

II

A Snapshot of the Border

THE MEANING OF THE BORDER

The twin city of Puerto Palomas, Chihuahua (pop. 9,000), and Columbus, New Mexico (pop. 900), typify the sleepy border town. The community is most famous as the location of Pancho Villa's crossborder raid into the United States in 1916. Around the twin cities are mountains, cacti, ranches, and the occasional tracks of antelope seeking water (*Economist* 1998). The emptiness may explain why border residents have been such model neighbors. A single road forms the main street of both towns—it is divided in the middle by the border. It is common for tourists to walk across the border, make purchases on the opposite side, then return to their home country after a few minutes. Families have intermarried for generations, and it is common for family members to live on both sides of the border. The two towns form a single community. They shared a fire department for several years, and they still share an ambulance service. For more than 40 years, the elementary-age children of Palomas were educated in Columbus while middle school and high school children traveled to the nearby town of Deming, N.M. For many residents of the area, it was as if the border did not exist. In effect, the border was simply a stop sign with guards (Bennett and Bennett 1997).

All this changed in 1997 when the U.S. Congress passed a law limiting the ability of aliens to register in public schools in the United States. The new law was aimed at reducing the cost of pub-

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lic education to U.S. taxpayers. Indeed, the cost of transborder cooperation has been borne by U.S. residents who, embedded in a far wealthier society, had access to state and federal grants and subsidies that paid for local services. The intention of Congress was to stop using U.S. taxpayer money for services provided to aliens, but the effect has been to disrupt the cultural and political institutions that had grown up to serve the residents of the border. Palomas students could no longer attend public schools in the United States, and a tradition that had lasted two generations ended.

As the example of Palomas-Columbus illustrates, the U.S.-Mexican border has become more of a blur—a zone of transition—than clear line of demarcation. It is a political construct imposed by national interests onto the local landscape. The border divides people and accentuates differences between the United States and Mexico, but the degree to which this is true varies depending upon the sphere of human activity considered (Forster and Hamlyn 2002). While the border is relatively impermeable to political institutions such as systems of law and regulation, the border is less impermeable to the movement of people, finances, and goods and services. The border, however, is almost completely permeable to communication, environmental pollution, and natural systems.

This chapter describes the border and the border economy. It is meant to provide a context in which decision-makers can develop a better appreciation for the issues faced on the border.

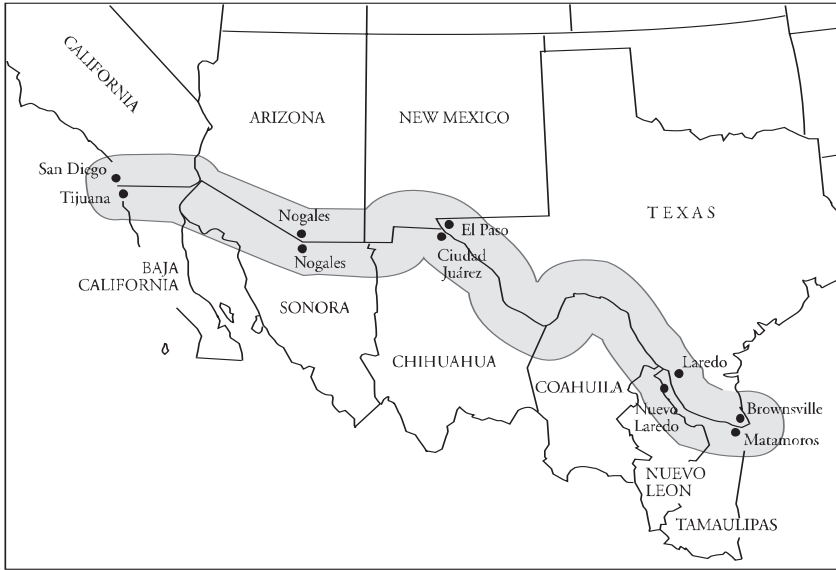
GEOGRAPHY

The U.S.-Mexican border is 1,952 miles long, stretching from San Diego-Tijuana on the Pacific coast to the Gulf of Mexico near Brownsville-Matamoros. It is the longest border between a developed and a developing country in the world. It is also the most frequently crossed border in the world. The La Paz Agreement¹ defines the border region as extending 100 kilometers (km) north and south of the political divide (Figure 1). It is this 200-km band that has served as the working definition of the border for several binational institutions (including the North American Development Bank [NADBank]). The region contains parts of four U.S. states—California, Arizona, New Mexico, and Texas—and six Mexican

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states—Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas. While the climate is varied, most of the border region is characterized by arid conditions, which makes water a major issue. Agriculture is the largest economic activity.

