



# Identifying and Characterizing Transboundary Aquifers between Mexico-US: An initial assessment

**Rosario Sanchez**

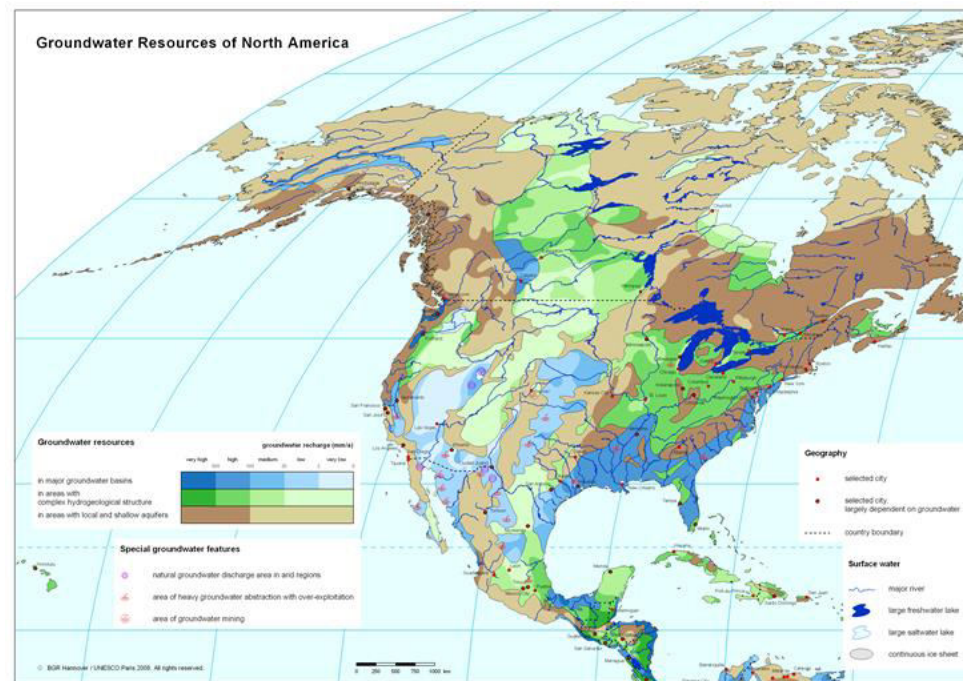
Water Management and Hydrological Sciences Program

*Co-author Gabriel Eckstein*



# What do we know?

- 600 transboundary aquifers have been mapped (IGRAC)
  - only one is managed collaboratively (Genevese Aquifer)
- International framework is limited
  - 1997 UN Watercourse Convention
  - 2008 Law of Transboundary Aquifers (draft)



# Int'l Legal Framework: limited

## 1997 Watercourse Convention

...a *system of surfacewaters and groundwaters* ...physical relationship a ***unitary whole***

and normally flowing into a ***common terminus..***

## 2008 Law of Transboundary Aquifers

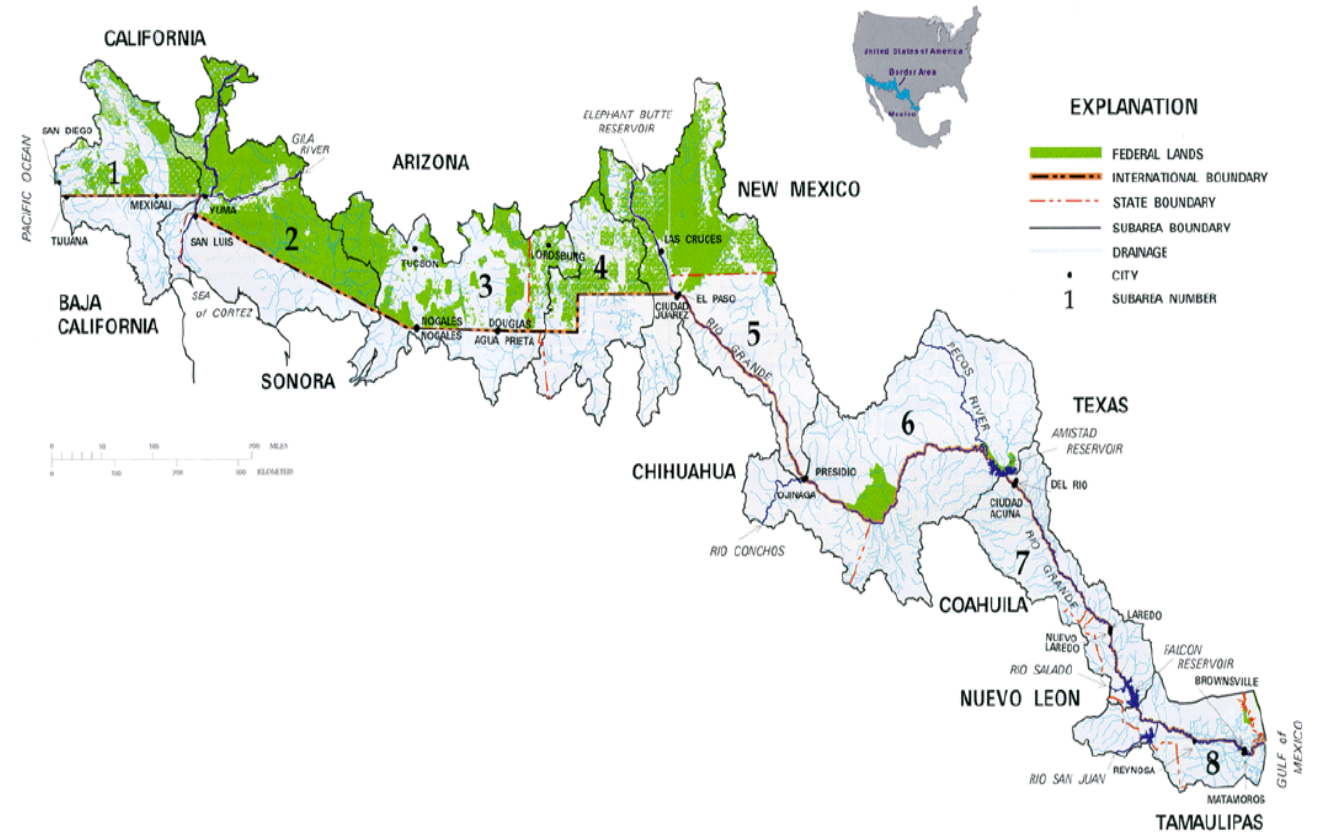
...***permeable water bearing*** geological formation underlain by a less permeable layer...

