosa colonias housing improvement	McAllen Economic Development Corp., Mexican government
Brownsville-Matamoros	Environment	Toxic chemical monitoring of maquiladoras	City of Brownsville, U.S. and Mexican state and federal governments, Coalition for Justice in Maquiladoras
		Wastewater treatment plant, Matamoros	State of Texas, Mexican federal government

Cross-Border Cooperation in Western Europe

An excellent example of successful cross-border cooperation that combines both formal and informal agreement is the various transfrontier planning programs in Western Europe. Anchored by the European Community and its social parliamentary cousin, the Council of Europe, this region is blessed with a number of attributes that facilitate transborder cooperation: geographic proximity and historically integrated border regions, a common fate in economy and defense that tends to tie nations together, and relatively similar economic levels across nation-state boundaries. This relative homogeneity and sense of common cause has been partly responsible for the proliferation of transfrontier planning programs beginning more than two decades ago. Especially notable have been cross-border programs of environmental cooperation and economic development along the Swiss-German-French, Swiss-Italian, French-Belgian, Dutch-German-Belgian, Spanish-French, and other European borders.³ Most of these programs have involved a combination of formal agreements between national governments, often negotiated in the Council of Europe, and informal arrangements across borders between officials and private entrepreneurs who are familiar with one another.

Perhaps the most important and successful example of European transfrontier planning is the Regio-Basiliensis, a regional planning entity in the Swiss-German-French border region near Basel, Switzerland.⁴ More than two million people live in the trinational urbanized region surrounding the city of Basel. Over one hundred thousand commuters travel into Switzerland to work on a daily basis in this region. Beginning in the 1960s, the framework for cross-border cooperation was established between the Swiss cantons, local universities, and Swiss industries. By 1975, the French and German authorities had formally joined in the process, and a commission of eight members was formed,

with all members appointed by the foreign ministries of the three nations. Regional committees were set to represent the two ecological subregions: the north and south Upper Rhine River areas. Further, a number of smaller, informal committees were set up, including the Upper Rhine Regional Planners. The Commission and the various regional and informal working committees meet regularly throughout the year. They address several basic planning problems in the region including traffic/transportation, culture, economic development, and the environment. The Regio-Basiliensis, which has become the planning arm of the Commission, has had great success in the area of transportation planning. Its crowning achievement was the construction of a trinational airport in Mulhouse, France, that serves the cross-border region. A more difficult problem has been that of nuclear power plants and their impact on the environment. Before the Regio came into existence, the three nations were concentrating too many nuclear plants in this border region, and they would all need to use the Rhine river for cooling, causing irreversible ecological problems for the river. Trinational planning and coordination allowed the local governments to demonstrate the long-term dangers of this trend, and the location of additional plants here has been curtailed.

Regional leaders in the Swiss-German-French borders recount that coordination is easier to achieve at the local level than at the national level, and that is one of the great advantages of informal cross-border coordination. It brings nations together over common interests (environment, economy, and so forth). The spirit of cooperation in this case is enhanced by the progressive leadership in the Council of Europe, where transborder concerns are given a high priority. The problem, however, is that none of the members of the Commission actually sits on the European parliament, thus limiting the political clout of this program. Further, it must, in the end, be acknowledged that the principal force behind the Regio is economic—large pharmaceutical companies in Basel seek markets in neighboring countries and want to ensure the stability of their home region.⁵

The Mexican-U.S. Border Region

The Mexican-U.S. border region brings together not only a plethora of government agencies at the federal, state, and local levels, but two very different cultures—Mexico and the United States—with distinct values and philosophies about cities, land development, and the environment. Equally important, the border brings together nations at very different stages of economic development. The United States is a world economic power, while Mexico is a developing nation with a long history of economic dependence on the United States. At the border, Mexico's dependence is underscored by the two most important border phenomena of our times: immigration and assembly plants (*maquiladoras*). Both are driven by the opportunities the border created, either for illegal

workers crossing to the north, or for cheap labor enclaves that bring multinational capital to the region. There must always be an awareness of these basic economic asymmetries that lie at the core of the U.S.-Mexican border relations.