Figure 1. The U.S.-Mexican Border Region



Source: U.S.-Mexico Chamber of Commerce

Formal ports-of-entry are located all along the border. These serve as conduits for both commercial and migration flows, thereby creating economic opportunities (Forster and Hamlyn 2002). Communities have developed around these ports-of-entry on both sides of the border, and it is in these twin cities that most of the border region population is located (Peach and Williams 2000). The largest of these twin cities are San Diego-Tijuana, Calexico-Mexicali (Imperial Valley), Nogales-Nogales (Ambos Nogales), El Paso-Ciudad Juárez (Paso del Norte), Laredo-Nuevo Laredo (Dos Laredos), Eagle Pass-Piedras Negras, McAllen-Reynosa, and Brownsville-Matamoros (Table 1). These urban agglomerations are often referred to as twin cities, although this phrase, while conven-

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ient, is misleading. The cities are twins in the sense that they are adjacent, grew up together, and arise from the same mother—the border. But at best they must be considered fraternal twins because certainly they cannot be thought of as identical—they differ in population, density, income, and environmental infrastructure. Despite the limitations of the term “twin city,” the phrase is well-established in the lexicon of the border (see, for example, EPA 2002f) and will be used in this monograph to refer to transborder urban areas that have grown up along the boundary.

THE ROLE OF POVERTY

The U.S.-Mexican border region faces a unique set of circumstances that arise from the juxtaposition of two economies at very different levels of development. Adjusting for purchasing power parity, U.S. per capita income is about four times higher than Mexican per capita income (\$36,100 versus \$9,100).² Moreover, the difference in per capita income is apparent in differences in the quality of life, as is obvious to even the most casual observer. Crossing the border from the United States to Mexico, one leaves a relatively prosperous developed country and enters a less-developed country. Conditions are more crowded, the infrastructure is not as well maintained, and sanitation is poorer in Mexico.

The situation is further complicated by the relative positions of the border communities within their respective countries (Erickson and Eaton 2002). The northern frontier of Mexico is characterized by the low income typical of developing countries, yet it is that nation’s wealthiest region. Mexico’s northern border region is more industrial and more urban than other regions of Mexico. In contrast, the U.S. borderlands are among the poorest in the United States (Peach and Williams 2000). Per capita income is less than 80% of the national average—approximately 60% of the national average if San Diego is excluded (Table 1). Unemployment is 50% greater than the national average. The poverty rate on the border is 25%, compared to 13% for the United States as a whole.

Table 1. U.S. Personal Income per Capita

City	1990	2000	% Change 1990-2000	% of Mean U.S. Personal Income
Brownsville	\$9,946	\$14,906	50%	51%
McAllen	\$9,325	\$13,344	43%	45%
Laredo	\$9,443	\$15,114	60%	51%
Eagle Pass	\$7,052	\$12,092	71%	41%
El Paso	\$12,404	\$18,535	49%	63%
Nogales	\$12,143	\$17,373	43%	59%
Calexico	\$16,069	\$18,469	15%	63%
San Diego	\$21,145	\$32,515	54%	110%
United States	\$19,572	\$29,469	51%	100%

Source: Bureau of Economic Development

The poverty of the borderlands and commensurate tax coffers limit the resources available to improve air quality there. The Mexican federal government has, reasonably, placed a higher priority on providing potable water and sewage than on improving air quality. Moreover, recognizing the northern border as relatively wealthy, the Mexican federal government often allocates central government funds to regions with more limited resources. Even for the United States, where air quality is a higher priority, other environmental concerns often take precedence over border communities faced with limited resources. For example, unincorporated subdivisions called *colonias*, which are common on the U.S. side of the border, often have inadequate water and sewage treatment and disposal capabilities. Water quality, endangered species, habitat preservation as well as other environmental and non-environmental projects all compete with air quality for local funds.

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Economic Development and Environmental Quality

The relationship among air and water quality and economic development is complicated. Several studies have explored this issue, and an empirical regularity—referred to as the Environmental Kuznets Curve (EKC)—has been detected.¹ As economic development and industrialization proceed, it might be expected that air and water quality would decline. After all, industrialization involves expanding output and shifting from relatively non-polluting traditional agriculture toward pollution-intensive industrial production techniques. But this is not what has been observed by economists. Rather, there appears to be an inverted-U relationship between economic development and environmental quality. That is, in the first phase of economic development, environmental quality declines, while in the later phase of economic development, environmental quality improves.

