Chapter 5

Chapter 5

Challenge Theme 3. Protecting the Environment and Safeguarding Human Health

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Introduction

Many of the diverse, fragile ecosystems of the United States–Mexican border region are reaching unsustainable levels because of rapid population growth and changes in land use. Water shortages and pollution, poor air quality, increased soil salinities, and pesticides and heavy metal contaminants are some of the many stressors that are degrading the quality of life in the Borderlands. Lack of water treatment and wastewater infrastructure on both sides of the United States–Mexican border contributes to elevated rates of various communicable diseases most commonly found in developing countries: tuberculosis, intestinal infections, and hepatitis. Chronic diseases (diabetes, cancer, and heart disease) also prevail at high rates along the border, resembling trends observed in developed countries. In addition, the subtropical climate of the Borderlands is particularly suited for vectors of tropical diseases, such as malaria and dengue fever.

Health problems caused by zoonotic and emerging infectious diseases as well as from environmental contamination are predicted to increase significantly along the United States–Mexican border in the years ahead. As human populations increase and urban areas expand along the border, the potential for more frequent interaction between humans and wildlife increases, which in turn increases the possibility of disease transmission between wildlife and humans. Since international borders are not barriers to disease migration, coordination among United States and Mexican health officials concerning global epidemics, such as avian influenza (bird flu), can be of great importance in controlling the spread of diseases.

Issues—Environmental Stressors

Agriculture

Plentiful land, subsidized irrigation, and access to laborers made farming and ranching prosperous pursuits in the U.S. border states during the second half of the 20th century. Agriculture remains an important economic force, but it also can act as a stressor on the environment. Agriculture affects the environment and human health in the Borderlands through pesticide use, chemical and fecal contamination of surface water and groundwater, dewatering of habitats, salinization of soils on irrigated lands, and habitat fragmentation (Eswaran and Dumanski, 1994; Eswaran and others, 2001). In the warmer climates of the Borderlands where population is increasing, the competing demands for water are causing local water managers to rezone farmland for other uses, but production of cotton, vegetable crops, melons, citrus, and pecans is still common from the Imperial Valley in California, through Yuma, Arizona, to the lower Rio Grande valley in Texas. More people are living in proximity to agricultural areas now than in previous decades.

Lack of Infrastructure

In Texas alone, more than 1,800 rural communities, known as colonias, lack adequate sewer and water infrastructure, proper roadways, or structurally sound housing (Parcher and Humberson, 2007) (fig. 5–1; see also chapter 6). Commonly, dwellings in colonias are constructed in ephemeral stream channels (arroyos or washes), and when water flows through these channels, especially during summer monsoons, it carries refuse and human waste from the colonias downstream, often into adjacent cities. In many border cities, the storm-sewer infrastructure is outdated and lacks required capacity. Consequently, during heavy rains, flooded residential areas do not drain properly; stagnant water can remain for weeks, creating areas for mosquitoes to breed and increasing the opportunity for transmission of water-borne diseases. In the Ambos Nogales watershed—the sister city area of Nogales, Arizona, and Nogales, Sonora—summer flooding has caused ruptures in sewer pipelines. The mayors on both sides of the border are working to manage this problem so as to avoid contaminating the local Santa Cruz River, the main source of water for the area.

Figure 5–1. Many colonias along the United States–Mexican border often have substandard housing and lack critical infrastructure such as potable water, adequate sewer systems, proper drainage, and paved roads.

Transportation

Currently, Mexico is the second largest trading partner of the United States, after Canada. Trade between the United States and Mexico has soared over the past decade since the North American Free Trade Agreement (NAFTA) went into effect in 1994. In 2000, the value of trade had increased by 17 percent per year since 1995 and was projected to continue to grow at about 5.9 percent per year (Jannol and others, 2003). Trade between the United States and Mexico reached $347 billion in 2007. Goods predominantly move across the border on trucks, which pass through 39 ports of entry between the Pacific Ocean and the Gulf of Mexico. The current border-crossing infrastructure was not designed to handle the large traffic volumes that have developed since NAFTA, so international trade-related traffic destined for the interior of the United States or Mexico increasingly uses local transportation systems, many of them urban. This large amount of vehicles not only causes problems such as air pollution from idling cars and trucks waiting to pass immigration inspection, but also contributes to the accumulation of waste tires (fig. 5–2), the prevalence of oil and gasoline storage facilities, and increased transport of hazardous waste.

A line of trucks waiting at the border crossing leaving Tijuana, Baja California

Figure 5–2 (facing page). Increased traffic across the United States–Mexican border, especially trade-related traffic, has led to the accumulation of several waste tire piles in the border region (bottom). The U.S. Geological Survey has been able to locate waste tire sites through orthodigital photography (top).

Industry

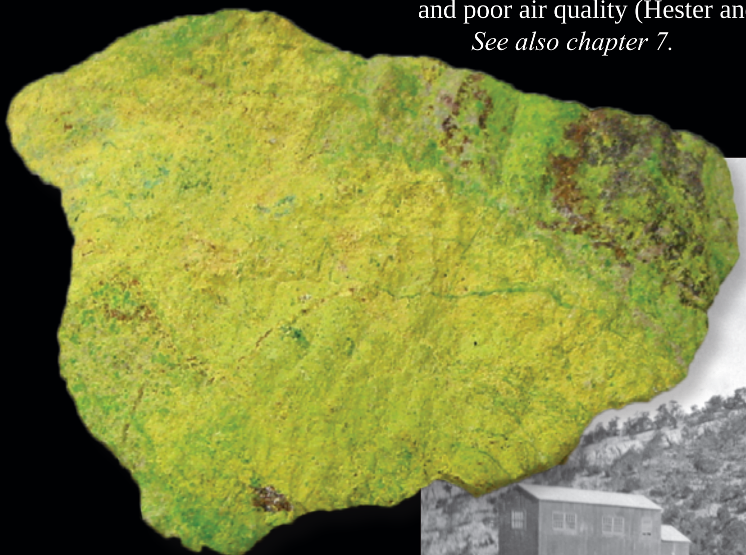
Foreign-owned manufacturing and assembly plants (maquiladoras) along the Mexican side of the border are an important source of employment, but many of these industrial sites are associated with negative effects on the environment. In 2007, more than one thousand industrial plants were estimated to be operating in the Mexican border states (Instituto Nacional de Estadística y Geografía, 2007). In addition to these facilities, more traditional sectors, such as petroleum refining and steel manufacturing, are also present in both countries. Despite laws on both sides of the border that regulate these industries, issues such as chemical production; pollutant discharge to air and surface waters; and the generation, transportation, storage, treatment, and inadvertent release of hazardous wastes contribute to environmental degradation (Good Neighbor Environmental Board, 2003, 2004; Anderson and Gerber, 2007).