Further, both the United States and Mexico have dramatically different forms of government and notions of politics. A somewhat dated case study of political officials along the California-Mexico border at Tijuana-San Diego reveals how the constellation of concerns differs among public officials. In an early 1980s survey, public officials on either side of the border were asked what the major issues facing the San Diego-Tijuana region were. The results are cited in Table 3.

Table 3: Major Issues Facing the Tijuana-San Diego Region

Mexican View (Tijuana)		United States View (San Diego)	
Economic Development	32%	Undocumented Aliens	79%
Trolley/Border Transport	30%	Better Cross-Border Dialog	62%
New Border Crossing	30%	Economic Development	47%
Problems of Population Growth	30%	Water/Sewage	44%
Unemployment	20%	Air Quality	32%
Industry/Tourism	18%	Tijuana's Negative Image in San Diego	30%
Narcotics Traffic	20%	Flood Control	23%

While this study is dated, its contents reveal some universal facts about cross-border public policy making. Economic development is the engine of cross-border shared consciousness, and both sides have shared a concern for it since the 1980s. However, Mexicans are also burdened by their economic shortages, which at times manifest in the form of unemployment, but, more importantly, continually plague the border with the vast deprivation in the colonias or unplanned squatter settlements that dominate the formation of Mexican border cities. U.S. officials feel the weight of those concerns, but express more immediate quality of life concerns about the negative spillover effects of Mexican border towns in the form of undocumented immigrants, sewage spills, flooding, air quality, and the generally negative image of Tijuana, which affects not only San Diegans, but outside business investors as well.

More recent studies have suggested a number of general and specific barriers to cooperation. General barriers might include language, culture, initiative, and politics.⁶ Many public officials from El Paso to San Diego lament their inability to speak Spanish. Even when officials do actually speak both languages, there are still problems in understanding the nuances of meaning and tone in face to face interaction. Mexican officials have expressed the opinion that their U.S. counterparts do not really understand Mexican culture, and this may cause them to cling to a proud kind of nationalism in dealing across the border. Fur-

ther, U.S. officials must always be aware of the differences in power, wealth, and development that underscore Mexican-U.S. relations. These differences have in the past led to what many observers have called a lack of initiative on both sides in moving beyond informal discussions to real policy making. For many years there was a consensus of agreement about common goals, but no real substantive implementation of change. This is changing in the 1990s, with the jolt given to the border by NAFTA, and the recognition of the inevitability of change.

Still, the biggest differences remain in the area of politics and governance. The United States has traditionally been the more decentralized federated government. Now Mexico is rapidly moving toward devolution of power to states and municipalities, although this process will take several decades to complete. In government, in the past, the United States has favored a civil service, merit-driven organization of managers, while in Mexico the management system was more tied to political affiliations. This too will soon change in the post-NAFTA era. Meanwhile, both nations have vastly dissimilar legal systems, with the U.S. system derived from British common law, and the Mexican from Napoleonic codes. The countries' actual laws vary in terms of individual rights, property, land-use law, business law, and so forth. Notions of private rights and "public interest," vital to such areas as land use, property, and environmental law remain distinct on either side of the border.

These differences will not likely continue to have the same influence on cross-border cooperation that they had in the past. However, a recent anecdotal survey of some U.S. border officials suggests that cooperation is still plagued by the obstacles of the recent past. From Brownsville to San Diego, border government officials and observers continue to worry about the lack of interaction with their Mexican counterparts. Most of their biggest concerns were expressed at the local level; for example, one Imperial County official said, "We've tried in the past years to set up meetings with planning officials in Mexico, but we haven't had success. Administrations in Mexico change every six years, and we can't seem to keep things going." Another official in California said, "We still only include our side of the border on our planning maps." Yet another local planning official on the California border said "I used to talk regularly with people in Mexico. But they are all political appointments, and they move on. I haven't had much contact lately." In Naco, Arizona, one local businessman stated that "There's really not anything here to work out with Mexico." In Arizona, a prominent business and management consultant said, "At this point our interaction with Mexico is somewhat limited, but our goal is to promote cross-border dialogue." A Mexican professor in El Paso stated that there is no formal mechanism for cross-border planning in El Paso-Ciudad Juárez partly because "El Paso doesn't believe it really needs Juárez to survive."

