Center for Research in Water Resources
The University of Texas at Austin

Water Management Information System for the Rio Grande/Rio Bravo Basin

Carlos Patino
Daene McKinney
David Maidment
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Motivation

- **Due to water scarcity during last 10+ years in Rio Grande/Bravo basin, it is necessary to:**
  - **Develop new reservoir/river simulation models;**
  - **Determine available water in the basin using hydrologic principles and actual data**
  - **Provide data analysis capability necessary for improved water management and planning**

Objectives

- Develop a framework to create basin-scale GIS databases
- Apply this framework to the Rio Grande/Bravo basin
- Develop a raster-network regionalization technique for large river basins and apply it to the Rio Grande/Bravo basin for delineating watersheds and calculating hydrologic parameters

Collaboration

Participants

- University of Texas at Austin
- Comisión Nacional del Agua

COMISIÓN NACIONAL DEL AGUA

Support

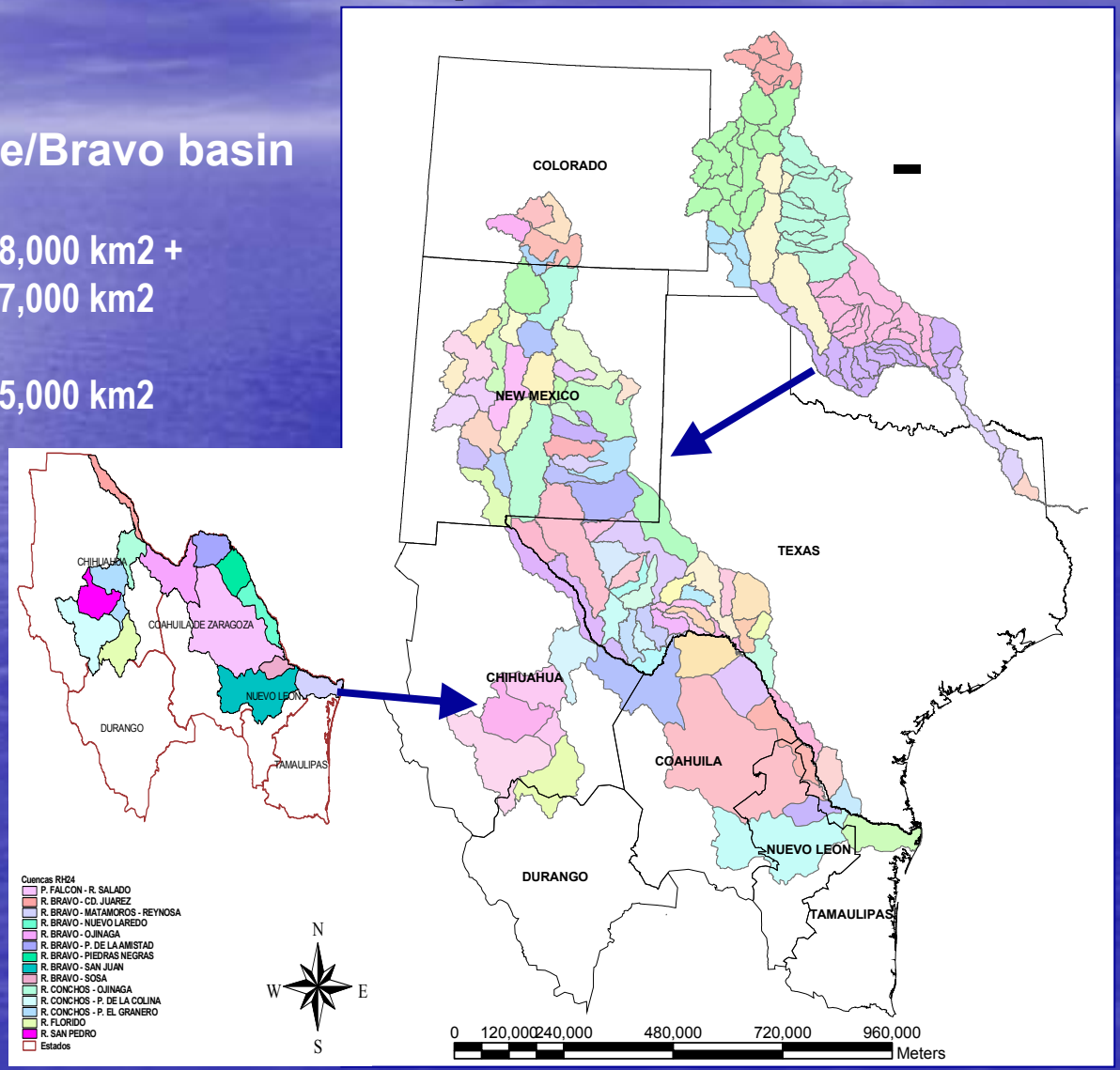
- Instituto Mexicano de Tecnologia del Agua
- Instituto Nacional de Estadistica, Geografia e Informatica
- Universidad Autonoma de Ciudad Juarez
- North American Development bank
- Texas Commission on Environmental Quality
- IBWC/CILA

