

U.S.-Mexico Border Environmental Health Initiative

(1) PROJECT ACCOMPLISHMENTS/CONTRIBUTIONS

Summary:

The Border Environmental Health Initiative (BEHI) website experienced increased use from FY06 to FY07 according to all metrics for visitation, data downloaded, and maps rendered. Four new datasets and digital orthophotos were acquired from Mexican sources and agreements were reached with Mexican authorities to partner in publicly serving some of the binational data. Several binationally integrated data layers were newly developed, updated, or are in progress. The Internet Mapping Service was improved to make it more user-friendly and a much needed data download feature was developed through which several datasets were publicly released after peer review. Several new static maps have been provided through the website including an integrated map featuring US federally managed lands and lands in Mexico protected for natural or cultural resources. The BEHI team has begun a collaborative partnership with public health professionals in the Lower Rio Grande Valley to use the BEHI GIS products to investigate linkages between environmental conditions and public health. The goal of this project is to provide a tool for public health officials to identify those geographical areas where poor human health is expected based on environmental conditions. A major outcome from this effort is development of a binational surface and ground water quality database for the entire US-Mexico border. In addition, Petroleos Mexicanos (PEMEX) has invited the BEHI team to become involved in their efforts to identify and implement appropriate models that can use their geospatial data products to answer resource questions relative to environmental quality in the gas fields of the Burgos Basin, northeastern Mexico such as the effects of gas exploration and development on groundwater. BEHI team members made five presentations at professional scientific and border meetings and published six reports. BEHI lead PIs serve on six border committees or workgroups.

Detail:

Task 1: Development of Data Applications

Application 1 – Use of Border Health GIS to Investigate Linkages between Environmental Conditions and Public Health. In late 2006, a collaborative project with the Pan American Health Organization (PAHO) to use a GIS-based approach to investigate linkages between environmental conditions and human health was accepted. The project uses environmental variables to predict fish health and to predict human health based on a GIS weight-of-evidence and linear regression statistical approach. The project will continue into FY2008 during which time the model will be run with available datasets and additional data will be collected on fish health. We will ultimately look at how well the health of biota spatially co-located with humans correlates with human health to determine whether fish health can be a predictor of general human health with respect to general environmental quality. Together with Sally Edwards of the PAHO we identified our study site and specific study objectives. Initially, PAHO had intended to contribute funds to support an epidemiologist for the project, but because of the late FY2006-2007 budget allocations for their agency they were unable to make the

commitment. In addition, Ms. Edwards was relocated to the CDC, Washington, DC and as a result became less involved in the project. Nevertheless, Hal Zenick of the EPA Border 2012 program has had the proposal reviewed by EPA staff and has agreed to provide funding to support an epidemiologist for the project. In addition to securing EPA funding for an epidemiologist in FY2008, project accomplishments include: 1) identifying and compiling all available fish health datasets from multiple state, federal and local sources; 2) training project staff to use the GIS weight-of-evidence/linear regression software and model; 3) meetings with Texas Department of Health Services, University of Texas-Brownsville Public Health Sciences researchers to identify an epidemiologist for the project and collaborative opportunities through this project; and 4) identification and compilation of a binational water quality database for both groundwater and surface water. We found that there were multiple efforts underway to develop an integrated binational water quality database for the border region. Therefore, we have worked with IBWC and state and federal agencies on both sides of the border to ensure that ongoing efforts are coordinated as well as possible, and to identify synergies among the ongoing efforts. Initial coordination has resulted in general agreement on the type of data (ie., that collected for a specified or continuous period of time and (or) for a specific purpose) to be used but approaches to compiling the data still need to be agreed upon. To this end, a workshop has been scheduled in Juarez, Chihuahua in December of 2007 to identify (particularly on the Mexican side) any existing data not yet collected that should be included in the compiled database and to decide on the specifics of how the database will be structured, compiled, and warehoused. The following are the data sources the USGS has identified thus far along with a description of the data. Note that the integrated binational water quality data will be provided through the BEHI website and IMS.

Texas Water Development Board (TWDB): approximately 4700 groundwater wells with water quality data (major ion, trace elements, TDS, pH)

Texas NWIS database: 380 sites with water quality data, 130 surface water sites, 239 ground water sites, and 13 springs (major ions, trace elements, nutrients, pesticides, VOC's). New Mexico and California have been contacted in order to obtain their data.

Environmental Protection Agency (EPA): Under the guidance of the Border 2012 program, constituents were limited to the following (Dissolved oxygen, nutrients, chlorophyll/biomass, conductivity, chloride, sulfates, Acidity/pH, Biochemical Oxygen Demand (BOD), total suspended solids (TSS), Fecal Coli form, Fecal Streptococci, Temperature, and Total Dissolved Solids (TDS). There are 1933 sites with water quality data (both surface water and groundwater). These data are from the Ca, NM, Az, and Tx Legacy Storet databases but collected by 19 different agencies.

