

WRRRC 2023 Annual Conference

**WHAT CAN
WE DO?**

**SOLUTIONS TO
ARIZONA'S WATER
CHALLENGES**

TRANSBOUNDARY AQUIFERS

Elia M. Tapia, Ph.D.
University of Sonora
July 12, 2023



COLLEGE OF AGRICULTURE & LIFE SCIENCES
COOPERATIVE EXTENSION
**WATER RESOURCES
RESEARCH CENTER**



01

FRESHWATER RESOURCES AROUND THE WORLD



EVERYTHING WE NEED TO LIVE A DECENT LIFE IS DIRECTLY RELATED TO WATER.

WATER IS A FINITE RESOURCE, UNEVENLY DISTRIBUTED, OVER EXPLOITED, AND OFTEN WASTED.

FRESHWATER REPRESENTS 2.53% OF THE EARTH'S WATER.

GROUNDWATER REPRESENTS 30% OF THE MASS OF FRESH WATER RESOURCES.

68% - GLACIERS AND ICECAPS

2% - SURFACE WATER

APPROXIMATELY 50% OF THE WORLD'S POPULATION DRINKS GROUNDWATER DAILY.

GROUNDWATER IS THE WATER FOUND UNDER THE EARTH'S SURFACE

AQUIFER - LAYER BELOW THE SURFACE OF THE EARTH WHERE YOU CAN FIND GROUNDWATER.

GROUNDWATER IS AN INVISIBLE RESOURCE

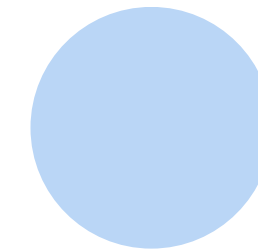
WE STILL DON'T KNOW SUFFICIENT ABOUT THE STATE OF AQUIFERS.

GROUNDWATER KNOWS NO BORDERS

APPROXIMATELY 600 TRANSBOUNDARY AQUIFERS HAVE BEEN IDENTIFIED AROUND THE WORLD.

GROUNDWATER NEEDS TO BE UNDERSTOOD AND SUSTAINABLY MANAGED

WE CANNOT MANAGE WHAT WE DON'T SEE OR MEASURE!



IMPROVING KNOWLEDGE ON TRANSBOUNDARY WATER RESOURCES

IN TERMS OF INTERNATIONAL LAW, THERE ARE ALL KINDS OF TOOLS THAT ADDRESS THE NEED OF IMPROVING KNOWLEDGE ABOUT TRANSBOUNDARY WATER RESOURCES.

Convention on the Law of the Non-navigational Uses of International Watercourses
1997

ARTICLE 9

REGULAR
EXCHANGE OF
INFORMATION

Adopted by the General Assembly of the United Nations on 21 May 1997.
Entered into force on 17 August 2014. See General Assembly resolution
51/229, annex, *Official Records of the General Assembly, Fifty-first Session,
Supplement No. 49 (A/51/49)*.



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2014

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE
COMMISSION ECONOMIQUE DES NATIONS UNIES POUR L'EUROPE
ЕВРОПЕЙСКАЯ ЭКОНОМИЧЕСКАЯ КОММИССИЯ
ОРГАНИЗАЦИЯ ЭКОНОМИЧЕСКИХ НАЦИЙ

Convention
on the Protection and Use of
Transboundary Watercourses
and International Lakes
as amended,
along with decision W/3 clarifying the accession procedure

Convention
sur la protection et l'utilisation
des cours d'eau transfrontières
et des lacs internationaux
telle qu'amendée,
ainsi que la décision W/3 clarifiant la procédure d'adhésion

Конвенция
по охране и использованию
трансграничных водотоков и
международных озер
с поправками
и решением W/3, разъясняющим процедуру присоединения



UNITED NATIONS
NATIONS UNIES
ОРГАНИЗАЦИЯ ЭКОНОМИЧЕСКИХ НАЦИЙ

ARTICLE 5 RESEARCH AND DEVELOPMENT

ARTICLE 6 EXCHANGE OF INFORMATION

ARTICLE 9 BILATERAL AND MULTILATERAL COOPERATION

ARTICLE 11 JOINT MONITORING AND ASSESSMENT

ARTICLE 12 COMMON RESEARCH AND DEVELOPMENT

ARTICLE 13 EXCHANGE OF INFORMATION

Draft articles on
the Law of Transboundary Aquifers,
with commentaries
2008

Text adopted by the International Law Commission at its sixtieth session, in 2008,
and submitted to the General Assembly as a part of the Commission's report covering
the work of that session (A/63/10). The report, which also contains commentaries on
the draft articles, will appear in the Yearbook of the International Law Commission,
2008, vol. II, Part Two.