Still, almost all of the local officials surveyed regularly meet with their Mexican counterparts, and are very anxious to promote cross-border cooperation.

As one administrator in the county of San Diego stated, "For people in our district, it's a cross-border culture." This same official made an important point that is echoed by all of the U.S. and Mexican officials interviewed: the best form of interaction currently is informal. Said the San Diego official, "Most of our interaction is informal. We all know each other. That's what works best for U.S."

Studies have shown that the best interactions are usually informal, face to face, and one on one. This seems to work much better than written or telephone communication. Many innovative local and informal arrangements, in the form of task forces and the like, have been successful in familiarizing all parties with local issues and in implementing projects. The categories of successful informal work include planning, construction and maintenance of international bridges, joint health and air quality monitoring, technical assistance, emergency management, fire control services, tourism promotion, cross-border education, and cultural activities. Some of the problems faced in the area of binational land-use planning are the divergent objectives of planning, the different regulations and codes and other tools on each side of the border, and the traditional divisions in the location of authority over planning decisions. Many of these differences can likely be mitigated in the future by better anticipation and understanding, a luxury that previous generations of planners did not have.

In a more practical sense, cross-border cooperation often is mediated in the physical space of the actual border crossings, since it is here that all of the people, capital, goods, and technology that fuels the border economy must pass. A number of problems plague international border crossings, including inadequate staffing that causes traffic flow problems; poor coordination between government agencies, both within and across borders; dismally slow processing of commercial traffic; an absence of efficient regularization of regulations to facilitate cross-border trade; port facilities that are not large enough to handle the volume of traffic that passes through them; and inadequate transport facilities connecting to the border crossings from surrounding regions.⁷

CASE STUDIES: RECENT SUCCESS STORIES IN CROSS-BORDER PLANNING AND COOPERATION

Notwithstanding all of the problems and obstacles to cross-border cooperation discussed in this report, there are a number of promising and innovative programs and examples of cutting edge border planning that must be carefully scrutinized. Clearly, border planning and cooperation remain works in progress. The following is a summary of some of the trends in border cooperation.

Innovative Public Sector Border Alliances

Many experts recognize that border decision making has not functioned well when it is restricted to either foreign policy circles at national levels, or informal dialogue at the local level. Recently, concerned policymakers have searched for a balanced mechanism that brings together various institutional levels into cross-border alliances, with an emphasis on self-government, economic development, and border management. Several examples can be cited:

- Border Liaison Mechanism (BLM) is a product of the U.S. State Department and the Mexican Ministry of Foreign Relations and seeks to bring local, state, and federal officials from both sides of the border together to deal with common border problems. Through a series of task forces on matters such as trade, tourism, movement of goods, public safety, education, and culture and migrant protection, key officials engage in frank discussions and seek to integrate their dialogue to the larger formal decision-making processes.
- Consultative Mechanism is a Mexican initiative that brings Mexican consuls in U.S. border cities and INS district officials together to deal with local economic, law enforcement, labor, human rights, and related issues. The purpose of the initiative is to bring federal officials together with local and regional actors.
- State Alliances are agreements between bordering U.S. and Mexican states to commit to long-term economic development by creating a binational regional strategic plan at the twin-state level. An example is the 1993 Strategic Economic Development Vision for the Arizona-Sonora Region. This plan emphasizes cross-border clusters of industry and seeks to develop strategies to make the Arizona-Sonora region globally competitive by promoting linkages and reducing cross-border barriers. Each state has an organization that oversees the process—the Arizona-Mexico Commission on the U.S. side, the Comisión Sonora-Arizona on the Mexican side. Among the many impressive projects in this cross-border alliance is a proposal called Unified Border Port Management, which seeks to find ways to streamline procedures at the ports of entry through a pilot project that focuses on more efficient movement of goods and people over the international boundary.
- The U.S.-Mexico Border Counties Coalition was created in 1998 by the 24 border counties on the U.S. side as a way of increasing their political visibility and effectiveness in getting the attention of federal governments to address border issues. The counties wanted a unified voice nationally to address the varied and growing list of problems within their jurisdiction, including indigent health care, housing, illegal border crossings, fire suppression, criminal justice costs, and “patient dumping” by federal agents (border patrol) into county health care