Energy and Mining

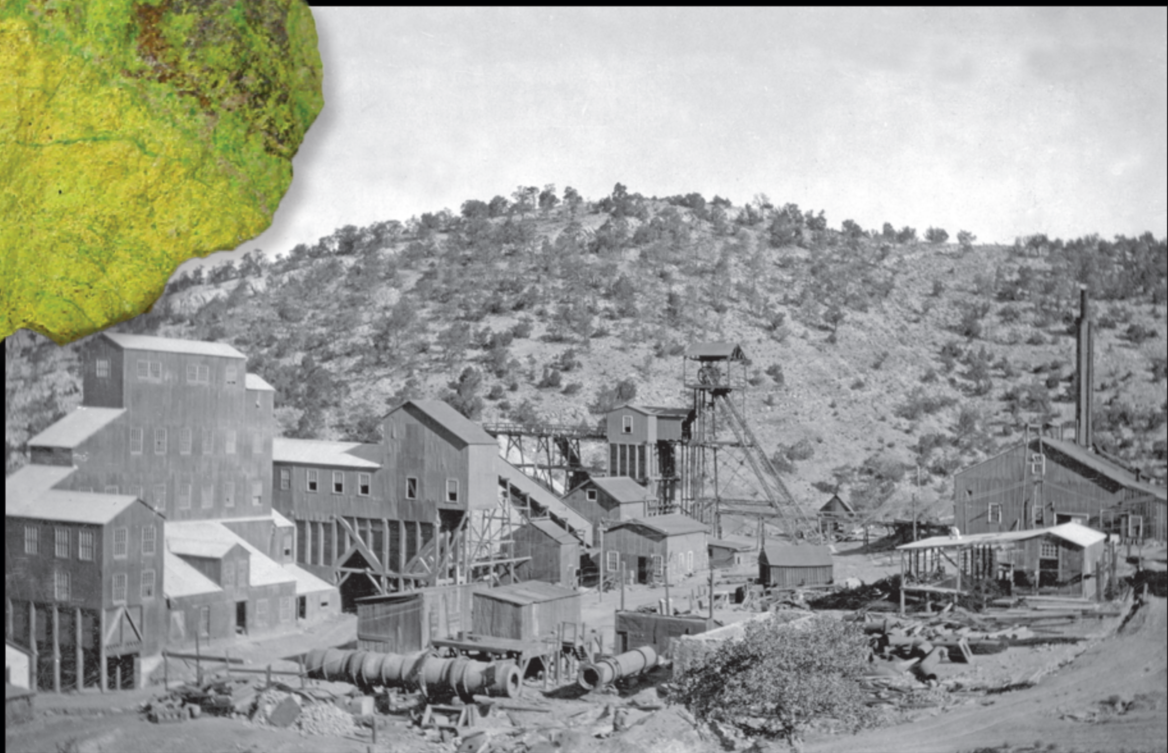
Northern Mexico and southern Texas have abundant energy resources including coal, coal bed methane gas, oil, and natural gas. The exploration, production, and transport of fossil fuels to provide for energy needs in both countries are expected to continue to grow into the near future (U.S. Energy Information Administration, 2010), and new infrastructure, such as power plants, coastal liquefied natural gas terminals, and wind turbine farms both on and off shore, will be needed.

Abandoned legacy mine lands dating from the Spanish colonial period to modern mines (to a lesser extent)—mining mostly porphyry copper–molybdenum, some gold, and other minerals—are sources of toxicants to land and water. For example, uranium ore has been mined along the Gulf Coast of south Texas (Finch, 1996), but continued mining of this resource threatens to affect air and water quality in the region. Activities of the energy and mining sectors may contribute to habitat destruction, water pollution, contaminated surficial soils, and poor air quality (Hester and Harrison, 1994).

See also chapter 7.



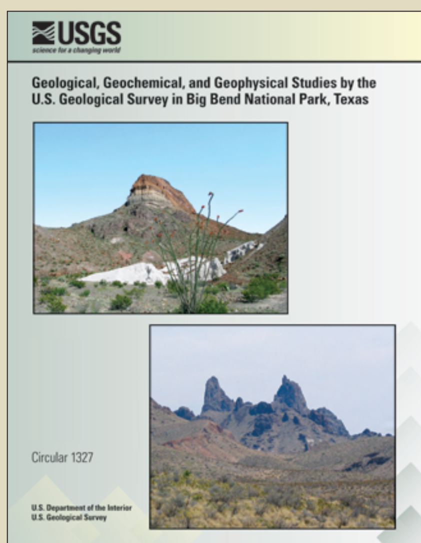
Uranium ore



Kelly mine, Socorro County, New Mexico, 1916

Mercury Contamination in Big Bend National Park, Texas

Big Bend National Park (BBNP) covers 324,231 hectares (801,163 acres) along a 190-kilometer (118-mile) stretch of the Rio Grande at the United States border with Mexico. The park is situated in the Chihuahuan Desert, an ecosystem known for its beautiful mountain and basin environments and extraordinary biological diversity of native plants and animals. The park is home to more than 1,200 species of plants and more than 450 species of birds, 56 species of reptiles, and 75 species of mammals. Mineral deposits bearing mercury, uranium, and fluorite have been found in BBNP, but of these, only mercury has been mined significantly. No mercury mines currently are operating in the area, but past total mercury production ranks the Terlingua district as the third largest mercury mining region in the United States. Mercury is highly concentrated around the abandoned mines, and water draining the mines enters streams in the local ecosystems. The effect of runoff from mines located inside and just outside the park boundary is a concern for both wildlife and humans. The USGS has been measuring mercury concentrations in mine waste, sediment, water, and air throughout BBNP to address potential mercury contamination around these mercury mines. Results of the USGS research (Gray and others, 2006) show that total mercury concentrations decrease in sediment collected more than 1 kilometer from the mine and are below the mercury concentration at which harmful effects are likely in sediment-dwelling organisms. Although mercury concentrations were elevated in mine waste, the concentrations of methylmercury were generally low in the ecosystems downstream because conditions for transformation to methylmercury are unfavorable in this hot and dry desert climate.



cinnabar

Stream sediments collected downstream from the Mariscal mine (bottom) in Big Bend National Park, Texas, showed rapid dispersion of total mercury and methylmercury (Gray and others, 2006). Mercury, such as contained in the cinnabar (mercury sulfide) sample shown (top), is no longer actively mined in the park, but mine waste can still contaminate the local ecosystems.

