U.S.-Mexico Border Environmental Health Initiative
&
U.S.-Mexico Border Geographic Information System

United Nations Regional Cartography Conference
August 2009

Presenter
Jean Parcher
Geographer
U.S. Geological Survey

jwparcher@usgs.gov

http://borderhealth.cr.usgs.gov

Project Background

The border region of the United States and Mexico encompasses a vast and diverse array of physical settings and habitats that are unique in terms of the diversity of their water, mineral, and biological resources.
Rapid population growth, economic development, and land-use changes threaten the quality of life in the region and raise concerns about the interdependence of environmental quality and human health.

The Internet Mapping Service showing Matamoros and Brownsville in a LANDSAT 7 ETM+ scene captured in spring of 2003, 432 band combination.

The Border Environmental Health Initiative goals

1) To provide science data in support of Environmental Health studies in the U.S.-Mexico Border region to enable scientists, public health officials, resource managers, and concerned citizens to make informed decisions.

2) To develop methodology to binationally integrate National level base digital cartographic and environmental data from the United States and Mexico and provide public access to the datasets along the U.S.-Mexico Border.

3) Investigate linkages between the condition of the physical environment and environmental and human health issues.
Eight major watershed regions of the U.S.-Mexico border as delineated by the Department of the Interior Field Coordinating Committee.
GIS DATA DOWNLOAD SITE
http://borderhealth.cr.usgs.gov/datalayers.html

Binational Partnership

- USGS – U.S. - Multi-disciplinary science (geology, geography, biology and hydrology) and National Mapping Agency
- INEGI – Mexican National Geography and Census Bureau
- Unique agreement to share data and provide integrated datasets to the public for the border region
- Sharing capacity building and new technology for geospatial datasets
Binational Land Use And Land Cover

Sources:
USGS National Land Cover Dataset
1992 and 2001
INEGI Series II and Series III
Uso de Suelo
1993, 2002

Level II
Urban, high intensity
Urban, medium intensity
Urban, low intensity

Level I
Urban

specific → general

Colorado River 1990

Map of Colorado River with various land use and land cover types.
Landscape Synthesis of Change – Pacific Basins – Salton Trough Watershed Area

1992

2001

Population Density Lower Rio Grande Valley

Brownsville, Tx. And Matamoros, Tam.

U.S. Census Block Groups And INEGI Urban and Rural Agebs
Watershed Boundaries, Hydro Network & Water Quality Database

USGS NHD and WBD – INEGI Red de Hidrografía and Cuencas Nacionales
Hydrography  Drainage Network

Potential Data Sources of Contamination

Water Quality Trends
Version 2 map presents new mapping based on analyzing and integrating geologic map data with remote sensing data (Aster and Landsat imagery), and geochemical data (soil and sediment samples). Our research resulted in refining mapping of the Pleistocene Beaumont (Qb) and Lissie (Ql) Formations in Texas, new mapping of the Beaumont and Lissie in Tamaulipas, Mexico, correlation of the Pliocene Colliad (Tg) Formation in Tamaulipas, and new mapping of Holocene deltaic deposits (Qcf) of the Rio Grande in Tamaulipas.
Potential Sources of Contaminants

CONTAMINANTS IN BIOTA

Legend
Potential Sources of Contaminants
- Natural Phenomena
- Humans
- Natural Phenomena/Industrial
- Waste
- Incinerator
- Natural Phenomena/Industrial

Exploration
CONTAMINANTS IN BIOTA

Matrix, Contaminant Group
- Iron, Element
- Sediment, Industrial
- Sediment, Element
- Soil, Element
- Water, Element

- Iron, Precipitate
- Sediment, Precipitate
- Soil, Precipitate
- Water, Precipitate

- Iron, Deanimate
- Sediment, Deanimate
- Soil, Deanimate
- Water, Deanimate

- Iron, Nonmetallic
- Sediment, Nonmetallic
- Soil, Nonmetallic
- Water, Nonmetallic