facilities. The purpose of the coalition is to get all of the counties working together to create good border policy making. This group has not yet brought in partners on the Mexican side, but the idea is promising. Recently, there has been a split between San Diego County and the other border counties over how to administer the project.

- Empowerment Zones are poles of development in less advantaged areas of the United States supported with federal monies to strategically jolt the local economy, a project that the Clinton administration continues to promote. The Lower Rio Grande Valley Rural Empowerment Zone has directed some \$40 million toward long-term regional economic development planning. Probably the biggest contribution the empowerment zones can make is in addressing the problem of border *colonias*, or unplanned construction of makeshift homes, often without services, in rural zones on the edges of metropolitan areas in Texas and New Mexico, as well as more sporadically in California and Arizona.
- Councils of Government (COG) are coalitions of U.S. border counties and/or cities that join together to address regional planning issues. An example would be the Lower Rio Grande Development Council that undertakes transportation planning in Hidalgo County and adjacent areas. It also promotes coordinated regional development.

Federal NAFTA-Driven Liaisons

With NAFTA, a set of new institutions were created to oversee the environment and infrastructure needs of the states along the Mexican-U.S. border. These institutions include Border XXI, Border Environment Cooperation Commission (BECC), North American Development Bank (NADBank), along with the existing International Boundary and Water Commission (IBWC). A comprehensive advisory group, the Good Neighbor Environmental Board, was established to advise the president and Congress regarding environmental and infrastructure needs and issues of the border region. The Border XXI workgroups have been impressive in the scope of functions and the degree of local involvement on such issues as air quality, water, hazardous waste, emergency planning, and natural resources.

Private Cross-Border Coalitions

Private cross-border coalitions seek to enhance cross-border cooperation using economic development as the anchor. Many of the binational urban regions have cross-border chambers of commerce and other economic coalitions. These coalitions not only handle economic development matters, but they also focus on managing investments, environmental concerns, housing and community development, public space, and the provision of services to poor communities.

For example, in McAllen-Reynosa, on the Texas border, the McAllen Economic Development Corporation has an International Relations Committee, which, among other concerns, seeks to assist the city of Reynosa with its housing shortages for its poorest inhabitants. For more than three decades Texas has been gradually fashioning a series of cross-border alliances, many driven by private sector economic development concerns, but some branching out into social and cultural arenas as well. In Ciudad Juárez-El Paso, the World Trade Center has been an important cross-border cooperation mechanism for the region. In the middle and lower Rio Grande region, the Rio Grande Valley Partnership has been set up to forge cross-border communication and cooperation on a variety of economic development issues. In Arizona, the state-to-state alliance mentioned earlier brings public and private interests together to determine the strengths and weaknesses of the region, and ways of expanding its connection to the global marketplace. In Southern California, a number of regional groups bring the private sectors together to discuss regional economic development. The U.S.-Mexico Border Chamber of Commerce links private interests at San Diego-Tijuana, as does the San Diego Dialogue, a public-private coalition seeking to coordinate cross-border efforts to grow the regional economy.