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2008

ARTICLE 7 GENERAL OBLIGATION TO COOPERATE

ARTICLE 8 REGULAR EXCHANGE OF DATA AND INFORMATION

JOINT EFFORT BETWEEN MEXICO AND THE UNITED STATES TO EVALUATE SHARED AQUIFERS.

IT ORIGINATES FROM U.S. PUBLIC LAW 109-448, WHICH APPLIES TO THE STATES OF TEXAS, NEW MEXICO, AND ARIZONA (2006).

US-MX. TRANSBOUNDARY AQUIFER ASSESSMENT PROGRAM

MEXICAN INVOLVEMENT STARTED IN 2009, AFTER THE SIGNING OF THE JOINT REPORT OF THE PRINCIPAL ENGINEERS REGARDING JOINT COOPERATIVE PROCESS UNITED STATES-MEXICO FOR THE TRANSBOUNDARY AQUIFER ASSESSMENT PROGRAM (JOINT REPORT).

THE OBJETVIVE OF THE TAAP IS TO IMPROVE THE KNOWLEDGE BASE ON THE AGREED-UPON AQUIFERS OF FOCUS, THE SANTA CRUZ, SAN PEDRO, MESILLA AND HUECO BOLSON, AND CHIHUAHUA, AND/OR ADDITIONAL TRANSBOUNDARY AQUIFERS IF DESIGNATED AND APPROVED BY THE TWO COUNTRIES.





PARTICIPATION IN BINATIONAL TECHNICAL WORKING MEETINGS, PUBLICATION OF JOURNAL ARTICLES AND REPORTS, PRESENTATIONS AT REGIONAL, NATIONAL, AND INTERNATIONAL CONFERENCES, ORGANIZATION OF FORUMS AND SEMINARS.



DEVELOPMENT OF WATER BALANCE MODELING TOOLS TO CHARACTERIZE THE EFFECTS OF SYSTEM CHANGES, PARTICULARLY RELATED CLIMATE UNCERTAINTIES AND CHANGES IN GROUNDWATER DEMAND



TRANSBOUNDARY AQUIFER RECONNAISSANCE WORK, CHARACTERIZATION OF SELECTED BORDER COMMUNITIES, COLLABORATIVE EFFORTS IDENTIFIED THROUGH THE TAAP COOPERATIVE FRAMEWORK (JOINT REPORT).



Editorial

Advances in Transboundary Aquifer Assessment

Anne-Marie Mathema and Sharon B. Megdal

Special Issue
Advances in Transboundary Aquifer Assessment
Edited by
Prof. Dr. Sharon B. Megdal and Dr. Anne-Marie Mathema

March 02, 2023

Advances in Transboundary Aquifer Assessment

United States

Mexico

(based on Sanchez et al., 2016)
Tapia-Villaseñor and Megdal, 2021)
Colorado/Yuma)

March 21, 2023

Increasing the visibility of transboundary groundwater

Arizona

Sonora

Chil

August 10, 2021

Science and Binational Cooperation: Bidirectionality in the Transboundary Aquifer Assessment Program in the Arizona-Sonora Border Region

Legend

Transboundary Aquifers of the World (ITAPAC, 2005)

Country Boundary

International Aquifers Studied

1. Santa Cruz Aquifer System
2. Hueco-Bolton Aquifer System
3. Colorado Plateau Aquifer System
4. Sacramento-San Joaquin River Delta
5. Aral Sea Basin Aquifer System
6. Aral Sea Basin Aquifer System
7. Santa Cruz
8. San Pedro
9. Mesilla
10. Hueco-Bolton

TAAP Aquifers of Focus

Arizona

United States

Mexico

Sonora

Chihuahua

New Mexico

Texas

February 18, 2021

The U.S.-Mexico Transboundary Aquifer Assessment Program as a Model for Transborder Groundwater Collaboration