...Obligation not to cause significant harm at ***the discharge zone***

- Confined, fossil aquifers do not seem to be considered
- Recharge zone is not directly addressed as part of the system

# Binational Efforts: transboundary groundwater framework

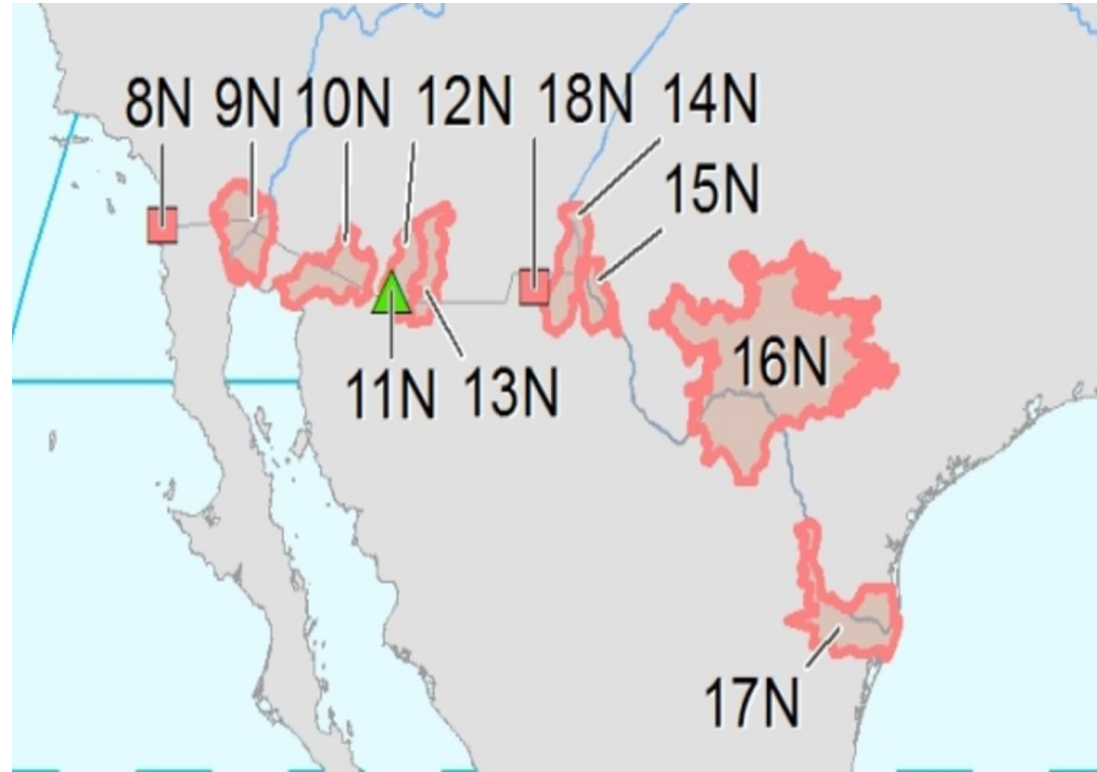
- 1973 Minute 242 (1944 Treaty)
- La Paz Agreement 1983
- 2006 US-Mexico Transboundary Assessment Act Program (TAAP)



# International Efforts: ISARM

## 11 transboundary aquifers

- San Diego-Tijuana
- Cuenca Baja del Rio Colorado
- Sonoyta-Papagos
- Nogales
- Santa Cruz
- San Pedro
- Mimbres-Las Palmas
- Conejos Medanos-Bolson de la Mesilla
- Hueco Bolson-Valle de Juarez
- Edwards Trinity-El Burro
- Cuenca Baja del Rio Grande



More problems: Aquifer boundaries???

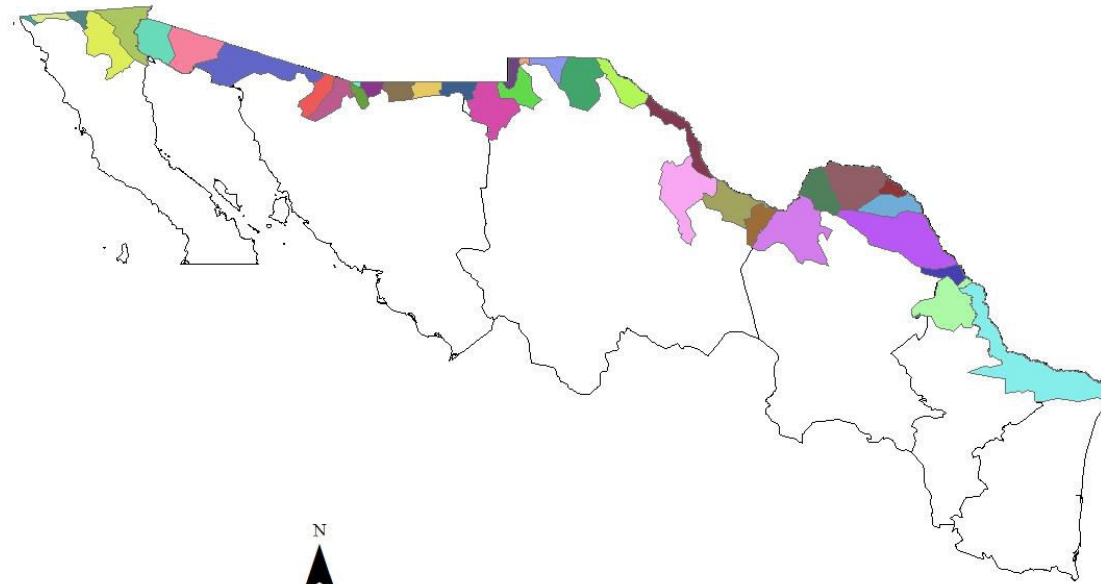
# US-Mexico transboundary groundwater framework

- How many transboundary aquifers do we have?