Local Programs

For a variety of reasons (history, geography, politics), some twin city regions have managed to create better cross-border liaisons than others. A few examples of successful local initiatives include:

- Instituto Municipal de Investigación y Planeación (IMIP), Ciudad Juárez, has a long history of centralized urban planning and administration. Local governments have traditionally been weak and underfunded, while the power over municipal planning and financing of infrastructure lie at the state and federal levels. Since the early 1990s, Mexico has been rapidly moving toward a decentralized political system, with the power to tax and spend shifted to municipal governments. The creation of municipal planning agencies represents an attempt to have independent city planning agencies that function without direct connection to the political party that controls the local and state government. These agencies receive their own funding and carry out research and planning autonomously. IMIP in Ciudad Juárez, has carried out some impressive empirical research on cross-border transportation in the Ciudad Juárez-El Paso region, including a detailed travel forecasting model.
- The Sonoran Institute. This is a small initiative linked to the University of Arizona that promotes community-based ecological development. It is involved in projects that include repair of riparian ecosystems,

development of ecotourism programs, and community workshops in rural areas.

- **Dos Laredos.** The Laredo-Nuevo Laredo region must be cited as an example of good cross-border cooperation through local, informal linkages. As early as 1881, an engineer hired by the Mexican government created a binational town plan for the two Laredos. Both cities were laid out in a similar plaza-street gridiron system, and this early parallel urban structure has reinforced the sense that the towns' development is intertwined. Both cities established planning departments about ten years apart, Laredo in the early 1980s, Nuevo Laredo in the early 1990s. By the 1990s, both cities acknowledged they needed to work together to address their common explosive growth. They created a joint urban plan and identified a set of common actions needed to unite them—environmental protection, tourism development, traffic management, and historical and cultural protection. This Joint Urban Plan, *La Carta Urbana de los Dos Laredos*, has been supported by both the U.S. and Mexican federal governments, and has been followed by a Joint Environmental Management Plan (funded by the EPA Border XXI program) and a joint historic preservation program. The political atmosphere appears to be in place to implement cross-border planning and environmental management.
- **The San Diego-Tijuana Region.** San Diego-Tijuana is the most heavily populated border subregion, and the most economically polarized as well. The challenges for cross-border cooperation are greater, both because the scale of urban growth is greater, and the differences in economy, lifestyle, and quality of life are more pronounced. While nearly 50 percent of city dwellers in the Ensenada-Tijuana corridor live in conditions of substandard housing and services, nearly three-quarters of Southern California's residents live in relatively luxurious (by comparison) suburban dwellings, with full complement of household services as well as neighborhood amenities such as schools, street lighting, and paved roads, something not all Mexican border dwellers can count on. Yet San Diegans have, in the last two decades, begun to acknowledge the need for cross-border planning and cooperation. Both the city and county of San Diego had border planning offices at one time, although tight budgets in the early 1990s wiped these out. Still there is great concern and attention to the cross-border problems of the region. The city of San Diego continues to address cross-border issues through the City Manager's Office, Binational Planning Program. The county of San Diego holds a U.S.-Mexico Border Summit, that brings together county officials and Mexican officials. The county is heavily involved in cooperation with Mexico on service issues, including criminal justice, agriculture, environmental health, child services, air pollution, and haz-

ardous materials. The San Diego Association of Governments is a regional planning agency that actively works on cross-border planning with Tijuana, especially in the areas of watershed research, energy, transportation planning, data collection, and the environment.

The biggest challenges facing all of these local entities lie in the areas discussed below. Although examples are cited from specific regions, these challenges confront local governments all along the border.