International Boundary and Water Commission (IBWC): 80 surface water sites that are part of the Clean Rivers program with water quality data (Major ions, conductance, Dissolved oxygen, pH, nutrients, fecal coli form, Chlorophyll-A, TDS). There are also approximately 100 sites that are not associated with the clean rivers program that are sampled infrequently and (or) have historical water quality data.

Center for Research in Water Resources (CRWR): Database is an Arc Hydro model geodatabase. This geodatabase contains 201 sites with water quality data (major ions, nutrients, pH, E. coli, Fecal Coliform, and Dissolved Oxygen). These

data are from IBWC and the Mexican National Water Commission (CNA – SNICA). There is some overlap between this database and IBWC's data set.

Mexican National Water Commission (CNA): 346 surface water sites with water quality data (Major Ions, pH, solids). Some of these data are overlap data and may already be included in the CRWR and (or) RTI databases.

Texas Commission on Environmental Quality (TCEQ): 360 surface water sites with water quality data (Major ions, Trace Elements, pesticides, nutrients, VOC's). Some of these data fall outside the study area boundary. Also, some of these data are overlap data and are already included in the IBWC and (or) NWIS databases.

Application 2 – GIS Applications for Land Use Planning: Collaborations with PEMEX (Petroleos Mexicanos) in the Burgos Basin of Northern Coahuila, Nuevo Leon, Tamaulipas, Mexico. BEHI leads attended a meeting in Mexico City at the invitation of PEMEX in early May to meet with personnel from the Instituto Nacional de Ecologia, PEMEX's Subdirección de Seguridad Industrial, Protección Ambiental y Calidad (SSIPAC-PEP), and the Instituto Tecnológico de Estudios Superiores de Monterrey. BEHI leads presented an overview of the BEHI project, the datasets we have available, and a variety of potential approaches and models as options for analyzing the GIS-based land use data collected in the Burgos Basin. Mexican participants expressed great interest in collaborating. It was agreed that BEHI leads would propose three focus areas for Mexico's consideration. These areas are: 1) analysis of habitat fragmentation, 2) analysis of groundwater contamination by potential sources of contaminants, 3) and analysis of air quality impacts. In FY2008, Mexico will review these proposals and if accepted, PEMEX will request scopes of work. An important aspect of this project is an official agreement between PEMEX and the USGS. BEHI leads have been working closely to assist Ms. Jean Weaver, Regional Specialist for Central America/ South America/Caribbean, International Programs in establishing this important agreement that will facilitate exchange of data, scientific materials, and mechanisms for funding joint projects.

Application 3 – Investigation of Linkages between Geologic Conditions and Human Health Risks. A first draft has been prepared of the USGS geologic map report on the middle Rio Grande: ***Page, William R., Snyders, Scott R., Berry, Margaret, and VanSistine, D. Paco, in review, Preliminary geologic map of the Ciudad Acuna, Piedras Negras, Nuevo Rosita, and Nuevo Laredo 1:250,000-scale quadrangles, Mexico, and the Laredo, Crystal City-Eagle Pass, San Antonio, and Del Rio 1:250,000 quadrangle, Texas: U.S. Geological Survey Open-File Report-XXX, scale 1:250,000-scale.*** The report includes a newly compiled geologic map digital dataset integrating geology from the Ciudad Acuna, Piedras Negras, Nuevo Rosita, and Nuevo Laredo 1:250,000-scale quadrangles, Mexico, and the Laredo, Crystal City-Eagle Pass, San Antonio, and Del Rio 1:250,000 quadrangle, Texas. It includes background information on the geology as it relates to environmental health, a full description of rock units in the study area, and a correlation of map units diagram that shows the chronologic relationship between map units. To supplement the geologic map dataset, we compiled several GIS layers which show locations of inactive and active mines, oil and gas wells, coal-burning power plants, major ground water aquifers, coal-bearing units, and uranium-bearing units. The geologic map has many applications; one of the most important is that it establishes the binational geologic framework required for

ground water modeling efforts, especially for the southern Carrizo-Wilcox aquifer, a major aquifer located in the heart of the study area. In order to assess and model transboundary aquifers in the US-Mexico border region, it is extremely important to establish the binational geology of transboundary aquifer systems.

Collaboration with Dr. Elizabeth Heise and graduate students (University of Texas, Brownsville) resulted in initiating a project “Radon in sediments and Soils; A case Study” in the Brownsville, Texas area.

September field work also included setting up geochemical sampling grids and collecting new stream sediment and soil samples for the greater Laredo, Texas area. These data will support Task 1, Application 1 by identifying potential contaminants that may have impact on human and wildlife health.

