



Shared Waters: why do we need to care about GW?

Rosario Sanchez

Senior Research Scientist

Texas Water Resources Institute

Texas A&M University

Why do we need to care?

1

Around 50% of the world's population will live in water scarce areas by 2050.

2

2 in 5 people rely on river basins that cross national boundaries for drinking and domestic water.

3

Around 40% of world's population rely on transboundary aquifers for drinking and domestic use.

4

Transboundary resources have become more important and strategic as national reserves are getting exhausted.

5

153 countries share transboundary rivers, lakes and aquifers, only 24 countries report having operational arrangements in place for all their transboundary waters.

6

There are 275 river basins around the world and over 3000 agreements between sharing countries. However, there are so far over 650 transboundary aquifers and only 7 recorded agreements worldwide.

7

Around 15 million people live in the border cities. At least half (over 7 million people) rely on transboundary aquifers for either domestic or ag use.

Why do we need to care?

The border cities of the State of Texas represent the **highest dependency** on transboundary aquifers accounting for over 750,000 inhabitants.

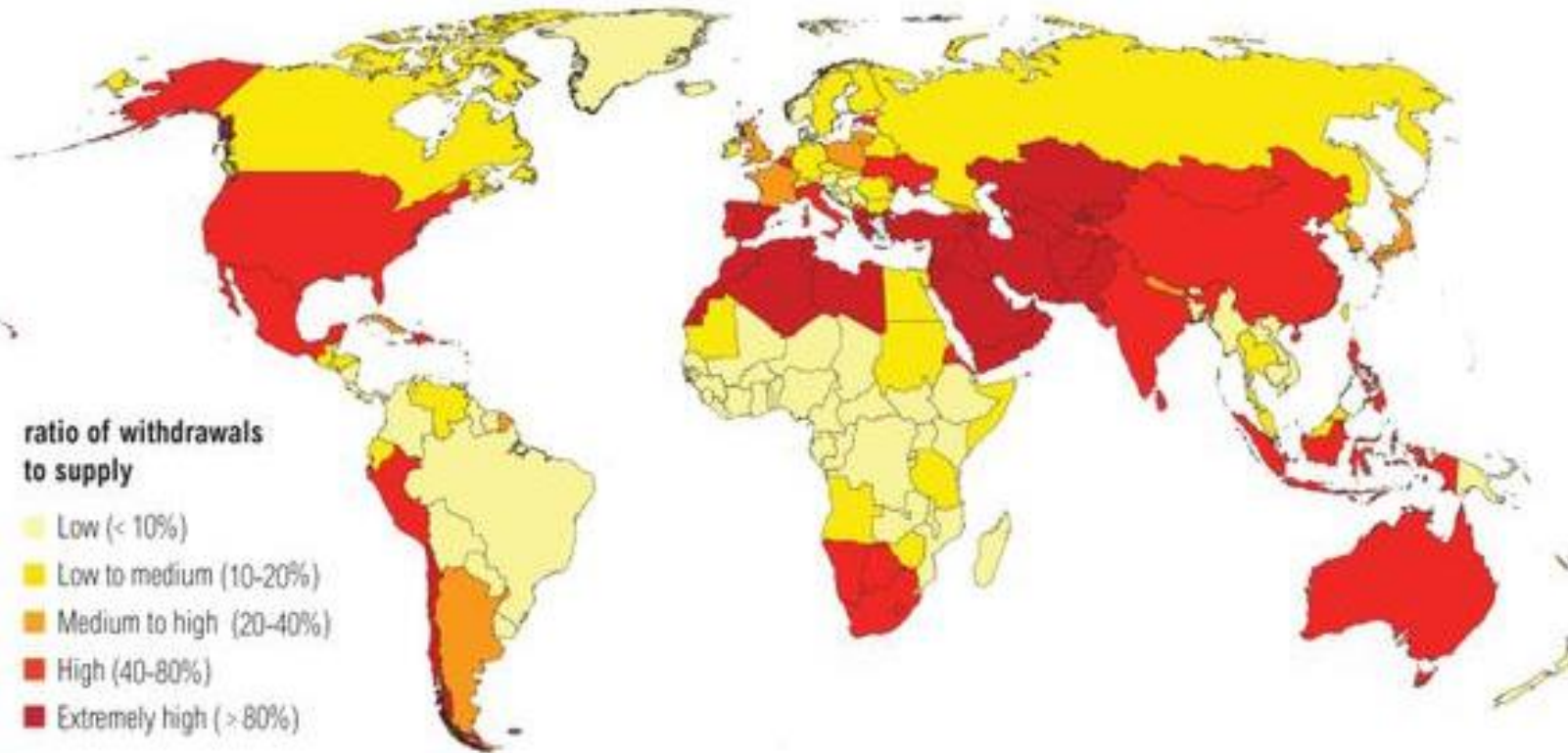
- Arizona around 700,000
- California with 240,000
- **New Mexico with around 150,000 inhabitants.**

- **Close to 2 million people in the US side** (30 percent) rely on groundwater from transboundary aquifers for domestic use
- **Over 4.2 million on the Mexico side** (70 percent).

The amount of people dependent on transboundary groundwater systems can easily **increase by half (9 million people)** as **surface water scarcity conditions persist.**

The future...

Water Stress by Country: 2040



NOTE: Projections are based on a business-as-usual scenario using SSP2 and RCP8.5.

For more: ow.ly/RiWop

The future...

- The population of many border cities will **double in 30 years**.
- U.S.-Mexico trade surpasses **\$1 billion every day**.
- If the border were a single country, it would be among the **five largest economies in the world**.
- More than 20 percent of U.S. jobs are linked to trade along the border.
- It is projected that municipal use will increase by **100% over the next 50 years** and industrial use by **40%**.
- Both international basins are overallocated.
- Annual **precipitation will remain variable** (uncertain) over the next century (IPCC 2022) and **temperature increase of 3° Celsius** over the next 50 years.
- *Aridification of the landscape in process*



Uncertainty: the new normal



An aerial view shows low water level in Yangtze river in Wuhan. *(Reuters)*



Climate crisis

Nasa images show extreme withering of Lake Mead over 22 years

The pictures from 2000, 2021 and 2022 offer a new view into its dramatically low water levels, now at just 27% capacity

Surface water availability: not an option

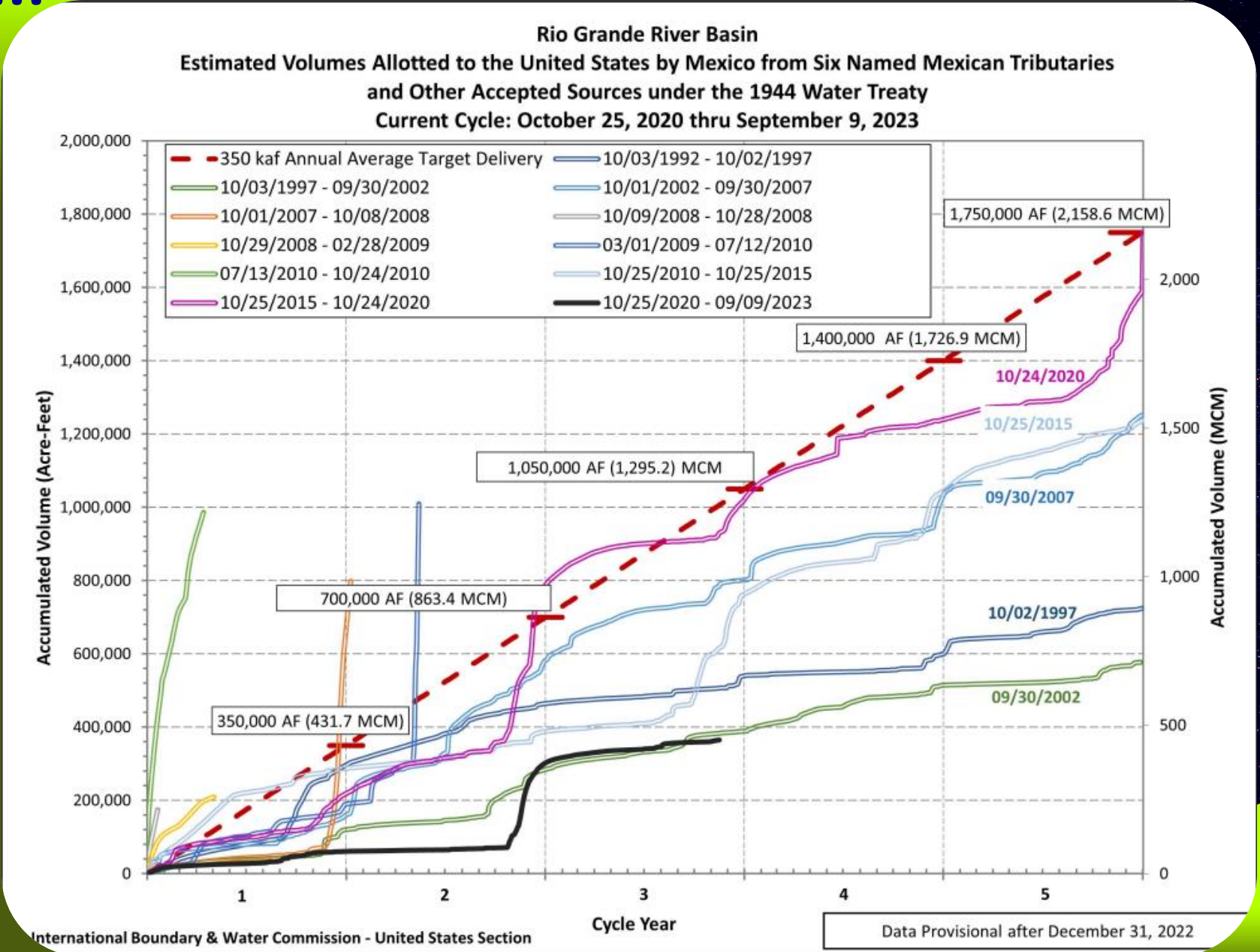


This summer, the Rio Grande disappeared entirely from Santa Elena Canyon in Big Bend National Park, pictured on May 29, 2022. Visitors gawked at the conspicuous absence of the river whose arching path gave the region its name. Credit: Dylan Baddour



The dry bed of the Rio Grande pictured May 29, 2022, at Black Dike in Big Bend National Park. The river dried up for more than 100 miles this summer. Credit: Dylan Baddour

The future...



Comisión Internacional de Límites y Aguas entre México y Estados Unidos

▼ Condiciones de las Presas Internacionales

[Click to collapse](#)

Comisión Internacional de Límites y Aguas entre México y Estados Unidos

Condiciones de las Presas Internacionales

18 de Septiembre de 2023 **8:00hr**

Presa La Amistad

NAMO(m)	4040.325
Almacenamiento (Mm ³)	Porcentaje de llenado
1,279.250	31.7 %

13 de Septiembre de 2023 **8:00 hr**

Presa Falcón

NAMO(m)	3264.813
Almacenamiento (Mm ³)	Porcentaje de llenado
470.583	14.4 %

Almacenamiento en millones de metros cúbicos

Información preliminar sujeta a cambios

The Rio Grande Basin

The Rio Grande is among the 10 highest water stress basins in the world (UNESCO, 2019),

with 83% of the river flow lost (WWF 2022).

The Rio Grande provides water to 7 states in 2 countries.

Source of water for 15 million people

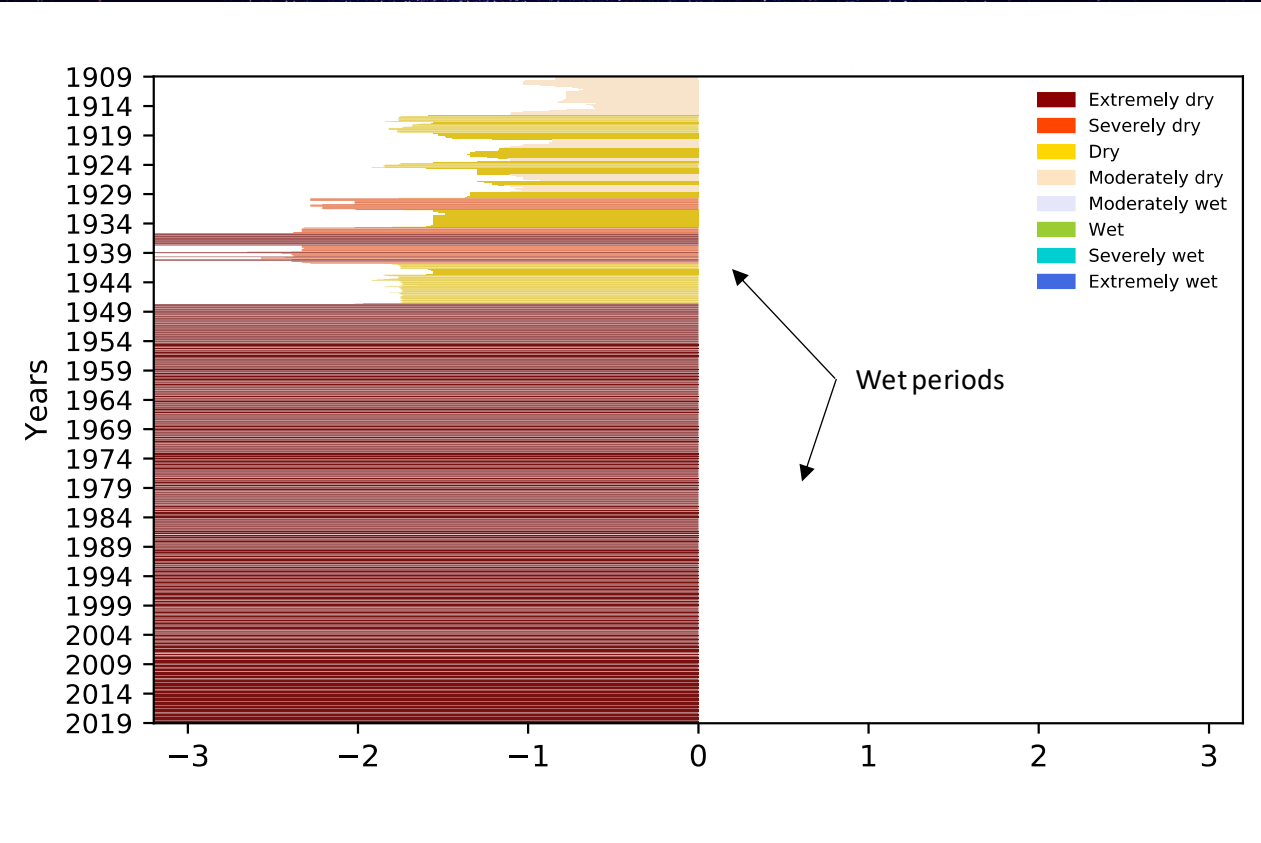
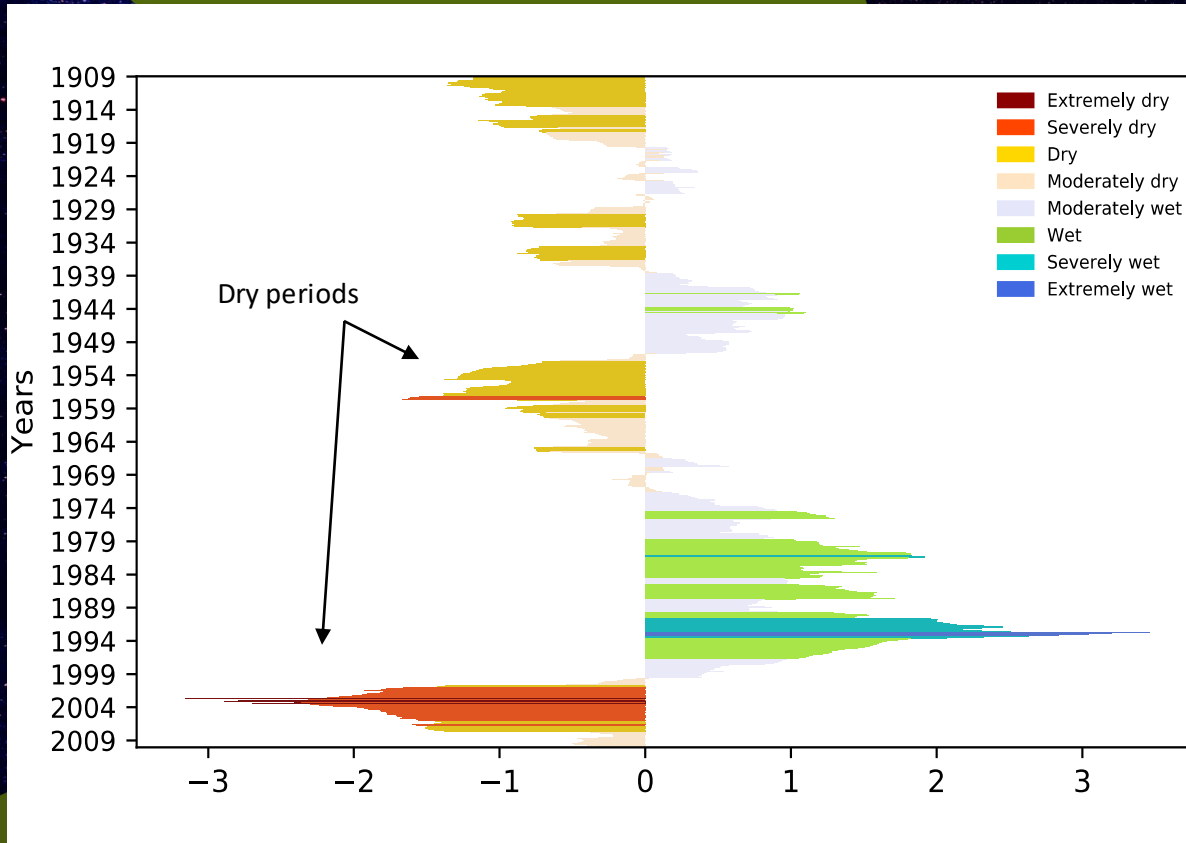
Annual precipitation will remain variable (uncertain) over the next century (IPCC 2022).