Status—Effects of Environmental Stressors

Air Quality

Large, industrial sister cities along the United States–Mexican border (San Diego–Tijuana, El Paso–Ciudad Juárez, and Laredo–Nuevo Laredo) fall short in meeting air quality standards (Naumann, 2004). The air pollution is contributing to human health problems and the loss of visual aesthetics (Sweedler, 2003). Emissions from cars, trucks, factories, and power plants and the burning of trash, especially tires, are the main sources of air pollution in the Borderlands (Sweedler, 2003; Good Neighbor Environmental Board, 2006).

A combination of high winds generated along dry/moist pressure gradients and abundant dust sources, including playas and dune fields, create dust storms; major storms occur almost annually in the Chihuahuan Desert area of Texas, New Mexico, and Chihuahua (T.E. Gill, Texas Tech University, written commun., 2004). In addition, the dry landscape, made up of agricultural fields, mine lands, and unpaved roads, is a constant source of airborne dust and particulates that contribute to the exposure of humans to potentially toxic heavy-metal and organic contaminants, pathogens, and allergens. The U.S. Environmental Protection Agency (EPA) has identified dust, sulfur dioxide, nitrogen dioxide, ground-level ozone, carbon monoxide, polycyclic aromatic hydrocarbons (PAHs), and mercury among the damaging pollutants affecting air quality along the United States–Mexican border (Currey and others, 2005; U.S. Environmental Protection Agency, 2011b).

2:40:06 pm

2:40:08 pm

2:40:11 pm

2:40:14 pm

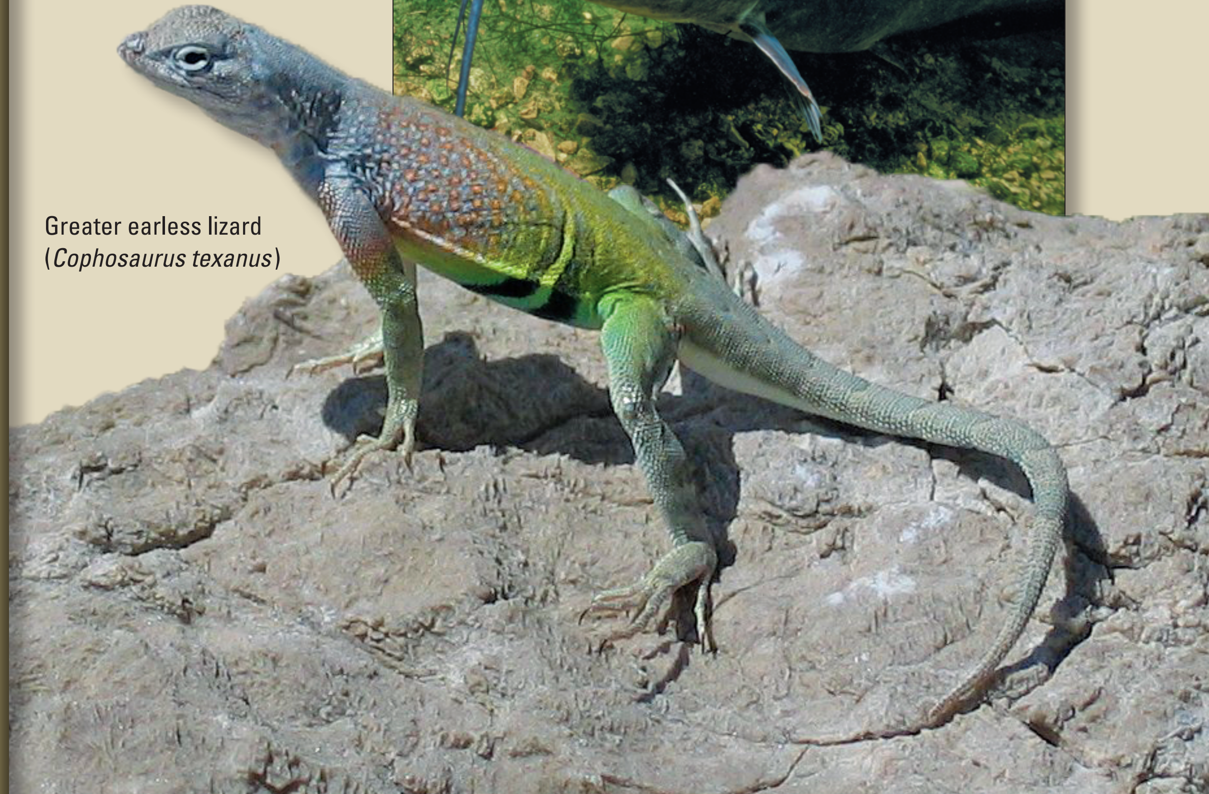
Time-lapse photos recording 8 seconds during a dust storm along south-bound Interstate 5 in southern California