- *Environmental Management.* As early as the 1930s, Tijuana and San Diego discovered that they shared a common ecological domain, most notably the watershed of a regional hydrological and drainage system. Sewage spills from Tijuana to San Diego have plagued the region through the 1990s. Nearly five decades of separate management of Tijuana and San Diego environmental systems must now be replaced by binational environmental management. Twin cities elsewhere along the border have had similar experiences.
- *Transport Infrastructure.* A transfrontier metropolis, by its very definition, is a place where the circulation of people, goods, and services across the border must be facilitated so that the boundary does not impede the daily economic circuitry of the transnational space. The region must be allowed to fulfill its destiny and become a city/region operating in the global economy. Thus, in Tijuana-San Diego, 600 global factories (maquiladoras) must be able to function within the transfrontier metropolis. Billions of dollars in commercial transactions must be facilitated. Tens of thousands of workers, business persons, and school children need to cross the border to reach their destinations on a daily and weekly basis. To allow the Tijuana-San Diego region to become truly transnational, more sophisticated transportation infrastructure will be needed. This is fully recognized by policymakers in the region, and discussions are under way to create a package of improved transport facilities such as a third border crossing facility, a redesigned border crossing at San Ysidro, a binational mass transit connection between downtown San Diego and downtown Tijuana, cross-border highway linkages, regional port improvements in San Diego and Ensenada (Tijuana's service port some 70 miles to the south), rail linkage connections from the urban hinterland to both ports, and a binational airport that would serve the transfrontier region. All border cities have significant transportation infrastructure needs.
- *Urban Design/Land-Use Planning.* The bottom line is that better environmental and transport planning need to fit the design and land-use configuration of the transfrontier metropolis. An interesting project for planners lies in the design of the space immediately adjacent to the international boundary. There has never really been a comprehensive urban design plan for the San Ysidro international border crossing area

between San Diego and Tijuana, even though it is the busiest border crossing in North America. The space consists of a chaotic juxtaposition of land uses: warehouses, parking lots, factories, retail stores, an immigration detention facility for illegal border crossers, freeways, residential neighborhoods, commercial strips and commercial centers, open space for wetlands and flood control, and privately owned farms. One of the biggest challenges will be to create a plan that allows for circulation and economic development while not compromising the need for immigration control and surveillance of smugglers. For the international customs and border patrol community, larger populations and higher urban densities represent potential obstacles to efficient transnational law enforcement. Good design strategies may be able to resolve this seeming contradiction.

CONCLUSION/FUTURE NEEDS

The transfrontier metropolis embodies a new urbanism, where city-regions emerge as bridges between national cultures and as the new spaces from which to launch the global activities of common markets or trade blocs. However, the path toward transnational urban planning is not without obstacles. The Mexican-U.S. border region epitomizes the condition of late twentieth-century urbanism. Notwithstanding the cross-border synergies discussed earlier, transfrontier metropolitan space in this part of the world is notable for its polarized social landscape.

The fusion of divergent styles of urbanism—one Iberian and Meso-American, the other Anglo-European—into a single-city region remains very much a work in progress. Several recommendations are offered:

Consolidation

The vast array of government programs, public-private partnerships, regional planning efforts, cross-border task forces, new and old programs of cooperation, and private sector economic development alliances is dizzying in its variety and depth. There are far too many different operations and efforts, and, while all are well intentioned, they either overlap or perform the same tasks repetitively. Some attempt should be made to consolidate cross-border dialogue into a set of uniform mechanisms that are used consistently across the 2,000-mile border from region to region.

Cross-Border Decision-Making Research

This report has uncovered a lack of good recent empirical studies of cross-border cooperation and planning. It is recommended that the EPA and other fund-

ing agencies consider immediately organizing a research effort to study cross-border decision making in each of the twin city regions, focusing on the key social, political, and cultural barriers that plague cross-border cooperation. Further, some attempt should be made to understand why some regions of similar size have better informal cross-border relations than others. In general, the positive aspects of face to face Mexican-U.S. interaction and cooperation on planning and environment need to be better understood as a way of improving the process of cooperation in decision making. If the border region is moving toward a period of more local control of the decision process, then it must be analyzed in order to become more effective. Some attempt might also be made here to incorporate the successes of the European transfrontier planning models to the Mexican-U.S. border.

Land Use/Research

Better land-use planning is the glue that makes transportation planning and environmental management work. It is suggested that funding agencies and existing programs emphasize joint land-use plans for twin-city border regions, as well as micro-level design studies of heavily used border crossings. These studies should be binational in scope and bring together the key actors from both sides of the border to study and create joint land-use programs.