- Result of the project
  - Rio Grande/Bravo basin **geodatabase**
    - Geographically referenced relational database
    - Geographic Information System (GIS) + Relational Database
    - Hydrologic and related data accessible for analysis
    - ArcHydro Framework
      - Organizes geodatabase according to the basin principle
  - Geodatabase
    - available to Mexican and U. S. federal, state, and local organizations
    - Assisting in developing US-Mexican bi-national cooperation concerning water in the Rio Grande basin

Study Area

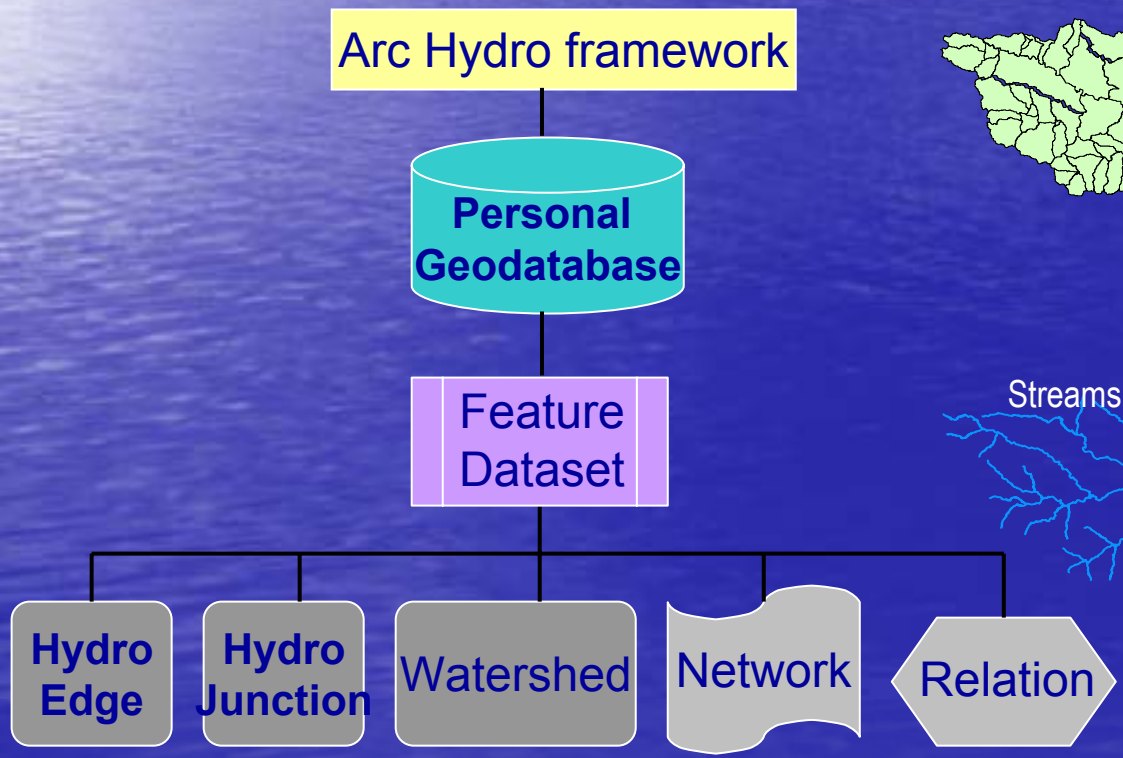
Rio Grande/Bravo basin

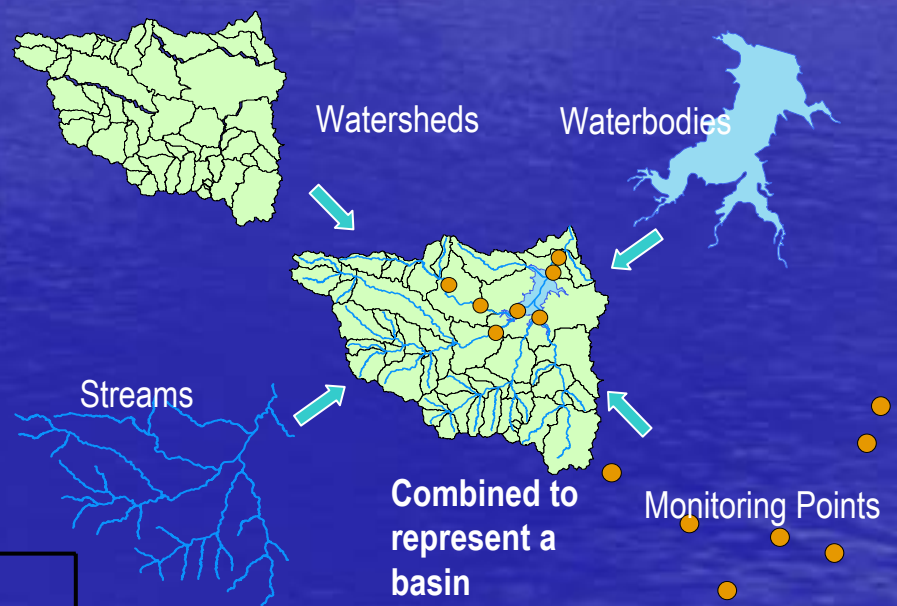
Mexico	228,000 km2 +
USA	327,000 km2
=	
Total	555,000 km2