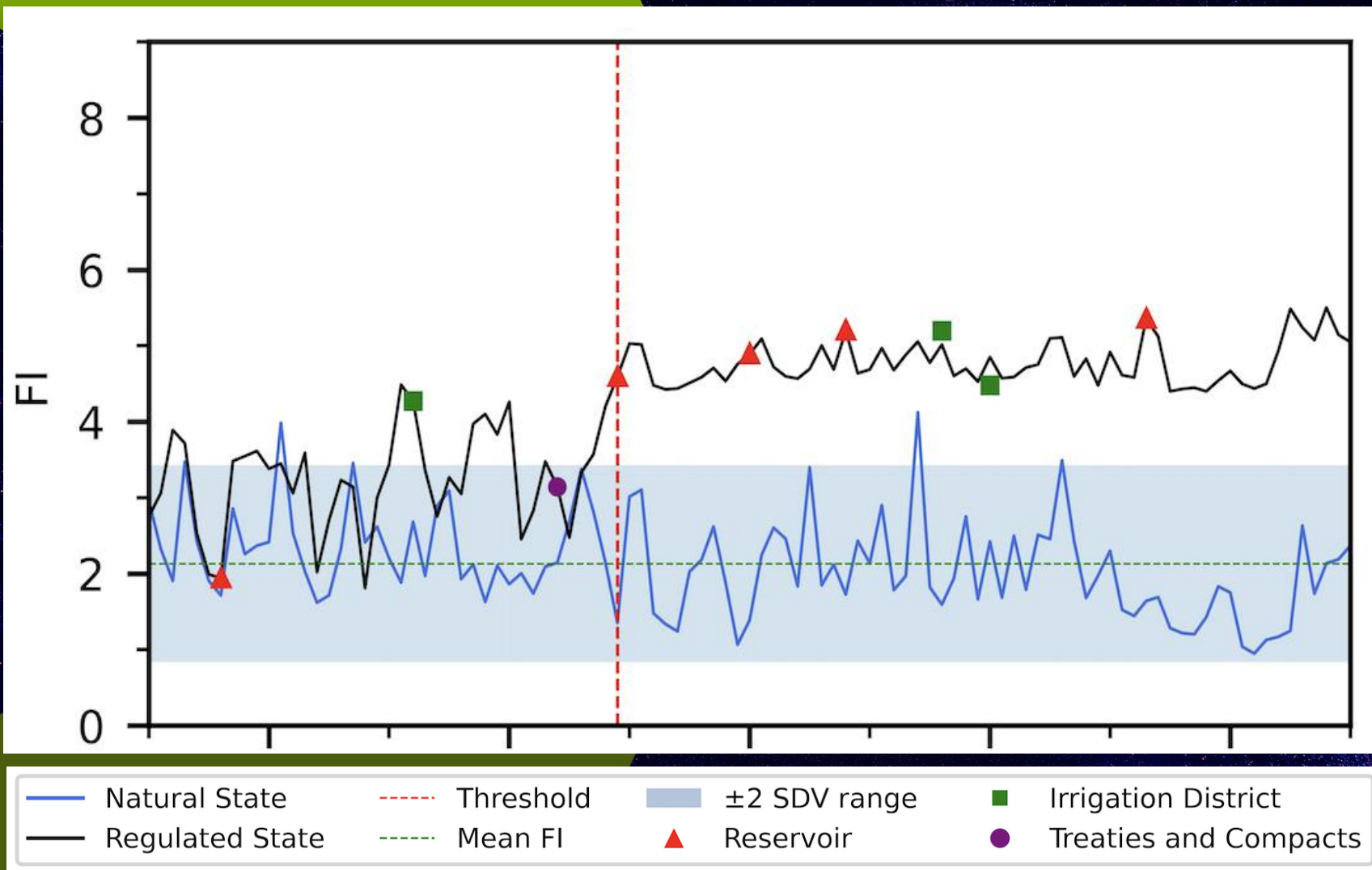
Induced or anthropogenic drought? The current state of the Rio Grande Basin

Natural flow (without human intervention)

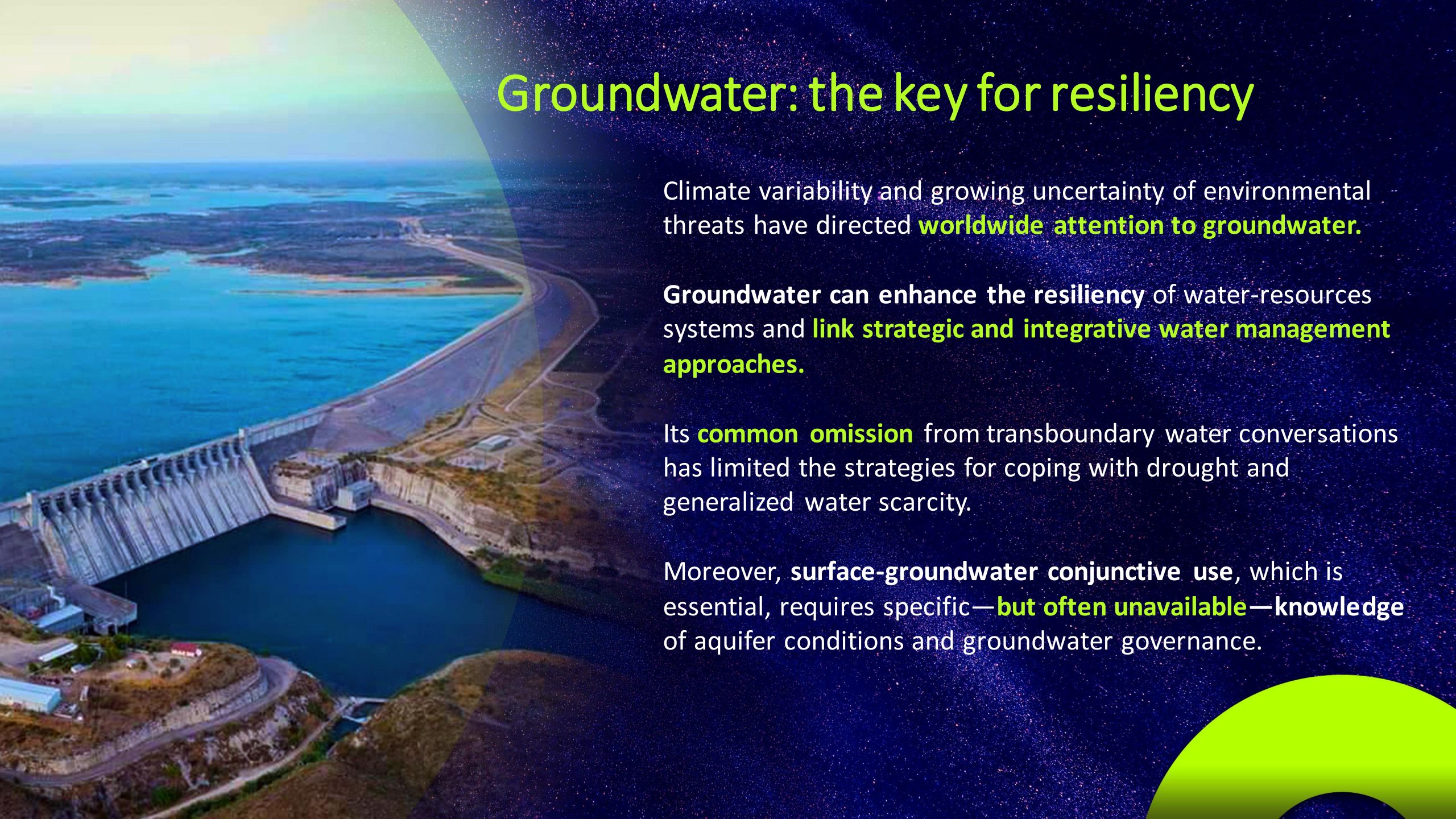
Current condition (with human intervention)



Induced or anthropogenic drought? The current state of the Rio Grande Basin



The divorce of
natural flow and
regulated flow

An aerial photograph of a large concrete dam with multiple spillways, situated on a rocky hillside. The reservoir behind the dam is a vibrant blue. The background is a dark, starry night sky. A green circular graphic element is visible in the bottom right corner.

Groundwater: the key for resiliency

Climate variability and growing uncertainty of environmental threats have directed **worldwide attention to groundwater.**

Groundwater can enhance the resiliency of water-resources systems and **link strategic and integrative water management approaches.**

Its **common omission** from transboundary water conversations has limited the strategies for coping with drought and generalized water scarcity.

Moreover, **surface-groundwater conjunctive use**, which is essential, requires specific—**but often unavailable**—knowledge of aquifer conditions and groundwater governance.

WHAT WE KNEW (OFFICIALLY) BEFORE 2016

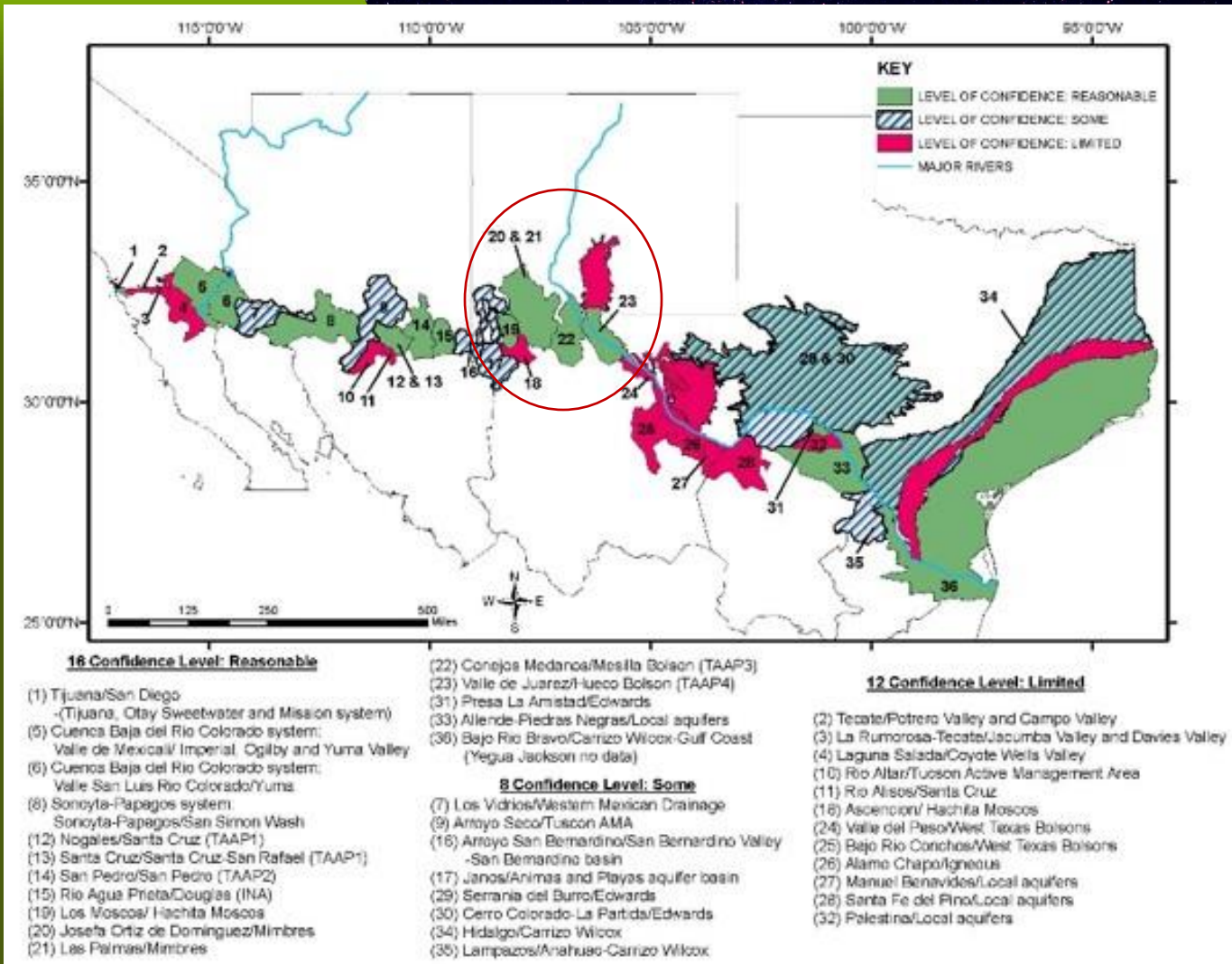
Only 11 aquifers recognized as transboundary
Only 4 aquifers are considered priority
Limited legal framework

Plus....

No surface water availability
Population will double in the next 40 years
Where will the water come from?



