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

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Why do we need to care?

Around 50% of the world's population will live in water scarce areas by 2050. 2 in 5 people rely on river basis that cross national boundaries for drinking and domestic water. Around 40% of world's population rely on transboundary aquifers for drinking and domestic use.

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

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



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.

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Around 15 million people live in the border cities. At least half (over 7 million people) relay 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) relay 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...



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

For more: ow.ly/RiWop

WORLD RESOURCES INSTITUTE

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

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) Almacenamiento (Mm³) 1,279.250

4040.325 Porcentaje de llenado 31.7 %

13 de Septiembre de 2023

8:00 hr

Presa Falcón NAMO(m) Almacenamiento (Mm³) 470.583

3264.813 Porcentaje de llenado 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)



Garza-Diaz and Sandoval-Solis, 2022

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



The divorce of natural flow and regulated flow

Garza-Diaz and Sandoval-Solis, 2022

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...



(1) Tijuana/San Diego

(Tijuana, Otay Sweetwater and Misaion system) (5) Cuenca Baja del Rio Colorado system: Valle de Mexicali/ Imperial, Ogilby and Yuma Valley (6) Cuenos 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

(23) Valle de Juarez/Hueco Bolson (TAAP4) (31) Presa La Amistad/Edwards (33) Allende-Piedras Negras/Local aguifers (36) Bajo Ric Bravo/Carrizo Wilcox-Gulf Coast (Yegua Jackson no data)

8 Confidence Level: Some

(7) Los Vidrios/Western Maxican Drainage (9) Amoyo 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/Anahuao-Carrizo Wilcox

12 Confidence Level: Limited

(2) Tecate/Potrero Valley and Campo Valley (3) La Rumorosa-Tecate/Jacumba Valley and Davies Valley (4) Laguna Salada/Coyote Wells Valley (10) Roo Altar/Tucson Active Management Area (11) Rio Alisos/Santa Cruz (18) Ascencion/ Hachita Moscos (24) Valle del Peso/West Texas Bolsons (25) Bejo Rio Conchos/West Texas Bolsons (26) Alamo Chapo/Igneous (27) Manuel Benavides/Local aquifers (28) Santa Fe del Pino/Local aquifers (32) Palestina/Local aquifers

36 TBAs

Sanchez, Lopez, Eckstein



WHAT WE KNEW IN 2018

Texas/Mexico



33 HGUs 60% of the shared area has good aquifer potential and good to moderate water



quality

After....(2021)

Before...



After....(2021)

Before...



After....(2021)

Before...





West Arizona/Mexico







New Mexico/Mexico

East Arizona/Mexico -112°0'0" -111°0'0" -110°0'0" -109"0"0" lexico/USA Geologic Units MESOZOIC Map 03 NITED STATES Geologic map Water untry Rorder State Border Charro Fm (Mex) CENOZOIC Cretaceous-Paleogene Conglomerates (Mex) N. M. Region 3 Mesa Fm (Mex) East Sonora-East Arizona Ot Alluvium/Ot Alluvium Chanate Fm (Mex) Qt Conglomerates/Qt Conglomerates 0 5 10 20 30 40 Cabullona Fm (Mex) Qt Basalt/Qt Basalt-Andesite Km MEXICO Cretaceous Granites/Volcanic Cretaceous Neogene Conglomerates/Neogene Con farahumara-Tuli Fm (Mex) Volcanic Breccia (Mex) Baucarit Em/Bouse Em Nashita Gr/Washita Gr Bisbee Gr/Cretaceous Rocks Und Tubutama Fm (Mex) Trachyte (Mex) **Bisbee Conglomerates (Mex)** Volcanic Rocks Undifferentiated/Rhvolitic Tul Glance Conglomerate (Mex) Dacite (USA) Jurassic Granites/Jurassic Granites Granite-Monzonite/Gr Covotillo Group (Mex) Andesite-Ignimbrite (Mex) Pinito Rhyolite/Jurassic Volcanic Rocks PALEOZOIC Andesite/Andesite Monzonites/Monzonites Paleozoic Rocks Undivided (USA) Tertiary Basalt-Andes Permian Sedimentary Rocks (USA) Tertiary Basalt-Andesite Escabrosa-Horquilla Em/Escabrosa-Horg Abrigo Fm/Abrigo Limestone Anache Gr (USA) PROTEROZOIC s Mestenas Grani zoic Plutonic Rocks (USA) rizona Sonora -112°0'0" -111°0'0" -110°0'0"





California/Mexico



West Arizona/Mexico



East Arizona/Mexico



New Mexico/Mexico



In 2021..



And and a state of the state of

Concession in the



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No William

8.200 - COSC-2

In 2021..

Distance -

Concession in the local division in the loca

And weather a section of the section



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.

Sanchez and Rodriguez 2021



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)



Sanchez & Eckstein

31% do not consider a framework agreement on groundwater necessary

existing or non-existent framework is sufficient

31% support a case-by-case scenario

he Driver for Cooperation: Water Quality (not quantity)



AS A&M

A M

Low

High

Formality

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

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