The EKC results from the interaction of industrialization with increased demand for environmental quality (Wheeler 2001; Deacon 1999). Countries regulate pollution more strictly as they gain wealth. Pollution becomes a higher priority as more basic educational and public health needs are satisfied. At the same time, higher incomes lead to stronger regulatory institutions as better trained technical personnel become more available and budgets more generous. Higher income and better education empower citizens to demand stricter enforcement of environmental regulations. The interaction between industrialization and greater demand for environmental regulation results in the inverted-U EKC. In the first stage of industrialization, air and water quality decline because communities are too poor to pay for abatement and people are more concerned about jobs and income. In later stages of development, the balance shifts and there is greater concern for the quality of the environment and, therefore, development and stricter enforcement of environmental laws.

Interestingly, the peak of the EKC is estimated to be between a per capita income of \$5,000 and \$8,000, which means Mexican per capita income is such that economic development is associated with improvements in air and water quality. Moreover, as Mexico moves further along the EKC, Mexican and U.S. preferences for improved air quality should converge.

¹ See, for example, Grossman and Krueger 1995; Wheeler 2001; Cole, et al. 1997; and Hettige, et al. 2000. For evidence contradicting the EKC hypothesis see Stern, et al. 2001.

POPULATION AND EMPLOYMENT

Perhaps the most significant stressor on the environment is human population, so understanding border population trends is useful in determining the environmental pressures faced by the border. Table 2 reports population statistics for 1990 and 2000 for the largest border cities and for the overall border. Also included for comparison are figures for Mexico and the United States as a whole. According to the 2000 census, the largest U.S. city on the border was San Diego (about 2.8 million), followed by El Paso (about 680,000). The largest Mexican cities are Ciudad Juárez (1.3 million) and Tijuana (1.2 million). Looking at combined populations, the largest twin cities are San Diego-Tijuana (slightly more than 4 million) and El Paso-Ciudad Juárez (slightly less than 2 million). These large cities have stressed the border environment in general and air quality in particular.

Population growth along the U.S.-Mexican border has varied (Table 3). On the U.S. side, the border population grew by 21% between the 1990 census and 2000 census, compared to 13% for the United States as a whole. McAllen was the fastest growing city (48%), followed by Laredo (45%). The only two U.S. border cities to lag behind the U.S. average population growth were San Diego (13%) and El Paso (15%). Population growth in Mexico is even more dramatic. Total Mexican border population grew by 43% between 1990 and 2000 while the overall population of Mexico increased by 20%. The Mexican cities with the most rapid growth

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Table 2. Urban Border Population by Twin City

Twin City	United States		Mexico		Total Urban Area	
	1990 Census	2000 Census	1990 Census	2000 Census	1990 Census	2000 Census
San Diego-Tijuana	2,498,016	2,813,833	747,381	1,210,820	3,245,397	4,024,653
Calexico-Mexicali	109,303	142,361	601,938	764,602	711,241	906,963
Nogales-Nogales	29,676	38,381	107,936	164,070	137,612	202,451
El Paso-Ciudad Juárez	591,610	679,622	798,499	1,276,573	1,390,109	1,956,195
Eagle Pass-Piedras Negras	36,378	47,297	98,185	137,764	134,563	185,061
Laredo-Nuevo Laredo	133,239	193,117	219,468	344,501	352,707	537,618
McAllen-Reynosa	383,545	569,463	282,667	402,039	666,212	971,502
Brownsville-Matamoros	260,120	335,227	303,293	434,692	563,413	769,919
Total Border	5,213,774	6,316,212	3,891,578	5,548,039	9,105,352	11,864,251
Total National	248,709,873	281,421,906	81,249,645	97,483,412	329,959,518	378,905,318

