

**ENVIRONMENTAL HEALTH IN THE U.S.-MEXICO BORDER REGION
FIVE-YEAR WORK PLAN
FOR FY2006 – FY2010**

BACKGROUND:

The border region of the United States and Mexico encompasses a vast and diverse array of physical settings and habitats that include wetlands, deserts, rangeland, mountains, and forests, which are unique in terms of the diversity of their water, mineral, and biological resources. The region is interconnected economically, politically, and socially owing to its bi-national heritage. In 1995, nearly 11 million people lived immediately adjacent to the border. By one account, the population could more than double by 2020. This rapid population growth and consequent economic development and land-use changes are pushing the limits of environmental sustainability and quality. Infrastructure development has lagged behind the rapid growth of the region, resulting in a shortage of water for municipal, agricultural, and industrial uses. These stressors threaten the quality of life in the region and raise concerns about the interdependence of environmental quality and human health. To allow for continued economic growth while protecting the area's natural resources and fostering a high quality of life, the United States and Mexico need an improved understanding of the threats posed by these anthropogenic changes.

International borders politically divide the landscape, but rarely represent barriers for environmental issues. The strategic issues surrounding the U.S.-Mexico border involve economics and population growth that present challenges to environmental management and natural resource planning. Resource managers and public health officials need ready access to accurate, impartial, scientific information to strike a balance among human needs for resource utilization, environmental quality, and human health. Bi-national information datasets are needed to develop a baseline of the status of the landscape, to monitor trends, and to facilitate analysis. Geographic data are readily available for both countries, but lack a structured framework and compatibility in terms of temporal and positional scale and consistent quality. This document presents information pertinent to the FY2006-2010 planning period, activities associated with this project are projected to extend beyond the current five-year plan.

OBJECTIVE:

The primary objective of this project is to develop a bi-national, web-based geographic information system (GIS) containing natural resource data that can be used to further our understanding of the links between the condition of the physical environment and environmental and human health issues (USGS 2004a). The web-based Internet Mapping Service (IMS) serves two functions: first, it provides a geospatial interface loaded with tools that allow the manipulation of spatial data; and second, it serves as a data portal allowing users to integrate the datasets into their own analyses.

KEY ISSUES:

The USGS has long contributed to understanding the implications of natural and anthropogenic processes to the status of the environment. In the past several years, concerted efforts have been made toward developing opportunities for collaborative research with public health agencies to improve our understanding of the linkages between the physical environment and human disease. These efforts have resulted in recognition by the biomedical and public health community of the significant potential for earth and biological sciences to assist in resolving a wide range of environmental health problems. The USGS is well-suited for providing the needed information.

Environmental issues of particular concern include:

- contaminants in ground water, surface water, and biota from agricultural, municipal, and industrial activities;
- airborne pollutants from fossil-fuel combustion and other activities;
- contaminants from past and present mining activities and mineral deposits; and
- pathogens, pharmaceuticals, hormones, and other contaminants released in treated and untreated human and animal wastewaters.

GEOGRAPHIC EXTENT:

The project will encompass the entire U.S.-Mexico border region (Figure 1), as indicated by the DOI U.S.-Mexico Border Field Coordinating Committee's (FCC) Water Resources Issue Team (Woodward and Durall 1996). As defined by the FCC, the border region contains about 157,600 square miles (408,185 square km) between the Pacific Ocean and the Gulf of Mexico. Surface-water drainage basins were used as the primary basis for delineating the extent of the border region from a shared-water resources perspective. Drainage basins either directly adjacent to or crossing the border were included; basins containing unconsolidated aquifers that extend to or across the border were included; and "protected areas" adjacent to the included basins were also selectively added to the border area. The limits of the hydrologic border region range from 4.5 to 285.2 km from the international boundary. The border region has been functionally partitioned into 8 sub-areas having similar hydrologic and physiographic features (Woodward and Durall 1996).

Initial project efforts (USGS 2004b) focused on the Rio Grande/Río Bravo from below Falcon Reservoir to the lower part of the Laguna Madre of Texas and the near-shore parts of the Gulf of Mexico (sub-area 8, as defined by the FCC). The sub-area encompasses 10,240 square miles-6,155 in Mexico and 4,085 in the United States (Figure 2). In Texas, the primary population centers are McAllen, Harlingen, and Brownsville; in Tamaulipas, they are Reynosa and Matamoros.

Figure 1. U.S.-Mexico border region as delineated by the FCC (Woodward and Durall 1996).