Soil moisture research and modeling which forms the basis of risk mapping for potential mosquito breeding habitats and spread of vector-borne disease continued. Fieldwork was conducted to validate and ground truth new mapping of the Beaumont, Goliad, and Lissie Formations, and Holocene Rio Grande fluvial/deltaic deposits in the Lower Rio Grande. Results of work will be published on Version 2 of the geologic map of Lower Rio Grande Valley.

Task 2: Identification and Assimilation of Supplemental Data

In FY 2007, a major focus included identifying, obtaining, and assimilating supplemental data for the Mexican portion of the border region and for the Southwest portion of the United States. Through partnerships with INEGI (the Mexican mapping and Census bureau), and SEMARNAT (Mexico’s Environmental Protection Agency) various critical data layers were obtained for incorporation into BEHI. The data provided through BEHI, in particular the new binational water quality database developed in support of Application 1, will facilitate development of a foundation for work under the “U.S.-Mexico Border Transboundary Aquifer Assessment Act”.

With acquisition of the Mexican Land Use and Land Cover (LULC) data we were able to make progress towards assimilation of a border wide binational Land Use and Land Cover (LULC) dataset for 2001. Now with the availability of the 1992 and 2001 temporal LULC datasets for the entire border region, synthesis of landscape characterization and change can be developed for the entire border region.

Hydrologic data at 1:50,000-scale in Mexico and the National Hydrography Dataset for the U.S. were obtained for the entire border region. With this data, transboundary hydrography network models were built under reimbursable funding from the International Boundary and Water Commission and hydrography data was assimilated for the entire Texas-Mexico border area.

In partnership with the National Geospatial Intelligence Agency, over \$1.5 million in funding was obtained to fly high resolution LIDAR data for the California, Arizona, and parts of New Mexico and Texas borders. These data include a 3-mile swath on the Mexican side and will be publicly available. Discussions were held with the USGS National Elevation Dataset team to harmonize the elevation data across the border using

the LIDAR data to smooth out elevation discrepancies between the two countries. This work will be undertaken in FY08.

Progress has been made in the assimilation of contaminants in biota data for the entire border region. The original contaminants and biota database underwent a thorough quality control assessment and has been restructured to facilitate access and use. Additional data records have been added for the border region and include 152 new sites, 251 new samples and 2051 new results.

The dataset of potential sources of contaminants was expanded beyond Texas to Arizona and Mexico. The original potential sources of contaminant dataset for Texas is quite unique and extremely useful for analyzing ground water and surface water contaminants. Similar data exist for the other border states, but the data are scattered among various state and local agencies and are not as comprehensive as in Texas. Funding provided to the Western Region, facilitated data collection for several counties in Arizona and Mexico (from INEGI's 1:50,000-scale vector datasets for urban features and named entities). Currently, INEGI is reviewing the data and the process before the USGS can publish this binational dataset.

USGS completed a binational transportation dataset for the Texas/Mexico border and a binational urban area extent dataset for the entire border. Through a partnership with New Mexico State University, the NMSU will finish the binational transportation dataset for the entire border region and add in border crossings.

In partnership with the Housing and Urban Development and the Texas Secretary of State, the Colonias Health, Infrastructure, Platting and Status (CHIPS) tool and colonias database has been published for six counties in Texas. The CHIPS tool and colonias data were used to report the status of colonias in Texas for the Texas SB 827 and Texas FY2007 Legislative session.

In FY2007, groundwater datasets have been identified in the US along the entire border and in some areas of Mexico. Data includes identification of well sites and water quality. Mapping of this information will take place in FY2008.

Preparation of Version 2 of the geologic map dataset for the Lower Rio Grande Valley continued. New work included replacing INEGI geologic datasets with the Servicio Geologico Mexicana (SGM) datasets. Although at the same scale of 1:250,000-scale, SGM datasets are much higher resolution than the INEGI datasets allowing greater unit correlation and vast improvement in the integration of US and Mexico map coverage data. SGM quadrangles for Reynosa, Monclova, Rio Bravo, and Matamoros were scanned and digitized. In addition, fieldwork was conducted for ground-truthing new mapping based on remote sensing and soil geochemistry. Sediment and soil samples were collected to fill in gaps from past soil sampling projects in Lower Rio Grande. Results of this fieldwork will contribute to the completed Version 2 map. Version 2 will replace Version 1 (currently on the IMS) on the borderhealth IMS website.

A clip of a 1:5,000,000-scale Geologic Map of North America was prepared and submitted to EROS for posting on the BEHI IMS website. Map shows seamless geology across the entire US-Mexico border region and includes a legend for units exposed in borderlands region. The map is currently a georeferenced graphic dataset that can be

displayed with the IMS viewer and analyzed with other binational datasets as a reconnaissance tool.

Work continued on binational geologic framework studies of the headwaters of the San Pedro river basin in Sonora and Arizona, and characterization of the San Pedro alluvial aquifer system based on geophysical and geologic data. The land use, geology, and contaminants data will provide valuable information for ground water/wellhead protection.