Sources: U.S. Census; INEGI

Table 3. Percentage Change in Border Population by Twin City

Twin City	1990-1995			1995-2000			1990-2000		
	United States	Mexico	Urban Area	United States	Mexico	Urban Area	United States	Mexico	Urban Area
San Diego-Tijuana	6%	40%	13%	7%	22%	11%	13%	62%	24%
Calexico-Mexicali	26%	17%	19%	4%	10%	9%	30%	27%	28%
Nogales-Nogales	19%	32%	36%	10%	20%	11%	29%	52%	47%
El Paso-Ciudad Juárez	11%	40%	27%	4%	20%	14%	15%	60%	41%
Eagle Pass-Piedras Negras	22%	30%	28%	8%	10%	10%	30%	40%	38%
Laredo-Nuevo Laredo	30%	44%	38%	15%	13%	14%	45%	57%	52%
McAllen-Reynosa	31%	17%	26%	17%	25%	20%	48%	42%	46%
Brownsville-Matamoros	19%	28%	24%	10%	15%	13%	29%	43%	37%
Total Border	12%	26%	18%	9%	17%	12%	21%	43%	30%

Source: Authors

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were Tijuana (62%), Ciudad Juárez (60%), and Nuevo Laredo (57%). In terms of impact on the environment, the most relevant population figures are not those for one side of the border or the other, but rather the population figures for the combined population of each twin city. Four twin cities had growth rates exceeding 40%. These were Laredo-Nuevo Laredo (52%), Nogales-Nogales (47%), McAllen-Reynosa (46%), and El Paso-Ciudad Juárez (41%). Combined population growth of the United States and Mexico was 30% between 1990 and 2000.

While the population growth rate has been rapid, it slowed down somewhat in the second half of the 1990s. The most dramatic decline in growth was in Nogales-Nogales and Laredo-Nuevo Laredo. Both these twin cities experienced rapid, perhaps unsustainable, growth during the early 1990s and both saw a dramatic slowdown in the late 1990s. Population growth on the border as a whole slowed by 5%, from less than 18% during the early 1990s to more than 12% during the late 1990s.

What is the outlook for urban growth on the border? Peach and Williams (2002), working with data from the U.S. and Mexican 2000 censuses, developed population projections for U.S. border counties and Mexican border *municipios*. Their medium growth scenario has the border population increasing to 14 million by 2010, 17 million by 2020, and 19 million by 2030. Peach and Williams project that the list of border cities with a population of more than 1 million—which now includes San Diego-Tijuana, Nogales-Nogales, and El Paso-Ciudad Juárez—will be joined by McAllen-Reynosa by 2005 and Calexico-Mexicali by 2010. Their projections suggest that border region population will grow by 20% between 2000 and 2010, which equals only about two-thirds the rate of the 1990s. Thus, it appears that the slower but still-substantial growth that characterized the late 1990s will continue into the current decade, which means population growth on the border is expected to continue and the already-apparent pressure from human populations on the environment will intensify. Meeting the needs of current and expected future populations yet maintaining adequate environmental standards is a premiere challenge for the border region (Hetch 2000).

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Another source of environmental stress is economic activity, which generates air pollutants as byproducts. Industry is a major source of most common pollutants. Power plants are a major source of SO₂; industrial solvents and paints are a source of volatile organic compounds (VOCs); and on the border, agriculture and industry remain significant sources of anthropogenic particulate matter (PM). In addition to the direct effect on air quality from economic development and industrialization, there is also the indirect effect of industrialization increasing the demand for transportation both by workers who commute to and from work sites and by operations such as trucking and warehousing firms that service manufacturers.

Of course, population and economic activity are closely linked, and the growth apparent in the population data is reflected in employment growth. Table 4 displays data for employment in large twin cities as well as for the national economies. Looking first at the United States, between 1990 and 2000 employment grew by 20% at the national level. Employment growth on the border was more rapid, with the most rapid growth occurring in Laredo (59%), followed by Eagle Pass (52%). Employment in San Diego and El Paso grew only slightly faster than the overall U.S. employment—21% in these two cities. Looking at Mexico, between 1990 and 2000 national employment grew by 44%. All border cities except Mexicali and Piedras Negras had employment growth exceeding the Mexican national average. The most rapidly growing city was Reynosa (85%), followed by Tijuana (71%) and Ciudad Juárez (69%). The two slowest-growing cities were Mexicali (42%) and Piedras Negras (43%).