Geo-Referenced Database of Contaminants in Biota

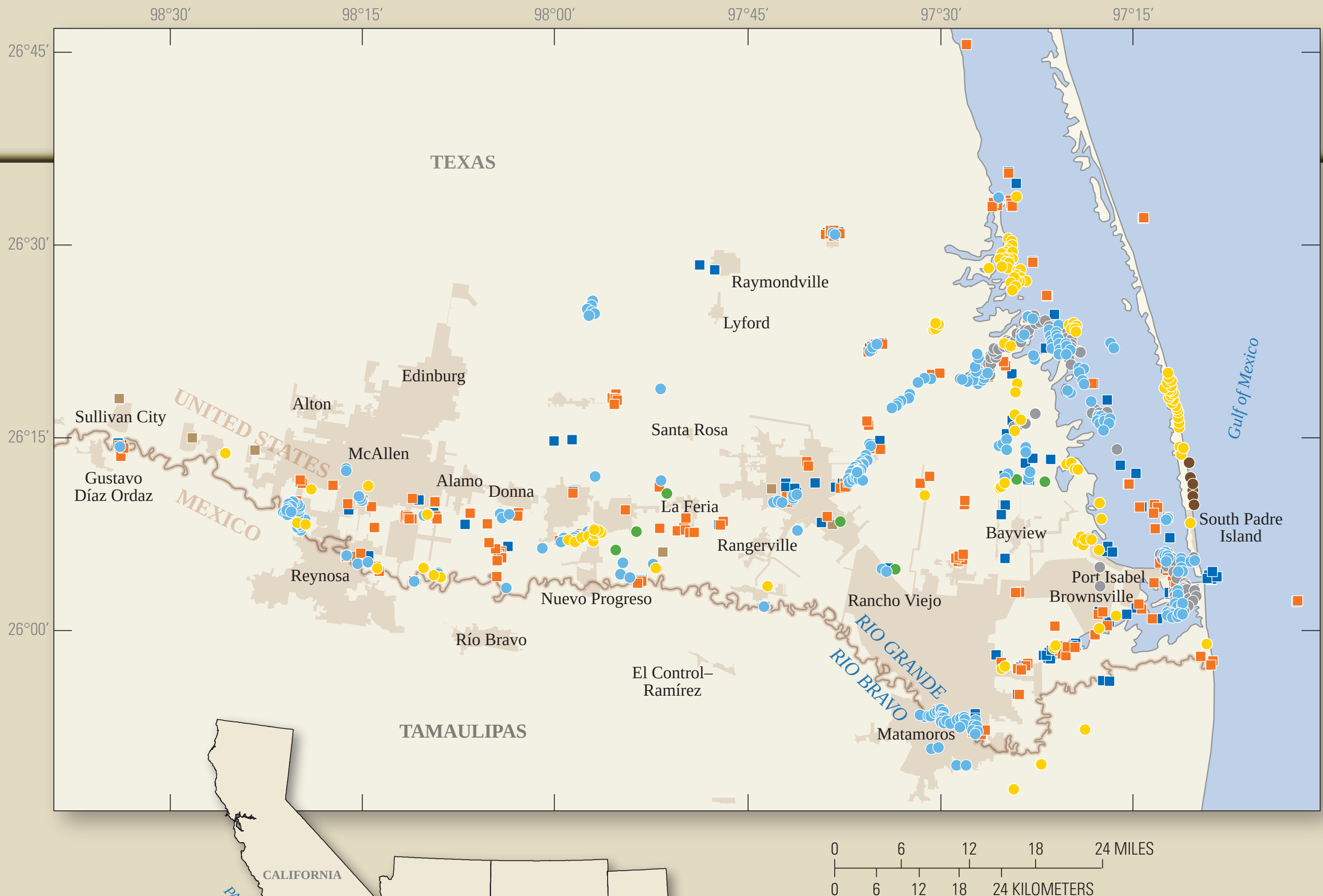
As part of the USGS Biomonitoring of Environmental Status and Trends program for the Rio Grande basin, contaminant stressors for the flora and fauna in the region were assessed. One product of the assessment was a geo-referenced contaminants-in-biota database of tissue residue information for aquatic and riparian species, collected from an extensive literature review (Mora and Wainwright, 1998). The assessment of the exposure of aquatic organisms to contaminants allows for the identification of those environmental contaminants to which humans and wildlife may be exposed. When combined with other data layers, public health professionals and natural resource managers can use this database to investigate relations between contaminants and potential sources (anthropogenic, geologic, etc.), map exposure routes, and indicate vulnerable communities or ecosystems.

Blue crab (*Callinectes sapidus*)

Channel catfish (*Ictalurus punctatus*)



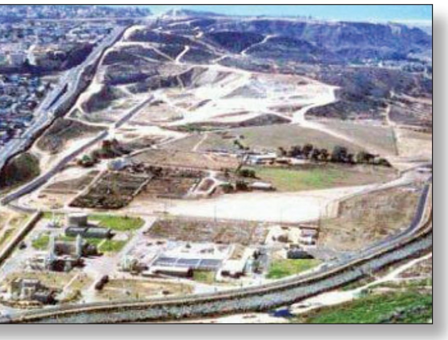
Greater earless lizard (*Cophosaurus texanus*)



Presence of contaminants in biota along the United States–Mexican border in the lower Rio Grande valley. Data from U.S. Geological Survey Border Environmental Health Initiative, Environmental Contaminants in Biota database (*http://borderhealth.cr.usgs.gov/datalayers.html*).

Great blue heron (*Ardea herodias*)

Water Quality



South Bay International Wastewater Treatment Plant

Agricultural practices on both sides of the border have led to pesticide contamination in lakes and rivers through agricultural runoff, as well as water contaminated by the elements selenium, manganese, aluminum, iron, zinc, and copper (Mora and Wainwright, 1998). Other sectors (industry and mining) might contribute to water contamination through the dispersion of cadmium, lead, cyanide, arsenic, mercury, PAHs, polychlorinated biphenyls (PCBs), and solvents from point and nonpoint terrestrial sources and aerial deposition. For example, heavy-metal concentrations from human sources in the San Pedro River of Sonora and Arizona exceed sediment-quality criteria (Gómez-Álvarez and others, 2007). Lack of proper or sufficient sewage and storm-water treatment facilities can also lead to water contamination, such as in the microbial contamination of potable and recreational waters in the Rio Grande (Texas Clean Rivers Program, 2009).

For many border communities, the Rio Grande is the only source of water for drinking, bathing, cooking, and washing clothes and dishes. Significant portions of the Rio Grande, however, do not meet standards for aquatic life and contact recreation uses, in large part because of the large amount of untreated wastewater and runoff that is discharged into the Rio Grande from both urban and rural communities, compounded by the limited flow and availability of water (Texas Clean Rivers Program, 2008). Conditions are equally poor in the western part of the Borderlands, where only recently the construction of new wastewater treatment plants has provided proper treatment for some of the millions of gallons of raw or undertreated sewage that flowed through California's New River (U.S. Environmental Protection Agency, 2011a) and Tijuana River. Nevertheless, the need to treat wastewater continues to exceed infrastructure capacity in much of the Borderlands (Briggs, 2007; Morales, 2007).

