

NEWSLETTER

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EDITOR'S MESSAGE

Welcome to the second edition of the IAH Transboundary Aquifers Commission (TBA Commission) Newsletter. I was very pleased receiving many very positive comments on the content of our first edition of our newsletter, so I am encouraged to continue; thank you so much!

Communication and outreach continue being our commission's main commitment; we are establishing a line of communication and dialogue with you. We brief you on the latest news, developments and diverse activities of the commission and anything related with transboundary aquifers worldwide, from identification, to assessments, to agreements, to shared management, and more.

This second issue includes a new section on "Knowledge Capsules on TBAs" where we intend to update and shed some light to some of the most important concepts used in the transboundary aquifers domain, including the questions of what, why, how, and when in relation to groundwater and aquifers as they connect into the transboundary context. In this issue, we initiate a discussion on the very important questions of cooperation, collaboration, agreements and arrangements under the transboundary context and begin an examination on the state of the current global situation on TBA arrangements and agreements, which we ask you to support by filling in the table provided in the link on the corresponding section.

You will also find the usual sections on News from TBA networks, People in the News, Upcoming Events, and Recent Publications. Overall, we engage with our network, share findings and stories, and introduce some of the brilliant people working in this exciting domain. It is my hope that this Newsletter continues the train of communication with all those interested in the precious resource of groundwater hidden within and under transboundary aquifers. Any comments and/or suggestions are welcome.

Good reading!



Alfonso Rivera
Chair, TBA Commission

NEWS FROM TBA NETWORKS

ISARM Americas



On October 7 and 14, two virtual conferences on the "Governance of groundwater and transboundary aquifers" were hosted by UNESCO and CeReGAS. On the first day, Alberto Manganelli presented the transboundary aquifers in the Latin-American and Caribbean region and the involvement of the ISARM programme in the generation of knowledge; Antonio Embid explained the regulatory framework and hydrological planning in this region.

On the second day, Francesco Síndico spoke about groundwater governance globally, and Pilar Villar referred to the Guarani Aquifer Agreement in particular.

The two webinars were well attended by more than 90 people, which reflect the importance of the issue of transboundary aquifers in the region as well as the need to continue the research and studies and the need for defining good shared management practices.

NEWS FROM TBA NETWORKS



UNECE Handbook on transboundary waters

UNECE is in the process of preparing a handbook on **Water Allocation in a Transboundary Context** (TB Handbook). The objective is to contribute to implementation of the best practice in water allocation in transboundary cooperation. This is done by providing a review of current practice and experience, drawing out key principles and guidelines regarding:

1. Prerequisites (e.g., institutional framework, data sharing, water diplomacy) for agreeing on water allocation;
2. Options and approaches that can be followed technically and legally;
3. Relevant considerations in designing a process to agree on (or renegotiate) water allocation; and
4. The benefits that can be drawn from agreeing on water allocation and/or associated benefit sharing.

The handbook's primary audience is government officials, basin authorities and water sector practitioners.

An international expert group under the leadership of UNECE has been convening and working on the TB Handbook since 2019. UNECE requested support and participation from IAH, and the IAH TBA commission has provided input on the groundwater aspects of transboundary water allocation, transboundary cooperation, etc., as well as case studies that have explicit components of groundwater.

Karen Villholth has been involved in this activity with support from Alfonso Rivera and Shammy Puri, present and former chairman of the IAH TBA Commission, respectively. We will keep you informed on the outcomes of this handbook in future issues of the Newsletter



ISARM-II World Conference

The preparations for the World Conference of ISARM Part 2 have begun.

More than a decade after the first very successful conference on ISARM (Internationally Shared Aquifers Resources Management) in 2010, the time has come to hold the second International UNESCO Conference on transboundary aquifers ISARM-II "Challenges and way forward". ISARM-II aims to be an opportunity for showcasing diverse efforts made by UNESCO and many partners across the world, including the IAH, GEF, FAO, WB, and the regional ISARM networks from the Americas, Europe, Asia, and Africa.