THE MAQUILADORA INDUSTRY

Twin cities have traditionally specialized in industries that serve the border, such as customs collection, transportation, and warehousing. These traditional border industries have become less important in recent years. During the last three decades, businesses have increasingly chosen to locate along the border to take advantage of the differences between the two countries in terms of wages and working standards. Indeed, the primary source of economic growth along the border has been the maquiladora industry. Maquiladoras, also commonly referred to as maquilas, are manufacturing assembly

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Table 4. Border Employment

Twin City	United States			Mexico			Binational		
	1990	2000	Change	1990	2000	Change	1990	2000	Change
San Diego-Tijuana	1,438,146	1,733,921	21%	261,526	446,339	71%	1,699,672	2,180,260	28%
Calxico-Mexicali	52,717	61,809	17%	200,104	284,884	42%	252,821	346,693	37%
Nogales-Nogales	5,876	7,542	28%	38,936	64,503	66%	44,812	72,045	61%
El Paso-Ciudad Juárez	269,821	327,289	21%	283,182	479,771	69%	553,003	807,060	46%
Eagle Pass-Piedras Negras	10,235	15,531	52%	32,095	46,010	43%	42,330	61,541	45%
Laredo-Nuevo Laredo	54,342	86,234	59%	69,803	115,669	66%	124,145	201,903	63%
McAllen-Reynosa	135,909	210,928	55%	90,573	167,138	85%	226,482	378,066	67%
Brownsville-Matamoros	99,420	141,146	42%	105,127	163,280	55%	204,547	304,426	49%
National Total	139,426,900	167,465,300	20%	23,403,413	33,730,210	44%	162,830,313	201,195,510	24%

Sources: Bureau of Economic Analysis; INEGI

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plants that take advantage of their location and provisions in Mexican and U.S. law that allow the duty-free import of parts for assembly into Mexico. The assembled product is then exported to its primary market, the United States. Only the increase in value due to assembly in Mexico is taxed upon re-entry into the United States. Foreign corporations, many of them U.S. firms, own approximately three-quarters of the maquilas in Mexico (Dwyer 1994).

The maquila program was formally initiated by Mexico in 1965 as a means of attracting foreign investment, increasing exports, increasing employment, and fostering development, particularly along the U.S.-Mexican border. Before the signing of the North American Free Trade Agreement (NAFTA), all production generated in Mexican plants had to be returned to the originating country or exported to a third country. NAFTA initiated a two-phase change in the maquila program. During the first phase, from January 1994 through December 2000, maquilas continued to benefit from a waiver on Mexican import duties on raw materials and components, but also benefited from preferential duties on products satisfying NAFTA rules of origin (Coronado de Anda and Matulewicz 2003). Starting in 1994, the restrictions on the sale of maquila products domestically in Mexico were phased out. In 1994, maquilas were allowed to sell up to 55% of the value of the previous year's imports within Mexico. Thereafter the limit was increased by 5% each year until 2000, at which time all maquilas' restrictions on domestic sales ended (Watkins 1994).

The maquila industry is controversial. The program is often criticized for its limited contribution to Mexican economic development. In particular, maquilas import materials for assembly from the United States and export the finished product back to the United States. In the past, most managerial and technical staffs have been supplied from the United States. In essence, maquilas are extensions of U.S. corporate supply chains. There was initially little opportunity for backward and forward links from the maquila sector to the rest of the Mexican economy (Skclair 1989). As a consequence, technology transfer has only recently had an impact and economic development has been stalled. The problem is exacerbated by a deliberate policy of the Mexican government to maintain low wages in the maquila industry.³ According to INEGI, wage rates in 2003

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for laborers, who are often young women from the interior of Mexico, are less than \$1.42 per hour. Moreover, working conditions are inferior to what is typically found in the United States and living conditions are poor. Not protected by U.S. labor laws, maquila workers are subject to long work weeks and dangerous working conditions, and some are under age (Dwyer 1994). Defenders of the maquila industry, while acknowledging that wages and working conditions in Mexican factories are low by U.S. standards, argue that wages are high compared to those paid in the interior of Mexico and higher yet when compared to many developing countries. Indeed, Mexico is not considered a low-wage country by international standards. Wages in Malaysia and Indonesia, to mention two countries often cited as competitors of Mexico's, are lower.

Another concern with the maquila industry is its impact on the environment. Certainly one of the major industrial sources of air pollution in twin cities is the maquila industry. Many observers have pointed to environmental regulation as an important consideration in locating on the border. They argue that pollution-intensive industries once investigated escaping strict U.S. enforcement of environmental laws by relocating across the border to Mexico, where, it is argued, monitoring and enforcement of environmental regulations is less strict. How important environmental concerns are in determining the country in which to locate is open to discussion. Transnational corporations look at all costs, not just regulatory costs, in deciding where to locate production. Several studies have found that compliance costs are not a major determinant of relocation (Wheeler and Mody 1992; Albrecht 1998; Eskeland and Harrison 1997; Wheeler 2001). Labor, transportation, material, and administrative costs are all considerations in addition to environmental regulations. Indeed, labor costs are traditionally cited as the primary reason for locating production in Mexico. Moreover, while it is probably true that environmental law enforcement is less strict in Mexico than in the United States, Mexico enforces environmental laws more strictly than many other developing jurisdictions. These issues will be addressed in greater detail in subsequent chapters. For now it is sufficient to say that there is some evidence at the margin of regulatory-induced industrial migration to the border, but that the effect is likely small compared to other factors.