Arc Hydro Framework

Arc Hydro Data Model: A Geodatabase containing a GIS representation of a Hydrological information System under a case-specific database design

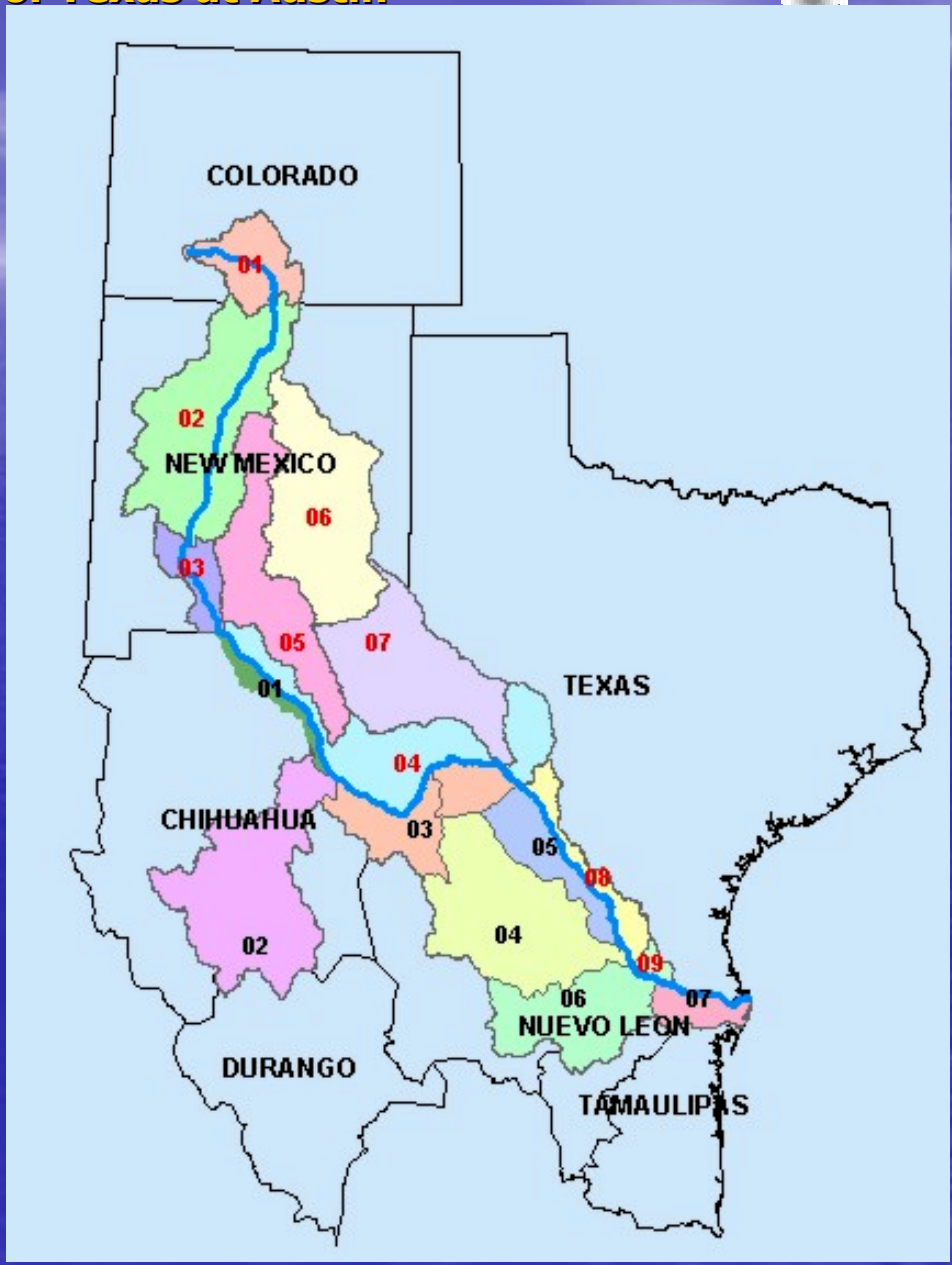




Rio Grande basin including HUC'S for the U.S. side, cuencas and subcuencas for the Mexican side