ACHIEVING WATER SUSTAINABILITY AND RESILIENCE THROUGH CROSS-BORDER COOPERATION

White Paper

Trasema Coronado, Francisco Lara-Valencia, Stephen Mumme, Christopher Brown, Paul Ganster, Hilda García, Donna Lybecker, Sharon Megdal, Rosario Sanchez, Alan Sweedler, Robert G. Varady, and Adriana Zuñiga

FEBRUARY 4, 2022

February 04, 2022

WATER MANAGEMENT ON THE U.S.-MEXICO BORDER: ACHIEVING WATER SUSTAINABILITY AND RESILIENCE THROUGH CROSS-BORDER COOPERATION

ARIZONA, UNITED STATES

SONORA, MEXICO

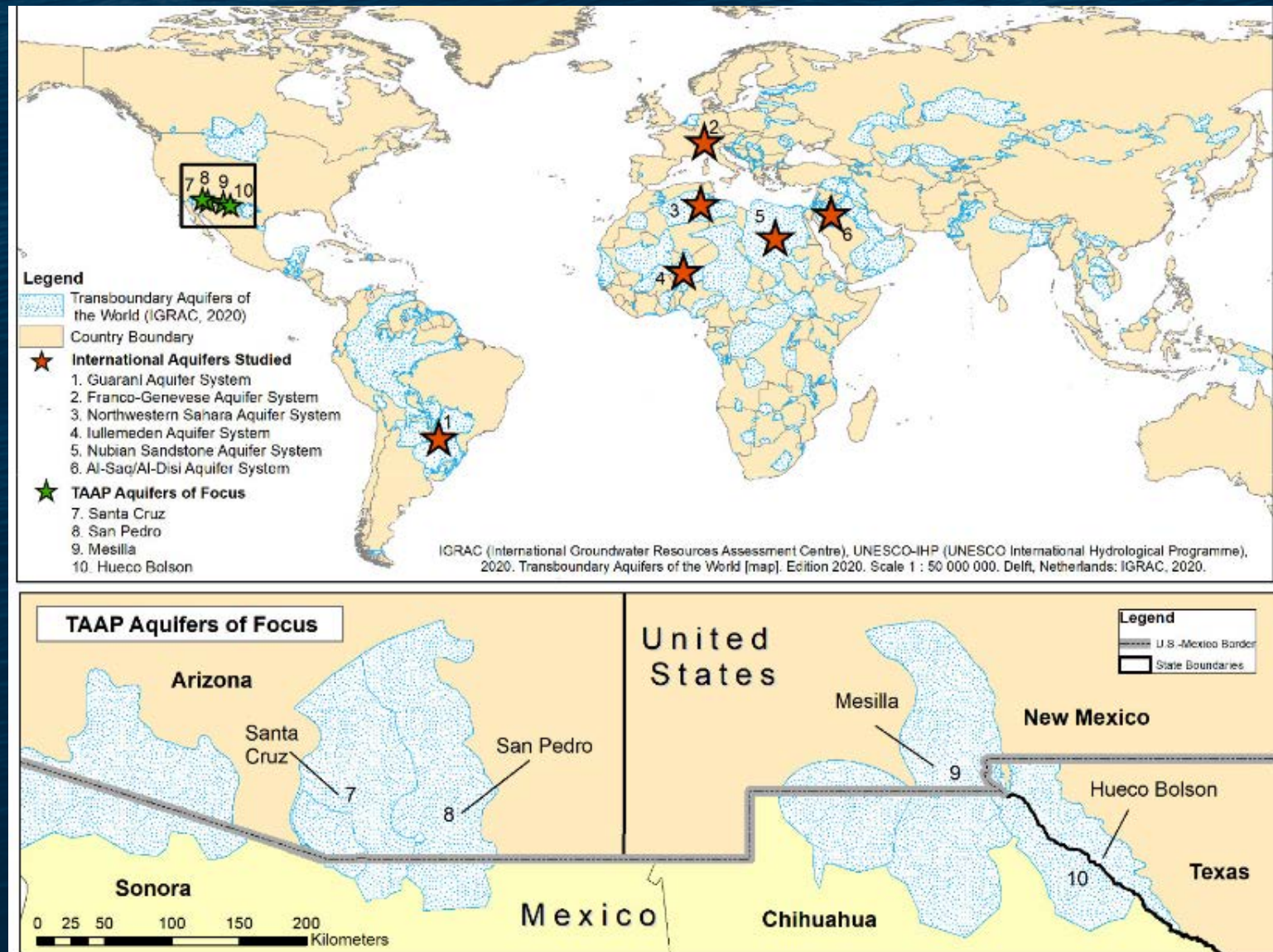
Legend

- Towns
- Climate Stations
- Stream Gauges
- Game-Cruz River
- Upper Santa Cruz River Basin (USCRB)
- San Rafael Valley, USA
- Santa Cruz AMA, USA
- Nogales Aquifer, MX
- Santa Cruz River Aquifer, MX