- Iron, Organic
- Sediment, Organic
- Soil, Organic
- Water, Organic

- Iron, Degradable
- Sediment, Degradable
- Soil, Degradable
- Water, Degradable

- Iron, Inorganic
- Sediment, Inorganic
- Soil, Inorganic
- Water, Inorganic

- Iron, Mineral
- Sediment, Mineral
- Soil, Mineral
- Water, Mineral

- Iron, Other
- Sediment, Other
- Soil, Other
- Water, Other

- Iron, Trace
- Sediment, Trace
- Soil, Trace
- Water, Trace

- Iron, Unknown
- Sediment, Unknown
- Soil, Unknown
- Water, Unknown

- Iron, Vehicular
- Sediment, Vehicular
- Soil, Vehicular
- Water, Vehicular

- Iron, Waste
- Sediment, Waste
- Soil, Waste
- Water, Waste

- iron
- precipitate
- iron
- degradation
- iron
- organic
- iron
- nonmetallic
- iron
- mineral
- iron
- other
- iron
- unknown
- iron
- vehicular
- iron
- waste

- Iron, Precipitate
- Sediment, Precipitate
- Soil, Precipitate
- Water, Precipitate

- Iron, Deanimate
- Sediment, Deanimate
- Soil, Deanimate
- Water, Deanimate

- Iron, Nonmetallic
- Sediment, Nonmetallic
- Soil, Nonmetallic
- Water, Nonmetallic

- Iron, Organic
- Sediment, Organic
- Soil, Organic
- Water, Organic

- Iron, Degradable
- Sediment, Degradable
- Soil, Degradable
- Water, Degradable

- Iron, Inorganic
- Sediment, Inorganic
- Soil, Inorganic
- Water, Inorganic

- Iron, Mineral
- Sediment, Mineral
- Soil, Mineral
- Water, Mineral

- Iron, Other
- Sediment, Other
- Soil, Other
- Water, Other

- iron
- precipitate
- iron
- degradation
- iron
- organic
- iron
- nonmetallic
- iron
- mineral
- iron
- other
- iron
- unknown
- iron
- vehicular
- iron
- waste

- Contaminants in Biota
- Sample Table
- GIS Table
- Reference Table
- Result Table
- Image

- Field
- Value
- sample_id
- DG
- result
- unit_cd
- metric

- Potential Sources of Contaminants
- Business/Industry

Location
- 24.742833, 95.37081873

Gulf of Mexico

Potential Sources of Contaminants
1 cm = 1 km
The Border Environmental Health Initiative goals

1) To provide science data in support of Environmental Health studies in the U.S.-Mexico Border region to enable scientists, public health officials, resource managers, and concerned citizens to make informed decisions.

2) To develop methodology to binationally integrate National level base digital cartographic and environmental data from the United States and Mexico and provide public access to the datasets along the U.S.-Mexico Border.

3) Investigate linkages between the condition of the physical environment and environmental and human health issues.

Cooperative Partnership
Pan American Health Organization (PAHO)

“Investigate the Relationships Between Environmental Changes, Contaminant Trends, and Human and Wildlife Health Along the Rio Grande from Laredo, Texas, to the Gulf of Mexico”
Weights of Evidence – Weighted Logistical Regression GIS Analysis

Inputs to the Arc Spatial Data Model * WOE/WLR

- Water Quality Toxicity Value Index
- Land Use & Land Cover
- Surface Runoff
- Toxic Release Inventory
- Fish Health Assessment
- Contaminants In Biota
- Potential Sources Of Contaminants
- Sediments
- Soil Geochemistry
- Human Health Index Statistics

* Maintained by Gary Raines
Soil Geochemistry

Priority Layers

Arsenic
Cobalt
Chromium
Copper
Nickel
Lead
Zinc

Initial Model Results

Studentized Contrast
For Copper in Geochemistry
And Contaminants in Biota
U.S.-Mexico Border Environmental Health Team

- Diana Papoulias - Biologist
- Jean Parcher – Geographer
- Sylvia Wilson – Geographer
- James Callegary - Hydrologist
- Laura Norman - Geographer
- Marie Socha - Epidemiologist
- Ric Page - Geologist
- Jim Stefanov - Hydrologist
- Manuel Mavila - Hydrologist
- Brian Reece - Hydrologist
- Natalie Houston - Geographer
- Helen Folgers - Geologist
- Sally Holl - Geographer