Mexico: 7 Hydrologic subregions

USA: 9 Hydrologic Subregions



Regional HydroID

- Assign unique regional HydroID for every feature class in Geodatabase

- 1st digit (**blue box**): Hydrological Region
- 2nd two digits (**yellow boxes**): Sub Region
- 3rd & 4th digits (**red boxes**): Feature Class
  - Control Point: 01
  - HydroEdge: 02
  - WaterBody: 03
  - Watershed: 04
  - And so on
- 5th – 9th digits (**green boxes**): Feature Number (1 - 99999)

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Attributes of Watershed

NAME	MEX_CODE	HydroID
R. CONCHOS - OJINAGA	24-J	2020400001
R. CONCHOS - P. EL GRANERO	24-K	2020400002
R. SAN PEDRO	24-N	2020400003
R. CONCHOS - P. DE LA COLINA	24-L	2020400004
R. FLORIDO	24-M	2020400005

1 Show: All Selected Records (0 out of 5 Selected.)

Attributes of HydroEdge2402

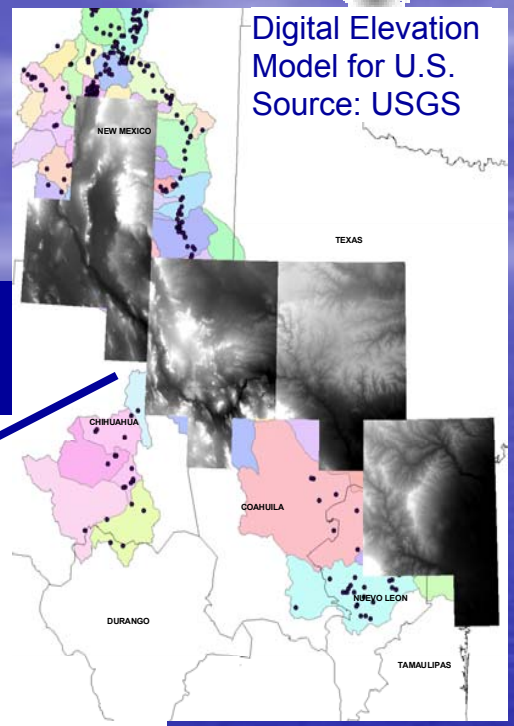
FTYPE	METERS	COUNTRY	HydroID
STREAM/RIVER	7314.414551	MEXICO	2020200025
STREAM/RIVER	953.084595	MEXICO	2020200026
STREAM/RIVER	9424.698242	MEXICO	2020200027
STREAM/RIVER	27536.109375	MEXICO	2020200028
STREAM/RIVER	268.818420	MEXICO	2020200029
STREAM/RIVER	4166.212891	MEXICO	2020200030
STREAM/RIVER	4082.232422	MEXICO	2020200031
STREAM/RIVER	5955.667480	MEXICO	2020200032
STREAM/RIVER	627.509399	MEXICO	2020200033
STREAM/RIVER	7094.148438	MEXICO	2020200034
STREAM/RIVER	4677.252441	MEXICO	2020200035
STREAM/RIVER	2006.286255	MEXICO	2020200036
STREAM/RIVER	12516.376953	MEXICO	2020200037
STREAM/RIVER	5575.266602	MEXICO	2020200038

Record: 1 Show: All Selected Records (0 out of *2000 Selected.)