May 01, 2021

A Review of Climate Change Impacts on the USA-Mexico Transboundary Santa Cruz River Basin

THE U.S.-MEXICO TRANSBOUNDARY AQUIFER ASSESSMENT PROGRAM AS A MODEL FOR TRANSBORDER GROUNDWATER COLLABORATION



Elements of Collaboration	TAAP	GAS	Franco-Swiss Genevese	Northwestern Saharan	Iullemeden	NAS	Al-Saq/Al-Disi
Objectives	Exchange data	✓	✓	✓	✓	✓	✗
	Concur on binational aquifer assessment activities	✓	✓	✓	✓	✓	✓
	Establish and coordinate technical advisory committees	✓	✓	✓	✓	✓*	✓
	Establish an official repository for binational project reports	✓	?	?	✓	?	✗
Framework (Process)	Establish technical groups	✓	✓	✓	✓	✗	✓
	Develop project progress reports	✓	✓	✓	✓	?	✓
	Publish final reports	✓	?	✓	✓	?	✗
Funding	Arranged between the parties	✓	?	✓	✓	?	?
Principles	Activities should be beneficial to both countries	✓	✓*	✓*	✓*	✓*	✓*
	Activities should be agreed on within the framework of the coordinating agency	✓	?	?	?	?	?
	Activities should respect the legal framework and jurisdictional requirements of each country	✓	✓	✓	✓	✓	✓
	No provision set forth in this agreement will limit what either country can do independently in its own territory	✓	✓	✓	✓	?	✓
	No part of this agreement may contravene what has been stipulated in the Boundary and Water Treaties	✓	✓	✓	✓	?	✓
Communication	The information generated from these projects is solely for the purpose of expanding knowledge	✓	✗	✗	✓	✗	✗
	An official repository of records will be present	✓	?	?	✓	?	✗
	Reports will be available to the public in each country	✓	?	✓	✓	?	✓
	Information obtained will be considered official data and will be shared without any restrictions	✓	?	✓	✓	?	✓
	Credit will be given to those who provide information	✓	✓*	✓*	✓*	✓*	?