Draft Binational Image Maps were prepared for the International Boundary and Water Commission under a reimbursable agreement. The final maps will be completed by INEGI. Capacity training by the USGS is to be provided to INEGI.

Task 3: Data Access and Internet Mapping Tools

To improve access to the binational datasets, the BEHI team created a new easy to use data download page which can be accessed at the main site or directly at, <http://borderhealth.cr.usgs.gov/datalayers.html>. The datasets range from binationally integrated fundamental geospatial and environmental scientific datasets for the U.S.-Mexico border study area at various scales. Links are available to the data in several formats, to current status maps of data holdings, and to the metadata files. Other features of the data download page include Internet URL addresses and instructions for accessing digital orthophotos, digital elevation models, and the North American Atlas from the USGS and INEGI online data sources.

The look and feel of the Internet Map Service (IMS) was updated to reflect technological advances. Seven updated or new data layers were added to the viewer. In addition, Mexican digital orthophotos were added to the BEHI IMS for viewing with the U.S. digital orthophotos. As new digital orthophotos become available for the U.S. side of the border, they will be added to the IMS.

New data access of the binational data in Google Earth and Google Map KML format is undergoing testing for public access from the data download page. This provides easy viewing ability for non-GIS users.

The International Boundary and Water Commission (IBWC) provided funding to develop and implement an interface between the on-line US-IBWC stream gage site information and the base binational data layers from BEHI to create a new IMS site at <http://igskmncngs086.cr.usgs.gov/website/ibwc/viewer.php>. The site provides an overview Web page for the US-IBWC monitoring sites, which displays a summary of available data, a map of the site area, a photograph of the site area (if available), and summary water flow graphs (if historical data is available). The data sources were formatted to streamline the operation and maintenance of the dynamic Web pages using an Access database that is compatible with the US-IBWC GIS.

Task 4: Publications, Outreach, and Training. See (3) and (4).

(2) PROJECT WORKPLAN AND BUDGET FOR FY2008 – See attached separate document.

(3) NOTEWORTHY COLLABORATIONS, MEETINGS, AND TECHNICAL TRANSFER ACTIVITIES

1. Developing a Binational Geodatabase to Examine Environmental Health and Quality-of-Life Issues along the U. S.–Mexico Border, 2006 at the Global Spatial Data Infrastructure Conference, November, Santiago, Chile.
2. U.S.-Mexico Border Environmental Health Initiative. 2006. Diana M. Papoulias. Environmental Sustainability: U.S.-Mexico Issues. November 14-17, Monterrey, Mexico
3. USGS's Border Environmental Health Initiative. Jim Stefanov and Jean W. Parcher. USGS National Water Science Meeting, New Orleans. January, 2007.
4. Multi-temporal Remote Sensing of Soil Moisture and Vector-borne Disease Potential in the Rio Grande Delta, South Texas/North Tamaulipas, US-Mexico Border Area. 2007. Bernard E. Hubbard, William R. Page, Helen W. Folger, Matthew D. Merrill, Jean W. Parcher. Second National Conference on USGS Health-Related Research, Reston, VA. February 27-March 1.
5. U.S.-Mexico Border Environmental Health Initiative. 2007. Diana M. Papoulias, Jean W. Parcher, Jim Stefano, William R. Page. Second National Conference on USGS Health-Related Research, Reston, VA. February 27-March 1.
6. USGS US-Mexico Border Workshop: Monitoring, Modeling, and Forecasting in Response to Climate Change, Tucson, Arizona, March, 2007. Purpose of the workshop was to help develop research pilot projects in the Earth and Life Sciences in the borderlands region, and to take part in discussions on pressing issues in the borderlands region and how USGS could collaboratively address those issues. A USGS Circular is scheduled to be published.
7. Briefed U.S. Embassy Science Counselor for Environmental Science and Technology Affairs, Mexico City. May 2, 2007.
8. Member participation and presentation on "Harmonization of Binational Datasets for Environmental Health Applications" at the Pan American Institute of Geography and History, Technical Commission Meeting, Itu Brazil. June, 2007.
9. The USGS and INEGI developed an Annex to the existing Memorandum of Understanding between our agencies to allow the release of the larger scale binational datasets (1:24,000 and 1:50,000) which are currently copyrighted by Mexico. The annex is under review in Mexico. This will allow the release of nine more Mexican datasets.