# Proposed US-Mexico Transboundary Aquifer/Basins Criteria Selection:

- Data availability
  - Selection: Reasonable, Some, None
    - Reasonable: US, Mexico, Intl sources
    - Some: Not enough data to confirm transboundary relationship
    - Limited
- Only hydrological/geological considerations

## Mexico Border Aquifers/Basins



### Legend

- ALAMO CHAPO
- ALLENDE-PIEDRAS NEGRAS
- ARROYO SAN BERNARDINO
- ARROYO SECO
- ASCENSION
- BAJO RIO BRAVO
- BAJO RIO CONCHOS
- CERRO COLORADO-LA PARTIDA
- CONEJOS-MEDANOS
- HIDALGO
- JANOS
- JOSEFA ORTIZ DE DOMINGUEZ
- LA RUMOROSA-TECATE
- LAGUNA SALADA
- LAMPAZOS-ANAHUAC
- LAS PALMAS
- LOS MOSCOS
- LOS VIDRIOS
- MANUEL BENAVIDES
- NOGALES
- PALESTINA
- PRESA LA AMISTAD
- RIO AGUA PRIETA
- RIO ALISOS
- RIO ALTAR
- RIO SAN PEDRO
- RIO SANTA CRUZ
- SANTA FE DEL PINO
- SERRANIA DEL BURRO
- SONOYTA-PUERTO PEÑASCO
- TECATE
- TIJUANA
- VALLE DE JUAREZ
- VALLE DE MEXICALI
- VALLE DE SAN LUIS RIO COLORADO
- VALLE DEL PESO