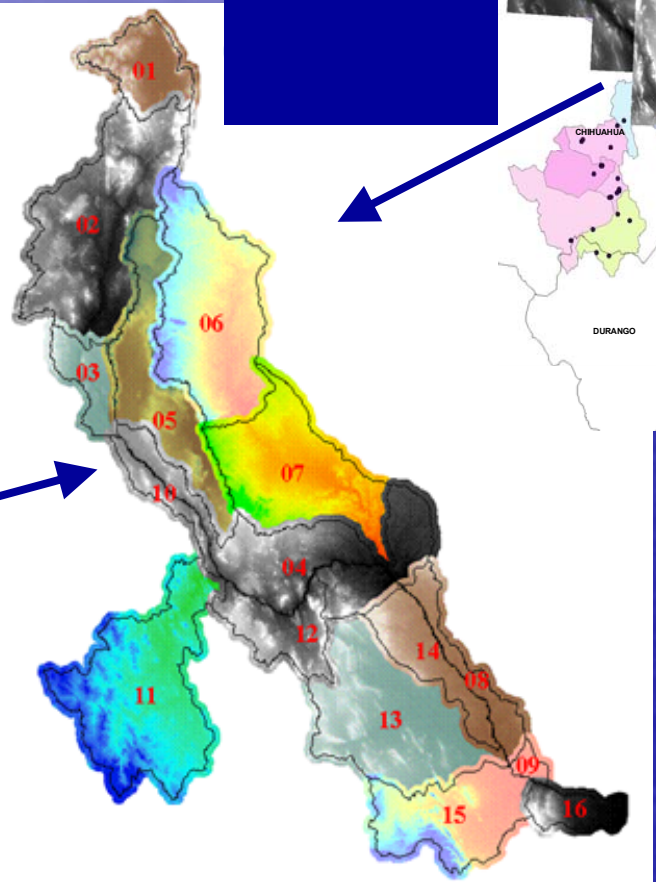
252,000
Meters

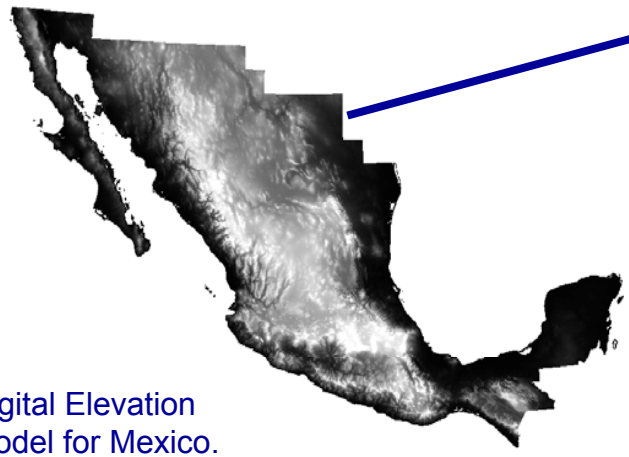
Rasters & Regionalization

Digital Elevation Model for the Rio Grande/Bravo basin. Cell size is 30 m and every regional DEM includes a 10 km buffer to delineate the watersheds correctly.



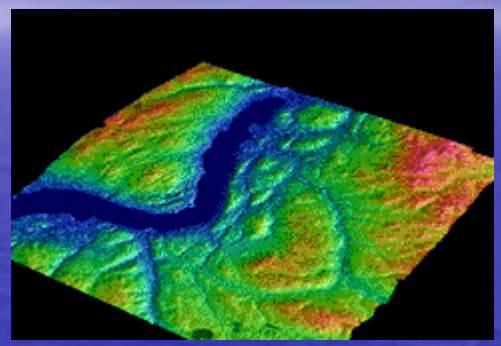
Digital Elevation Model for U.S. Source: USGS



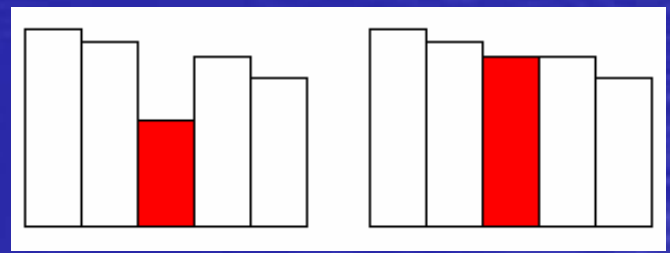


Digital Elevation Model for Mexico. Source: INEGI

Rasters & Regionalization (cont.)