10. Drafting of a Memorandum of Understanding between USGS and the Pan American Health Organization. (in review)
11. Herbert T. Buxton, USGS Toxic Substances Hydrology Program, <http://toxics.usgs.gov> included the BEHI on their health website [http://health.usgs.gov/health_data.html].
12. Article on the binational hydro network for the U.S.-Mexico Border Environmental Health project published in the NHD newsletter. http://nhd.usgs.gov/newsletters/News_Jan_07.pdf
13. Member participation in UNESCO/OAS Transboundary Aquifers of the Americas Program, including attendance at annual workshop in San Salvador, El Salvador, November 2006. Program promotes the scientific, legal, socio-economic, institutional and environmental assessment of internationally shared aquifers and will generally advance our understanding of U.S-Mexico transboundary groundwater issues and inform USGS responsibilities under the Transboundary Act .
14. Member participation on Good Neighbor Environmental Board, Presidential Advisory Group for the U.S.-Mexico Border.
15. Presentation of BEHI at Global Environment Facility (GEF) Project Rio Grande-Bravo Workshop in Juarez, Mexico, October 2006.
16. Member participation in USGS Borderlands Workgroup including the development of a "Border Circular" scheduled to be published in December 2007.
17. Member participation in the Rio Grande Watershed Federal Coordinating Committee headed by Congressman Sylvester Reyes.
18. A new map and layer showing the entire U.S.-Mexico Border region and Federal lands in the United States and Protected Areas in Mexico was prepared for U.S. Congressional Representative Mark Souder

(4) REPORT PRODUCTS AND BIBLIOGRAPHIC UPDATE

- Parcher, J.W., Norman, L.M., Papoulias, D.M., Stefanov, J.E., Wilson, Z.D., Page, W.R., Gary, R.H., 2006. Developing a Binational Geodatabase to Examine Environmental Health and Quality-of-Life Issues along the U. S.–Mexico Border: Global Spatial Data Infrastructure Conference No. 9 <http://gsdidocs.org/gsdiconf/GSDI-9/papers/TS58.3paper.pdf>
- Parcher, J.W., Norman, L.M., Papoulias, D.M., Stefanov, J.E., Wilson, Z.D., Page, W.R., Gary, R.H., 2007 Salud Ambiental y los Asuntos de Calidad de Vida a lo largo de La Frontera de Mexico - Estados Unidos de America, 2007. Boletin de Las Sistemas Nacionales Estadistico y La Informacion Vol. 3, No. 1. INEGI. http://www.inegi.gob.mx/prod_serv/contenidos/espanol/bvinegi/productos/integracion/especiales/BoletinSNEIG/2007/Bsneig6.pdf

- Parcher J.W. and Humberson, D.G., CHIPS: A New Way to Monitor Colonias Along the United States – Mexico Border. U.S. Geological Survey Open-File Report 2007-1230, 23p. <http://pubs.usgs.gov/of/2007/1230/>
- <http://borderhealth.cr.usgs.gov/datalayers.html>:

Complete for Entire Border

Study Area boundary for the Border Environmental Health Initiative, based on 250k watershed boundaries.

Metadata

http://borderhealth.cr.usgs.gov/metadata/study_area.htm

The unofficial international boundary used by the BEHI to merge data across the countries.

http://borderhealth.cr.usgs.gov/metadata/int_boundary.htm

Major Cities Along the United States-Mexico Border (based on population and areal extent)

http://borderhealth.cr.usgs.gov/metadata/major_cities_binational.htm

Cities Along the United States-Mexico Border (classified as small, medium, and large based on population and areal extent)

http://borderhealth.cr.usgs.gov/metadata/cities_binational.htm

Urban areas based on census data collected from the United States and Mexico.

http://borderhealth.cr.usgs.gov/metadata/binational_urban_areas.htm

Binational Land Use/Land Cover dataset for the entire Border.

http://borderhealth.cr.usgs.gov/metadata/binat_lulc30m.htm

Complete for Texas

Colonias, which are communities with substandard water, wastewater, or infrastructure conditions, in Texas

<http://borderhealth.cr.usgs.gov/metadata/colonias.htm>

Locations of Hospitals within the state of Texas and for the entire border in Mexico.

http://borderhealth.cr.usgs.gov/metadata/binational_hospitals.htm

Locations of schools in Texas and in the entire border in Mexico.

http://borderhealth.cr.usgs.gov/metadata/binational_schools.htm

(5) ACKNOWLEDGEMENTS/ENDORSEMENTS and TESTIMONIALS (Quotes)

1. **Ing. Antonio Hernández-Navarro, Director General Adjunto de Geomática (INEGI), (4/30/07):** I want to send you congratulation for the US-Mexico Border GIS Data Download webpage. It is really very friendly use, and I hope the user will have the same positive reception.
2. **Gilbert Anaya, International Boundary and Water Commission:** Very good resource for the Border, very user friendly.
3. **Vicki Lukas, Chief, USGS Western Region NSDI Partnership Office:** This is great! I have forwarded it to John Mahoney with the suggestion that he elevate it

to Carswell and Ivan. Have you done a DOI highlight on this? Also might be a great item for the NGPO/FGDC highlights.