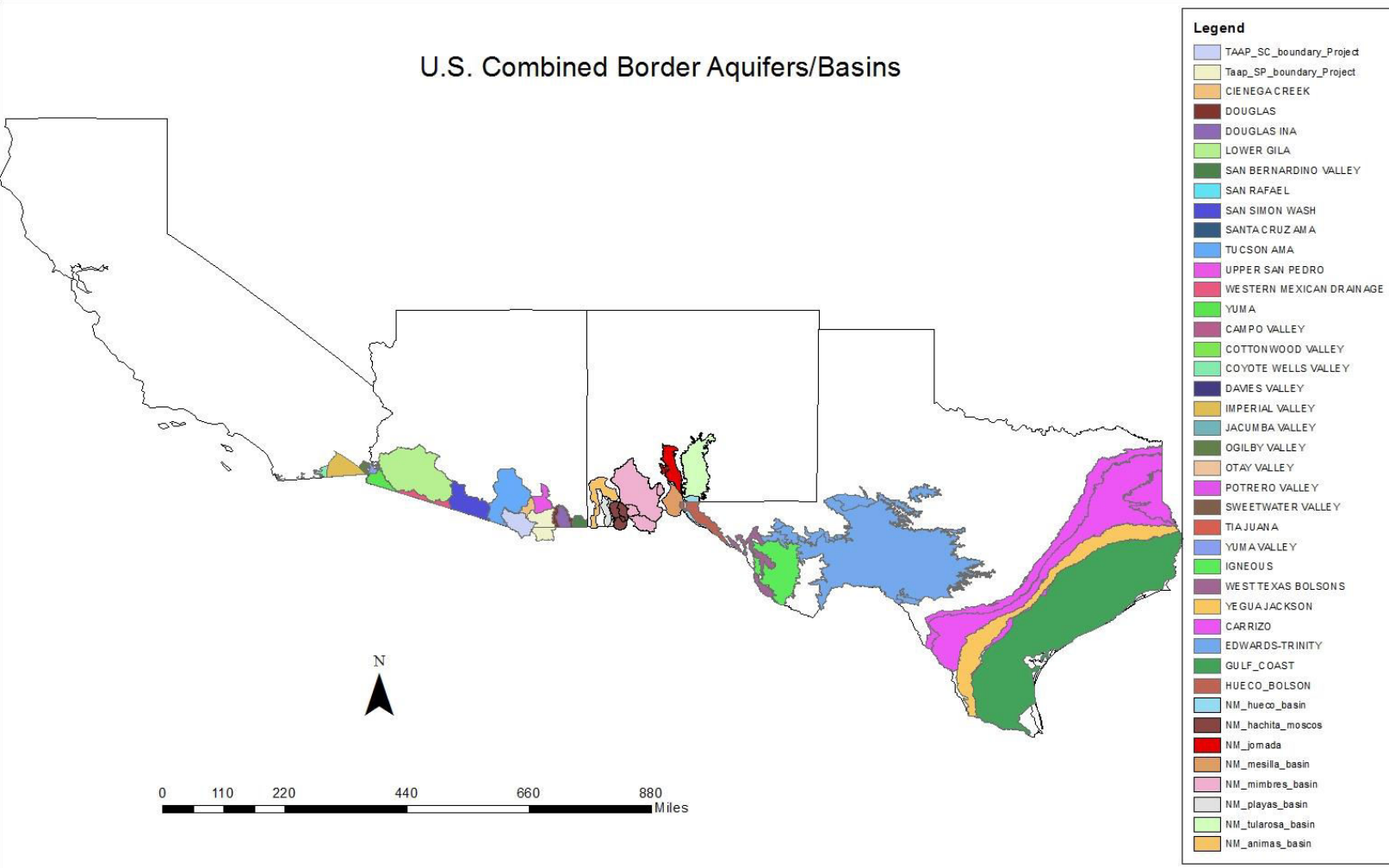
N



0 87.5 175 350 525 700 Miles



# U.S. Combined Border Aquifers/Basins



- Legend**
- TAAP\_SC\_boundary\_Project
  - Teap\_SP\_boundary\_Project
  - CIENEGA CREEK
  - DOUGLAS
  - DOUGLAS INA
  - LOWER GILA
  - SAN BERNARDINO VALLEY
  - SAN RAFAEL
  - SAN SIMON WASH
  - SANTA CRUZ AMA
  - TUCSON AMA
  - UPPER SAN PEDRO
  - WESTERN MEXICAN DRAINAGE
  - YUMA
  - CAMPO VALLEY
  - COTTON WOOD VALLEY
  - COYOTE WELLS VALLEY
  - DAVE S VALLEY
  - IMPERIAL VALLEY
  - JACUMBA VALLEY
  - OGILBY VALLEY
  - OTAY VALLEY
  - POTRERO VALLEY
  - SWEETWATER VALLEY
  - TIA JUAN A
  - YUMA VALLEY
  - IGNEOUS
  - WEST TEXAS BOLSONS
  - YEGUA JACKSON
  - CARRIZO
  - EDWARDS-TRINITY
  - GULF\_COAST
  - HUECO\_BOLSON
  - NM\_hueco\_basin
  - NM\_hachita\_moscos
  - NM\_jomada
  - NM\_mesilla\_basin
  - NM\_mimbres\_basin
  - NM\_playas\_basin
  - NM\_tularosa\_basin
  - NM\_animas\_basin



Figure 1. California-Baja California Transboundary Aquifers/Basins

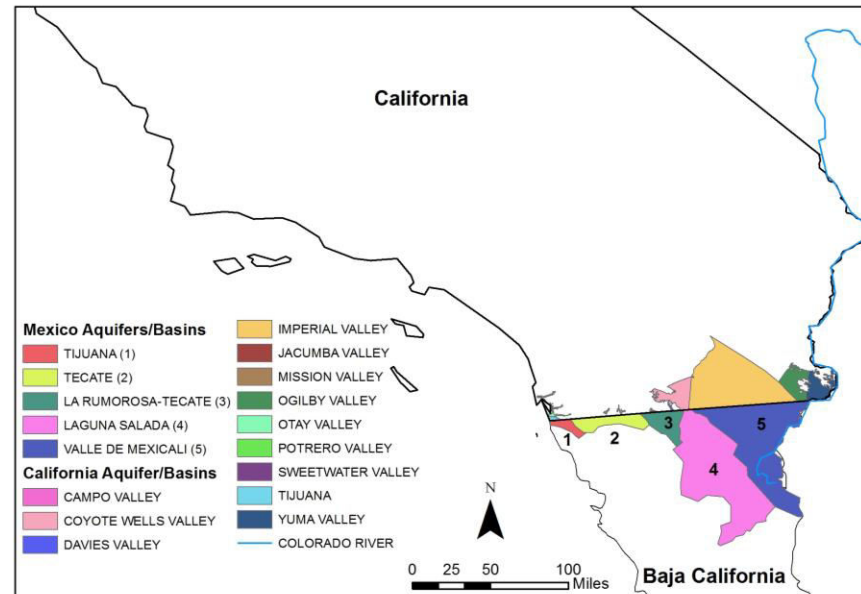
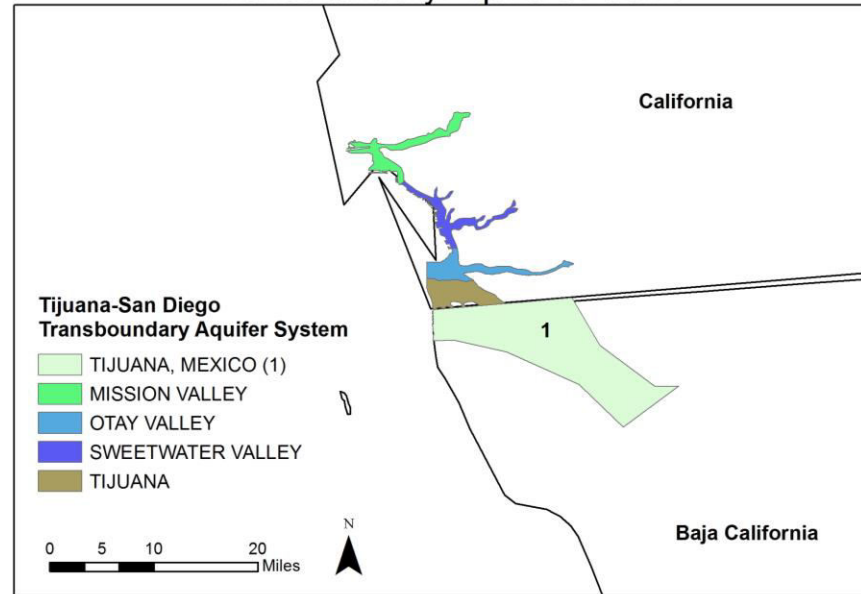