The 2nd ISARM conference on the Transboundary Aquifers of the world will be held at the UNESCO Headquarters in Paris, 6-8 of December 2021. The overarching theme of the conference will be the challenges and the way forward into addressing transboundary aquifers management. The conference will cover five topics: 1. The contribution of Transboundary Aquifers (TBA) to the sustainable development in the framework of global and regional agendas; 2. The Science/Policy interface of TBA: the role of science in the governance and management of TBA; 3. Advances in the assessment and mapping of TBA and hydrogeological methods; 4. Governance of TBA: strengthening cooperation; and 5. Education, capacity development and raising awareness

The first announcement has been sent and the first deadline for submitting abstracts is 30 December 2020, *à vos plumes!*

Visit this site for more information: <https://en.unesco.org/conference/isarm2021>



SADC-GMI

A Transboundary Diagnostic Analysis (TDA) was carried out of the Eastern Kalahari-Karoo Transboundary Aquifer system (EKK-TBA), which is shared between Botswana and Zimbabwe. The main aim of the TDA was building a comprehensive understanding of the state of the surface water and groundwater resources in the EKK-TBA system, their uses, spatial and temporal variability, interactions, and impacts as well as human benefits derived from various ecosystem services and existing infrastructure. The EKK-TBA system was redefined from an original size of 34 000 km² and now straddles two river basins: Okavango and Zambezi, which calls for joint governance and management efforts.

NEWS FROM TBA NETWORKS



UNESCO/UNECE SDGs

The results of the first questionnaire on the Sustainable Development Goal SDG6.5.2 were synthesized in the Report 2018: Progress on Transboundary Water Cooperation-Global baseline for SDG Indicator 6.5.2

In brief:

- **153** countries with transboundary waters
- **62** countries considered in this first assessment
- Operational arrangements for TBAs are still rare around the world
- This indicator is a country-based process
- Aquifer component: 64 no clarification, 22 require clarification, 67 did not respond

See the full report [here](#)

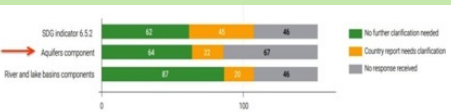
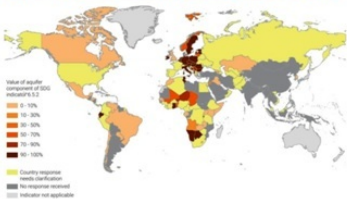


Figure 8: National level of cooperation on transboundary aquifers, and countries where further clarification is still needed



Permanent Forum of Binational Waters

On October 14 and 15 the Permanent Forum of Binational Waters hosted the US-MX Transboundary Groundwater Conference: Innovation and Creativity, Strategies for Unprecedented Challenges. This was a binational effort jointly organized by the Texas Water Resources Institute (TWRI) and the Instituto Mexicano de Tecnología del Agua (IMTA). Topics addressed highlighted transboundary groundwater challenges from technical, managerial, environmental and legal perspectives and strategies for future assessments. Around 140 people attended representing all sectors involved in science and policy arenas, as well as different levels of water governance at binational level. Full sessions are available here under Conference Material:

<https://binationalwaters.tamu.edu/events-archives/transboundary-conference/>



GGRETA Project

The GGRETA Project (Governance of Groundwater Resources in Transboundary Aquifers) Phase 3 for the Central Asia region has officially started. Funded by the SDC (Swiss Agency for Development and Cooperation), the project will be coordinated by UNESCO-IHP. It will be implemented from 2020 to 2022 through three inter-linked components:

1.1-Data collection, hydrogeological mapping and data harmonization on Pretashkent transboundary aquifer;

2.2 - Development of strategy of governance and management of non-renewable groundwater resources of Pretashkent TBA; 3 - Creating the mathematical model of Pretashkent TBA as a basis of shared (Kazakhstan - Uzbekistan) governance of its transboundary resources.

COOPERATION AND COLLABORATION

In the last newsletter, we announced an initiative to compile a working list of all transboundary aquifer agreements and arrangements. The TBA commission committee has started the process of compiling a list in collaboration with IGRAC and UNESCO IHP and we are now reaching out to all members to assist us in identifying and describing agreements and arrangements over transboundary aquifers, may these be formal or informal. Please assist us by adding any agreements or arrangements that you know of to the table linked below, take your time to add as much detail as possible. All contributions can be added to the working google document linked below:

<https://docs.google.com/document/d/1Q09-OzIDhuqREoy979teG04n8A4uv14yWPiPunT4Kck/edit>

PEOPLE IN THE NEWS

This section highlights the work of individuals working in areas related with transboundary aquifers across the world. The work of professionals and emerging stars from developing countries will be emphasized, not only in hydrogeology but in any science or activity dealing with transboundary water issues: natural, social, political, or economic.

This second edition includes two young women working in TBA-related professions, both members of the newly formed IAH TBA Commission, and a professional hydrogeologist of the ISARM-Europe network.

So let's celebrate Laura Movilla, Elia Maria Tapia, and Gabriel de los Cobos; congratulations to you!