4. **Bryon Haney, US Army Corps of Engineers (July 11, 2007):** Again, you have been able to provide more than we expected. Now they are talking about expanding the exercise in the future due to all the data availability. Really appreciate it.
5. **Dr. Natalia Volkow Fernandez, General Director of Distribution, INEGI Letter from Publications (July 16, 2007):** In particular, we appreciate your contribution [to our Boletin] of your work titled : “ Environmental Health and Quality of Life Issues along the UnitedStates-Mexico Border Region”, published in this version of our Boletin. Without the participation of such outstanding specialists such as your team we would not be able to guarantee such academic high level content in our Boletin. At the same time, I would like to affirm the invitation for you to continue collaborating with other articles that deal with Statistics and Geography for our publications.
6. **Craig Wolff, M.S., Eng., Research Scientist and IT/GIS Manager, Environmental Health Tracking Program, California Department of Health Services: Environmental Health Investigations Branch:** I’ll be putting together a web mapping site for CA along the US/Mexico border in the coming month. I’ve noticed a few binational layers available through the border_health WMS and will use those. It’s very nice to not have to duplicate those datasets at my map server. Any other binational layers that you’ll be collecting and adding to the service for CA that I should be aware of? I noticed that TX had a whole series of local-scale layers. Too bad those aren’t available for CA/Baja.... thank you for the offer of assistance.... The default map will perform well, since all of these image tiles have been cached.

(6) PROJECT TEAM DIRECTORY –

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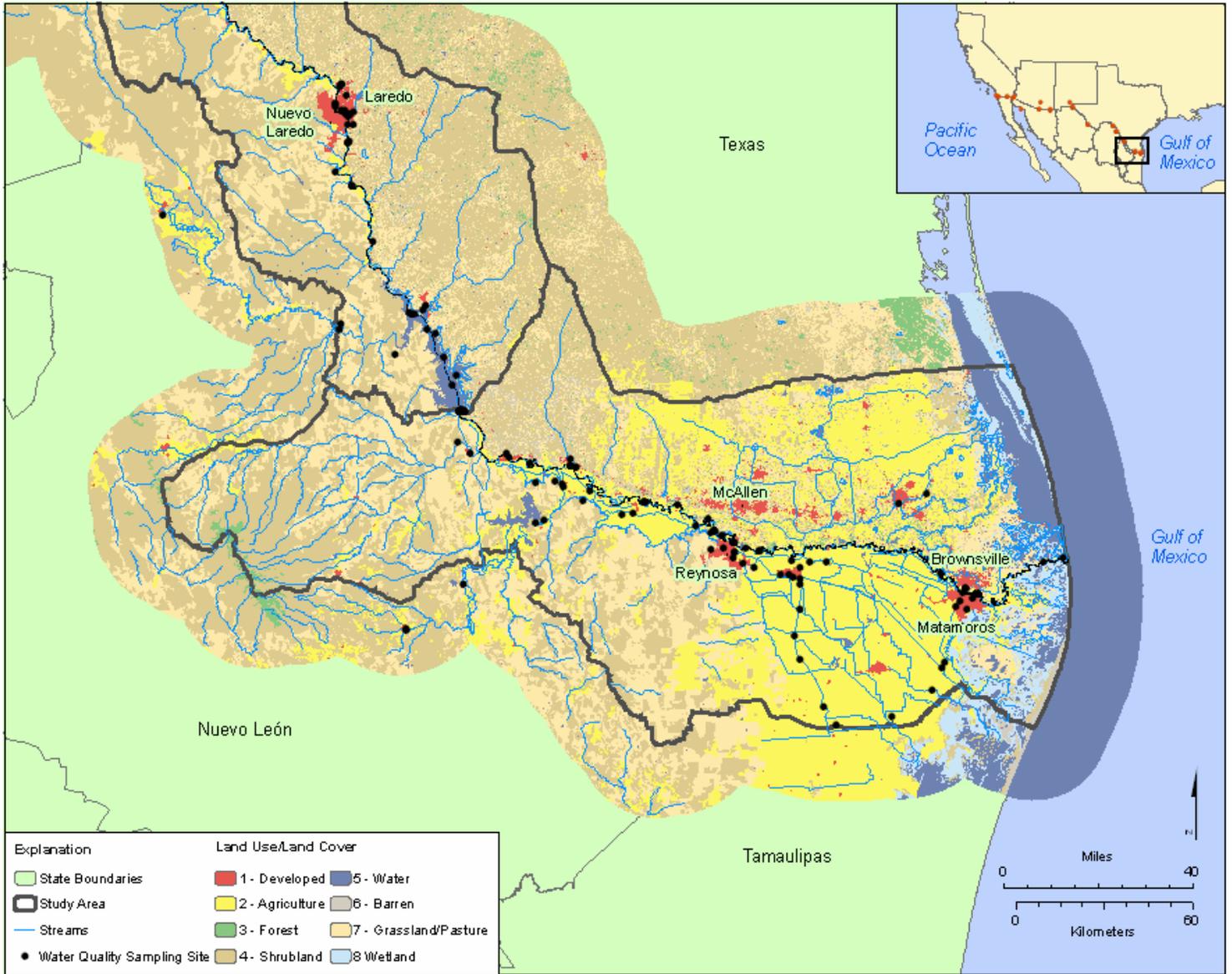
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(7) PHOTOS AND RESULTS GRAPHICS –