Figure 3. Arizona-Sonora Transboundary Aquifers/Basins

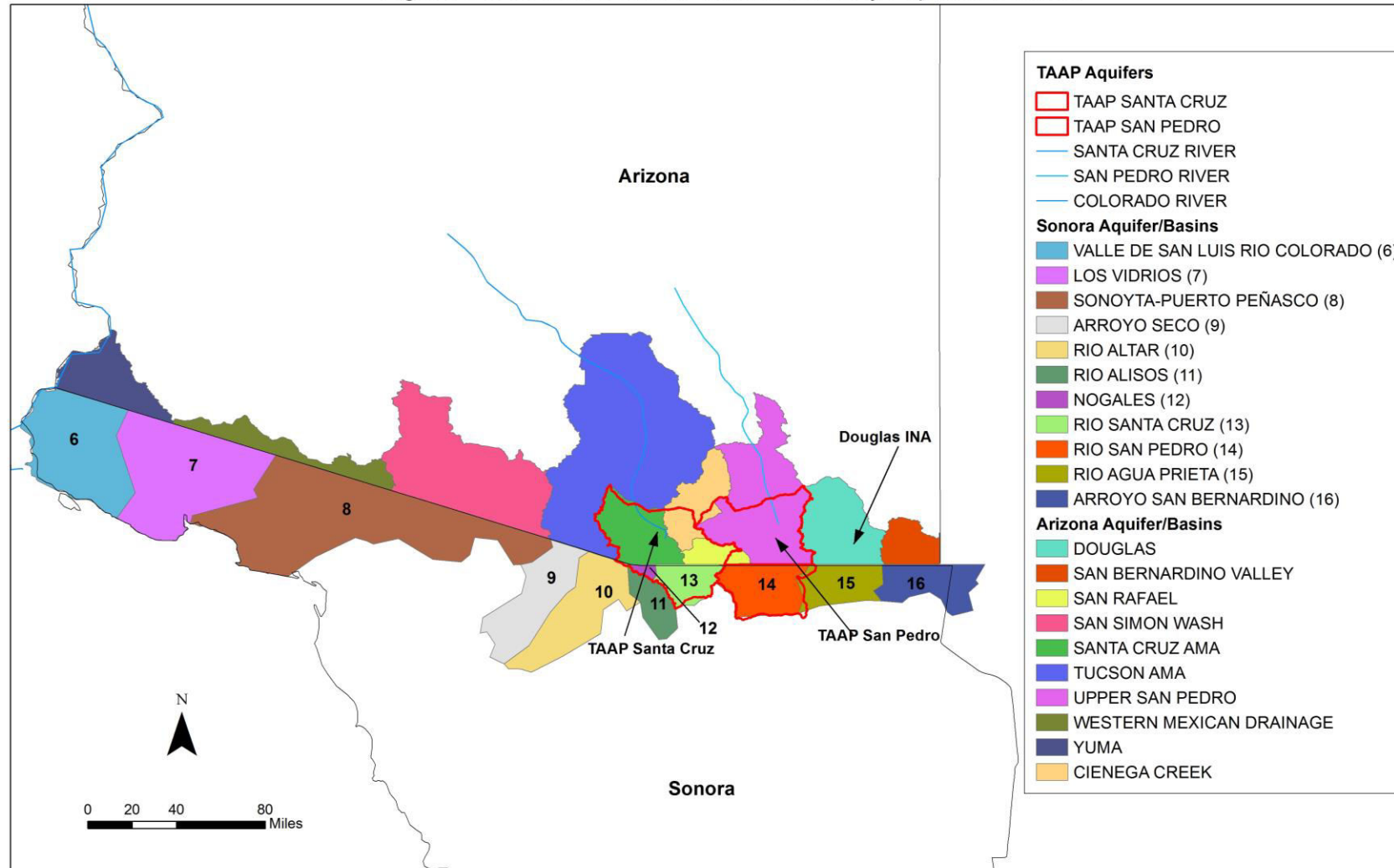


Figure 5. Chihuahua- New Mexico Aquifers/Basins

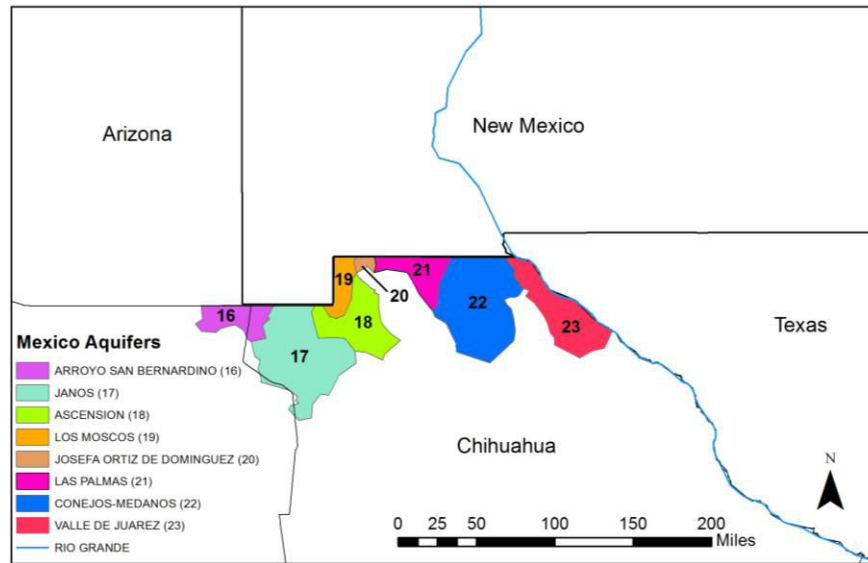
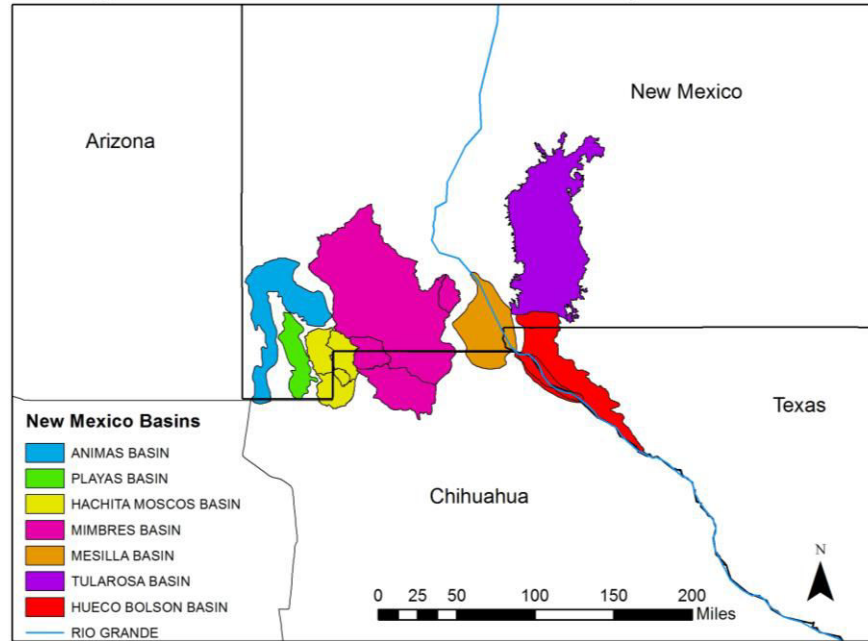