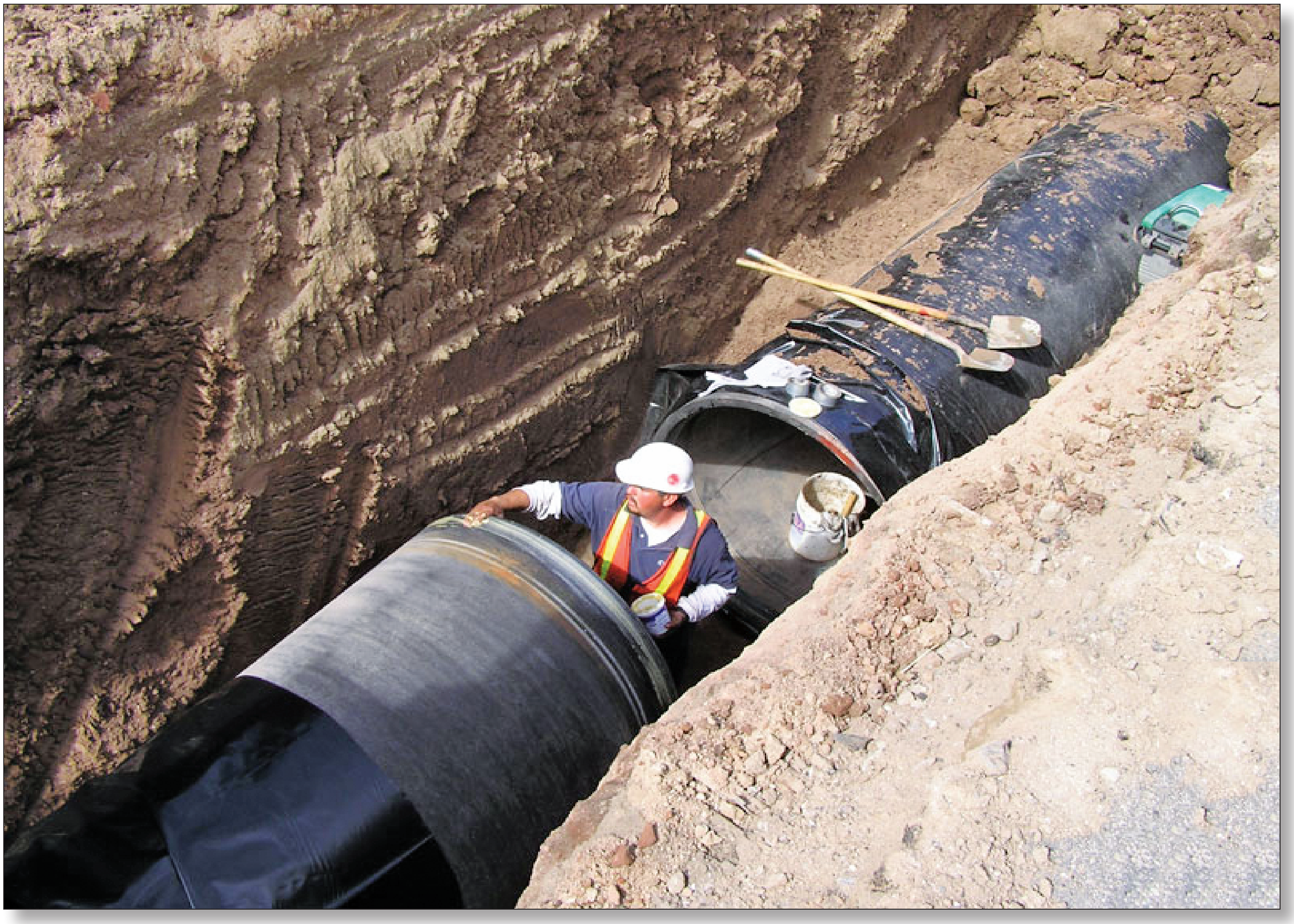
See also chapter 4.

Nogales International Wastewater Treatment Plant

Nuevo Laredo International Wastewater Treatment Plant

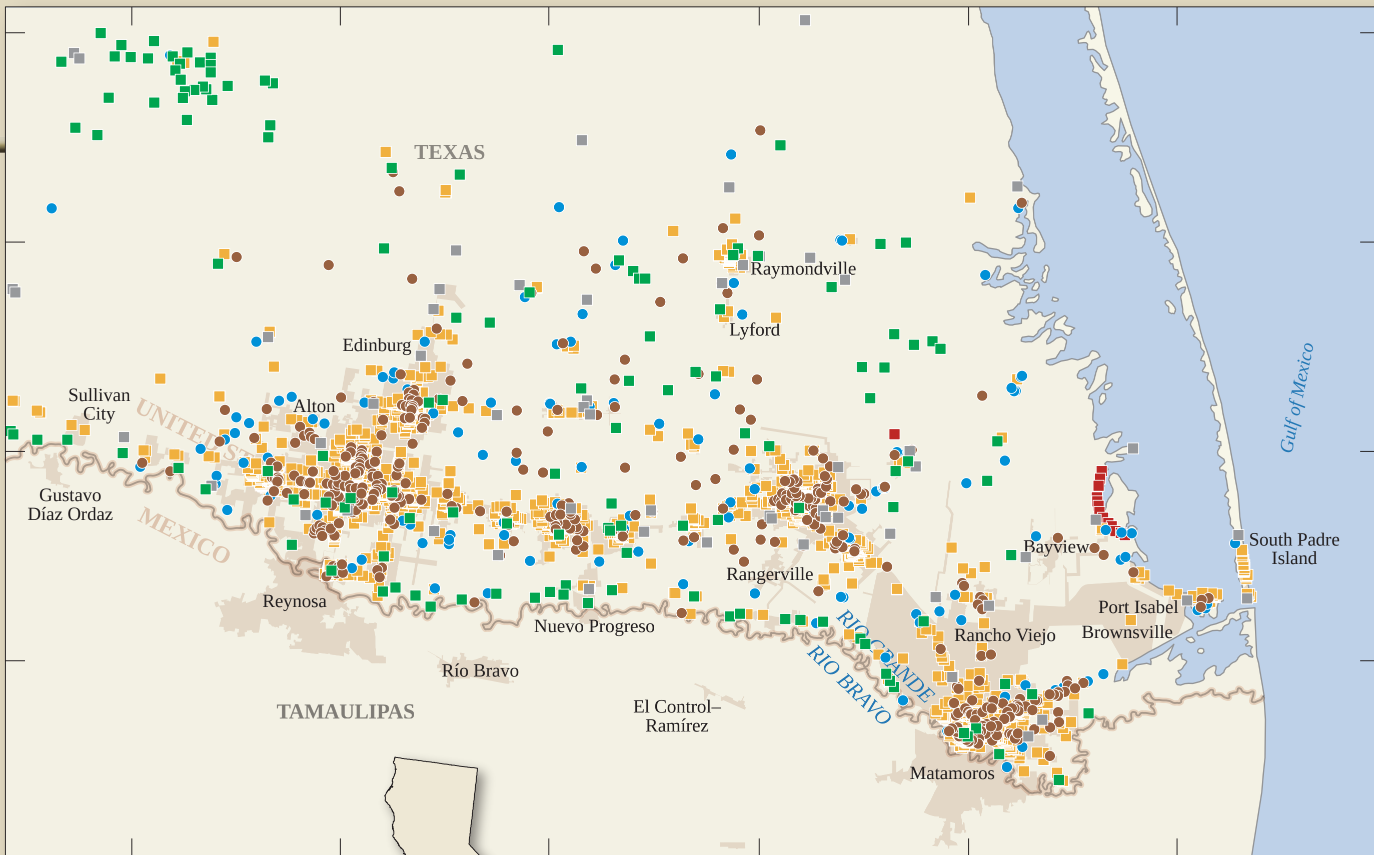
New River crossing the border into California