COMMON ELEMENTS OF COLLABORATION BETWEEN THE TAAP AND OTHER TRANSBOUNDARY GROUNDWATER AGREEMENTS

THE PATH TO BIDIRECTIONALITY IN THE TAAP

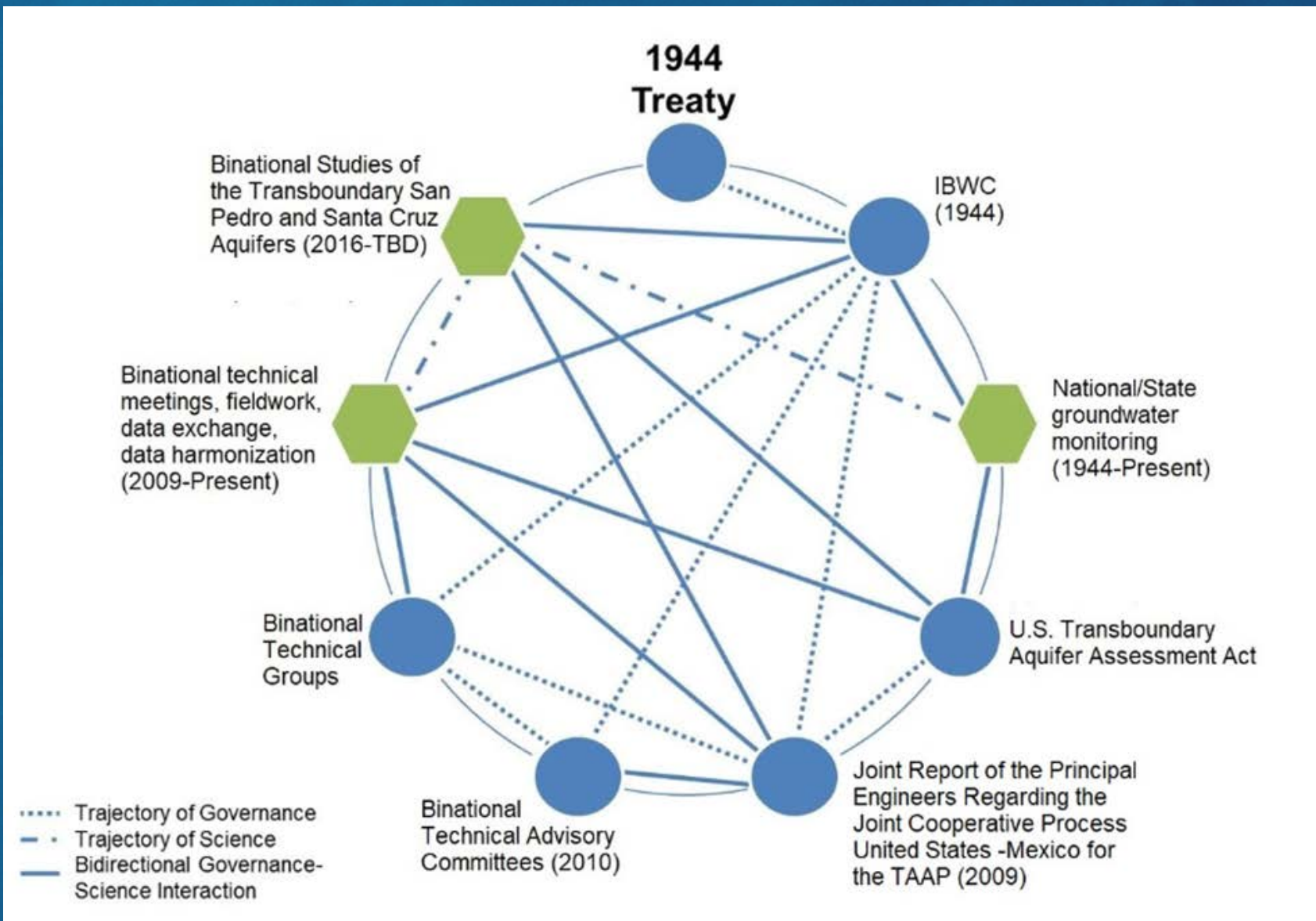
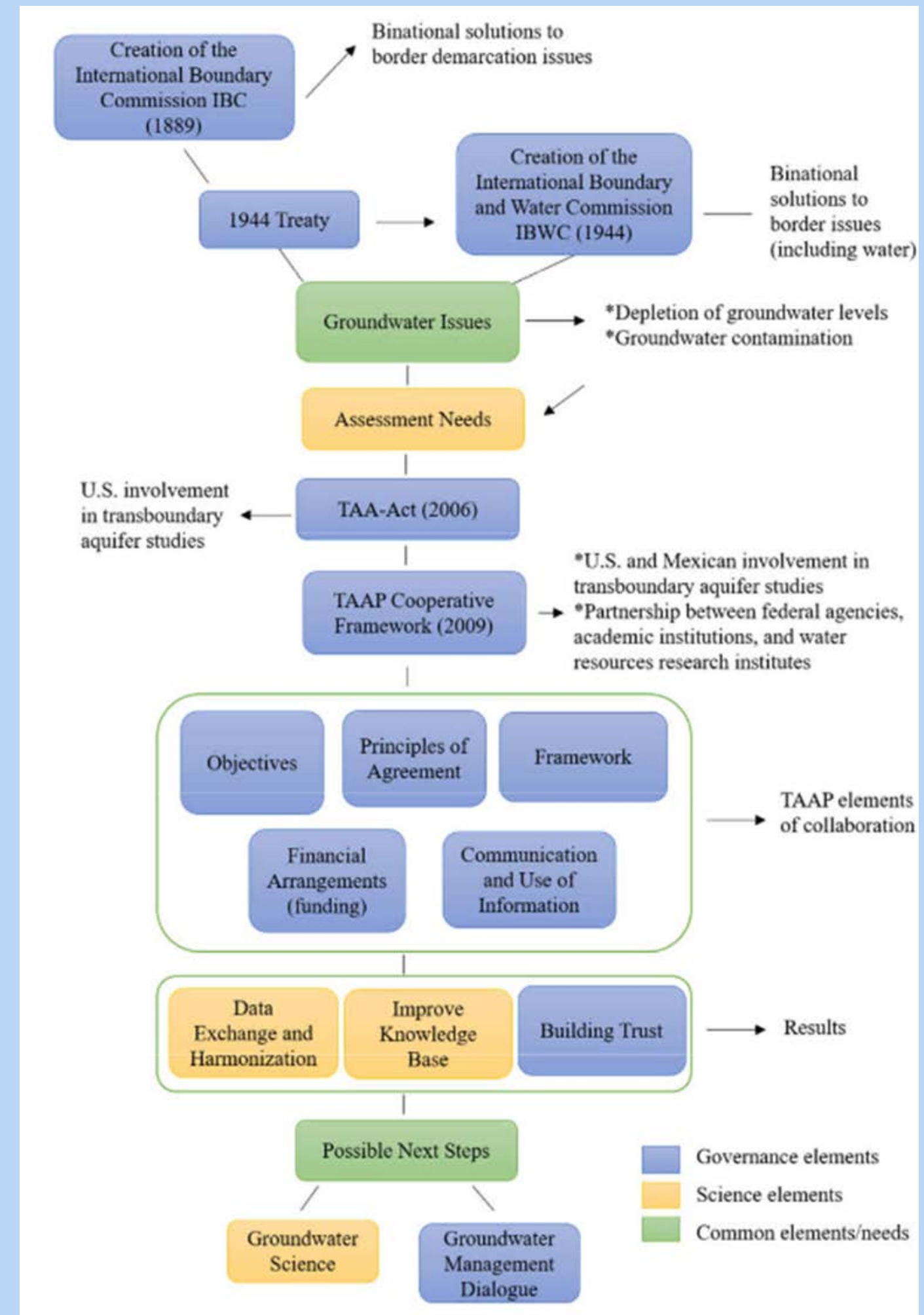
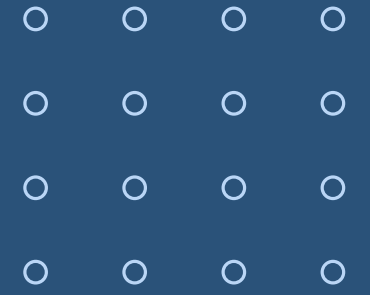