Figure 6. Chihuahua-Coahuila-Nuevo Leon-Tamaulipas-Texas Aquifers/Basins

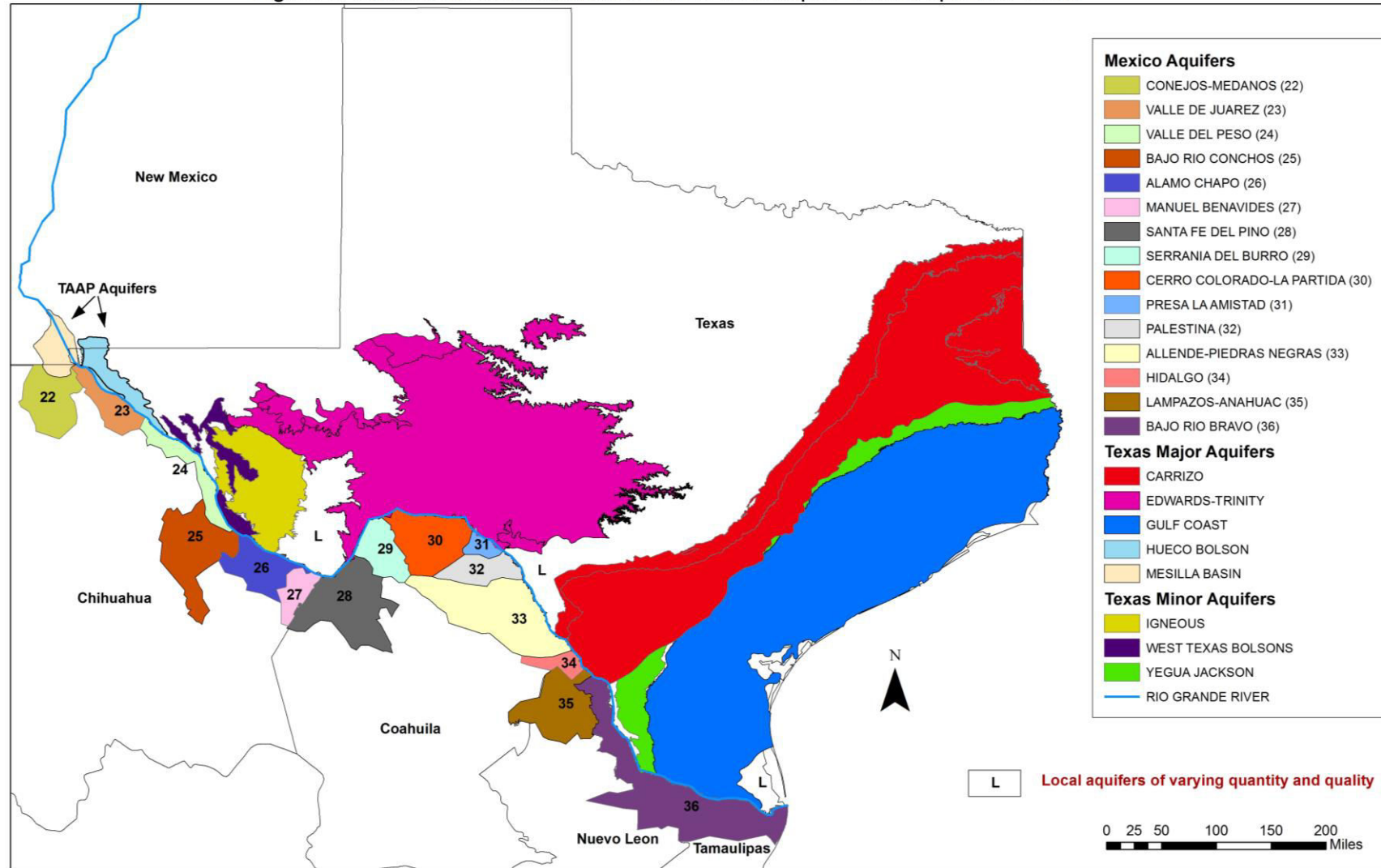