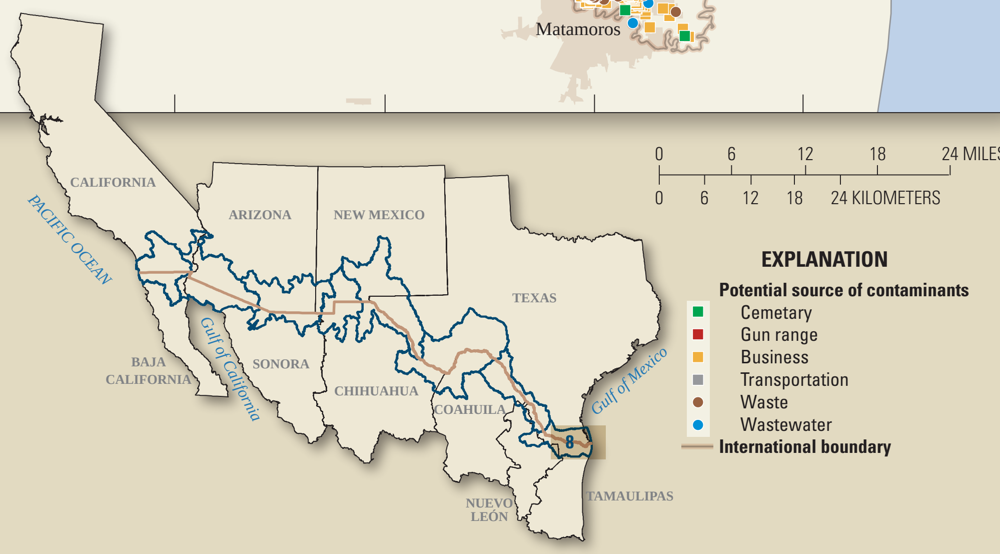
(Below) Sewer pipe being installed near the United States–Mexican border



Potential Sources of Contaminants in the Lower Rio Grande Valley

In the United States, the Safe Drinking Water Act requires that each State prepare a source water assessment of public water supplies. In cooperation with the Texas Commission on Environmental Quality, the USGS collected and geo-referenced more than 65,000 potential sources of contaminants (PSOCs) to groundwater supplies in Texas including landfills, waste piles, hazardous waste disposal sites, waste injection wells, oil and gas wells, and certain types of businesses. Because Mexican data gathered for this purpose are lacking, PSOCs in Mexico were interpreted from the most current Instituto Nacional de Estadística y Geografía (INEGI) vector and geographic names (topónimos) data. The United States and Mexican datasets were merged and then clipped along the binational watershed boundary for inclusion in the BEHI project. The dataset currently is limited to the border region between Texas to the north and Tamaulipas and Nuevo León to the south, but digital cartography information from the INEGI is being used to expand the dataset to include the adjoining Mexican states.

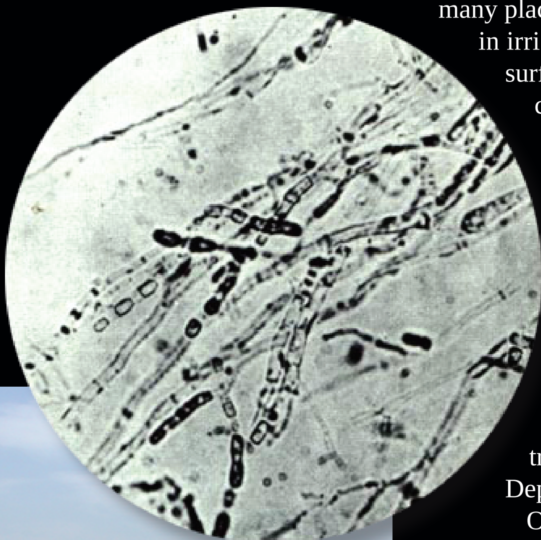




Potential sources of contaminants in eastern Texas along the United States–Mexican border. Data from U.S. Geological Survey Border Environmental Health Initiative, Potential Contaminants database (*http://borderhealth.cr.usgs.gov/datalayers.html*).

Soil and Sediment Quality

Sputum culture of *Coccidioides immitis*



Although air and water quality are of greatest concern with respect to environmental and human health throughout the Borderlands, contaminated soils and sediment are of concern in many places in the border region. Salt is present in all irrigation water, so its concentrations in irrigated soils increase over time, left behind after applied water evaporates from the surface or is transpired by plants. Soil salinization as a result of irrigation practices continuously increases in arid lands and, unless managed appropriately, eventually the land can no longer support life. Poor agricultural practices, among other causes, can also contribute to increased sedimentation in reservoirs and rivers, and sediments can choke and fill streams and wetlands, leading to stagnation and buildup of toxic contaminants. It is estimated that the storage capacity of the Amistad-Falcon reservoir system on the lower Rio Grande will be reduced 3.5 percent by 2060 given current sedimentation rates (Texas Water Development Board, 2005). Another effect of poor soil quality is the presence of Valley Fever, a common debilitating fungal disease caused by the microbe *Coccidioides immitis* and carried in windborne arid soils (Bultman and others, 2004; see also *http://health.usgs.gov/inhalation/valley_fever.html*). The rate of Valley Fever has tripled from 1999 to 2007 in Arizona, including those counties on the border (Arizona Department of Health Services, 2008).

One consequence of the maquiladora phenomenon over the last four decades is the accumulation of and increased exposure to industrial hazardous waste. Hazardous waste is dumped illegally just outside city limits, often in desert habitats; neighborhoods and communities are exposed to abandoned waste sites or industrial facilities; and hazardous waste from major industries is transported to municipal landfills, some which may not have the ability to safely store such waste. For example, unhealthy levels of arsenic and lead have been found in soils and sediments around a mine smelter in El Paso, Tex. (Ketterer, 2006).

Populations at Risk

The sectors of the human population most likely to exhibit poor health as a result of environmental degradation along the border are the young, the elderly, and pregnant women. Wildlife is also exposed to the same environmental stressors and in some cases even shares pathogens with humans. Air pollution puts the elderly and children, especially, at risk for respiratory diseases, irritated eyes, alterations in the body's defense systems against foreign materials, damage to lung tissue, carcinogenesis, and premature death. In 2004, the nonprofit organization Clear the Air projected that the total deaths attributable to power plants in California in 2010 would be 249, with related hospital admissions at 195; for Texas, the deaths were estimated at 1,160 and the hospital admissions at 1,105 (Schneider, 2004). Infectious diseases, particularly those associated with water such as gastrointestinal diseases and hepatitis A, are more prevalent in the Borderlands population than in the general U.S. population. In 2002, the rate of hepatitis A was 12.10 cases per 100,000 Hispanic children in San Diego County, compared to about 5.0 for all children nationally (Weinberg and others, 2004; Wasley and others, 2008). Mosquitoes carrying West Nile virus and dengue fever are of concern in the lower Rio Grande valley. The USGS is aiding public health officials by developing methods to identify areas of high soil moisture and therefore potentially stagnant water, which can be potential mosquito breeding grounds (Hubbard and others, 2008).