Air Quality and Power Generation on the Border

The failure to coordinate environmental policy on the border can result in a regulatory situation that is costly to business and confounds efforts to improve air quality. Two electric generating facilities (EGFs) located in Mexicali—Sempra Energy Resources' Termoeléctrica de Mexicali (TDM) Plant and InterGen's La Rosita Facilities—provide an interesting illustration of this point.

The Sempra plant is a \$350 million, 600-megawatt (MW) facility located in the Mexicali Valley 18 kilometers (km) west of the city and adjacent to the Mexicali-Tijuana highway (Sempra 2003a). InterGen's plant is a \$484 million, 1,065-MW EGF also located outside Mexicali within eyesight of the Sempra plant. The two plants are approximately 10 km south of the border. Both plants are natural gas-fired, combined-cycle facilities (InterGen 2003a) and both draw water for cooling. Fuel for the two plants is transported through a new 126-mile, crossborder natural gas pipeline running from Ehrenberg, Ariz., to the plant sites near Mexicali. The facilities connect to the western U.S. electrical grid system via transmission lines that cross the border near El Centro, Calif. The plan is to market to U.S. customers a significant portion of energy produced at these facilities.¹ Both plants have supplied power to the United States since test runs, which began in January 2003.

Electric power generation is a source of air pollutants, especially sulfur dioxide (SO₂), carbon monoxide (CO), and nitrogen oxides (NO_x). A single poorly designed power plant can have a significant adverse effect on regional air quality, so extra care is taken in granting a permit to build one. In the United States the process takes about two years; in Mexico it takes about six months (Dow Jones Wire Service 2003). Sempra and InterGen hoped to take advantage of the more streamlined regulatory process, as well as cheaper land and labor, in Mexico by building in Mexicali.

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Environmentalists have expressed considerable skepticism about the motivation of Sempra and InterGen in building in Mexico, contending that the reason to build in Mexico is to avoid U.S. clean air laws. These skeptics claim that the two power plants could never have obtained U.S. permits to operate in the Imperial Valley if they had been located in the United States. Opponents believe the two EGFs will significantly boost emissions in the common air basin of Mexicali and Imperial County, which is already plagued by air quality problems and labeled nonattainment for several criteria pollutants. Earth Justice (2003), for example, states in its lawsuit and on its web page that the operation of these power plants would “significantly degrade air and water quality and would likely degrade public health in the border region.”

Both InterGen and Sempra are sensitive to their critics. Both facilities far exceed Mexican minimum emission design requirements. Moreover, Sempra maintains that the TDM facility is in full compliance with California laws and is as clean as any facility operating in California (Sempra 2003b). However, although it may be in compliance with areas in California that already have clean air, they are not in compliance in Imperial-Mexicali because of the area’s ambient air nonattainment status. While the La Rosita EGF is not in compliance with California law as originally designed, InterGen agreed in January 2003 after public pressure to retrofit the plant to reduce NO_x emissions to meet California standards (InterGen 2003b).

Environmentalists had little success in attempts to influence the Mexican permit process for the plants, so they focused efforts on blocking the U.S. permits for the transmission lines from the two Mexican facilities into the United States. On May 2, 2003, environmentalists scored a significant victory when a federal judge ruled that the U.S. Department of Energy acted inappropriately in determining that two Mexicali EGFs would not significantly affect the crossborder region’s air and water

quality. The ruling dealt a blow to energy companies, which are planning to build more power plants in Mexico to sell electricity in the United States (Lundquist 2003).

¹ InterGen plans to sell only about one-third of its power to U.S. customers. The remaining two-thirds will be sold to Comisión Federal de Electricidad for distribution to Mexican customers. Sempra plans to sell all power to U.S. customers.