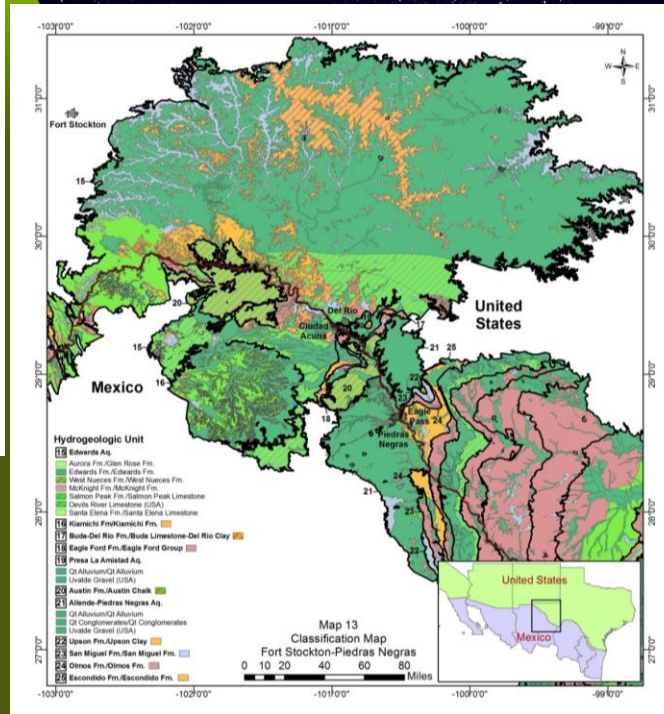
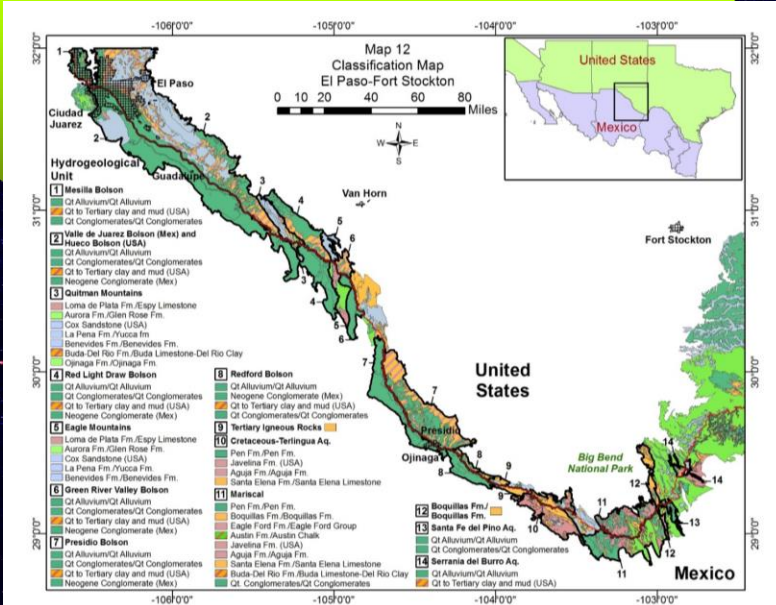
WHAT WE KNEW IN 2016...



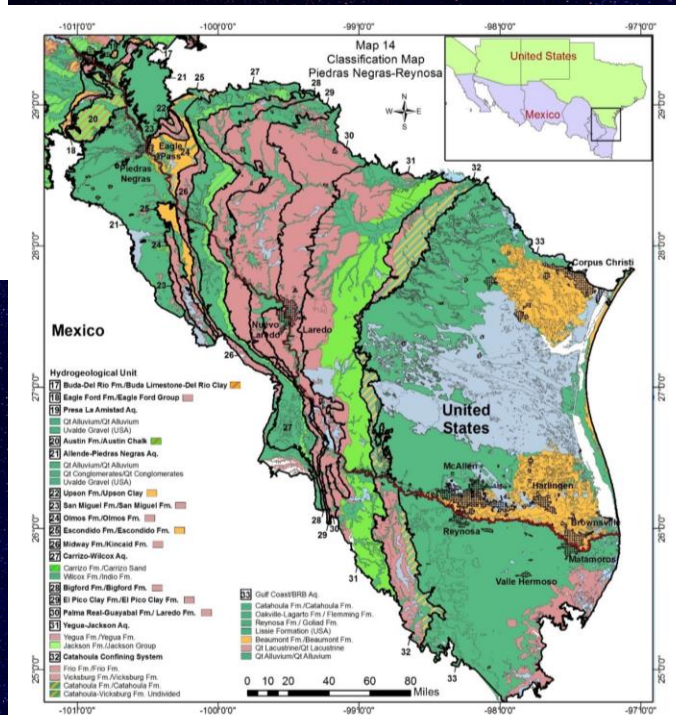
36 TBAs

WHAT WE KNEW IN 2018

Texas/Mexico



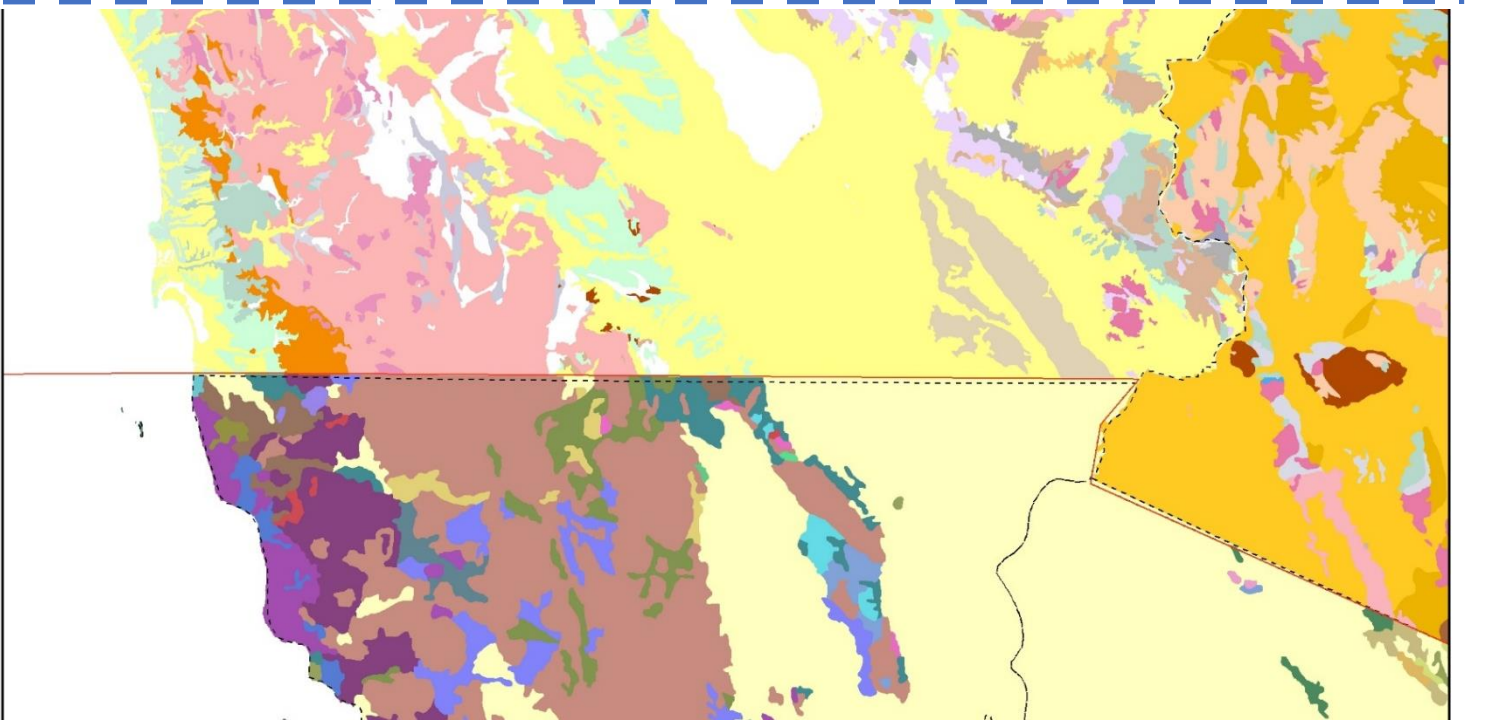
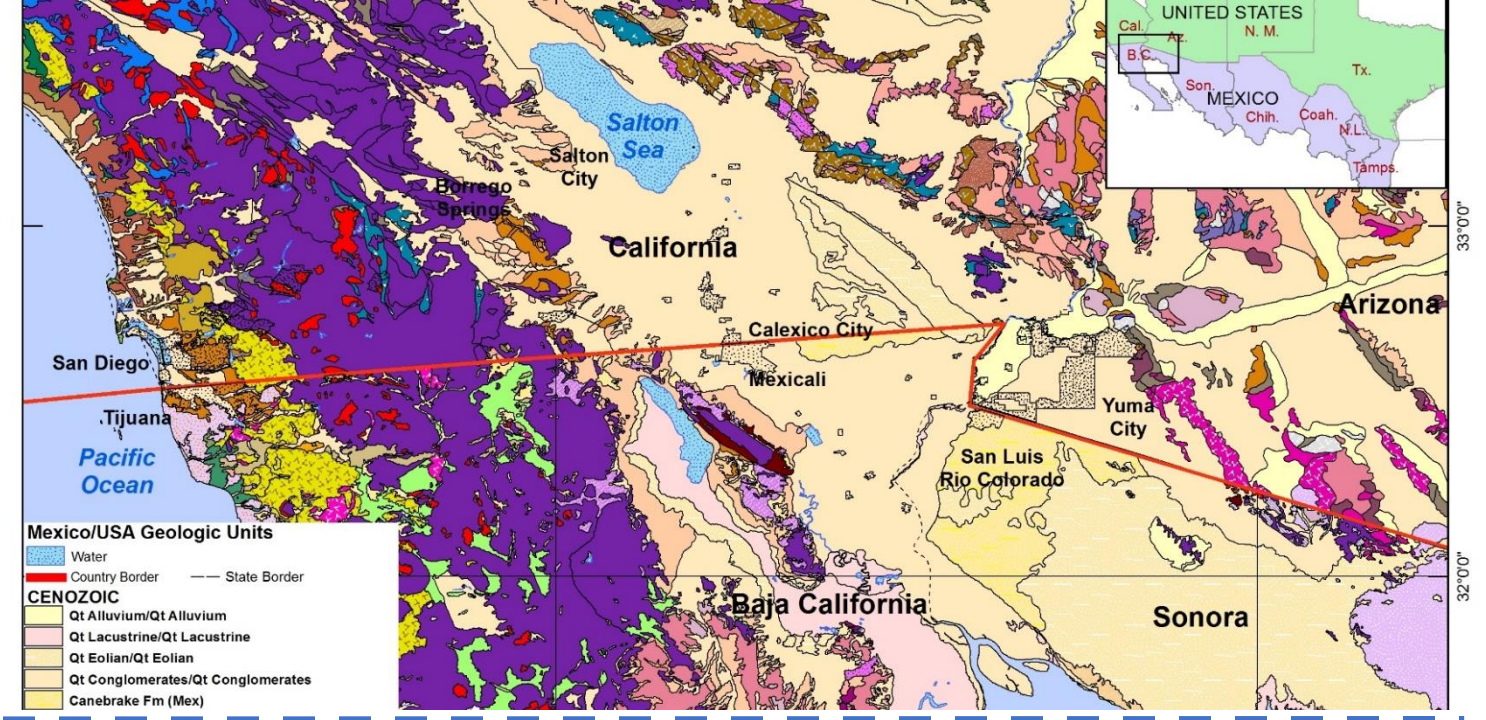
33 HGU's
60% of the shared area has good aquifer potential and good to moderate water quality



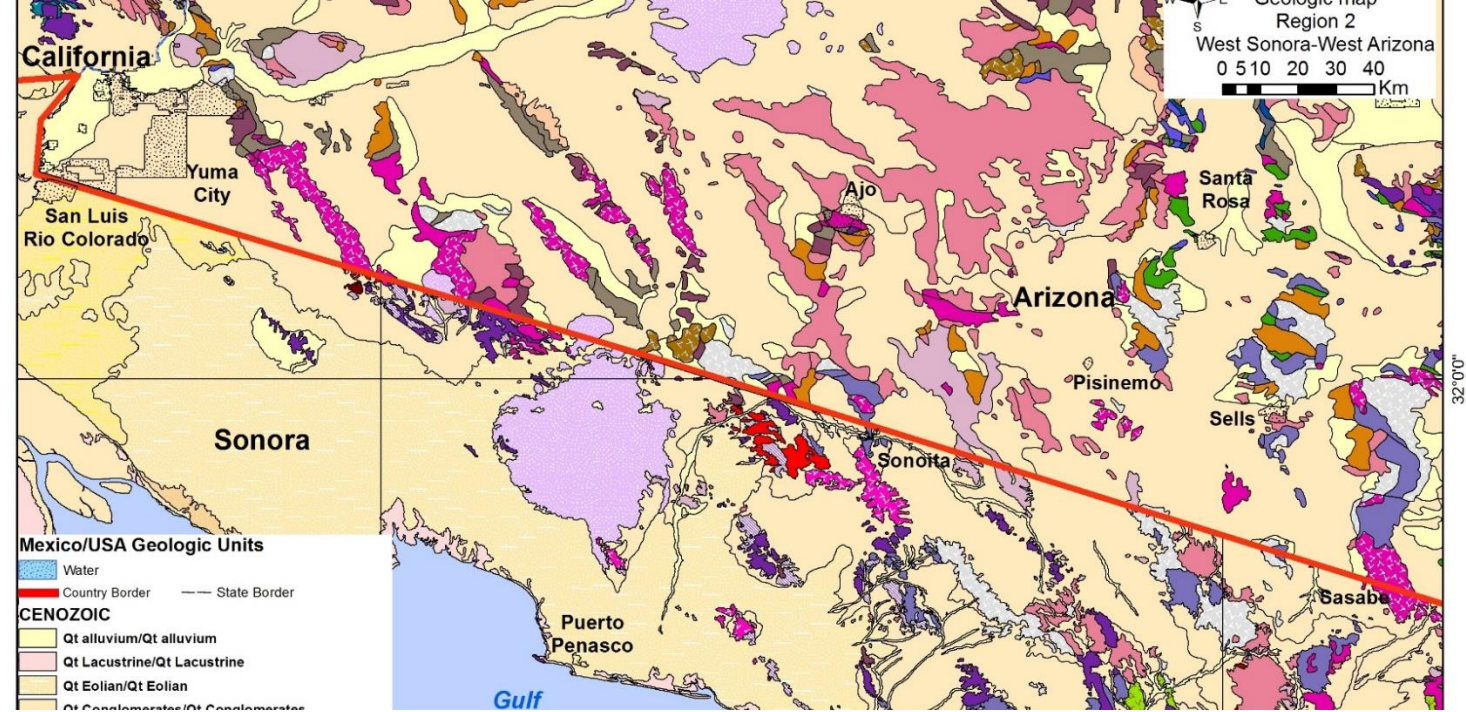


After....(2021)