Laura Movilla obtained her PhD from the University of Vigo, Spain. Laura is the first 2020 recipient of the IWRA Water Drop Award. This new award is granted to students or early career professional in the water sector, for innovative contributions to the water sector. Laura had already received an award for her doctoral thesis in 2015, on the law of transboundary aquifers: the "Adolfo Miaja de la Muela", by the Spanish Association of International Law and International Relations Scholars (AEPDIRI). ¡Felicidades Laura!



Elia M. Tapia Villaseñor is a research professor at Universidad de Sonora in Mexico. She received her Ph.D. in Arid Lands Resource Sciences from the University of Arizona under Dr. Sharon B. Megdal's supervision. She was awarded the Babbitt Center for Land and Water Policy's Dissertation Fellowship for her doctoral thesis on water resources in the borderlands of the Colorado River Basin. Elia spent the past nine years working for the U.S.-Mexico Transboundary Aquifer Assessment Program, a joint effort between the two countries to evaluate shared aquifers. Her research work involves hydrology, groundwater management, and climate change impacts in transboundary settings. She advocates for stakeholder engagement, knowledge improvement, and the sustainable use of water resources in the desert watersheds of the U.S. and Mexico. ¡Enhorabuena Elia!



The IAH TBA Commission acknowledges the great work by Gabriel de los Cobos on the occasion of the 40th anniversary of The Genevese transboundary aquifer (Switzerland-France). The secret of 40 years of successful management resides in the multidisciplinary approach of financial, technical, political and legal point of views; no doubt, Gabriel's work has been crucial in supporting these activities.

The Genevese TBA presents results of successful management between France and Switzerland since their initial arrangements dating back from 1978. Extending over 19 km, 90% of aquifer is located in the Canton of Geneva and 10% in France; it constitutes an example of a transboundary agreement between a European Community Member Country (France) and a Swiss Canton (Genovese) providing water supply for around 700,000 inhabitants. This is the only case of a TBA having a legally binding agreement (December 2012) with many good lessons to be learned from the 40 years' experience of that case (see [here](#)). Félicitations Gabriel!

KNOWLEDGE CAPSULES ON TBAs

We have added a new section with “knowledge Capsules on Transboundary Aquifers” where we intend to update and shed some light to some of the most important concepts used in the transboundary aquifers domain. This new section includes the questions of *WHAT, WHY, HOW, and WHEN* in relation to groundwater and aquifers as they connect into a transboundary context.

Most of the aquifer and groundwater concepts are well known in classic physical and chemical hydrogeology, but when groundwater and/or aquifers traverse two or more jurisdictions, other factors, not the least the boundaries, acquires a more complex meaning. Groundwater and chemical sciences are no longer sufficiently adapted for the many other interrelated aspects with transboundary aquifers, such as cooperation, collaboration, social interaction, agreements, prejudices, asymmetries, shared management, and others.

At times, transboundary groundwater and/or aquifers seemed to become wicked problems, social or cultural or political problems that are difficult or impossible to solve for. There is incomplete or contradictory knowledge; a large number of stakeholders and opinions involved; a large economic burden for some countries; and the interconnected nature of these problems with other problems.

In this new section, we try to provide insight on these concepts with short definitions and scientific references, when existing. These are working definitions subject to change; they are defined following lessons learned and knowledge generated on transboundary aquifer practices around the world. Therefore, there will be some disagreements because cultural, political, economic, and social factors differ around the world.

Aquifer?

Many definitions exist on the concept of “aquifer”; these may be engineering, managerial, environmental, geographical, or political definitions. In fact, any water-saturated body of geological material from which enough water can be drawn at a reasonable cost for the purpose required, can be considered as “aquifer”. An aquifer is only a relative term and is best illustrated by extreme examples. An aquifer in an arid region required to supply water to a single farm, for example, may be adequate if it can supply 1 m³/day. Such an aquifer would not be considered sufficient by any industry looking for cooling water in the order of 10,000 m³/day. An aquifer is commonly thought of as water-bearing material from which water is most easily extracted. An aquifer is by no means equivalent to a single geologic, lithographic, or stratigraphic unit; in fact, two contiguous layers of sand and limestone may form a single aquifer.

Transboundary aquifer?

This is a relatively new concept, coined from the need to share an aquifer that has been divided artificially by two or more jurisdictions. The definition of aquifer provided above applies in this case too, but in the transboundary aquifer case, jurisdictional boundaries are added to the natural boundaries of the aquifer. The ISARM programme launched in 2001 by UNESCO and the IAH has so far identified 600 transboundary aquifers and/or groundwater bodies. Two examples of contrasting conceptual definitions of aquifers are the Groundwater Bodies in Europe, and the Administrative Aquifers in Mexico; in the former, aquifers are defined by jurisdictional (international) boundaries, in the latter, aquifers are defined by administrative boundaries (national); in both cases the natural boundaries of aquifers are neglected in the management.