Proposed Study Area



Study Area for Application 1. Use of Border Environmental Health to Investigate Linkages between Environmental Conditions and Public Health

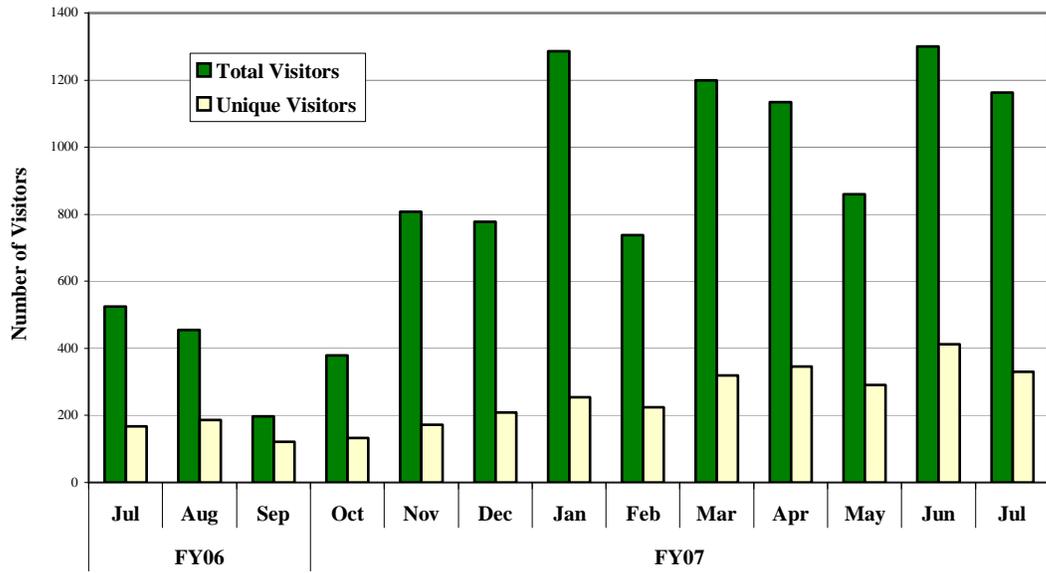


Base from North American Atlas and U.S. Geological Survey, [various dates]
Contiguous Lambert Conformal Conic Projection

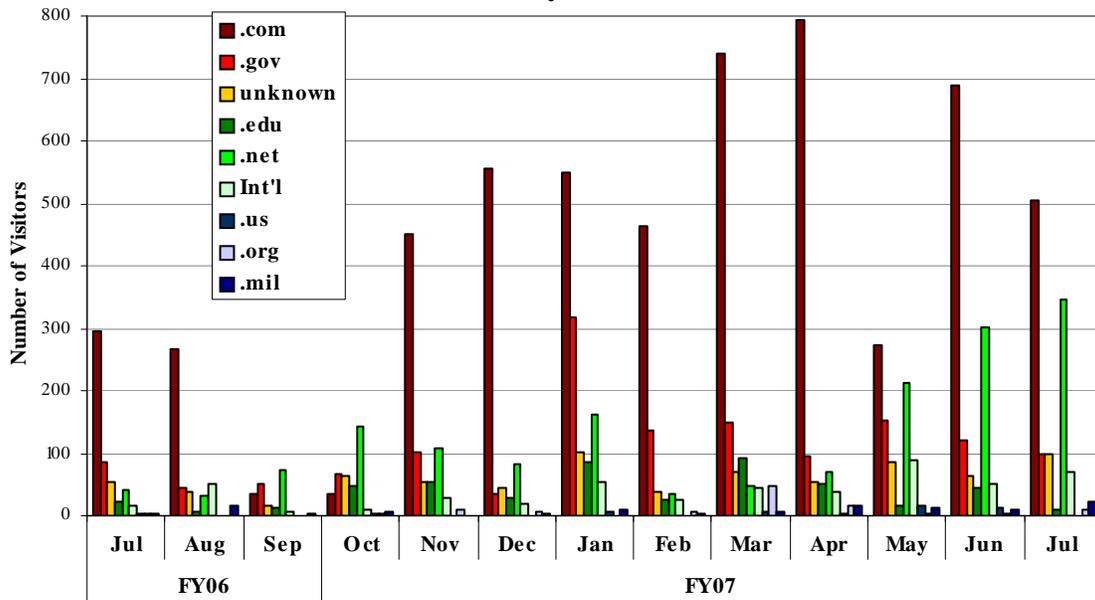
United States Federal Lands and Indian Reservations are from the National Atlas of the United States, 2005
Protected areas in Mexico are from the Comisión Nacional de Áreas Naturales Protegidas, 2006