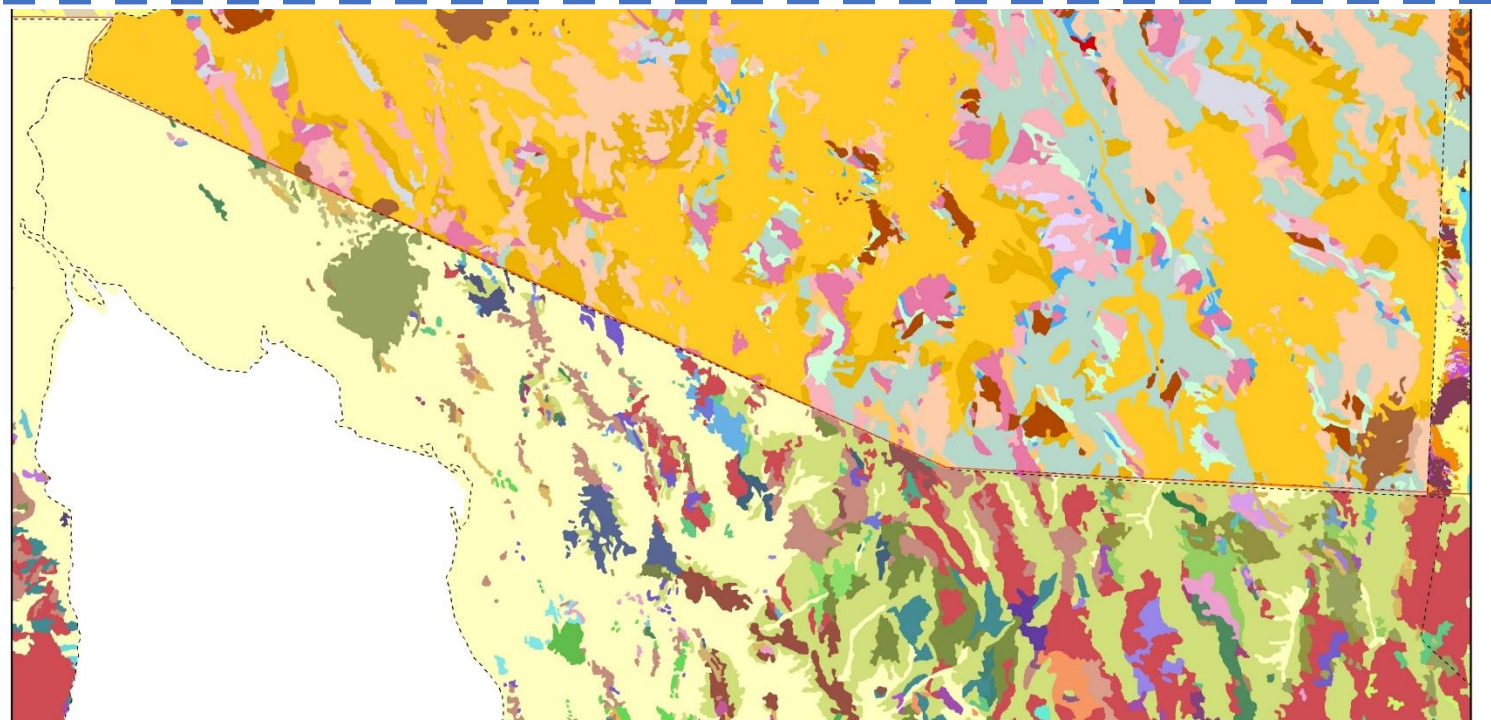
Before...

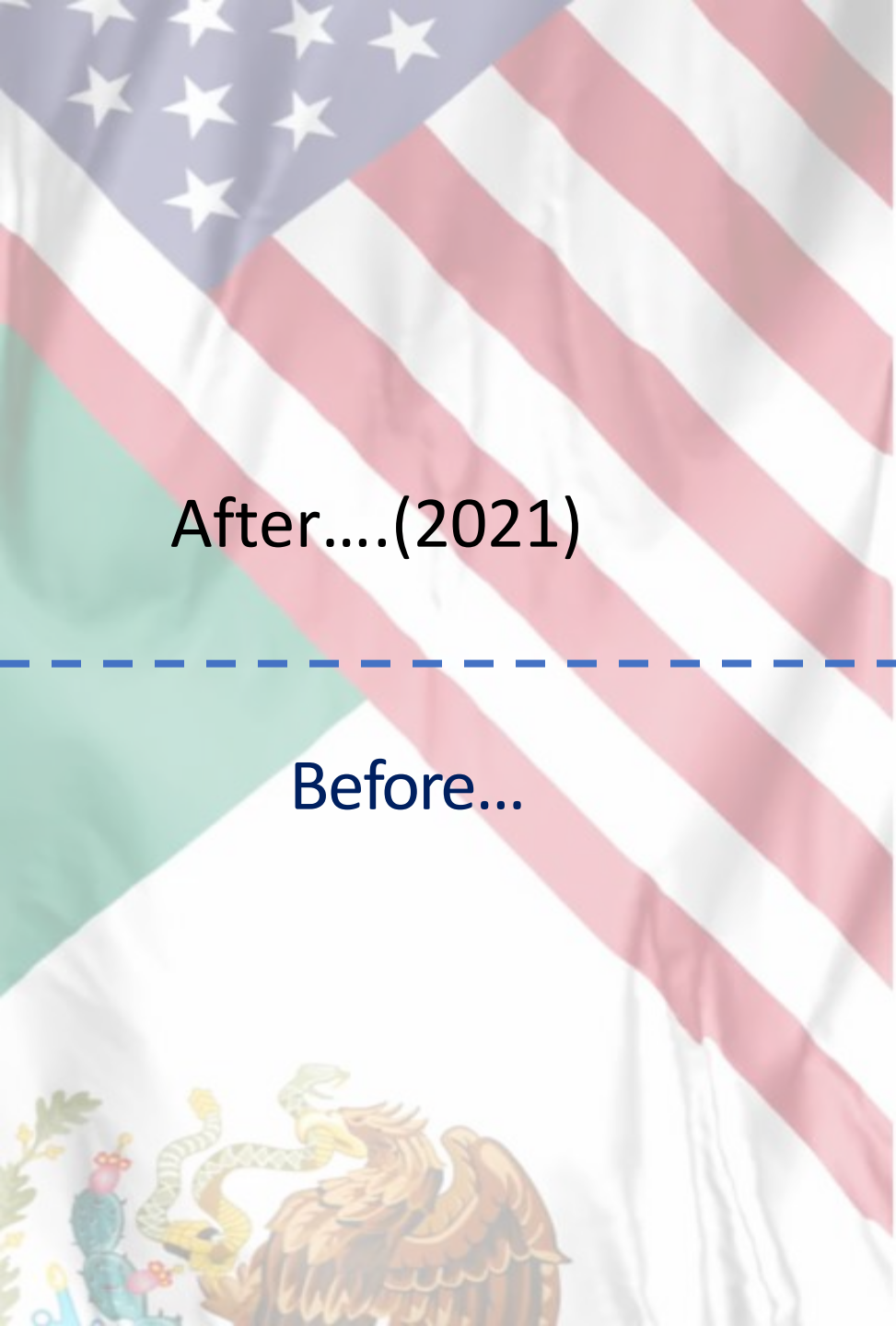


After....(2021)



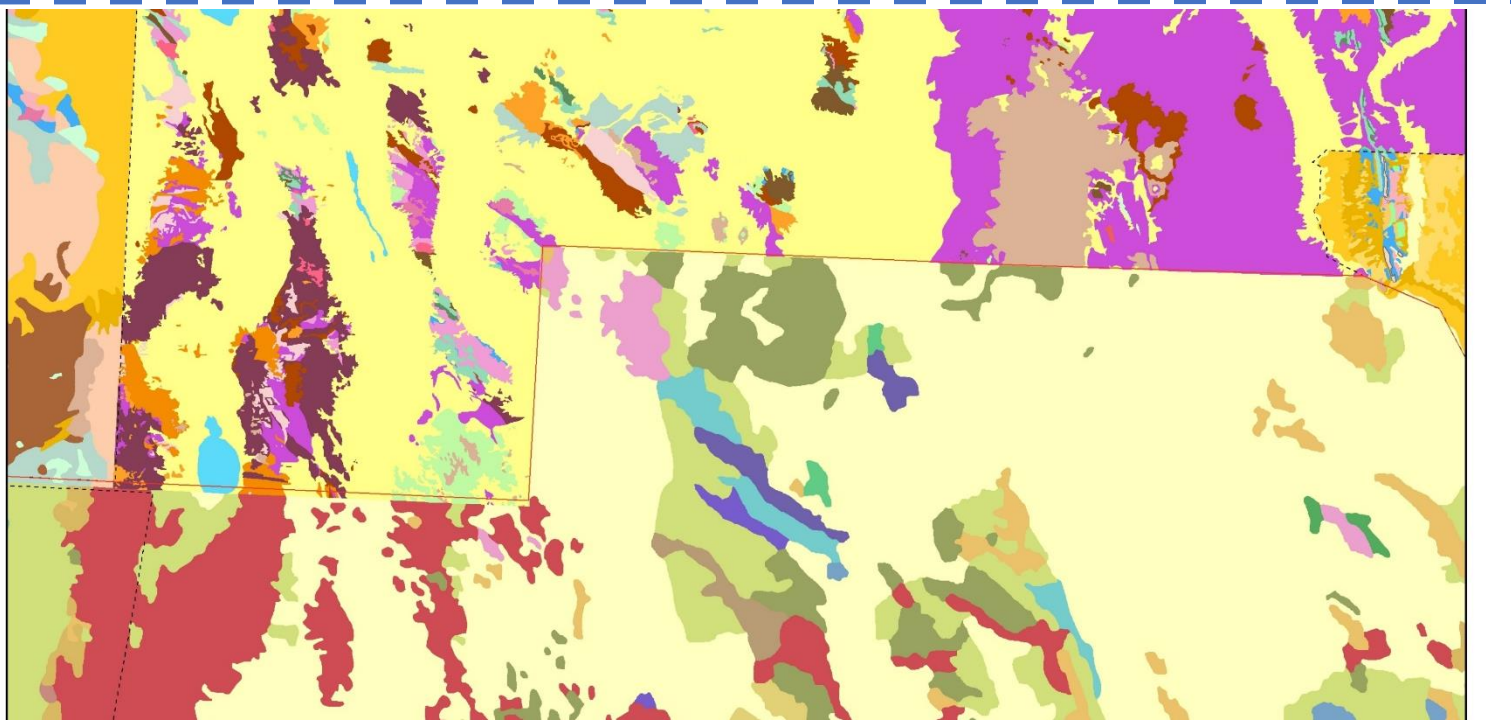
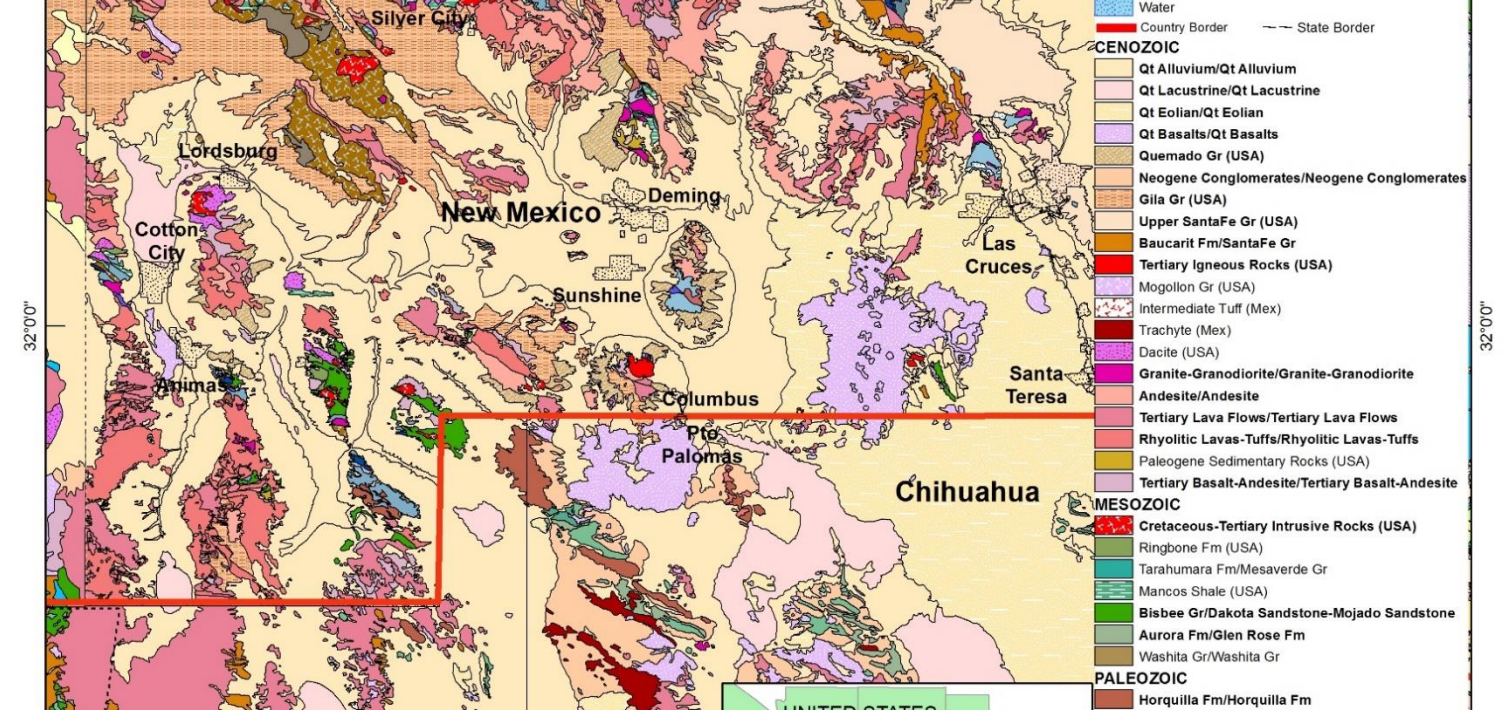
Before...