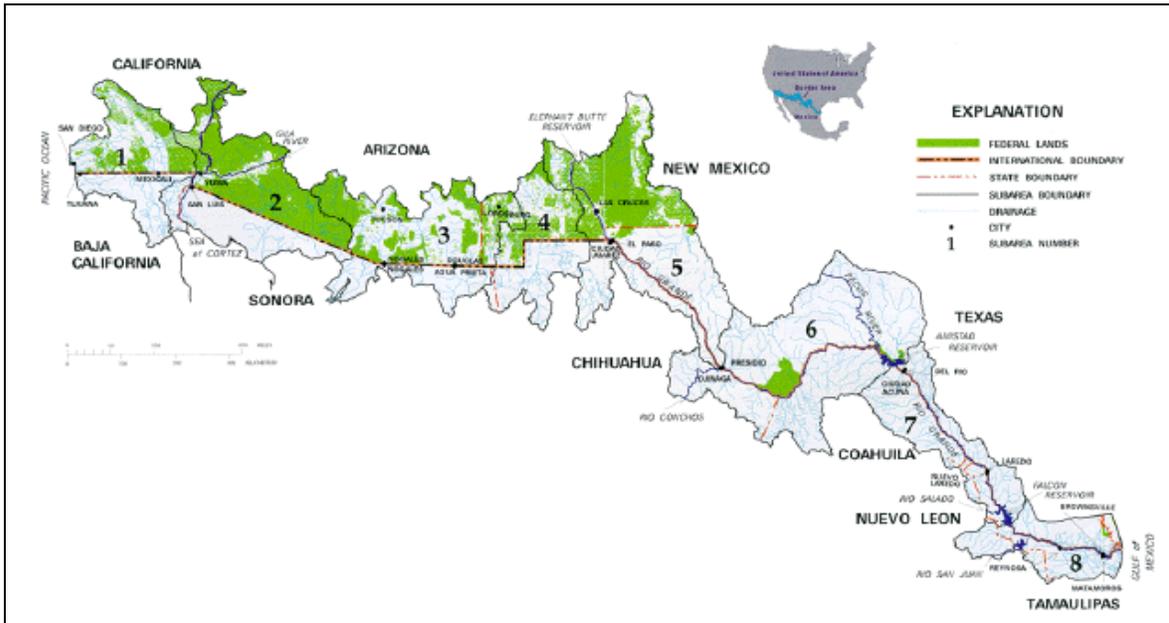
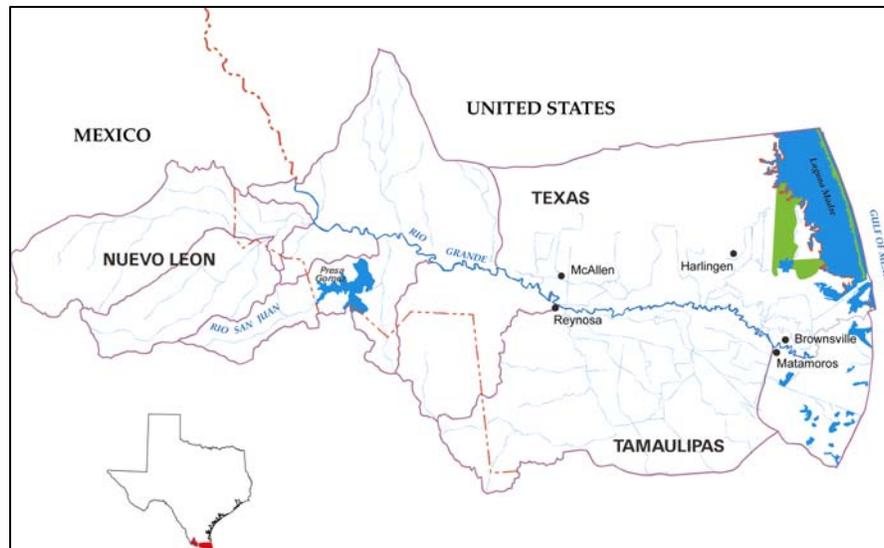


Figure 2. Sub-Area 8, as defined by the FCC (Woodward and Durall 1996).



METHODS:

Our efforts in FY2004-2005 in the Lower Rio Grande pilot sub-area have demonstrated that compiling and integrating datasets into a seamless, bi-national coverage presents significant challenges. Frequently, differences in scale, scope, definition of terms, and

methods of data collection are encountered. A major goal of this project is to preserve the accuracy and associated attributes of each dataset. Established accuracy, content, and symbolization standards ensure quality and comparability. USGS geographers, water resource specialists, geologists, and biologists have worked to develop comparable bi-national coverage and to verify the legitimacy of dataset integration. Project team members also investigate and interpret potential correlations within their respective disciplines that result from the integrated, bi-national database.

To create seamless, bi-national coverage in the pilot sub-area, the USGS assembled a wide cross-section of available datasets from both the United States and Mexico. The base map includes:

Level 1: Regional Base Map Layers:

- Medium-resolution satellite imagery;
- Medium-resolution digital elevation models;
- Major urban areas;
- Major roads;
- State and federal boundaries; and
- 1:5,000,000-scale geology.