The maquila industry imports, as measured by a number of employees and number of maquilas, peaked in 2000 and has plateaued below that peak (Millman 2003). INEGI reported a peak employment of 1,310,171 in January 2001 at 3,713 maquilas and current employment of 1,097,447 at 2,820 maquilas as of April 2004 (*Twin Plant News* 2004). Table 5 shows maquila employment for eight Mexican border towns. The city with the greatest maquila employment is Ciudad Juárez (more than 250,000 at its peak, but approximately 205,000 now), followed by Tijuana (more than 187,000 at its peak but approximately 150,000 now) (*Twin Plant News* 2001; 2004). Between 1990 and 2000, maquila employment growth ranged from 213% in Tijuana to 41% in Nuevo Laredo, but has since fallen between 10% and 25%. Among border cities, only Tijuana and Mexicali had more rapid maquila growth than the national average. Historical restrictions placed on the location of maquilas within Mexico—they had been restricted to within 100 km of the U.S.-Mexican border—causes this phenomenon. In recent years, though, the 100-km restriction has been phased out. With the relaxation of the restriction on location, more and more maquilas have located in the interior, thereby reducing the growth of maquilas on the border. Nevertheless, 86% of maquila production remained in Mexican border states as of 2000 (Erickson Forthcoming).

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Table 5. Mexican Maquiladora Employment by
Municipio

City	1990	2000	Change	2004	Change
Tijuana	59,870	187,339	213%	150,815	-19%
Mexicali	20,729	60,063	190%	50,487	-16%
Nogales	19,714	38,633	96%	28,783	-25%
Ciudad Juárez	122,231	249,509	104%	204,922	-18%
Piedras Negras	7,986	14,546	82%	13,051	-10%
Nuevo Laredo	16,036	22,603	41%	19,765	-13%
Reynosa	23,541	66,091	181%	77,828	16%
Matamoros	38,360	66,023	72%	52,507	-20%
Nation	446,436	1,285,007	188%	1,092,447	-15%

Source: INEGI; *Twin Plant News* 2004

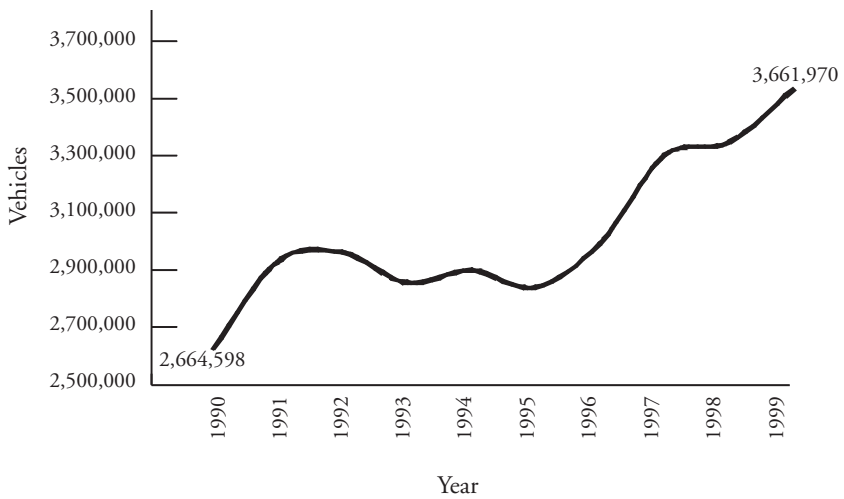
MOTOR VEHICLES AND THE BORDER

A major source of air pollution, as indicated above, is motor vehicles—or so-called mobile source pollution. Vehicles contribute to the deterioration of the environment in several ways. They are a major source of carbon monoxide (CO), sulfur dioxide (SO₂), ozone (O₃), and PM and they emit these pollutants directly into the air. When they drive on unpaved roads, they add to the problem by sending dust into the air. There are also indirect costs to the environment from vehicles. Disposal and recycling of old tires, junk cars, and trucks is expensive and difficult. Refining fuel used by automobiles also generates air pollution. Generally speaking, greater economic activity means more vehicles and lower air quality. Thus, it is expected that the number of vehicles registered on the border has increased since 1990. And in fact, the number of motor vehicles registered in Mexican border states increased by 1 million, from 2.7

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million in 1990 to 3.7 million in 2000, during the decade of rapid economic and population growth (Figure 2). In 2000, just more than 1.3 million vehicles were registered in Mexican border cities (Figure 3). A significant source of mobile air pollution is emissions from vehicles delayed at the border for inspection and for general entry into the country. Truck crossings at Texas border towns have increased since 1990, particularly at Laredo (Figure 4).