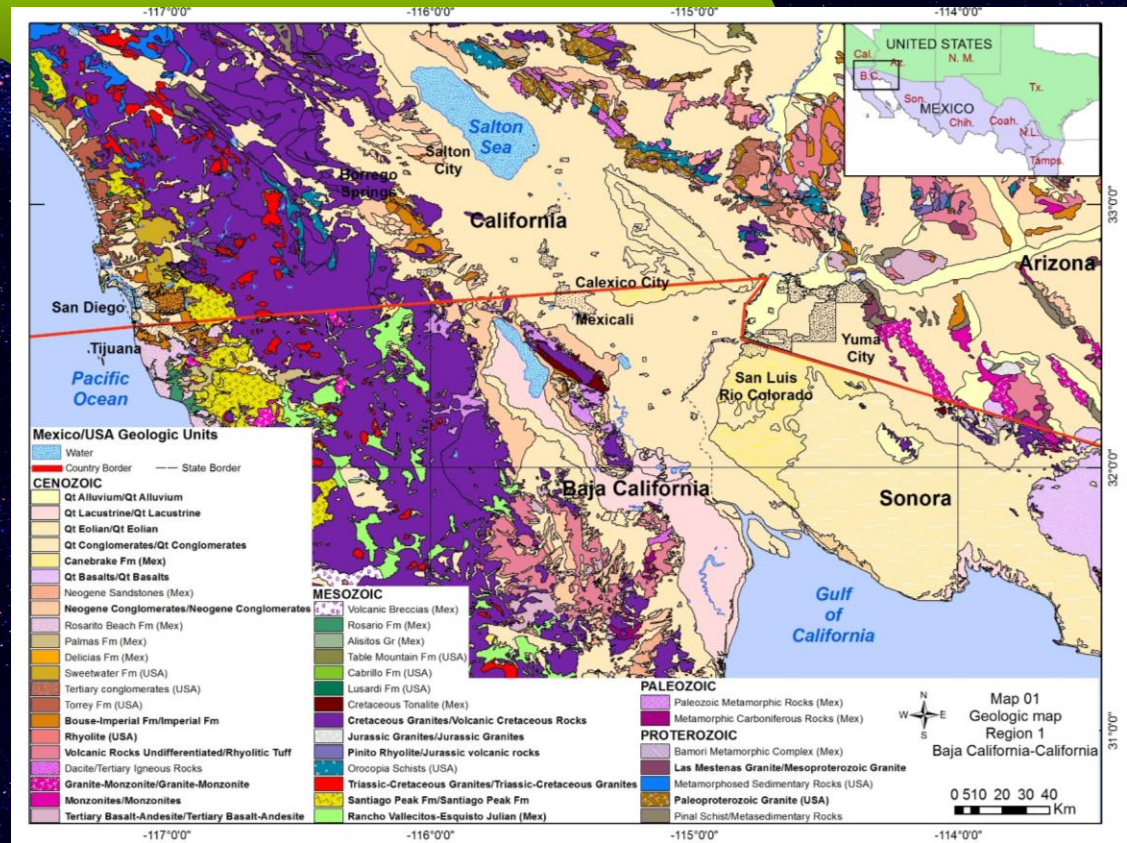
After....(2021)

Before...

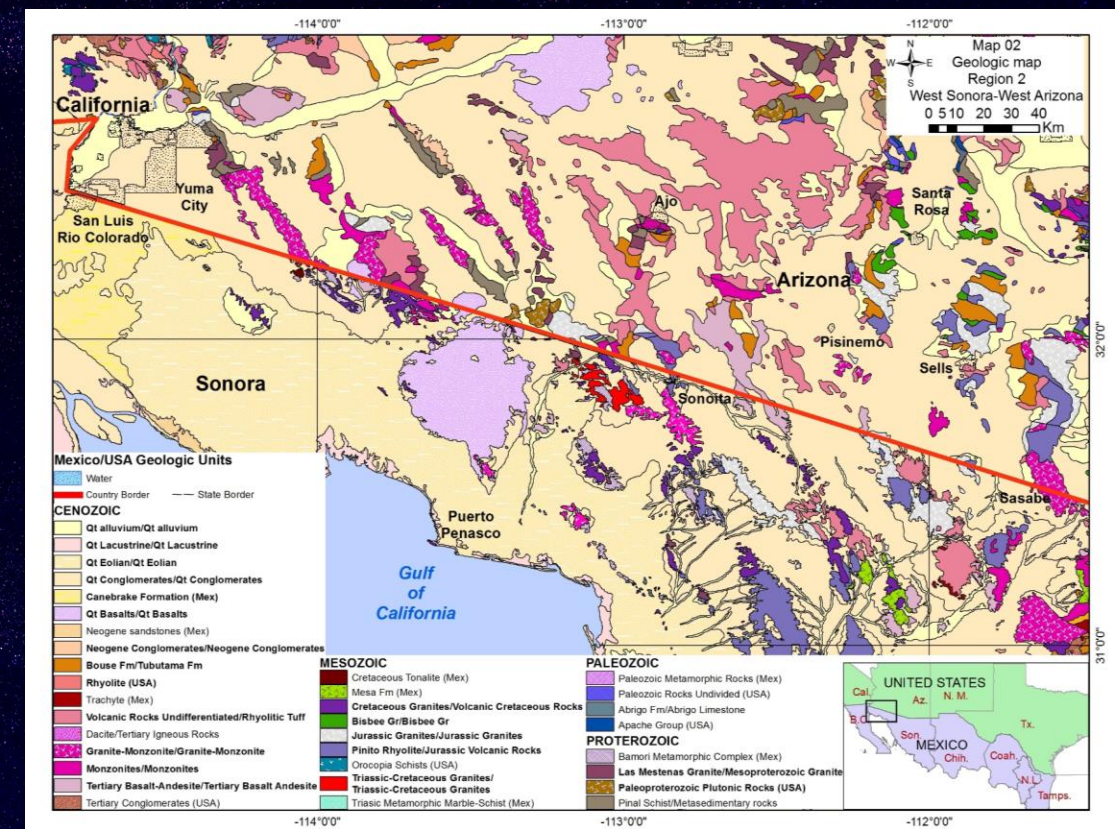


IN 2021

California/Mexico



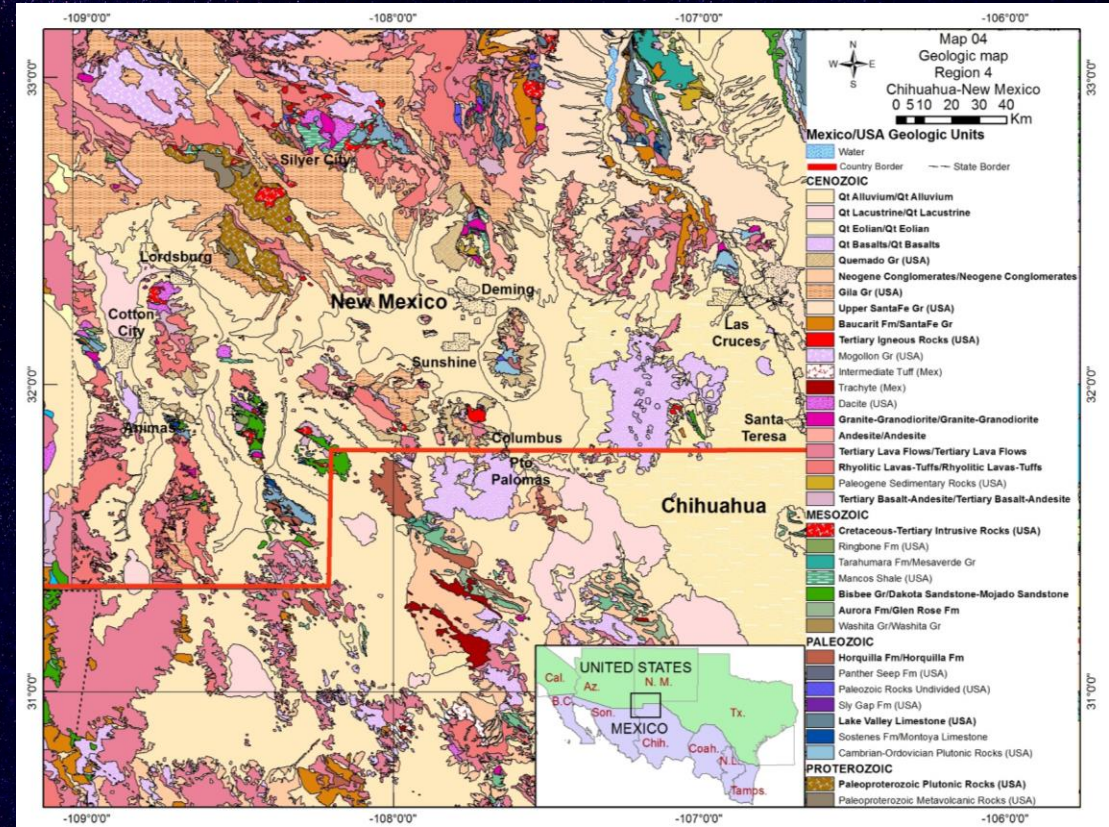
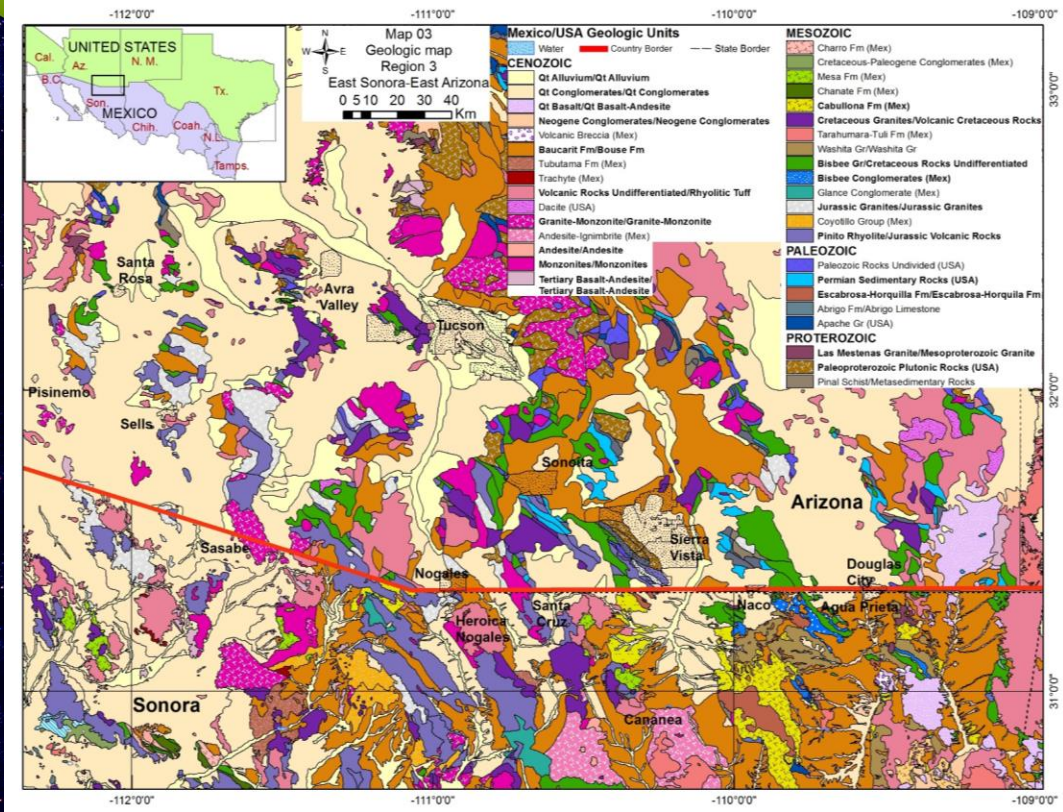
West Arizona/Mexico