Border Crossings/Land-Use Planning

As the data in Table 2 suggest, a great deal of project development along the border lies in border crossing infrastructure. However, what is still missing is a set of integrated cross-border land-use plans that show how improvement of the border crossings fits into the larger regions and how it will be co-managed by the U.S. and Mexican governments. The most striking example is the border crossing at San Ysidro in Tijuana-San Diego. While it is the busiest crossing along the entire border, San Ysidro's land-use configuration is chaotic and unplanned, something that must be changed if the U.S.-Mexican goal of economic and environmental integration is to be achieved. Substantial investment in developing a cross-border land planning process for the major border crossings along the entire border is needed, starting with San Ysidro.

Socioeconomic Asymmetry/Colonias

Clearly the major obstacle facing the border region lies in the vast landscapes of residential poverty in the form of colonias that blanket urban areas on both sides of the boundary. Existing research on colonias should be channeled into environmental management and other efforts to create cross-border planning.

NOTES

1. Herzog, *Where North Meets South*, 139–44.
2. See House, *Frontier on the Rio Grande* for an excellent review of this dynamic along the Texas-Mexico border.
3. See Council of Europe, “The State of Transfrontier Cooperation”; Herzog, “International Boundary Cities.”
4. Briner, “Regional Planning,” 45–53.
5. Herzog, “International Boundary Cities,” 593–94.
6. See Saint Germaine, “Problems and Opportunities.”
7. See Arizona-Mexico Commission, “Arizona Vision Study.”
8. All interviews were given on the condition of anonymity.

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SCERP Mission

The Southwest Center for Environmental Research and Policy (SCERP) was established by the U.S. Congress in October 1990 to "initiate a comprehensive analysis of possible solutions to the acute air, water quality, and hazardous waste problems that plague the United States-Mexico border region." SCERP is a consortium of five U.S. universities (Arizona State University, New Mexico State University, San Diego State University, University of Texas at El Paso, and University of Utah) and four Mexican universities (Instituto Tecnológico de Ciudad Juárez, Instituto Tecnológico y de Estudios Superiores de Monterrey, Universidad Autónoma de Baja California, and Universidad Autónoma de Ciudad Juárez). SCERP carries out its mission through a cooperative agreement with the U.S. Environmental Protection Agency. A permanent administrative office is maintained by the consortium in San Diego.

Environmental Problems of the U.S.-Mexico Border Region

The border region lies 100 kilometers/60 miles on each side of the U.S.-Mexican border and encompasses parts of four states in the United States (Texas, New Mexico, Arizona, and California) and the six Mexican states of Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas. Approximately 12 million people live in the U.S. counties and Mexican municipalities on the border. The high density of people and increased industrialization since the passage of NAFTA have placed an even greater burden on the inadequate infrastructure and environmental resources of the region. Exacerbating the problem is the fact that many U.S. counties along the border are categorized as "economically distressed," and few communities possess the resources needed to address environmental concerns. Some of the critical border environmental issues include, but are not limited to:

- Rapid urbanization and lack of adequate infrastructure
- Air pollution from open burning, vehicle emissions, and industrial operations
- Contamination of surface and ground water from open sewers and industrial waste
- Over-utilization of aquifers and surface streams
- Transportation and illegal dumping of hazardous wastes
- Destruction of natural resources.

The SCERP Solution

SCERP utilizes a broad, integrated, multidisciplinary approach to address the issues of the border. SCERP's researchers collaborate with the U.S. Environmental Protection Agency and Mexico's Secretaría de Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP), as well as local and state governments, business and industry, non-governmental organizations, and communities of the border region. SCERP organizes research, outreach, and training programs devoted to improving environmental conditions and to building capacity in the border region for resolving critical environmental problems. SCERP is pioneering a model of binational cooperation that brings U.S. and Mexican researchers together and introduces new skills and perspectives in binational environmental problem solving.



SOUTHWEST CENTER FOR ENVIRONMENTAL RESEARCH & POLICY