Figure 5. The path to bidirectionality/binationality in the TAAP. Governance elements are represented by blue circles; science elements are represented by green hexagons. Figure by authors.

Petersen-Perlman, Jacob D., Tamee R. Albrecht, Elia M. Tapia-Villaseñor, Robert G. Varady, and Sharon B. Megdal. 2021. "Science and Binational Cooperation: Bidirectionality in the Transboundary Aquifer Assessment Program in the Arizona-Sonora Border Region." *Water* 13 (17): 2364. <https://doi.org/10.3390/w13172364>.





GROUNDWATER IS
FUNDAMENTAL TO
LIFE ON EARTH

GROUNDWATER IS
EVERYWHERE BUT
INVISIBLE

"THE IDENTIFICATION, MAPPING,
ASSESSMENT AND DEVELOPMENT
OF GOVERNANCE MECHANISMS
FOR TRANSBOUNDARY AQUIFERS
ARE IMPORTANT TASKS FOR
ENSURING THE SUSTAINABILITY OF
THESE RESOURCES AND PEACEFUL
COOPERATION BETWEEN
COUNTRIES." [1]

"TRANSBOUNDARY WATER
COOPERATION IS ESSENTIAL TO
PROMOTE SUSTAINABLE ECONOMIC
DEVELOPMENT, HUMAN AND
ENVIRONMENTAL HEALTH,
BIODIVERSITY, CLIMATE ACTION AND
RESILIENCE, DISASTER RISK
REDUCTION, AND PEACE." [2]



[1] IGRAC. 2021. Transboundary Aquifers of the World. Update 2021.
[2] Groundwater in the UN Water Agenda. UN Water Conference., NY, 2023.

A hand holding a globe of the Earth against a blue background with decorative white arcs.

THANK YOU!

For more information please visit:

<https://wrrc.arizona.edu/programs/taap-transboundary-aquifer-assessment-program>