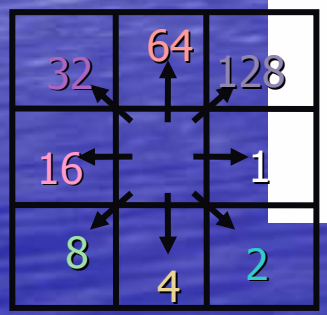


Burn the Streams



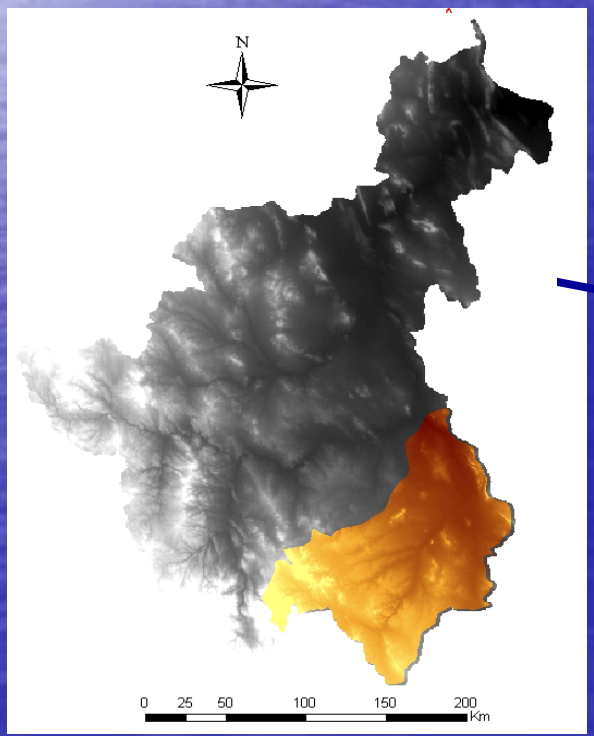
Fill the sinks

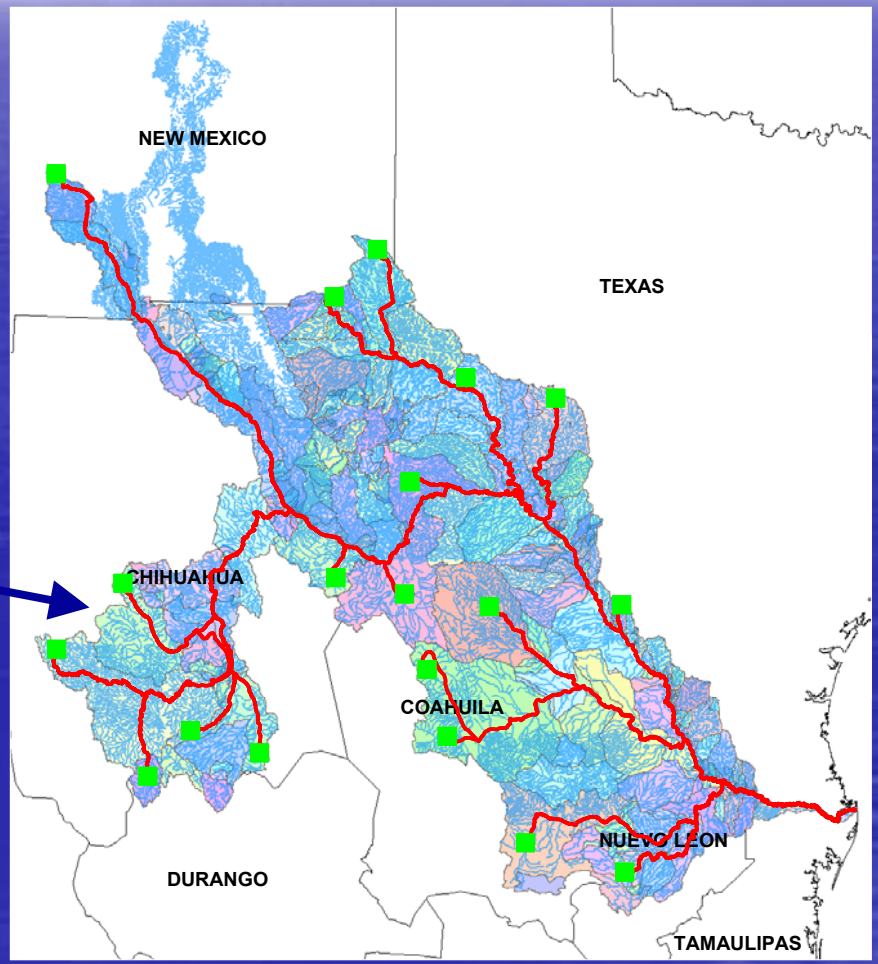
Flow Direction Grid



Rasters & Regionalization (cont.)

Each sub-basin is delineated from its DEM (raster), streams are computed and connectivity is established (vector). Then sub-basins are assembled into the full basin