Lupus rates in Nogales, Ariz., (94 cases per 100,000 inhabitants) have been reported to be higher than the highest published rates recorded in medical literature (Balluz and others, 2001). This auto-immune disease is believed to be linked to environmental causes and in Nogales, Ariz., may be related to environmental contaminants (Balluz and others, 2001). Studies done in partnership with the Centers for Disease Control and Prevention have also noted suspected clusters of multiple sclerosis cases near a smelter in El Paso, Tex., (*http://www.dshs.state.tx.us/epitox/mspilot.shtm*) and childhood leukemia cases near a military installation at Sierra Vista, Ariz. (*http://www.cdc.gov/nceh/clusters/sierravista/*).

mosquitoes

Mosquitoes can transmit diseases such as West Nile virus and dengue fever. Prevention includes managing populations of live carriers (for example, *Aedes albopictus*, left) and identifying areas of standing water that serve as breeding grounds (top, *Culex* sp. larvae).

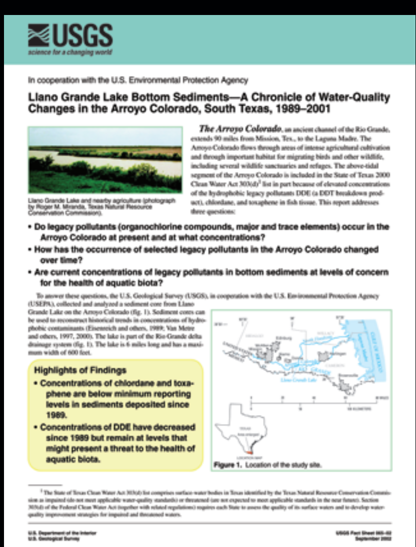
Exposure to environmental contaminants or pathogens can put stress on wildlife in the Borderlands already stressed by habitat loss, potentially making them more susceptible than unstressed populations to the health effects of toxins and disease-causing organisms. The health status of fish and wildlife species is detected through Federal monitoring programs, and the causes for poor health are investigated through laboratory and field studies. In this way, a wide range of contaminant-related wildlife health cases have been documented. Some migratory birds and predatory raptors show elevated levels of metals, organochlorine, and organophosphate pesticides, which affect reproduction (Mora, 2003; Mora and others, 2007), and similar chemical compounds at levels that exceed toxicity thresholds have been found in the tissues of fish from the Rio Grande, with biomarkers suggesting effects on their reproductive systems (Schmitt and others, 2005). The consumption of water contaminated by mine waste can also poison birds and other wildlife. Fish in some areas of the lower Rio Grande valley are contaminated with mercury and organochlorine pesticides to such an extent that the Texas Parks and Wildlife Department has issued human consumption advisories (Texas Parks and Wildlife, 2012). To the east, encephalopathic chronic wasting disease in white tail deer has just recently arrived at the Chihuahuan border from the north—it is unknown how this new disease will affect already stressed populations.

Sediment Cores as a Record of Environmental Contamination along the Rio Grande

Most chemical compounds released into the air and soil are eventually found in surface water and groundwater. Those compounds with chemical properties that make them difficult to breakdown can adsorb to sediment particles and be deposited on the bottom of a lake or at the mouth of a river. Over time, as sediments accumulate, a record of chemical inputs to the environment can be detected in the layers of sediment. The Texas Water Resources Center, through the USGS National Water-Quality Assessment Program, and State partners have been collecting data from sediment cores from a number of surface waterbodies associated with the Rio Grande basin in south Texas (Van Metre and others, 1997; Mahler and Van Metre, 2002). The results have facilitated an analysis of temporal trends and the identification of contaminant sources. Data have also been useful in water quality and risk assessment.

For example, in 1993, the EPA discovered high concentrations of PCBs in Donna Canal, an 11-kilometer (6.8-mile) canal flowing north from the Rio Grande to Donna Reservoir in Hidalgo County, Tex. In an attempt to determine the source of the contaminant, the USGS made five sampling trips to Donna Canal from February 1999 to April 2001, with the results of each trip narrowing the sampling area for the next trip (Mahler and others, 2002). The results of the sampling identified a 600-meter (1,969-foot) reach as the likely source, allowing the Texas Natural Resource Conservation Commission (now the Texas Commission on Environmental Quality) to focus their assessment and remediation efforts.

Example of a sediment core ready to be sliced for analysis.



In cooperation with the U.S. Environmental Protection Agency

Llano Grande Lake Bottom Sediments—A Chronicle of Water-Quality Changes in the Arroyo Colorado, South Texas, 1989–2001

Llano Grande Lake and nearby agriculture (photograph by Roger M. Miranda, Texas Natural Resource Conservation Commission).

The Arroyo Colorado, an ancient channel of the Rio Grande, extends 90 miles from Mission, Tex., to the Laguna Madre. The Arroyo Colorado flows through areas of intense agricultural cultivation and through important habitat for migrating birds and other wildlife, including several wildlife sanctuaries and refuges. The above-tidal segment of the Arroyo Colorado is included in the State of Texas 2000 Clean Water Act 303(d)[1] list in part because of elevated concentrations of the hydrophobic legacy pollutants DDE (a DDT breakdown product), chlordane, and toxaphene in fish tissue. This report addresses three questions:

- **Do legacy pollutants (organochlorine compounds, major and trace elements) occur in the Arroyo Colorado at present and at what concentrations?**
- **How has the occurrence of selected legacy pollutants in the Arroyo Colorado changed over time?**
- **Are current concentrations of legacy pollutants in bottom sediments at levels of concern for the health of aquatic biota?**

To answer these questions, the U.S. Geological Survey (USGS), in cooperation with the U.S. Environmental Protection Agency (USEPA), collected and analyzed a sediment core from Llano Grande Lake on the Arroyo Colorado (fig. 1). Sediment cores can be used to reconstruct historical trends in concentrations of hydrophobic contaminants (Eisenreich and others, 1989; Van Metre and others, 1997, 2000). The lake is part of the Rio Grande delta drainage system (fig. 1). The lake is 6 miles long and has a maximum width of 600 feet.

Highlights of Findings

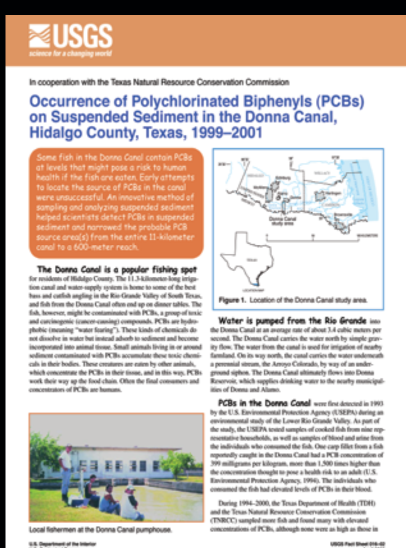
- **Concentrations of chlordane and toxaphene are below minimum reporting levels in sediments deposited since 1989.**
- **Concentrations of DDE have decreased since 1989 but remain at levels that might present a threat to the health of aquatic biota.**

Figure 1. Location of the study site.