Federal Lands and Protected Areas along the U.S.-Mexico Border. Map can be downloaded from http://borderhealth.cr.usgs.gov/maps/fed_landmap.pdf

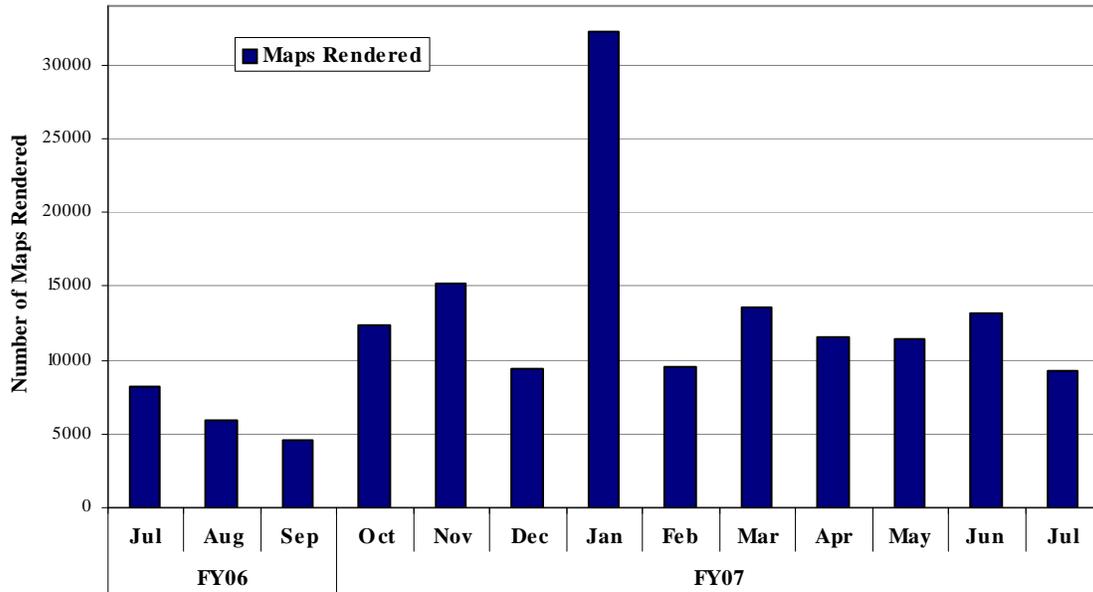
Total Visitors VS Unique Visitors



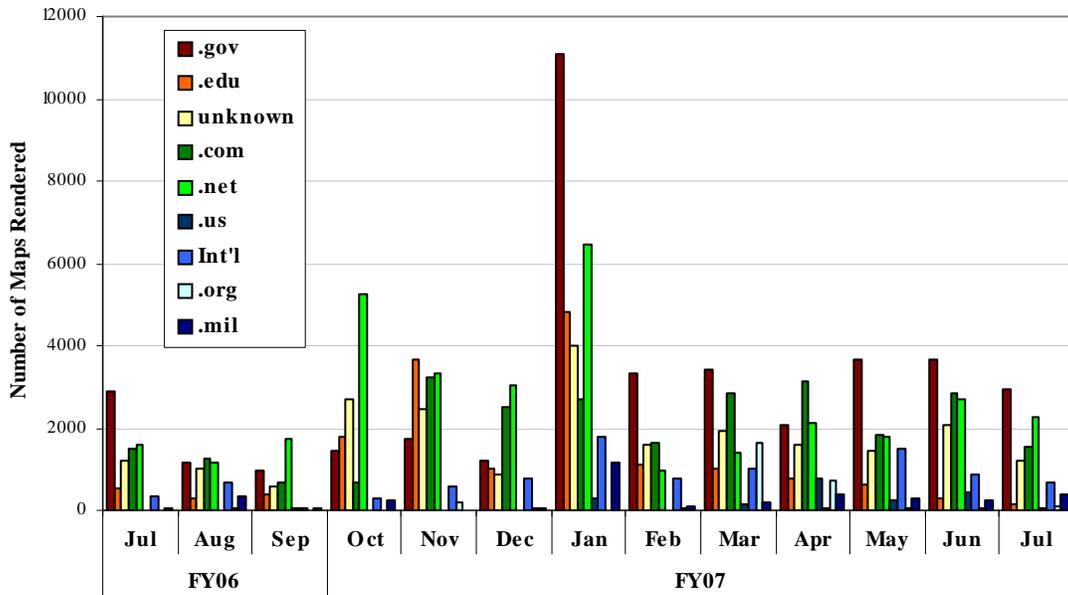
Visitor By Domain



Maps Rendered (Number of times an image is drawn)



Maps Rendered By Domain



Number of Requests Per Dataset

