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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

Cosponsored by the Southwest Center for Environmental Research and Policy, the United States Environmental Protection Agency, and the Border Trade Alliance

SOUTHWEST CENTER FOR ENVIRONMENTAL RESEARCH & POLICY

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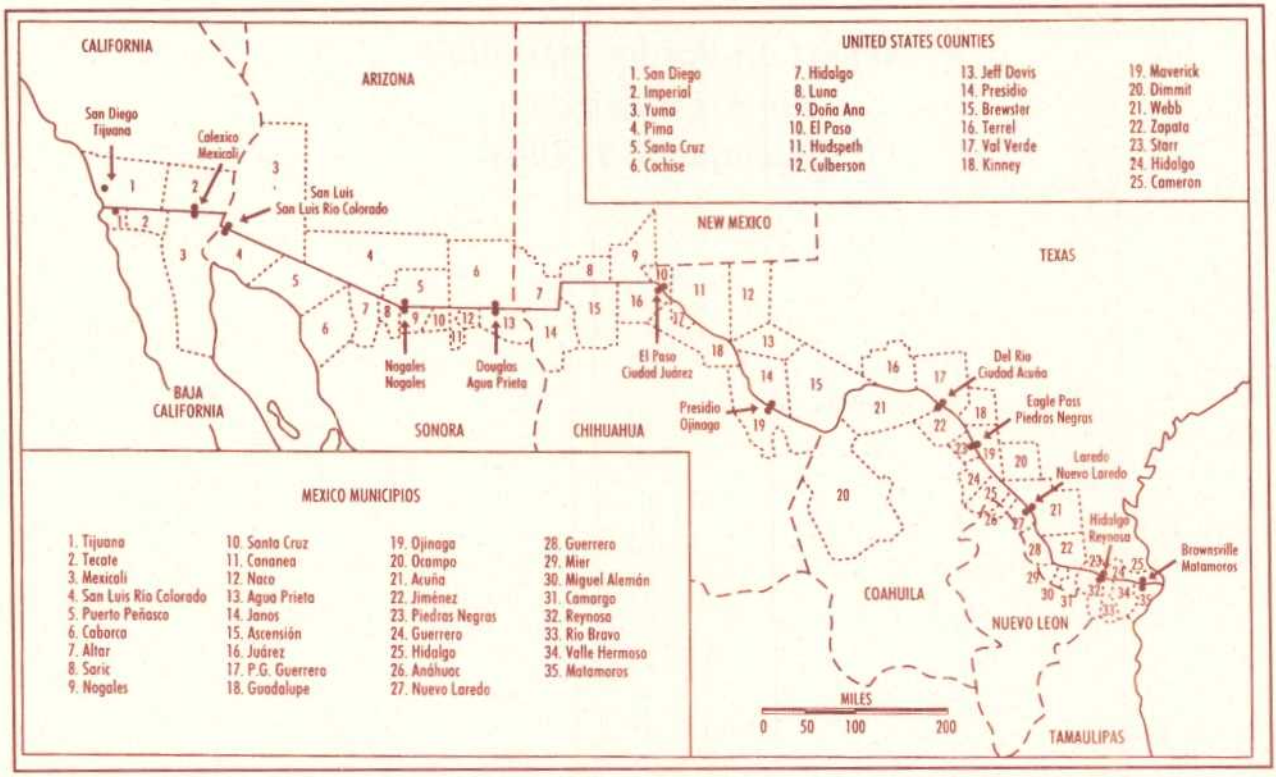

Figure 1. U.S. Counties and Mexican *Municipios* of the Border

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Executive Summary

The Border Institute, held late in 1998 in Rio Rico, Arizona, brought together some sixty 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 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 cosponsors 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, with the exception of San Diego. The poorest region of the United States is along the border with Mexico. In economic terms, the 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 8 to 10 times higher and municipal budgets are up to 50 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 with increasing transboundary 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 deterioriation 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.