Level 2: Local-level Base Map Layers:

- Existing land use and land cover data;
- Urban census and demographic data;
- Stream, canal, and river paths;
- Transportation routes;
- County and municipio boundaries;
- Urban area polygons;
- GNIS: features, airports, hospitals; and
- 1-500,000-scale geology.

Level 3: Area-Specific Layers

- Potential sources of contamination;
- The occurrence and distribution of contaminants in biota;
- The occurrence and distribution of contaminants in geologic formations;
- Human disease occurrence; and
- Integration of existing detailed geologic, geochemical, and geophysical data.

The Internet Mapping Service (IMS) for the pilot sub-area is now available to the public at <http://borderhealth.cr.usgs.gov> (USGS 2004b).

PROJECT TIMEFRAME:

The pilot effort has developed a functional interdisciplinary team approach, an appropriate geospatial framework, and compatible sets of procedures for continuation and completion of this border-wide project. This initial effort has provided a foundation that

will facilitate development of the GIS product in the remaining geographic reaches of the border.

In FY2006, efforts will establish a border-wide base map on the IMS using a medium-resolution basic geospatial framework including satellite imagery and digital elevation models with the locations of the major population centers (Level 1 coverage). This will provide the platform upon which to subsequently overlay more comprehensive datasets. For the remaining sub-areas in Texas and the adjoining Mexican States of Chihuahua, Coahuila, and Nuevo Leon (sub-areas 5, 6, and 7), we will add specific, local-level datasets such as high resolution aerial photos, land use and land cover, hydrography, demographics, transportation, potential sources of contaminants and contaminants in biota (Levels 2 & 3). Bi-national seamless integration methodologies developed in the Lower Rio Grande Pilot will be used to build integrated datasets.

In FY2007-2008, efforts will be ramped-up for completion of the comprehensive datasets Levels 2 and 3 across the entire border. The comprehensive datasets will be compiled and integrated to complete sub-areas 1-4. As with the pilot study in sub-area 8, applications will be developed to demonstrate the utility of our data integration and compilation efforts. Our existing team of scientists will be expanded to add regional expertise for sub-areas 1-4, which include California/Baja California, Arizona/Sonora, and New Mexico/Chihuahua.

In FY2009-2010, with the completion of bi-national integration of the data, multi-disciplinary research and analysis between USGS scientists and collaborative organizations can be implemented. Desired research includes a comprehensive border-wide land cover change detection from 1992 to 2002, demographic growth in relation to naturally occurring contaminants in soil and underlying rocks, surface water transport of industrial and agricultural contaminants, and investigation of habitat suitability for species at risk. Possible linkage to human health issues will be at the forefront of all research efforts.

PARTNERSHIPS AND COLLABORATION:

In FY04 and FY05, the multi-disciplinary team has established strong working relationships with the following agencies and US-Mexico Border Groups:

Data:

Instituto Nacional de Estadística, Geografía e Informática

Comisión Nacional del Agua

Texas Natural Resources Information System

University of Texas – Brownsville

University of Texas – Center for Space Research

University of Texas – Center for Research in Water Resources

University of Texas – Bureau of Economic Geology

Texas A&M University

Environmental Issues:

Border 2012 – EPA and SEMARNAT
U.S. Fish and Wildlife
Texas Office of the Attorney General

Public Health Issues:

Instituto Nacional de Salud Pública
United States-Mexico Border Health Commission
Texas State Department of Health Services

INTERACTION WITH UNIVERSITIES, BI-NATIONAL PARTNERS, AND OTHER PROGRAMS:

Efforts in the pilot sub-area have benefited greatly from interaction with the academic community. It is anticipated that strong partnerships will be developed and maintained with border-state universities throughout the life of the project. Additionally, this effort will continue to be of bi-national scope and value and will seek to include significant input and involvement of counterparts in Mexico. Our collaborators in Mexico will continue to be important contributors to the project as sources of pertinent data, as partners in study implementation and data integration, and as users of the final product. Efforts will be made to continue our established partnerships and to collaborate on the development of documentation of procedures for integration of bi-national data. Finally, the project will continue to seek opportunities for integration with existing and future USGS programs. As a case in point, this project could support the proposed USGS Transboundary Aquifer Assessment Program by serving as its geospatial foundation.

REFERENCES:

- USGS. 2004a. Science Data in Support of Environmental Health Studies in the U.S.-Mexico Border Region. U.S. Geological Survey Fact Sheet 2004-3013. February 2004.
- USGS. 2004b. Internet Map Service for Environmental Health in the U.S.-Mexico Border Region. U.S. Geological Survey Fact Sheet 2004-3140. December 2004.
- Woodward, D.G. and R.A. Durall, 1996. United States-Mexico Border Area, as Delineated by a Shared-Water Resources Perspective. U.S. Department of the Interior Field Coordinating Committee Fact Sheet 1.