IN 2021

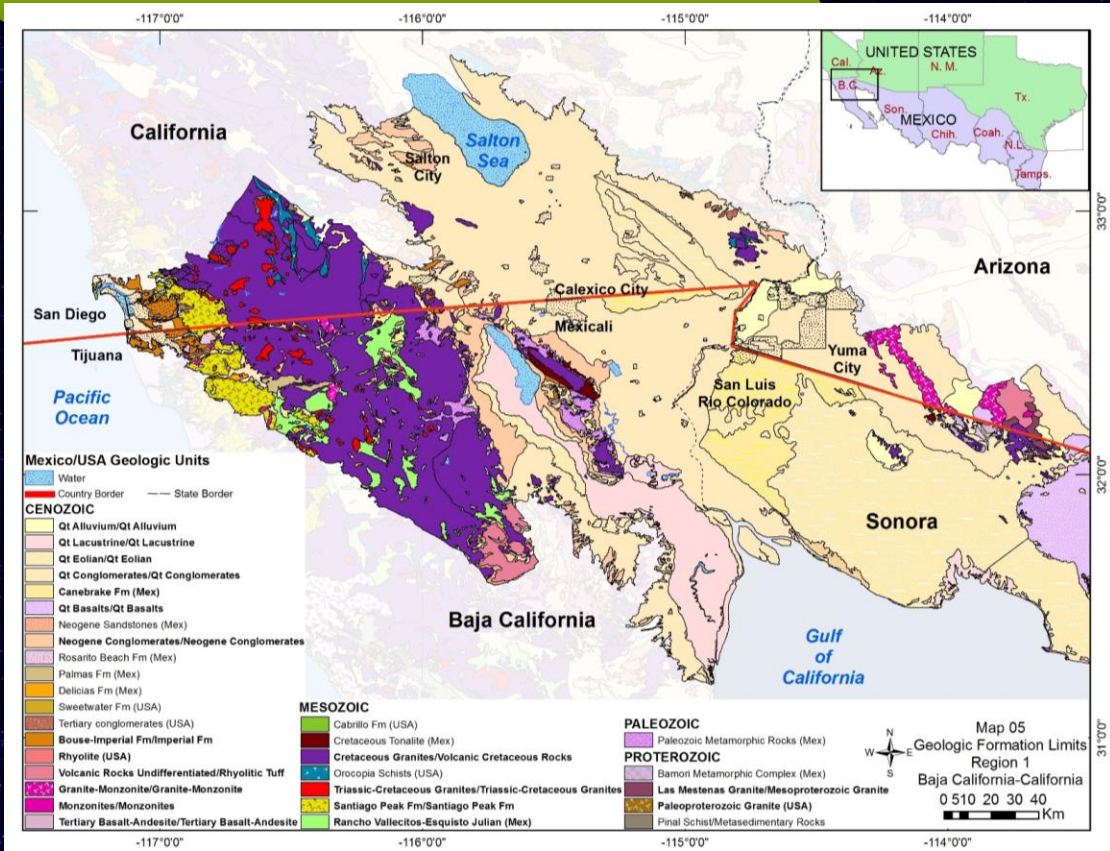
East Arizona/Mexico

New Mexico/Mexico

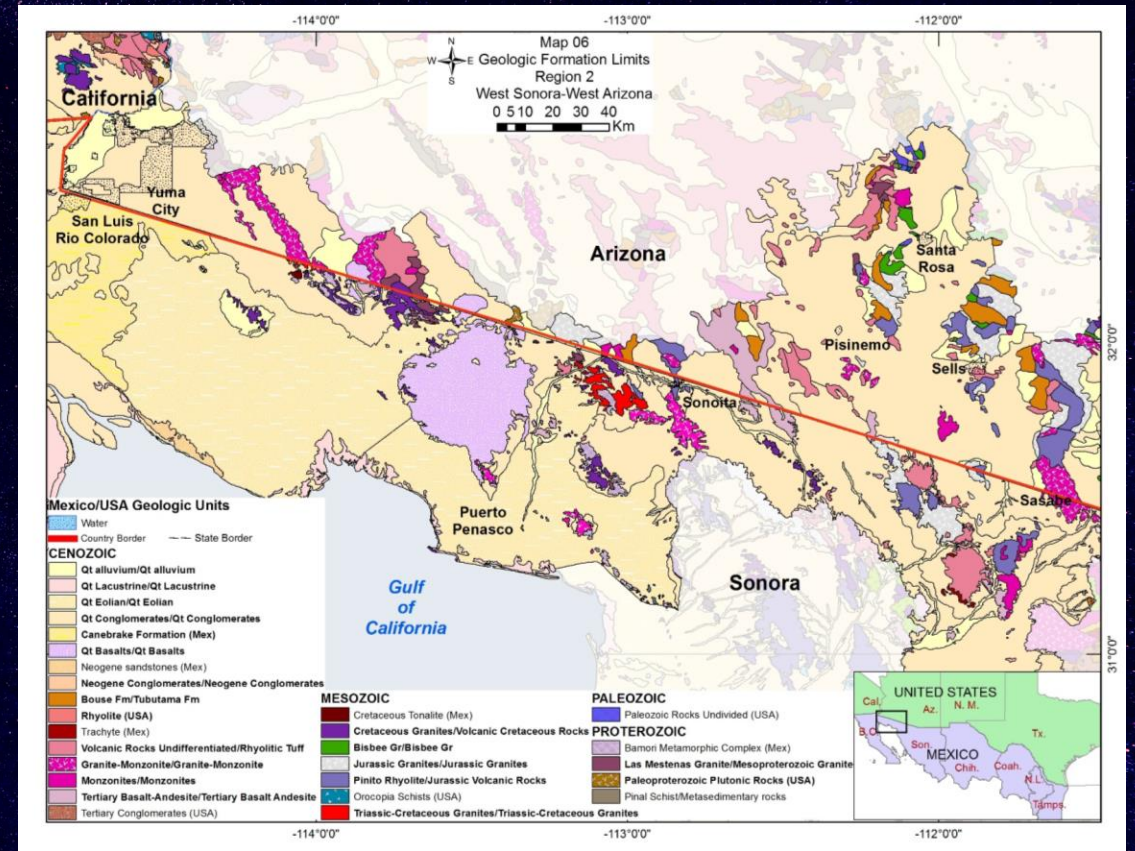


IN 2021

California/Mexico

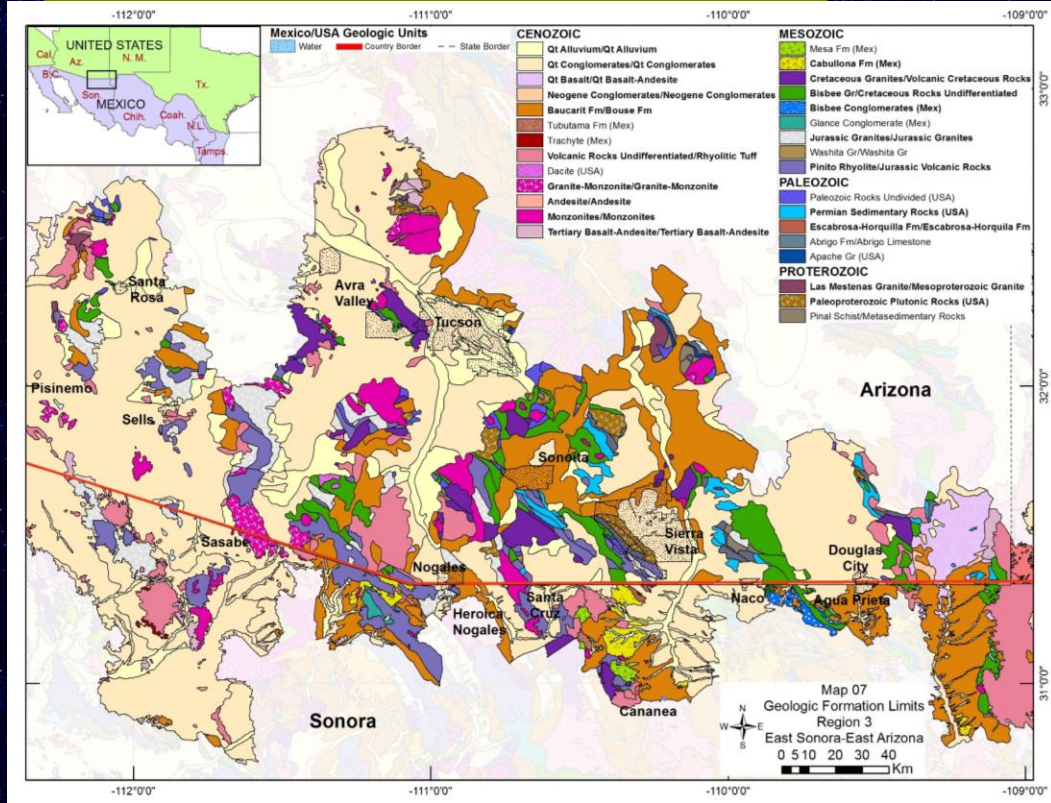


West Arizona/Mexico

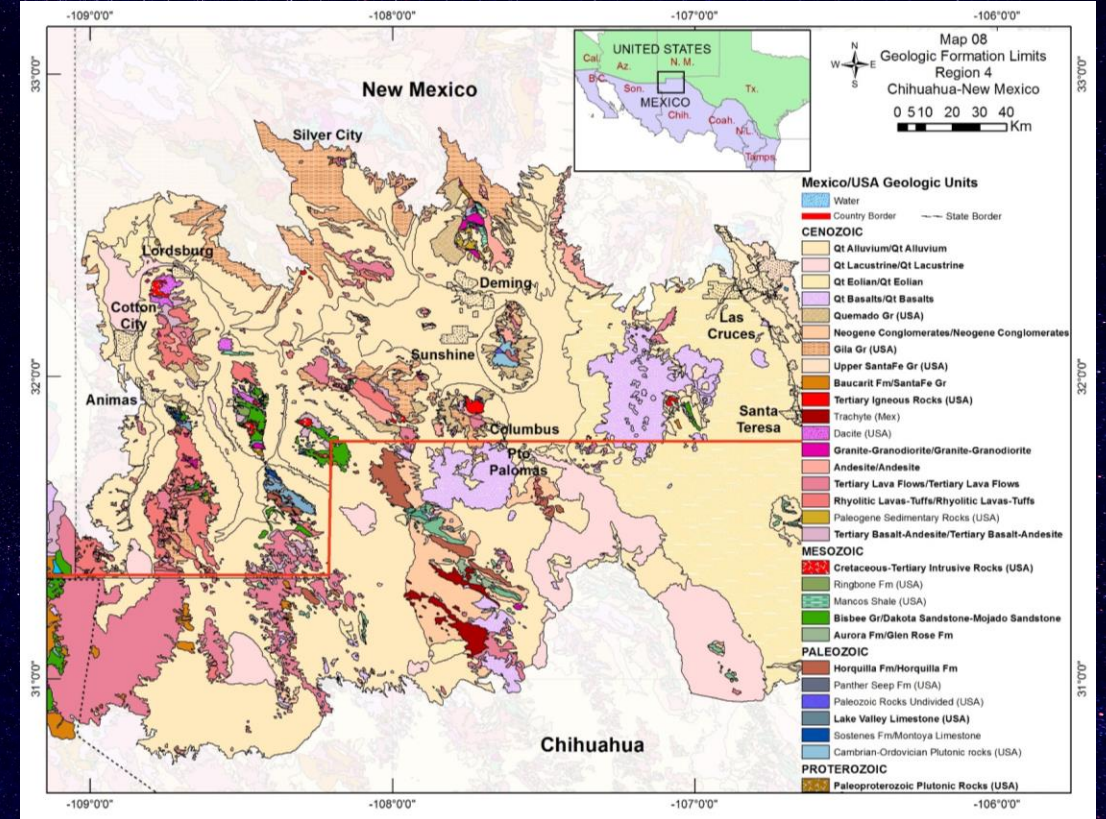


IN 2021

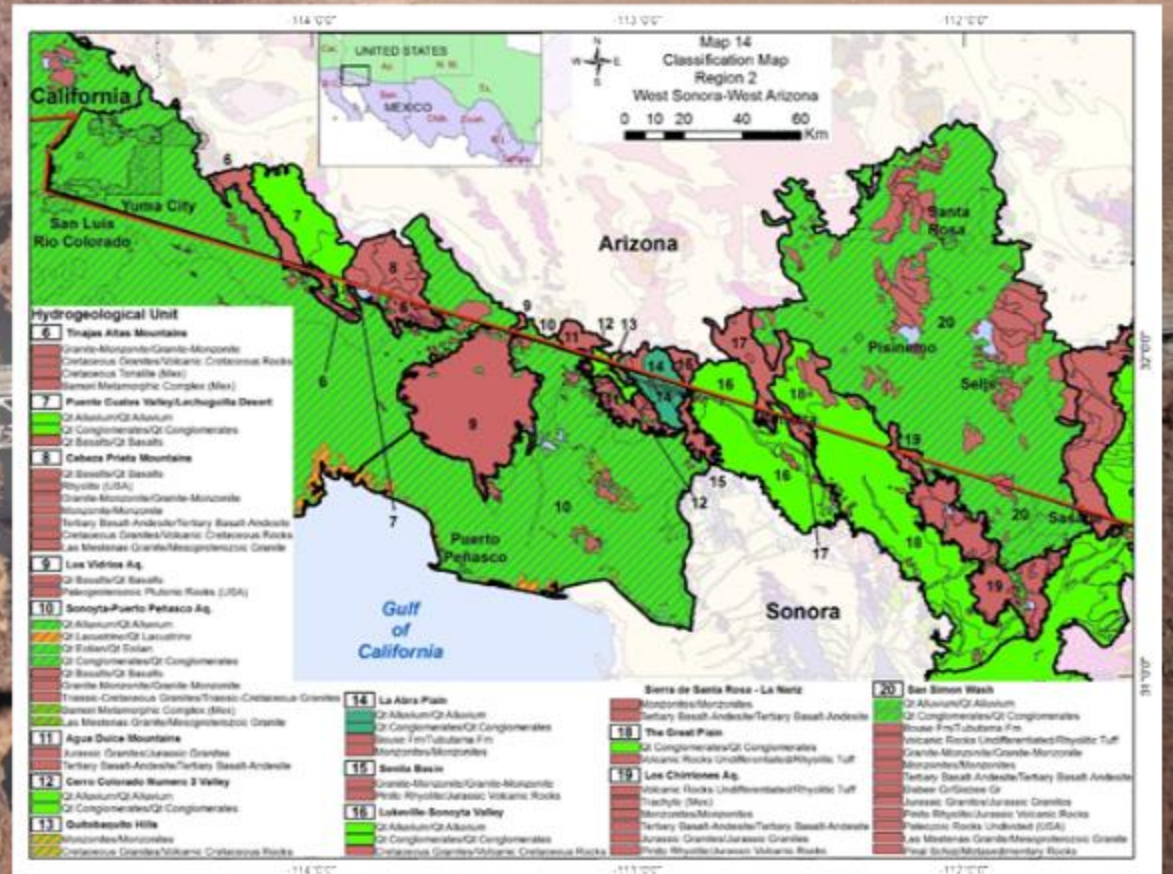
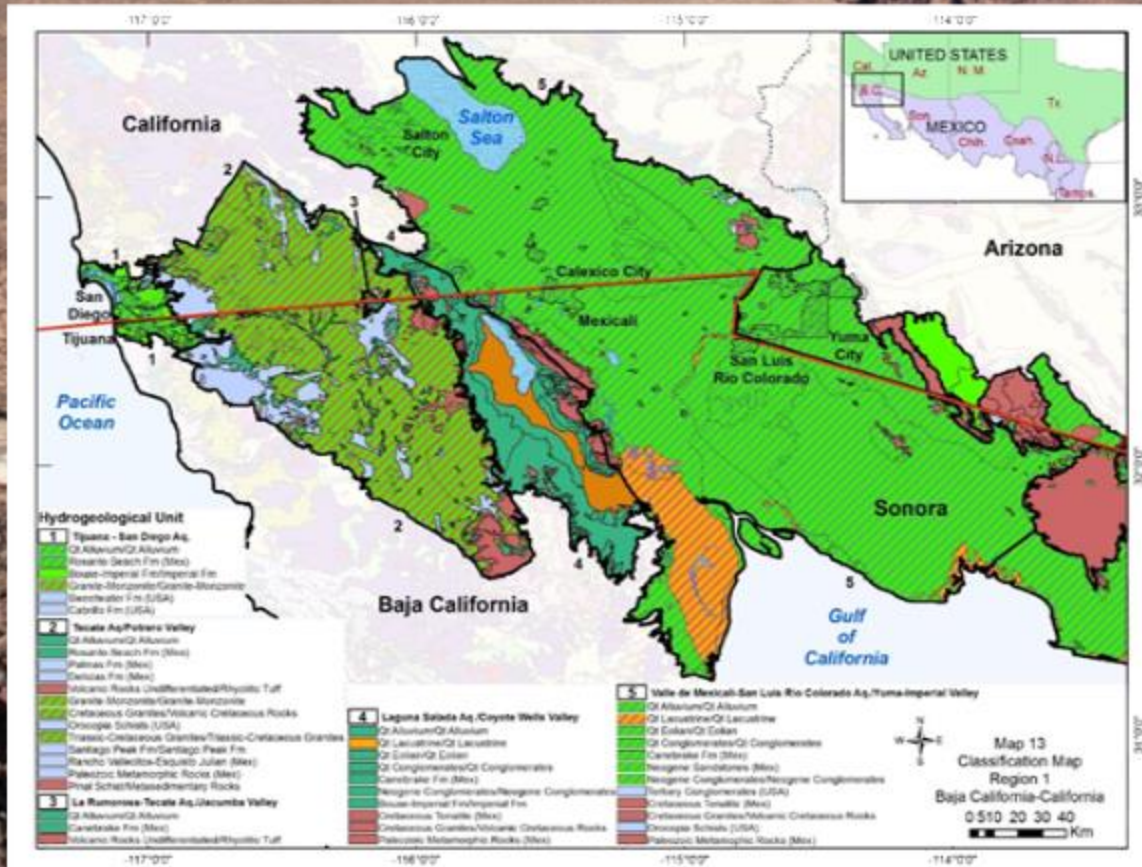
East Arizona/Mexico