Fossil water?

Fossil water or paleowater is an ancient body of water that has been contained in some undisturbed space, typically groundwater in an aquifer, for millennia under climatic conditions different from the present. Some of the aquifers containing fossil water are hundreds of meters deep and underlie vast areas of land such as the Nubian aquifer shared by Sudan, Libya, Egypt, and Chad; and the Ogallala aquifer in the USA. Modern (at least not since the last climate transition of the Pleistocene-Holocene, 10k yrs ago) infiltration does no longer recharge aquifers, although a multi-layered aquifer system may contain both modern infiltration and fossil water

Groundwater age?

The groundwater age is the time elapsed since a water parcel was recharged in the subsurface until it reaches a location where it is sampled. The groundwater residence time is the time it takes for particles of water to travel from recharge at the water table to discharge area of the aquifer.

Age “tracers” allow to estimate the age of young (³H, ^T/³He, CFC, SF₆), old (³⁹Ar, ¹⁴C,) and very old groundwater (³⁶Cl, ⁸¹Kr). Groundwater age data can be used to determine the flushing time scale of contaminants within an aquifer, or constrain groundwater flow models.

HOW DO YOU

Design a groundwater management unit?

Defining the physical boundaries of transboundary aquifers is difficult but feasible; however, defining groundwater units for managing an aquifer shared by two jurisdictions becomes more challenging; currently there are various different approaches. So, what should be the unit of management in a transboundary context: individual formations, hydraulically related multilayered formations, the entire international border, other units?

Following lessons learned from 20 years of ISARM, there seems to be a paradigm shift in the way aquifers are perceived – and studied – when dealing with multiple jurisdictions or transboundary issues; the very nature of the transboundary aquifer concept is still being debated:

- Should the complete aquifer be considered?
- Only the groundwater within the aquifer?
- An aquifer system?
- Groundwater flow systems and groundwater stocks?
- Etcetera.

In Europe for example, there are 226 “transboundary aquifers”, officially recognized, which are not really aquifers, rather, they are conveniently called “Groundwater Bodies” to suit the European Water Framework Directive ([WFD](#), 2000).

The lessons from ISARM have thought us that it is not always necessary, sometimes not even required, to integrate the whole transboundary aquifers in shared management decisions (UNESCO, [2015](#)). One of those practices require sparsing out aquifers by dividing them into groundwater flow systems and identifying the systems and their relations to each other based on scientific, social, economic and political needs and issues (UNESCO, [2015](#)). Another approach claims that for simpler local-based groundwater management scenarios, effective TBA areas could be defined by identifying the priority areas of an aquifer using “pumping hot spots” (Sanchez et al., [2020](#)).

As this practice is constantly evolving, the concept of groundwater management unit under the TBAs context will be further defined later, and study cases presented when available.

WHY

Is long-term data on water levels important?

Well water levels are very important parameters used to understand the dynamics of groundwater within an aquifer, as well as the aquifer connectivity to other water bodies (e.g., surface water, wetlands). Water levels provide the change in groundwater elevation per unit of distance in a given direction, and the decrease in the head, representing the hydraulic gradient, which is the main driving force for groundwater flow. Together with tracers (e.g., isotopes) and modeling, water levels are very useful in defining the most relevant groundwater units for share management under a transboundary context.

UPCOMING MEETINGS AND CONFERENCES

NGWA Groundwater Summit December 8-10, 2020 **Virtual event**

While the format may be different from years' past, the Summit will still be this year's NGWA's premiere event in which the latest in groundwater research and knowledge will be shared.

While NGWA is still in the process of reviewing submissions for the Summit — the program of which will be posted on the Summit website as soon as it's available — click here to get a sneak peek at this year's [keynoteaddress](#) to be given by Alfonso Rivera, who will discuss the “State of Knowledge and Shared Management of Transboundary Aquifers at the Global Scale.”

The 2020 Groundwater Summit registration also provides access to all the virtual components of [Groundwater Week 2020](#). This includes all workshops, the virtual exhibit hall, and online networking opportunities with attendees. You may also upgrade to attend any of the in-person Groundwater Week activities for a small fee.

3rd SADC Groundwater Conference 24th-26th November, 2020 **Virtual event**

The theme of this year SADC Groundwater Conference is ‘Enhancing Water and Food Security through Sustainable Groundwater Development in the SADC Region’. Sub-theme 3 will be of interest to our network members as it looks at ‘Enhancing the Contribution of Groundwater in the WEF Nexus through Effective Groundwater Governance at National and Transboundary level’.