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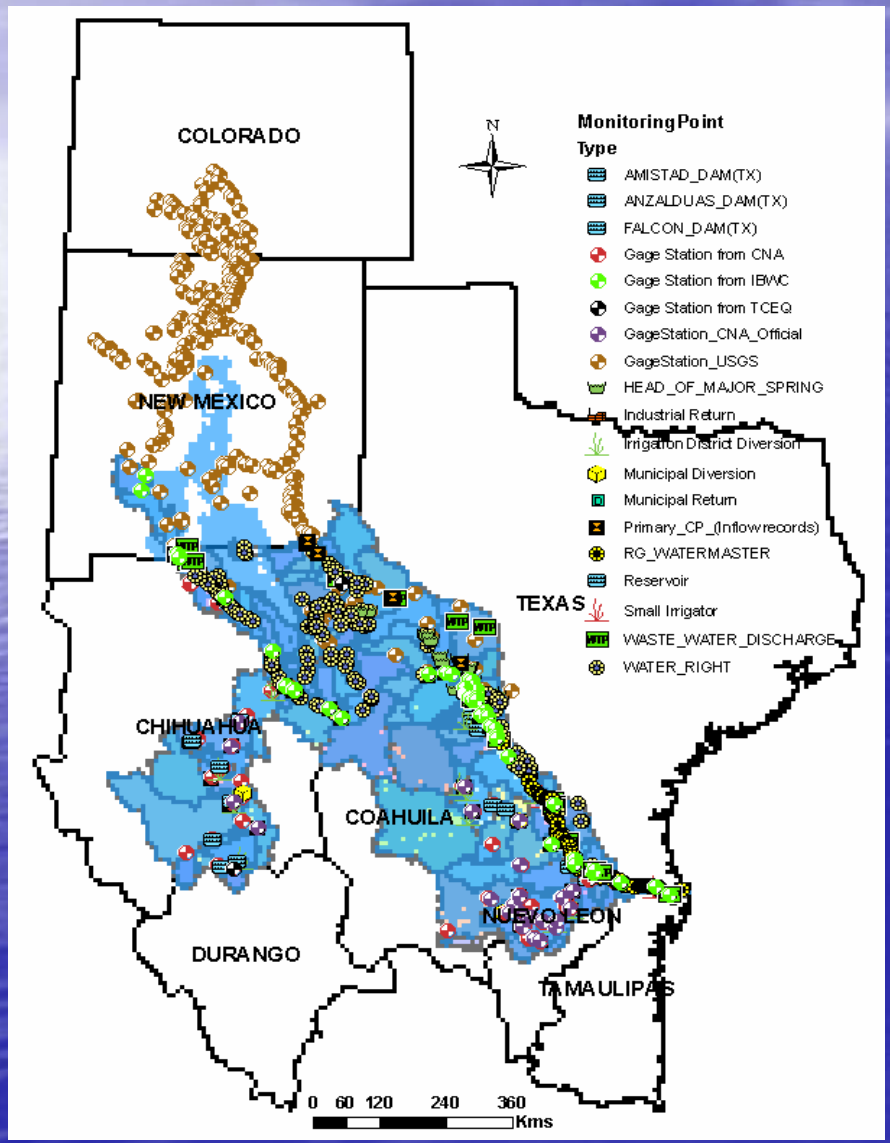
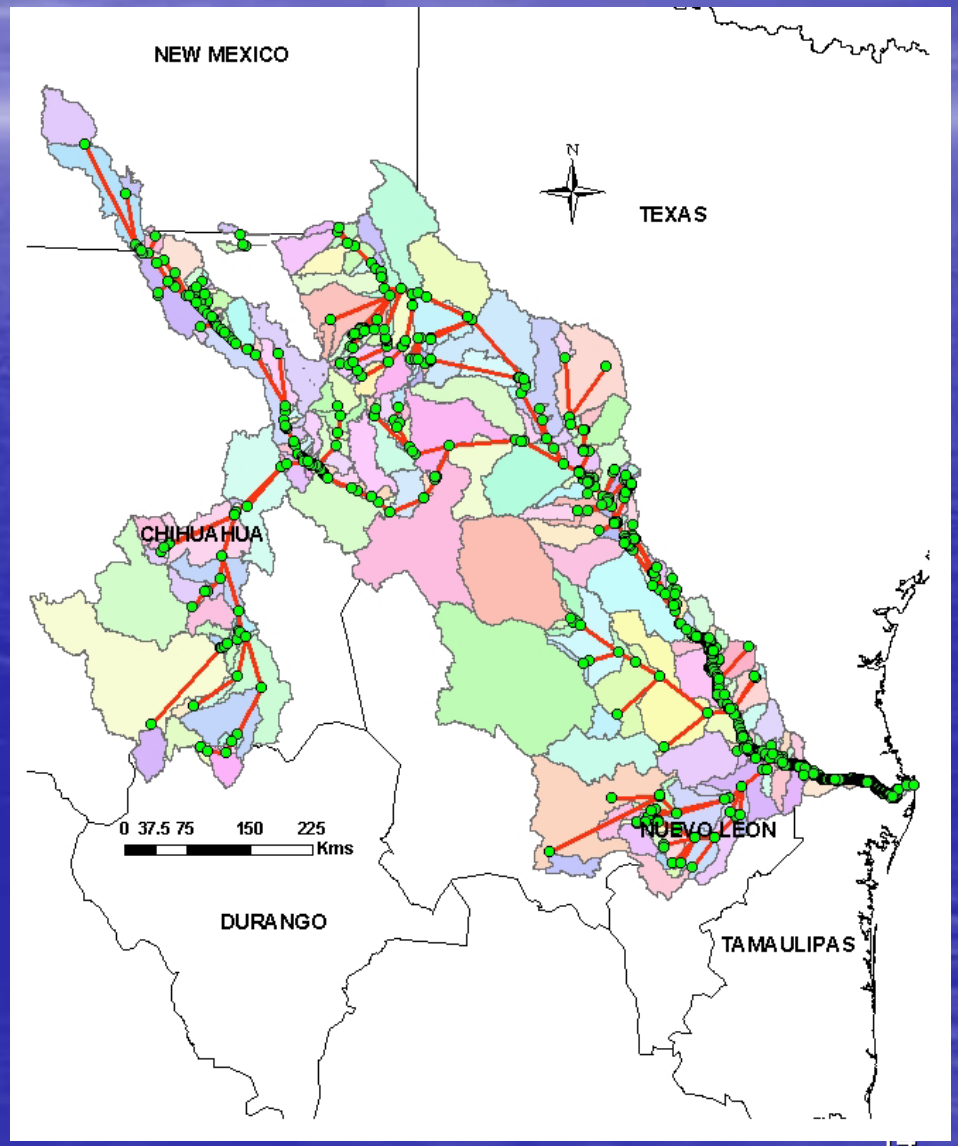
Binational Geodatabase