The Border Institute, 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 sixty 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. A list of participants is appended at the end of this document.

The first part of the Border Institute included presentations by experts on selected topics that were accompanied by free-flowing discussions among participants.* 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 desirable 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 report.

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 1shows 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 data referred to in this summary are derived from briefing papers prepared for the Border Institute: 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." These papers will be published with full references and illustrations later this year by SCERP. The publication will be noted on the SCERP web site: *www.scerp.org*

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.

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.

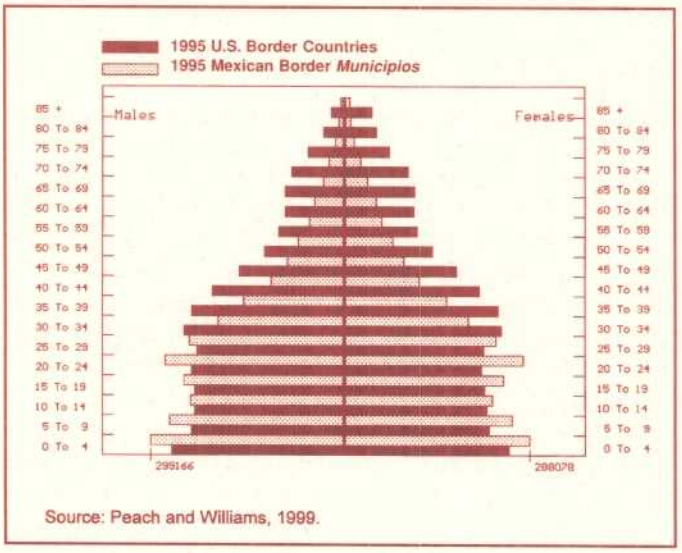

Figure 2. Border County and Border *Municipio* Population Pyramid 1995

The age structure of the population is quite different on the Mexican and U.S. sides of the border. Figure 2 shows the different age structures of Mexican and U.S. border populations in 1995. The most striking 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 *muncipio* 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 post-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.

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 increase and migration, along with other factors. Below are three population projections. 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, 1999

These projections indicate that the border region will experience a significant increase 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 and raise wages, a significant change in cross-border migration 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.

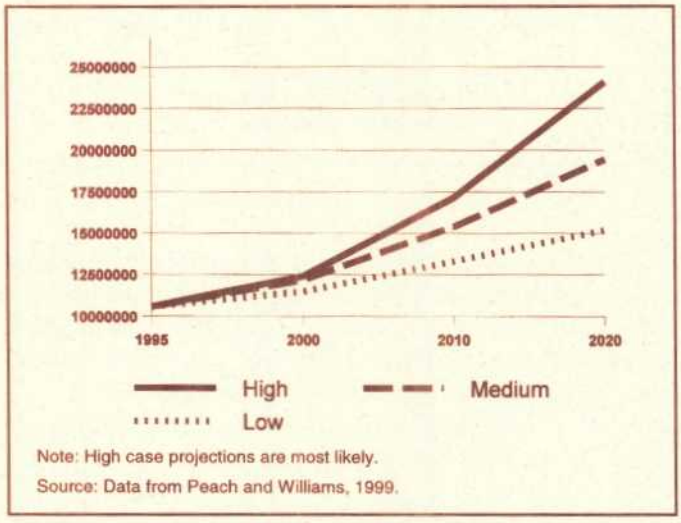

Figure 3. Population Projections for Border Counties and *Municipios*

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–early 1995 peso crisis from which Mexico has not yet fully recovered.