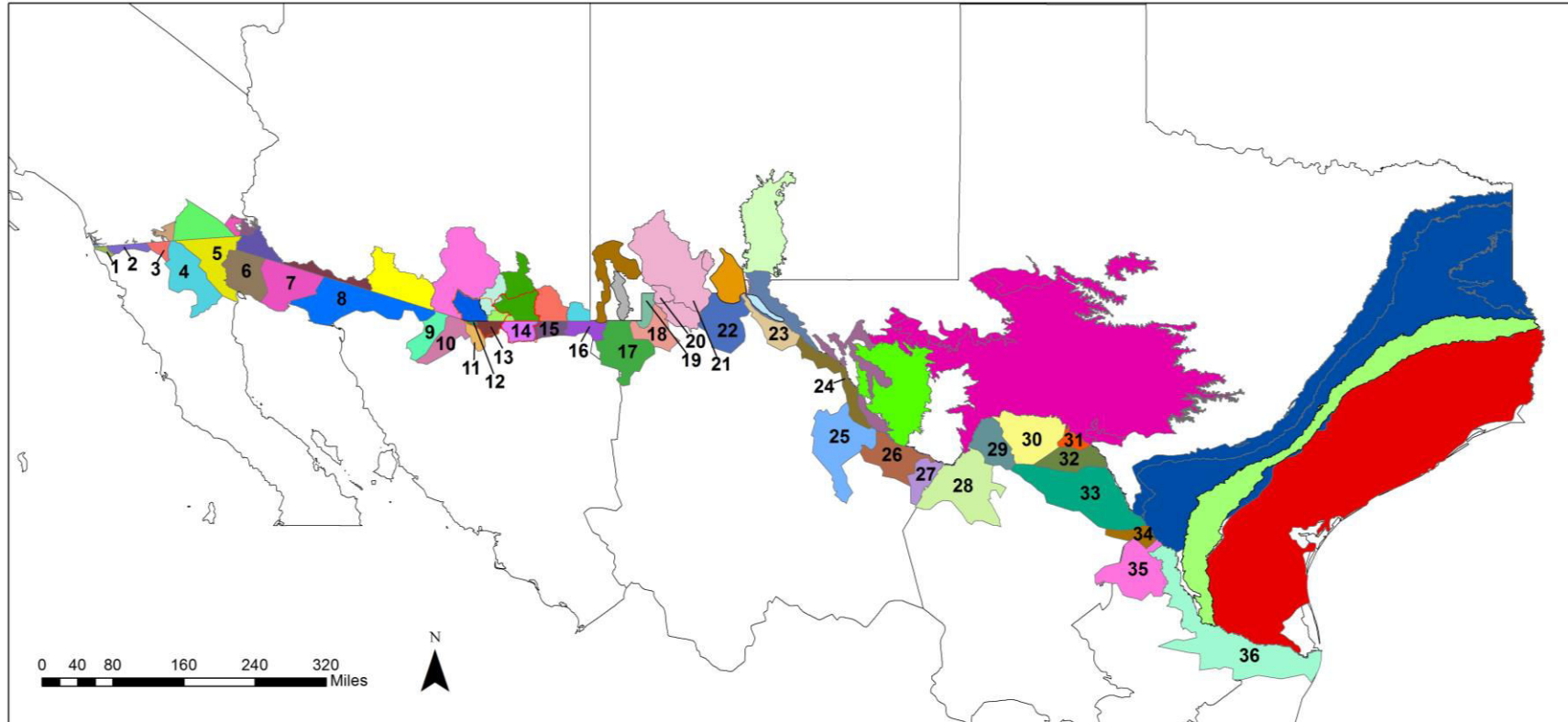
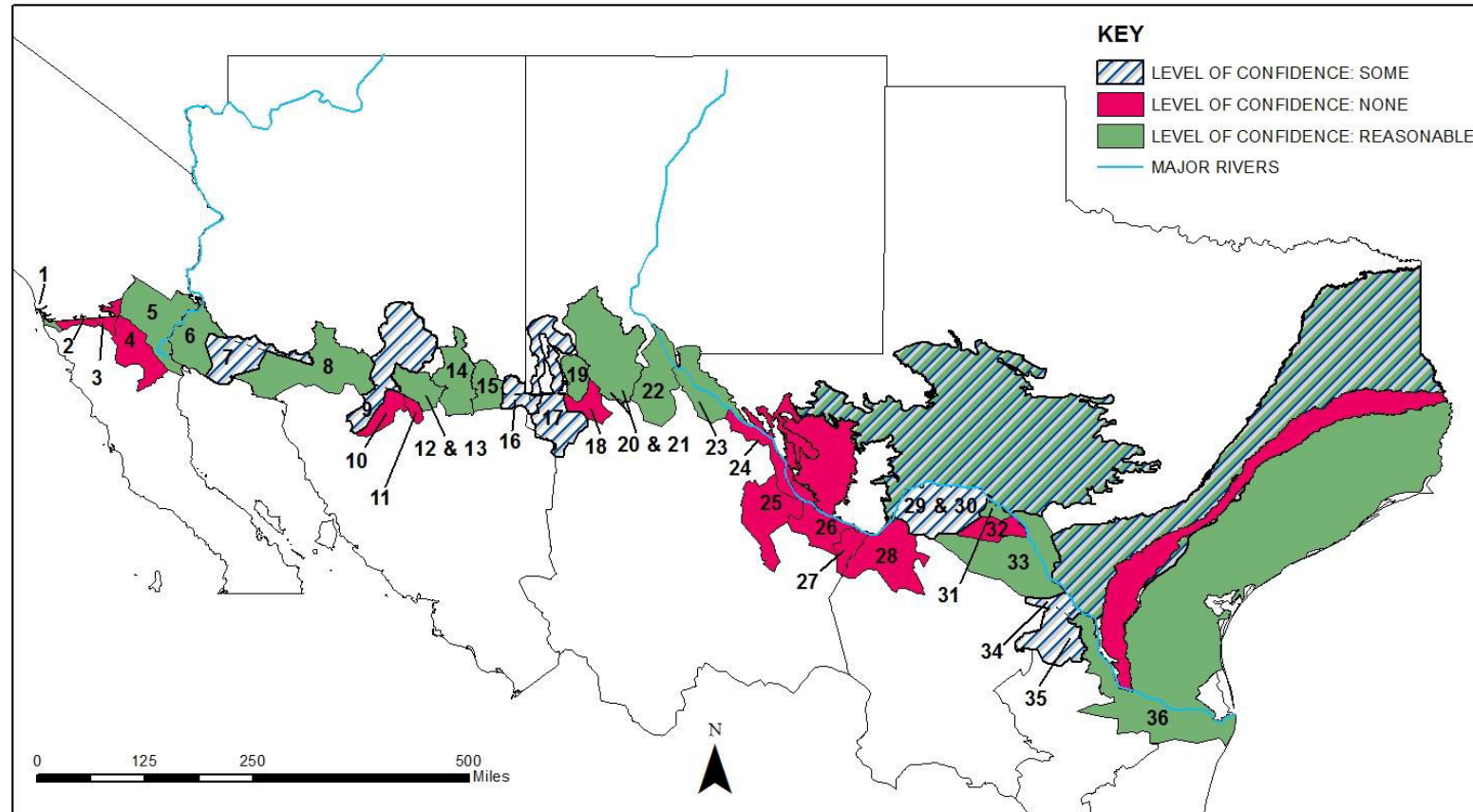