[1] The State of Texas Clean Water Act 303(d) list comprises surface-water bodies in Texas identified by the Texas Natural Resource Conservation Commission as impaired (do not meet applicable water-quality standards) or threatened (are not expected to meet applicable standards in the near future). Section 303(d) of the Federal Clean Water Act (together with related regulations) requires each State to assess the quality of its surface waters and to develop water-quality improvement strategies for impaired and threatened waters.

U.S. Department of the Interior
U.S. Geological Survey

USGS Fact Sheet 065-02
September 2002



In cooperation with the Texas Natural Resource Conservation Commission

Occurrence of Polychlorinated Biphenyls (PCBs) on Suspended Sediment in the Donna Canal, Hidalgo County, Texas, 1999–2001

Some fish in the Donna Canal contain PCBs at levels that might pose a risk to human health if the fish are eaten. Early attempts to locate the source of PCBs in the canal were unsuccessful. An innovative method of sampling and analyzing suspended sediment helped scientists detect PCBs in suspended sediment and narrowed the probable PCB source area(s) from the entire 11-kilometer canal to a 600-meter reach.

The Donna Canal is a popular fishing spot for residents of Hidalgo County. The 11.3-kilometer-long irrigation canal and water-supply system is home to some of the best bass and catfish angling in the Rio Grande Valley of South Texas, and fish from the Donna Canal often end up on dinner tables. The fish, however, might be contaminated with PCBs, a group of toxic and carcinogenic (cancer-causing) compounds. PCBs are hydrophobic (meaning "water fearing"). These kinds of chemicals do not dissolve in water but instead adsorb to sediment and become incorporated into animal tissue. Small animals living in or around sediment contaminated with PCBs accumulate these toxic chemicals in their bodies. These creatures are eaten by other animals, which concentrate the PCBs in their tissue, and in this way, PCBs work their way up the food chain. Often the final consumers and concentrators of PCBs are humans.

Figure 1. Location of the Donna Canal study area.

Water is pumped from the Rio Grande into the Donna Canal at an average rate of about 3.4 cubic meters per second. The Donna Canal carries the water north by simple gravity flow. The water from the canal is used for irrigation of nearby farmland. On its way north, the canal carries the water underneath a perennial stream, the Arroyo Colorado, by way of an underground siphon. The Donna Canal ultimately flows into Donna Reservoir, which supplies drinking water to the nearby municipalities of Donna and Alamo.

PCBs in the Donna Canal were first detected in 1993 by the U.S. Environmental Protection Agency (USEPA) during an environmental study of the Lower Rio Grande Valley. As part of the study, the USEPA tested samples of cooked fish from nine representative households, as well as samples of blood and urine from the individuals who consumed the fish. One carp fillet from a fish reportedly caught in the Donna Canal had a PCB concentration of 399 milligrams per kilogram, more than 1,500 times higher than the concentration thought to pose a health risk to an adult (U.S. Environmental Protection Agency, 1994). The individuals who consumed the fish had elevated levels of PCBs in their blood.

During 1994–2000, the Texas Department of Health (TDH) and the Texas Natural Resource Conservation Commission (TNRCC) sampled more fish and found many with elevated concentrations of PCBs, although none were as high as those in

Local fishermen at the Donna Canal pumphouse.

U.S. Department of the Interior
U.S. Geological Survey

USGS Fact Sheet 016-02
April 2002

USGS Capabilities

The USGS can provide valuable resources in database development and geospatial analysis in both the human and environmental health fields to State, local, and binational commissions with responsibility for ensuring health and quality of life in the Borderlands. Within all the disciplines, USGS expert modelers work with others to develop the scientific tools to support management of our Nation’s natural resources and help protect lives and property. Scientists with the USGS involved in the Border Environmental Health Initiative project (BEHI; *http://borderhealth.cr.usgs.gov*) are working to facilitate compatibility and comparability between United States and Mexican databases on census information, health statistics, water quality, and contaminants to allow more rigorous transborder analyses of human health issues.

A number of Federal, State, and academic institutions are actively involved in addressing the effects of agriculture, and the USGS historically has supported these activities by providing long-term water quality monitoring, data modeling, and land cover and land use mapping. An expanded USGS role would provide leadership in the interpretation of water quality data relative to human and wildlife health, more extensive real-time surface water and groundwater monitoring information, long-term monitoring of biota for contaminant exposure and effects, aerial photography to enable the study of landscape conditions through remote-sensing analysis, and the studies needed to define transboundary groundwater resources and their interaction with surface waters. Currently, the USGS is leading a team to build a binational water quality database in southern Texas.

The USGS also has the opportunity to collaboratively develop systematic approaches for identifying and characterizing hazardous waste dump sites on both sides of the border. In the field of hazardous waste site monitoring and measurement, scientists with the USGS have developed new approaches and technologies to substantially improve the cost-effectiveness of site characterization. The collection, processing, and analysis of remote sensing data could be used to identify, assess, and monitor hazardous waste disposal sites and their history.

The complex political, sociocultural, and environmental conditions in the Borderlands present challenges to understanding current conditions and planning for future sustainability, but the scientific expertise of the USGS can provide the data needed to address those challenges. Communities and decisionmakers need sophisticated tools that accurately describe and monitor the state of the environment through the development and application of environmental indicators. Environmental indicators are statistics, measures, or parameters that track changes over time and summarize complex information about the environment into key measures (physical, chemical, biological, or socioeconomic) to holistically evaluate the condition of the environment. Indicators are developed by synthesizing and transforming extensive scientific and technical data into simply stated, meaningful information, providing an integrated approach to addressing environmental problems. Consistent measurement of indicators allows conditions to be assessed and monitored over short and long time periods and events to be forecasted or predicted. For example, the EPA identified the number of days during a given year in which air quality exceeded particulate matter standards as an indicator of air quality in the lower Rio Grande valley. Data collected by the USGS can contribute to the development of similar environmental indicators in the areas of water, geography, biology, and geology. The USGS can also provide state-of-the-art geospatial and remote sensing technology, as well as the powerful data management and information dissemination capabilities that are used in indicator assessment and monitoring activities. In addition to the scientific and technological capabilities of the USGS, its existing datasets for the Borderlands and its long-standing professional associations with Mexican scientists make it ideally suited to the development of environmental indicators in the Borderlands.

References cited in this chapter are listed in chapter 12.