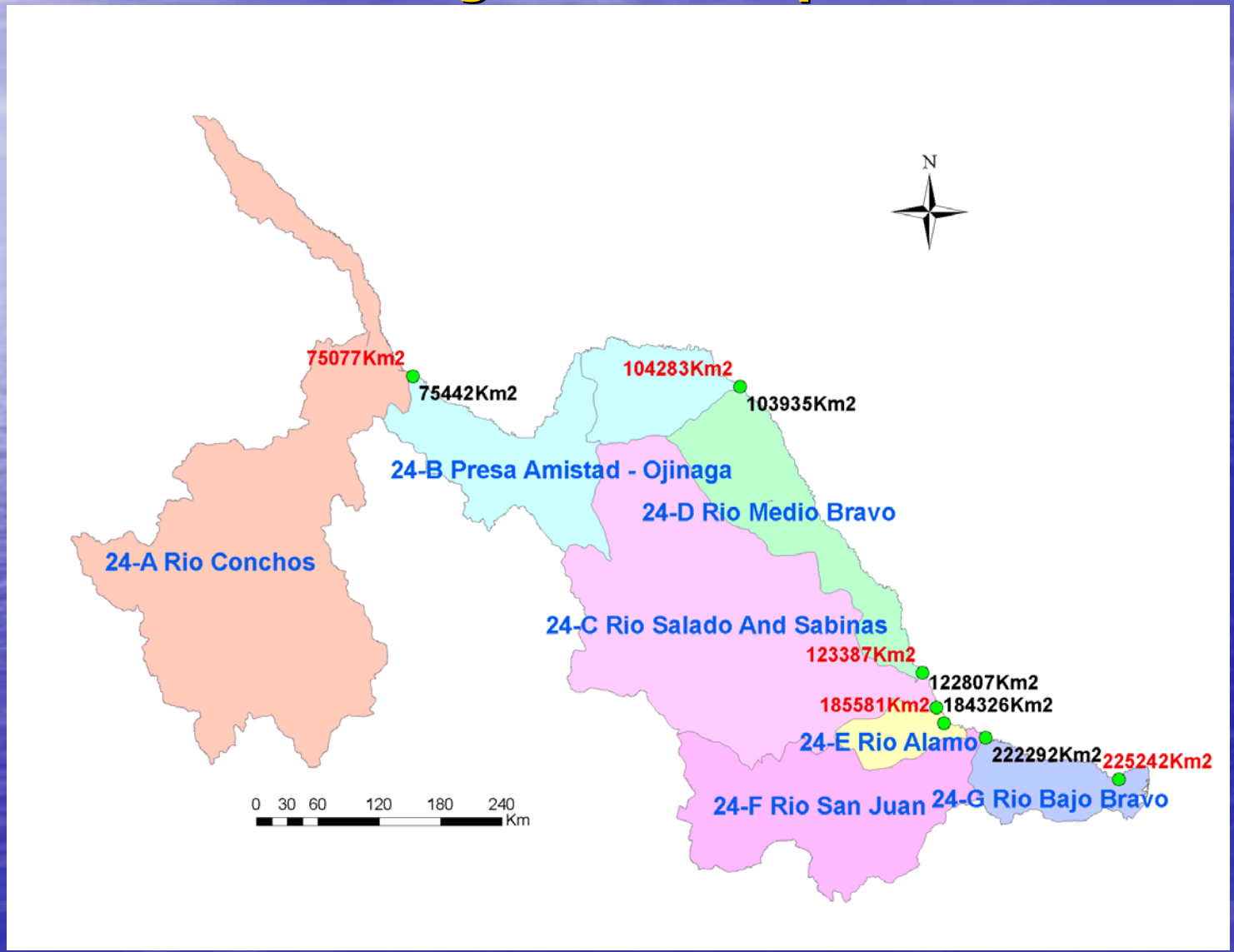




Regionalization process for the Río Grande/Bravo basin

DEMO in GIS

Drainage Area Comparison



Conclusions

- A binational geodatabase was created for the Rio Grande/Bravo basin including more than 5 million records within time series
- An operational method for the automated parameterization of large river basins (>500,000 Km2) was developed and applied
- The Raster-Network regionalization technique has been successfully applied for the binational Rio Grande/Bravo basin
- The Regional HydroID assignment is critical to the success of the regionalization

Geodatabase Distribution

www.crwr.utexas.edu/riogrande.shtml