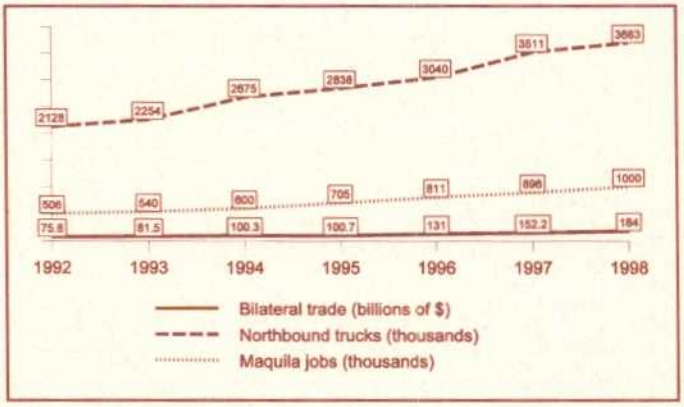

Figure 4. Growth of U.S.-Mexican Bilateral Trade

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.

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 8 to 10 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 relative 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.

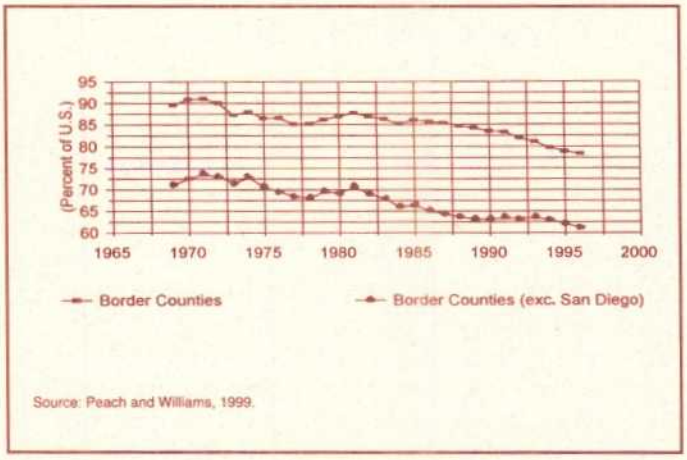

Figure 5. Border Region Per Capita Income as Percent of U.S. Per Capita Income

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 unemployment rates in double digits.

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 of low wages in Mexican border cities are compounded by the "dollarized" economy and the very high cost of living.

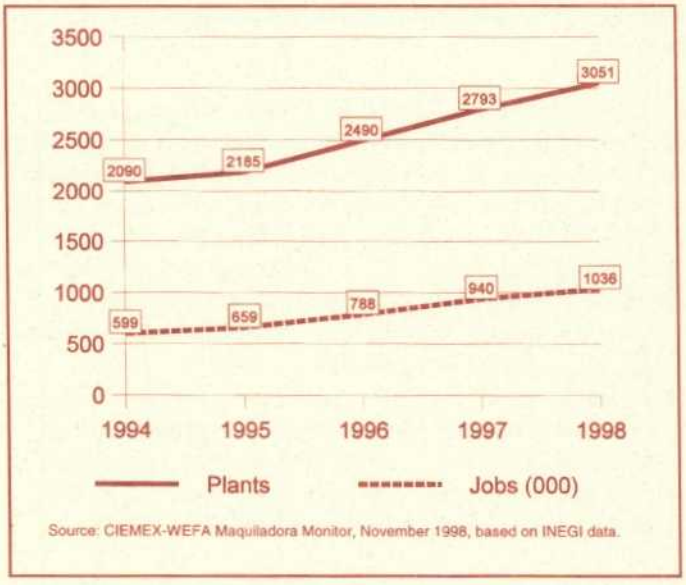

Figure 6. Growth of *Maquiladora* Plants and Jobs

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 assistance. 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.

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 governments 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 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, with limited water supplies for human activities and maintenance of important habitats and ecosystems adjacent to rivers, streams, and lakes. Increasing levels of competition among urban, agricultural, industrial, and environmental uses of water are seen 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. 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 deterioriation 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 rise 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, although 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 10 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, 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. 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 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 (PM10 and PM2.5) that is also carcinogenic.