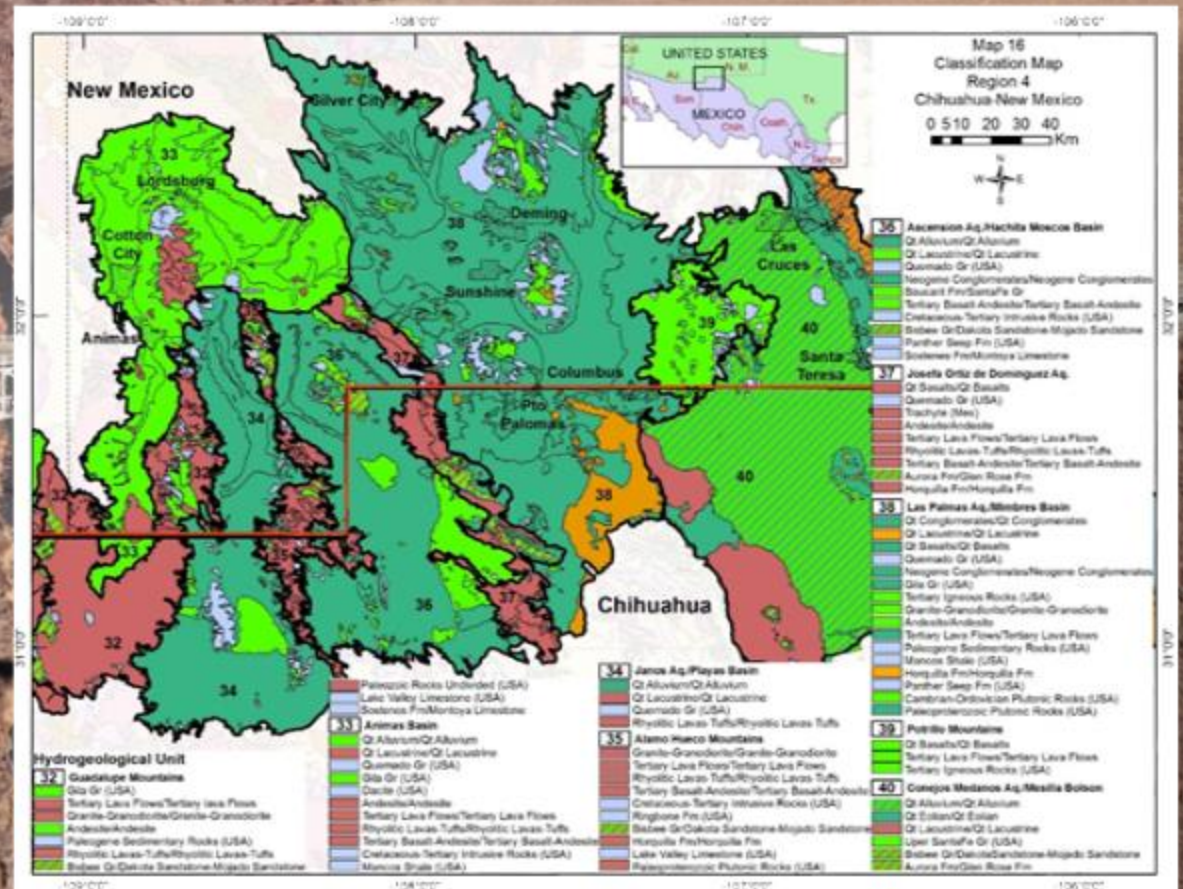
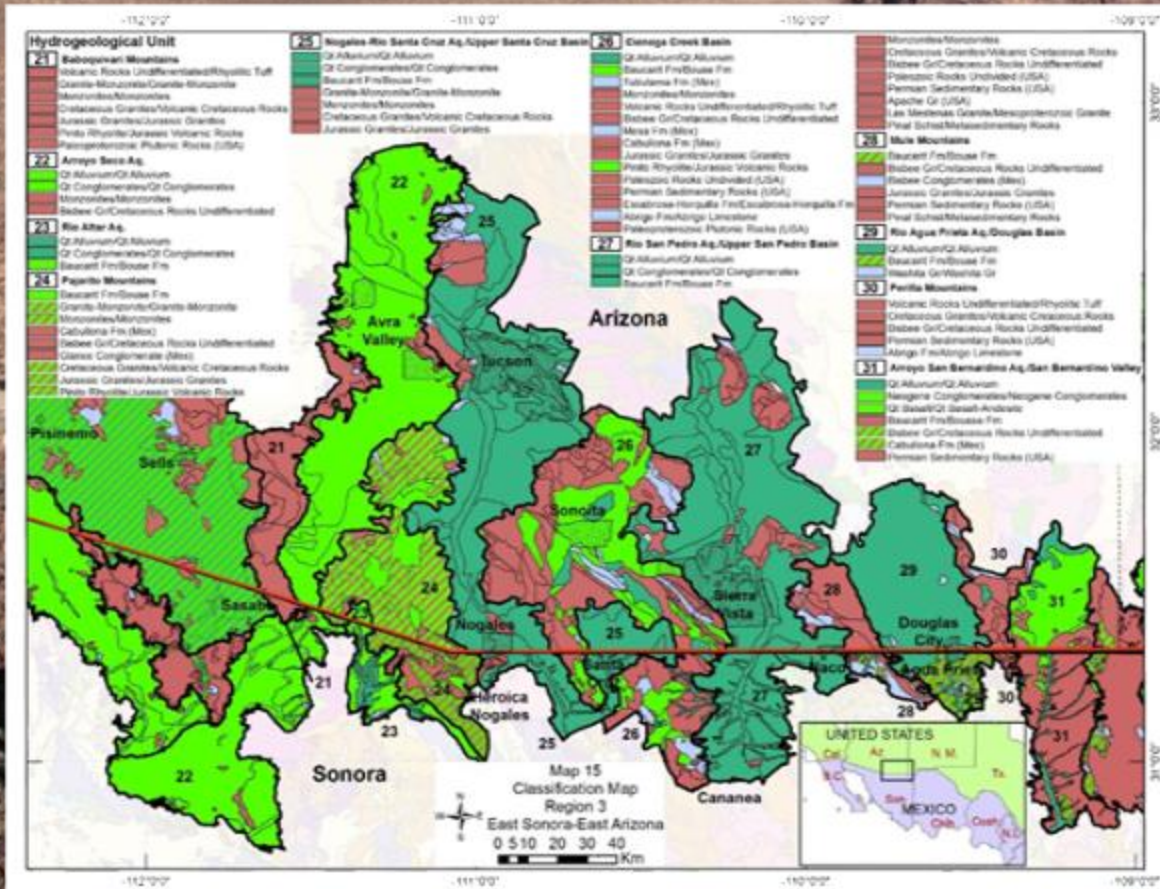
New Mexico/Mexico



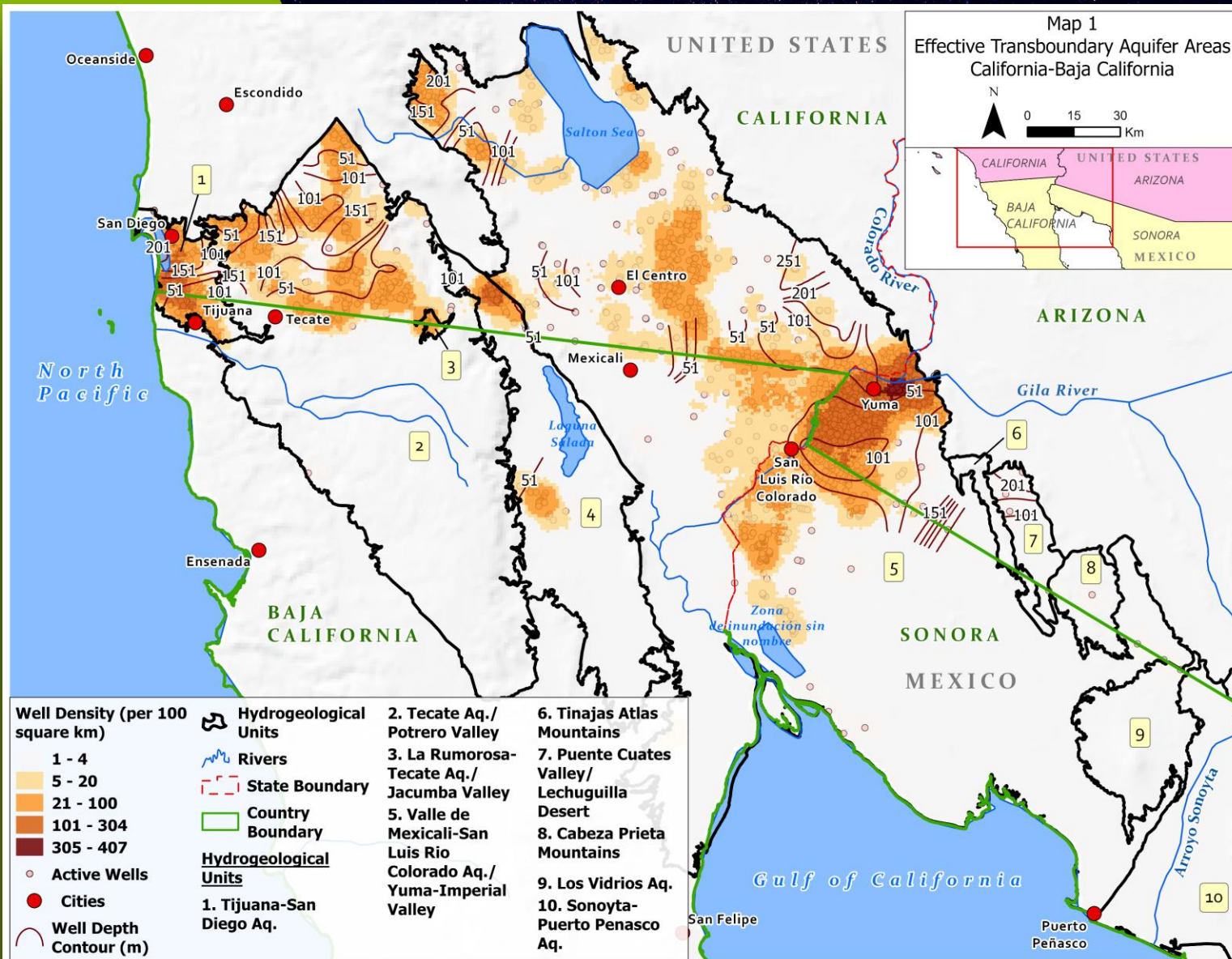
In 2021..



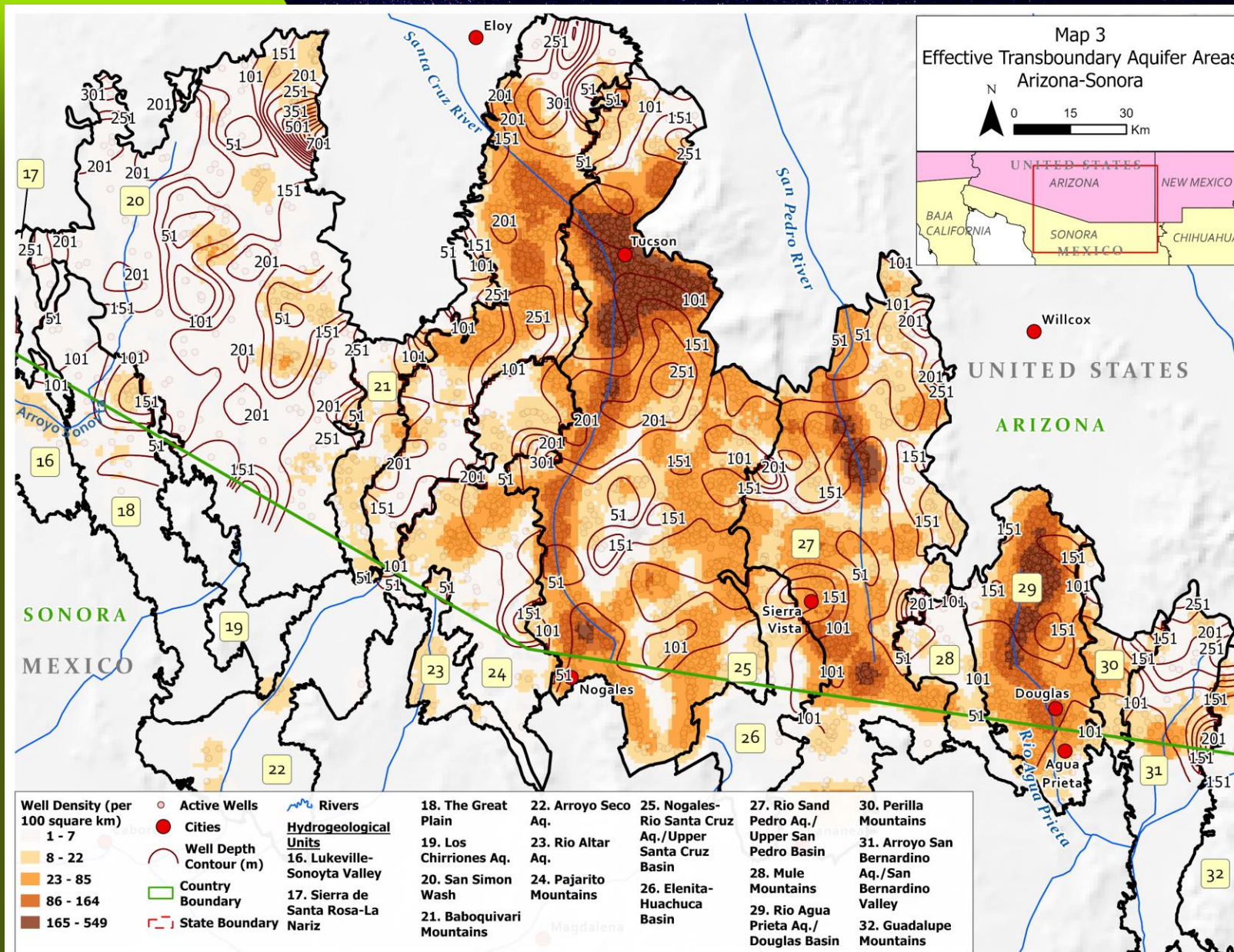
In 2021..



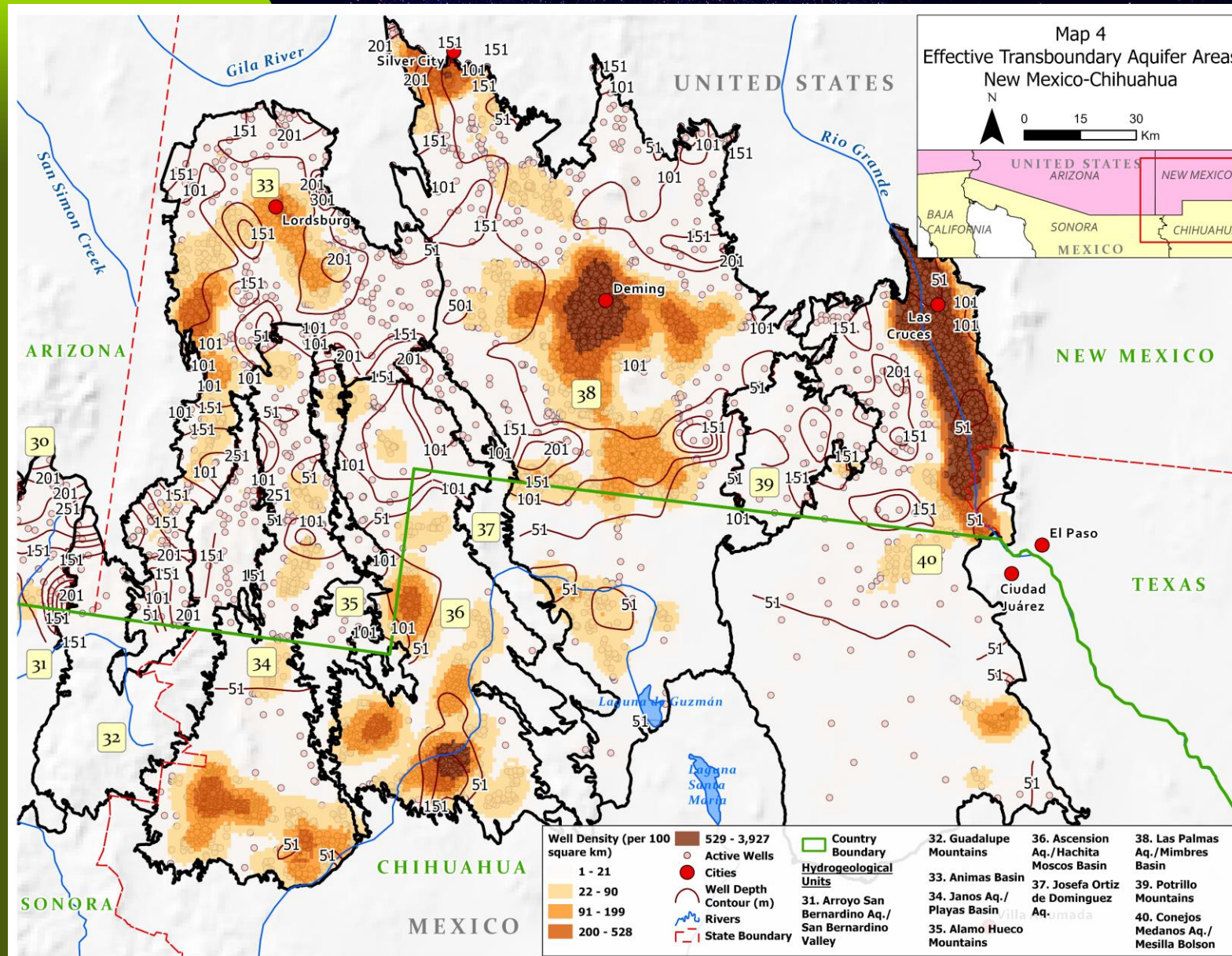
Upcoming... Effective Transboundary Aquifer Areas (hot spots)