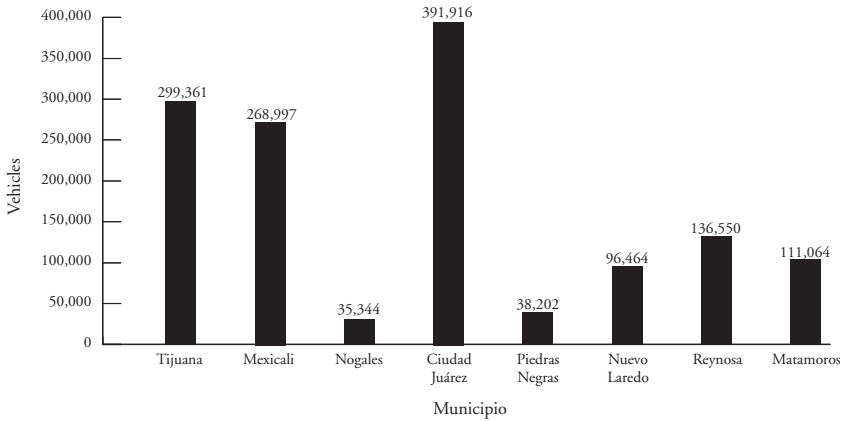
Figure 2. Vehicles in Mexican Border States



Source: Sistema Municipal de Baso de Data

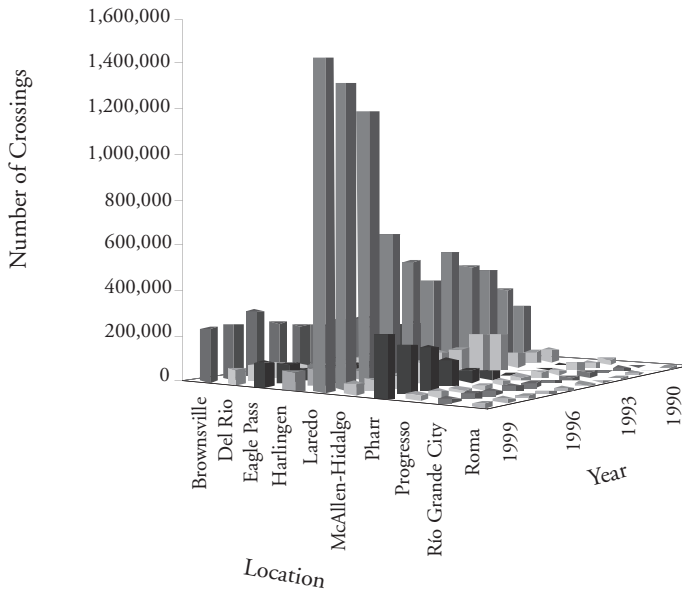
Improving Transboundary Air Quality with Binational Emission Reduction Credit Trading

Figure 3. Vehicles in Mexican Border Towns



Source: Sistema Municipal de Baso de Data

**Figure 4. Number by Location of Truck Crossings
into Mexico from Texas**



Source: Sistema Municipal de Baso de Data

THE ENVIRONMENT, HUMAN ACTIVITY, AND THE BORDER

The complex interplay of human activity and the environment is ubiquitous, but special issues are at work on the border. These include rapid population growth, complex cultural interactions, and the juxtaposition of two countries at very different levels of development. Poverty characterizes both sides of the border. This poverty limits the resources available for pursuing environmental goals, including improved air quality. The poverty of the border makes the logic of emission reduction credit trading more obvious. If the government does not have the resources for air quality improvement, then a policy like emission reduction credit trading, which uses private funds to finance air quality improvements at a lower overall cost to society, is even more valuable. An added benefit is that in most cases, it will be firms in the relatively wealthy United States that will pay for emission reductions by Mexican firms.⁴

ENDNOTES

¹ U.S. President Ronald Reagan and Mexican President Miguel de la Madrid signed the La Paz Agreement on August 14, 1983. It deals with cooperation on the border and serves as the legal basis for much of the subsequent cooperation on environmental issues.

² These are estimates for 2000 (CIA 2002).

³ Generally speaking, wages in Mexico are not determined in the market. Instead, wages are set by negotiation between semi-official labor unions and the federal government. Thus, the central government has considerable influence over wages.

⁴ Of course, the U.S. firms are not doing this out of altruism but because they can achieve their emission reduction goals at a lower cost by buying emission reduction credits from Mexican firms. Thus, as argued in Chapter I, emission reduction credit trading is a win-win situation.