Figure 8. Mexico-U.S. Border Aquifers/Basins



STATES (MEXICO-US)	Level of information available/research to define the transboundary character		
<b>BAJA CALIFORNIA-CALIFORNIA</b>	<b>REASONABLE</b>	<b>SOME</b>	<b>LIMITED</b>
	(1) Tijuana/San Diego- (Tia Juana, Otay Sweetwater and Mission system)		(2) Tecate/Potrero Valley and Campo Valley
			(3) La Rumorosa-Tecate/Jacumba Valley and Davies Valley
			(4) Laguna Salada/Coyote Wells Valley
<b>BAJA CALIFORNIA-CALIFORNIA-SONORA-ARIZONA</b>	Cuenca Baja del Rio Colorado system (5) Valle de Mexicali/ Imperial, Ogilby and Yuma Valley		
	Cuenca Baja del Rio Colorado system (6)Valle San Luis Rio Colorado/Yuma		
<b>SONORA-ARIZONA</b>	Sonoyta-Papagos system (8) Sonoyta-Papagos/San Simon Wash	(7) Los Vidrios/Western Mexican Drainage	(10) Rio Altar/Tucson AMA
	(12) Nogales/Santa Cruz (TAAP1)	(9) Arroyo Seco/Tuscon AMA	(11) Rio Alisos/Santa Cruz
	(13) Santa Cruz/Santa Cruz-San Rafael (TAAP1)		
	(14) San Pedro/San Pedro (TAAP2)		
	(15) Rio Agua Prieta/Douglas (INA)		
<b>SONORA-ARIZONA-NEW MEXICO</b>		(16) Arroyo San Bernardino/San Bernardino Valley-San Bernardino basin	
<b>CHIHUAHUA-NEW MEXICO</b>	(19) Los Moscos/Moscos-Hachita	(17) Janos/Animas and Playas aquifer basin	(18) Ascencion/Los Moscos-Hachita
	(20) Josefa Ortiz de Dominguez/Mimbres		
	(21) Las Palmas/Mimbres		
<b>CHIHUAHUA-TEXAS-NEW MEXICO</b>	(22) Conejos Medanos/Mesilla Bolson (TAAP3)		
	(23) Valle de Juarez/Hueco Bolson (TAAP4)		
<b>CHIHUAHUA-TEXAS</b>			(24) Valle del Peso/West Texas Bolsons
			(25) Bajo Rio Conchos/West Texas Bolsons
			(26) Alamo Chapo/Igneous
			(27) Manuel Benavides/Lower aquifers
<b>COAHUILA-TEXAS</b>	(31) Presa La Amistad/Edwards	(29) Serrania del Burro/Edwards	(28) Santa Fe del Pino/Lower aquifers
	(33) Allende-Piedras Negras/Lower aquifers	(30) Cerro Colorado-La Partida/Edwards	(32) Palestina/Lower aquifers
		(34) Hidalgo/Carrizo Wilcox	
<b>NUEVO LEON-TEXAS</b>		(35) Lampazos/Anahuac-Carrizo Wilcox	
<b>TAMAULIPAS-TEXAS</b>	(36) Bajo Rio Bravo/Carrizo Wilcox-Gulf Coast (Yegua Jackson no data)		
<b>Total</b>	<b>16</b>	<b>8</b>	<b>12</b>

Figure 9. Confidence Level of the Transboundary Nature of Aquifers between Mexico and the U.S.



**16 Confidence Level: Reasonable**

- (1) Tijuana/San Diego  
-(Tijuana, Otay Sweetwater and Mission system)
- (5) Cuenca Baja del Rio Colorado system:  
Valle de Mexicali/ Imperial, Ogilby and Yuma Valley
- (6) Cuenca Baja del Rio Colorado system:  
Valle San Luis Rio Colorado/Yuma
- (8) Sonoyta-Papagos system:  
Sonoyta-Papagos/San Simon Wash
- (12) Nogales/Santa Cruz (TAAP1)
- (13) Santa Cruz/Santa Cruz-San Rafael (TAAP1)
- (14) San Pedro/San Pedro (TAAP2)
- (15) Rio Agua Prieta/Douglas (INA)

- (19) Los Moscos/ Hachita Moscos
- (20) Josefa Ortiz de Dominguez/Mimbres
- (21) Las Palmas/Mimbres
- (22) Conejos Medanos/Mesilla Bolson (TAAP3)
- (23) Valle de Juarez/Hueco Bolson (TAAP4)
- (31) Presa La Amistad/Edwards
- (33) Allende-Piedras Negras/Local aquifers
- (36) Bajo Rio Bravo/Carrizo Wilcox-Gulf Coast  
(Yegua Jackson no data)

**8 Confidence Level: Some**

- (7) Los Vidrios/Western Mexican Drainage
- (9) Arroyo Seco/Tuscon AMA
- (16) Arroyo San Bernardino/San Bernardino Valley  
-San Bernardino basin
- (17) Janos/Animas and Playas aquifer basin
- (29) Serrania del Burro/Edwards
- (30) Cerro Colorado-La Partida/Edwards
- (34) Hidalgo/Carrizo Wilcox
- (35) Lampazos/Anahuac-Carrizo Wilcox



# Discussion/questions

- i. What is the **criteria** we should use to identify transboundary aquifers between US and Mexico?
- ii. What are the potential **units of management** (level of management) of transboundary aquifers?)
- iii. What are the main **principles** (based on the existent international framework on transboundary waters) that fit into the characteristics of the transboundary conditions between US and Mexico that could be used to develop a regional framework



Water Management and Hydrological Sciences Program  
College of Geosciences  
[Waterprogram.tamu.edu](http://Waterprogram.tamu.edu)  
[rosario@tamu.edu](mailto:rosario@tamu.edu)