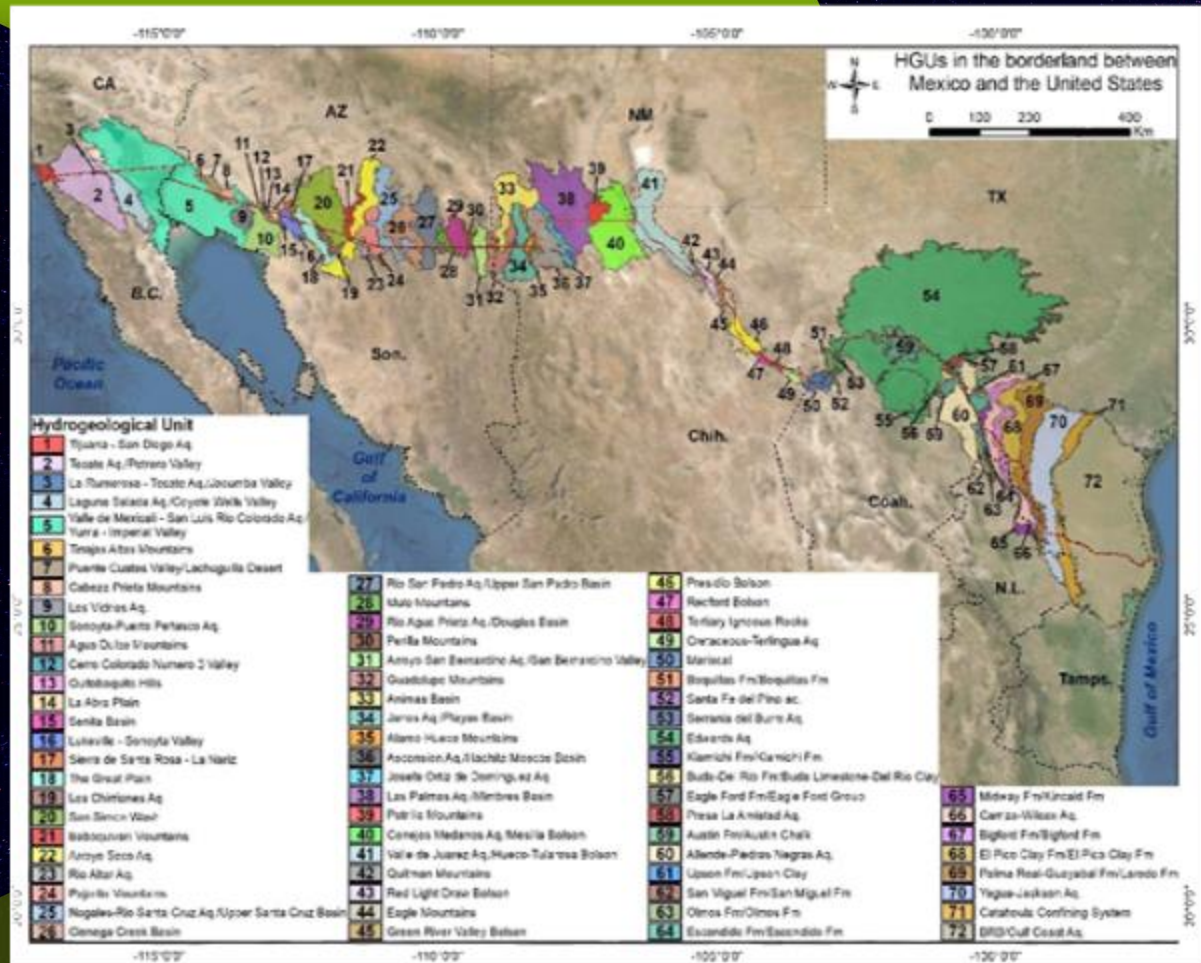
Upcoming... Effective Transboundary Aquifer Areas (hot spots)



Upcoming... Effective Transboundary Aquifer Areas (hot spots)



Shared groundwater: Opportunity or threat?

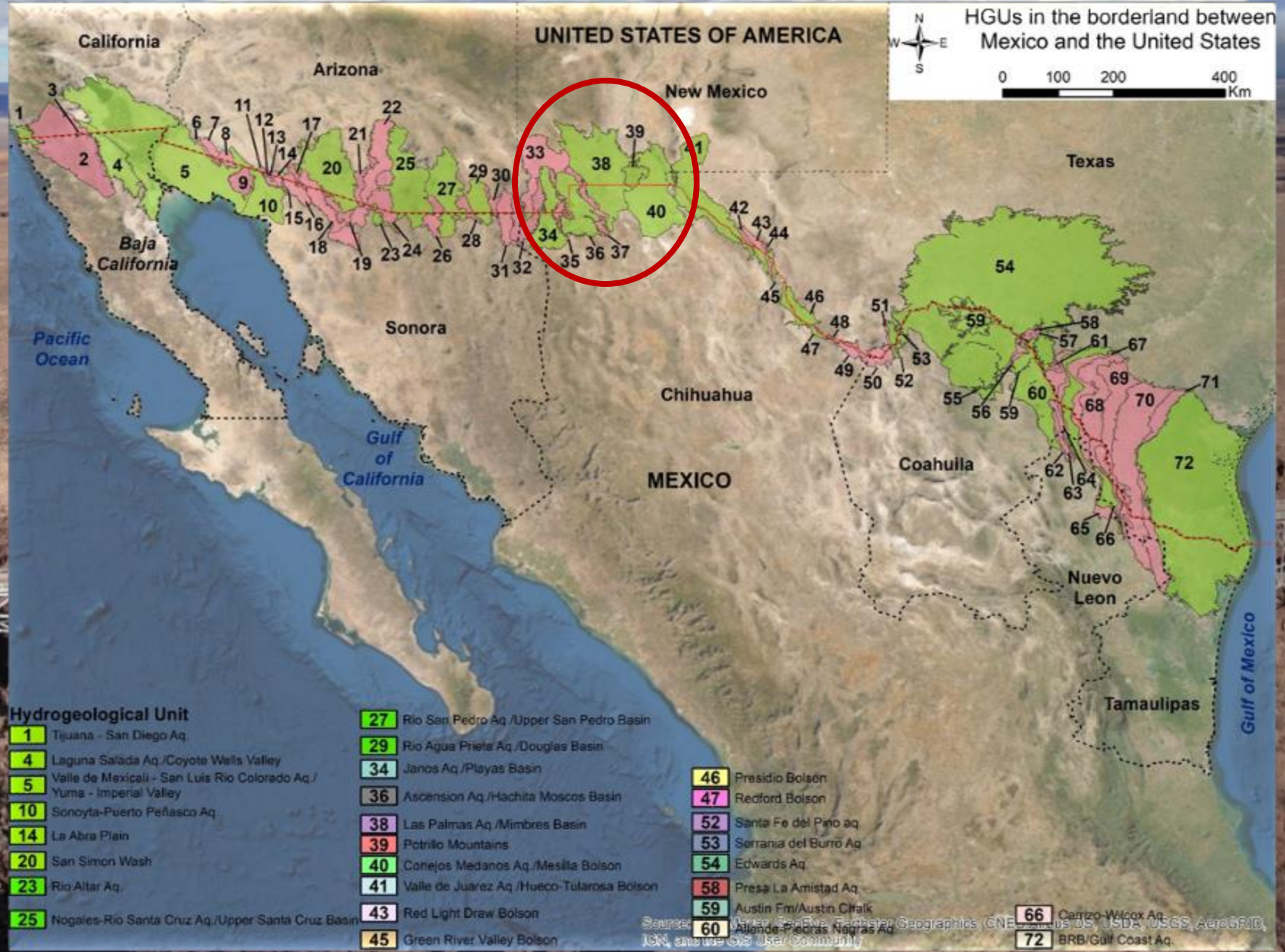


At least half of the shareable land between Mexico and the US has good aquifer potential with good to moderate water quality.

Political pressure as surface water is not an option for the new water demands in the region or even to fulfill treaty commitments.

Limited legal frame-work elevates the risk at which shared groundwater resources are being used.

28 TBAs have been identified.



And the 1944 treaty?

A threat or an ally?

What is the opportunity and privilege of the 1944 Treaty?

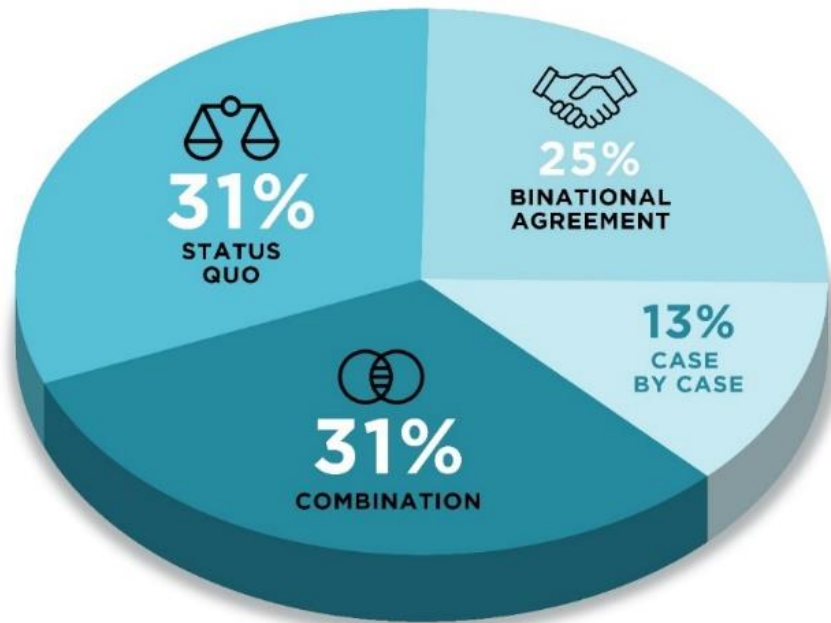
ADAPTATION!!

And the 1944 treaty?

- 327 Minutes = flexibility
- Minute 323...= adaptability
- Do we need a groundwater agreement?

Do we need a groundwater agreement?

PREFERENCE OF BINATIONAL GROUNDWATER AGREEMENT VS OTHER OPTIONS
(PERCENTAGE OF INTERVIEWERS)

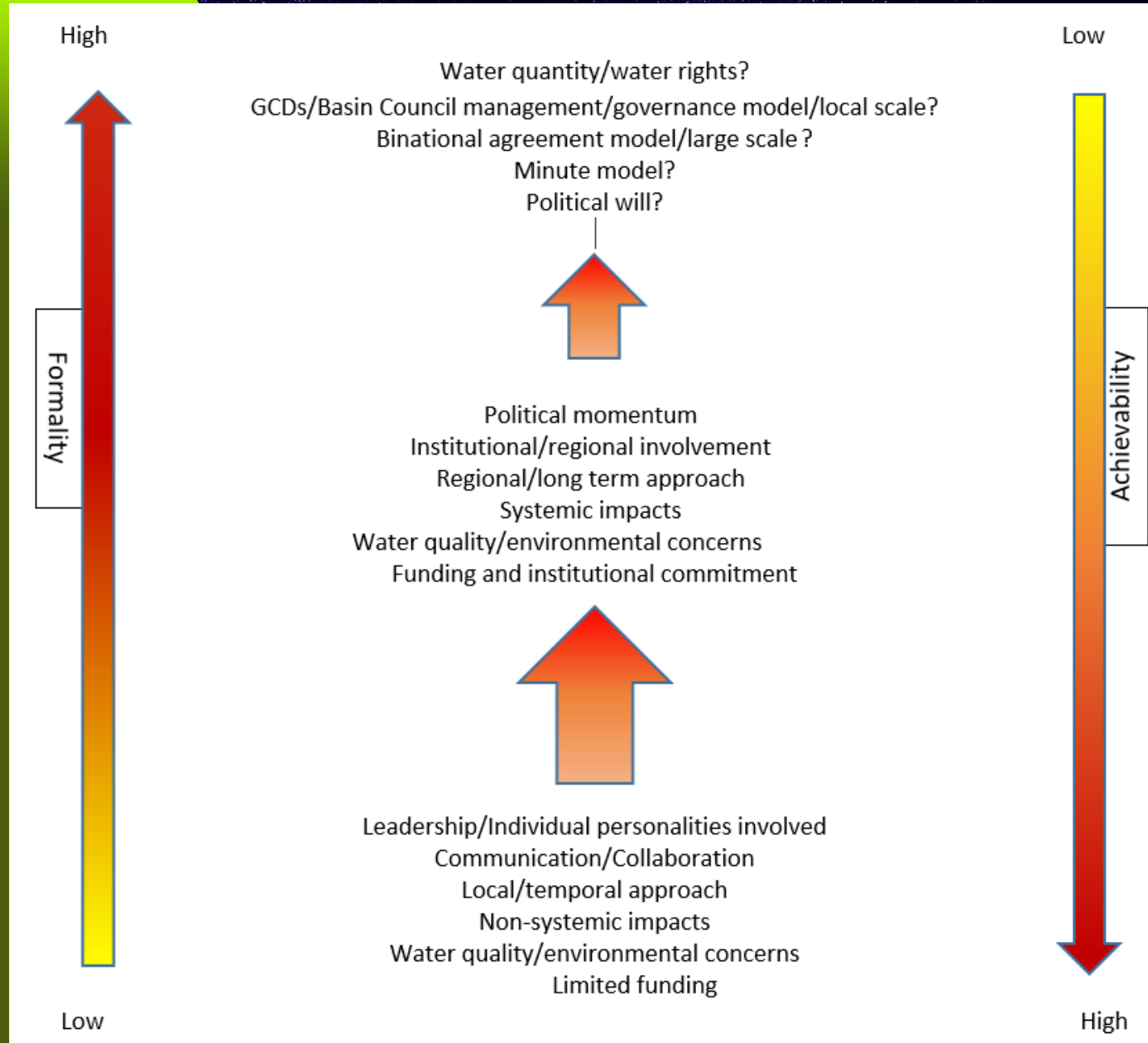


31% do not consider a framework agreement on groundwater necessary

→ existing or non-existent framework is sufficient

31% support a case-by-case scenario

The Driver for Cooperation: Water Quality (not quantity)



What is the recipe?

- **Local scale**
- **Non-binding agreements**
- **Focused on quality and environment**
- **Leadership**



And the challenge of
science?

**“Is not enough to be right.
You also have to be effective”**

Thank you

Rosario Sanchez

Senior Research Scientist

Texas Water Resources Institute ·

Texas A&M University ·

Permanent Forum of Binational Waters, Director ·

IAH Transboundary Aquifers Commission, Co-Chair ·

rosario@tamu.edu 

transboundary.tamu.edu 

binationalwaters.tamu.edu 