With respect to point sources of air pollution, industrialization has accelerated in the region. 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, destruction of native habitats through grazing activities or agriculture, 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 or the Gulf of Mexico of the border region, particularly on the Mexican side of the border, is an important estuarine resource of significant value with diverse aquatic and terrestrial

ecosystems. 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 fish 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 in 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 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.

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 the affected 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 requires 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 United States Environmental Protection Agency 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 and 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 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 while designing procedures and programs, a process that considerably prolonged the start-up phase. To date, BECC has certified some twenty-four 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 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 were products of considerable discussion and a process of consensus building. There are several important concepts that underlie the vision statements:

- 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.

- The vision encompasses not only binational social and political arrangements but must be based on effective collaboration among the governmental, private, and public sectors.

- 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.

- 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.

- Quality of life factors, including health protection, educational opportunities, and equity concerns are critical to the vision of sustainability.

- 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 nonformal education.

Recommendations by Conference Participants

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

- 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

- 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.

- 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

  - Development of strategic objectives for economic development that may include border empowerment zones, diversification 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

- 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 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.

- 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.

- It is imperative that 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.

- 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.

- 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 problems of the border will have to be resolved through border institutions, cultures, and political will. These approaches will have to be unique to the region.

- 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.

- 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.

- 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.

- 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.

- A priority must be to promote economic development rather than growth, and local communities should:

    - Create appropriate business climate
    - Work to improve standard of living
    - Facilitate job creation in well-paying positions
    - Promote binational development collaboration
    - Adopt disincentives and incentives that promote long-term economic sustainability

- 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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The Southwest Center for Environmental Research and Policy (SCERP) is a consortium of five U.S. universities (San Diego State University, Arizona State University, New Mexico State University, University of Texas at El Paso, and the University of Utah) and four Mexican universities (Universidad Autónoma de Baja California, Instituto Tecnológico de Ciudad Juárez, Universidad Autónoma de Ciudad Juárez, and Instituto Tecnológico y de Estudios Superiores de Monterrey) dedicated to the resolution of border environmental issues. The consortium conducts applied research projects in cooperation with nongovernmental organizations; Indian tribes; the private sector; state, local, and federal entities; and other stakeholders in the border region. SCERP is actively involved in a spectrum of solution-oriented, multidisciplinary programs investigating transboundary watersheds and air basins, market incentives for pollution prevention, and border community and tribal environmental needs assessments. For more information on SCERP, see its web site at *www.scerp.org*

The **United States Environmental Protection Agency** (EPA) and its counterpart in Mexico, the Secretaría de Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP), are the lead federal coordinating agencies for the Border XXI Program, a five-year binational program to improve environmental conditions in the border area. Participants also include the Departments of Interior and Health and Human Services for the United States, the Secretaría de Salud for Mexico, and state environment, natural resources, and health agencies on both sides of the border. For more information on the Border XXI Program, visit the web site at *www.epa.gov/usmexicoborder/*

The **Border Trade Alliance** (BTA) is a grassroots organization dedicated to improving conditions for trade and economic development along the northern and southern borders of the United States, and elsewhere in the Americas. The mission of BTA is to promote, monitor, and influence public policy and private sector initiatives for the facilitation of international trade and commerce through research and analysis, strategic planning, issue development, education, and advocacy. Much of the work of BTA is accomplished by committees (Agriculture, Environment and Health, Industrial and Economic Development, Infrastructure, Maquiladora/Production Sharing, Ports of Entry, Retail and Tourism, Strategic Planning, Trade, and Transportation) that meet at the BTA international conferences. The BTA conferences meet each year in Washington, D.C., a border location, Canada, and Mexico. BTA headquarters are located in Phoenix and can be reached at (800) 333–5523.

SCERP, EPA, and BTA are planning Border Institute II for the spring of 2000. For more information, contact SDSU's Institute for Regional Studies of the Californias, *irsc@mail.sdsu.edu*

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