The conference is free to all students and young professionals (below 35 years old) and abstracts are being accepted until the 9th October. More details and registrations can be found [here](#).

Launch of the Governance for Transboundary Freshwater Security – a Massive Open Online Course (MOOC)

WP, GEF IW: Learn and Partners have opened a MOOC on "Governance for Transboundary Freshwater Security." This course may be of interest to some members within our commission. It is particularly aimed at professionals who manage and make decisions about transboundary waters in ministries and river basin organizations, as well as young professionals and future leaders in transboundary waters, including undergraduate and graduate students. Find more information [here](#).

Special Issue Announcement - "Advances in Transboundary Aquifer Assessment"

A special Issue of the journal *Water* (ISSN 2073-4441, IF 2.544) entitled "Advances in Transboundary Aquifer Assessment" has been announced. This issue invite papers reporting on transboundary aquifer assesment research.

Guest editing this Special Issue is Sharon B. Megdal, Ph.D. Director, University of Arizona Water Resources Research Center and Dr. Anne-Marie Matherne of the U.S. Geological Survey. Papers may submitted any time between now and April 1, 2021.

https://www.mdpi.com/journal/water/special_issues/transboundary_aquifer

Fraser, C.M., Kalin, R.M., Kanjaye, M., and Uka, Z., 2020. A national border-based assessment of Malawi's transboundary aquifer units: Towards achieving sustainable development goal 6.5.2. *Journal of Hydrology: Regional Studies* : <https://doi.org/10.1016/j.ejrh.2020.100726>

Iván, V., Stevenazzi, S., Pollicino, L.C., Masetti, M and Mádl-Szonyi, J. 2020. An Enhanced Approach to the Spatial and Statistical Analysis of Factors Influencing Spring Distribution on a Transboundary Karst Aquifer. *WATER* 2020, 12, 2133; doi:10.3390/w12082133

Martin-Nagle, R., 2020. *Governance of Offshore Freshwater Resources, Leiden, The Netherlands: Brij-Nijhoff, ISBN 9004421041, 9789004421042*. 310 pages.

Milanes, M.E. 2020. The US-Mexico Transboundary Aquifer Assessment Act, 2006. Cooperation between the US and Mexico, Achievements and Efforts in the Mesilla Aquifer Basin. Chapter in: *International Groundwater Law and the US-Mexico Border Region*, Page 189–220 https://doi.org/10.1163/9789004385085_008

Yu Liu, Ping Wang, Hongwei Ruan, Tianye Wang, Jingjie Yu, Yanpei Cheng and Rashid Kulmatov. 2020. Sustainable Use of Groundwater Resources in the Transboundary Aquifers of the Five Central Asian Countries: Challenges and Perspectives. *WATER* 2020, 12, 2101; doi:10.3390/w12082101.

RECENT PUBLICATIONS

Vives, L., Rodríguez, L., Manzano, M., Mira, A., Araguás-Araguás, L., Ortega, L., Heredia, J and Matsumoto, T. 2020. Using isotope data to characterize and date groundwater in the southern sector of the Guaraní Aquifer System. *Isotopes in Environmental and Health Studies*. <https://doi.org/10.1080/10256016.2020.1810684>

Rodriguez, L., R., Sanchez, H., Zhan, and P.S.K., Knappett. 2020. The Transboundary Nature of the Allende–Piedras Negras Aquifer Using a Numerical Model Approach. *Journal of the American Water Resources Association* 56 (3): 387–408. <https://doi.org/10.1111/1752-1688.12843>

Roger D. Gonçalves 1, Elias H. Teramoto 1 and Hung K. Chang 2. 2020. Regional Groundwater Modeling of the Guarani Aquifer System. *WATER*2020, 12, 2323; doi:10.3390/w12092323

Tapia-Villasenor, E.M., E. Shamir, S.B. Megdal, and J.D. Petersen-Perlman. 2020. Impacts of Variable Climate and Effluent Flows on the Transboundary Santa Cruz Aquifer *Journal of the American Water Resources Association* 56 (3): 409–430. <https://doi.org/10.1111/1752-1688.12853>.

Cital, F., Rivera, A., Rodríguez-Burgueño, E., and Ramírez-Hernández, J., 2021. A governance panorama of an aquifer in a semiarid region, Mexico. Accepted by the UNESCO Global Water Security Issues: The role of sound groundwater resources management and governance to achieve water security. To be published in collaboration with the International Water Resources Association.



To subscribe to our newsletter please email: marieamelie.petre@gmail.com

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