

# NEWSLETTER



**International Association of Hydrogeologists**

**IAH TRANSBOUNDARY AQUIFERS COMMISSION**

## EDITOR'S MESSAGE

**Alfonso Rivera**  
**Chair, TBA Commission**



In 2022 we experienced the struggles that scientists, policy makers, managers, and the public at large, faced in trying to better understand the mystery of groundwater and its management, for the benefits of humans and ecosystems. Our commission contributed with groundwater knowledge and case studies on transboundary groundwater and aquifers to try to demystify that precious resource. We recognize that integrating groundwater sciences with social sciences and policy makers, is imperative for judicious management of this resource.

This issue of our newsletter intends to synthesize where we are following the successful year of groundwater, the invisible resource.

We have begun the third decade of the 21st century, with raising worldwide concerns for human sustenance on an Earth where finite water and land resources must be shared by humans and the environment. It is widely recognized that groundwater is a vital source of freshwater for communities around the world, and that this fragile natural resource is vulnerable to overexploitation and pollution, seemingly constrained by climatic variability. During the year of groundwater, we noticed that nations around the world are confronted with the difficult task of sustainable groundwater management. During the many events of the year of groundwater, we noticed that this task is overwhelmed with challenges of science and technology, as well as of human behavior, finances, and lack of data. The good news is that world institutions, governments and academia came together to create a coalition and agreed to support transboundary water cooperation on policy, governance, capacity development, technical support, and finance.

We try to briefly summarize what we heard and provide quick analysis and opinions on some of the themes and issues discussed during the year 2022.

## WHAT'S INSIDE THIS ISSUE:

2022 Year of Groundwater, summary

Participation and outcomes of the GW Summit, Paris December 2022

News from the ISARM Networks (Africa, Americas, Asia, Europe)

GGRETA completed

Opinion: The Silala story, every little counts

Events

People in the news

Other short news

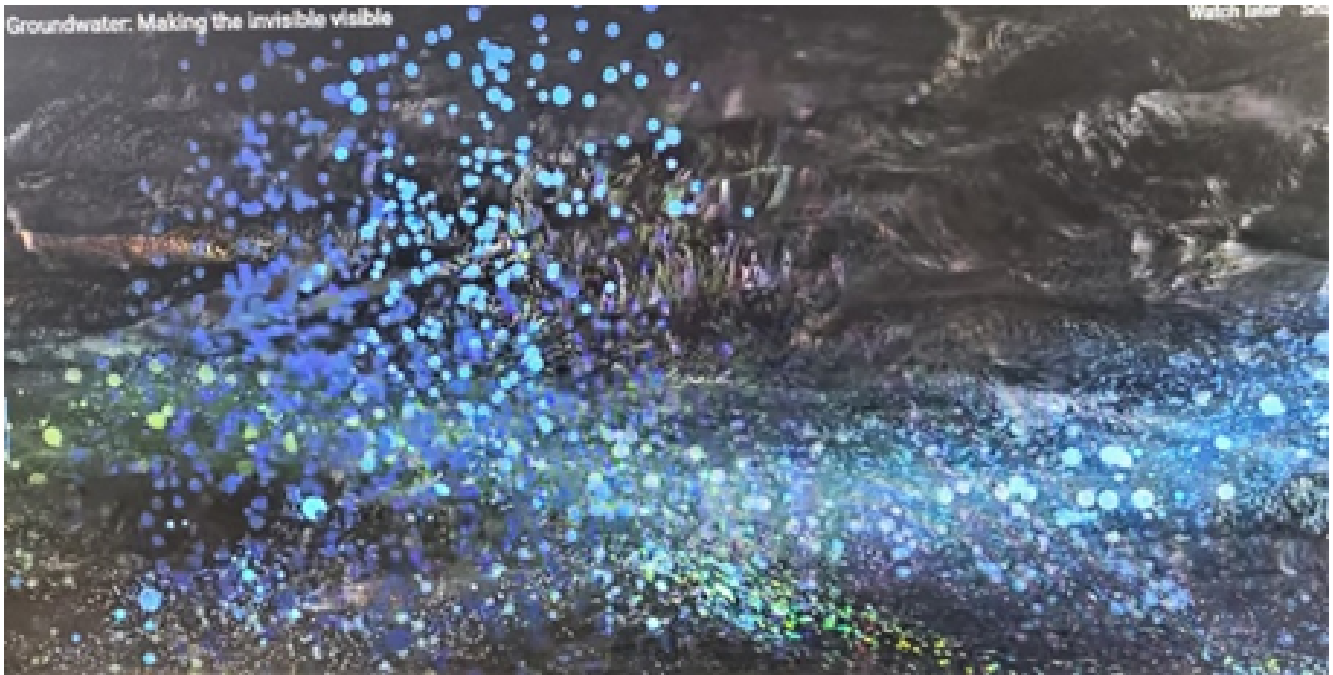
Knowledge capsules on TBA

Recent TBA-related publications

**Good reading!**

# Summary of 2022 The Year of Groundwater

By Alfonso Rivera



We have just completed a year fully dedicated to “Groundwater: an invisible resource,” it was a year of a kind!

Throughout the year, there were many well-attended events focusing on groundwater; it was so successful that we can no longer claim that groundwater is “invisible.”

In fact, groundwater is no longer a mysterious phenomenon since long time ago; since groundwater has been used for domestic and irrigation needs from time immemorial. Yet its nature and occurrence have always possessed a certain mystery because water below the land surface is invisible and relatively inaccessible. However, the influence of this mystery remains in some dogmas that govern groundwater law, as well as some practices in the management of this precious resource.



The scientific understanding of groundwater has gradually grown together with its development for human use. So, groundwater has lost its shroud of mystery, at least within the groundwater community of scientists and engineers.

It is in the realm of policy and management where groundwater is still a mystery, or not well understood. It is in those two domains where hydrogeologists need to keep pushing the finger on those buttons; we need to get strongly involved with social scientists, law makers, politicians, and water managers. It is good to attend, present, and discuss our results to our peers, but now it is more important to take those actions outside our own domain.

This is even more needed when dealing with transboundary groundwater and aquifers.

I think that we should keep the momentum created in 2022 ongoing, and continue spreading the news on the potential of groundwater to provide societies with incredible social, economic, and environmental benefits and opportunities. We should fully consider groundwater as a resource necessary for sustainable development, linked to the United Nations Sustainable Development Goals.

I leave you with this poem created by OpenAI (ChatGPT):

Beneath the surface of the earth,  
A hidden treasure lies,  
A life-giving force,  
That never sleeps or dies.

Transboundary groundwater,  
A precious resource so rare,  
It flows across borders,  
Without a thought or care.

But as we draw it from the ground,  
And put it to our use,  
We must remember to be kind,  
And never let it be abused.

For though it knows no borders,  
And flows without a sound,  
Transboundary groundwater,  
Is fragile, and must be found.

So let us be its guardians,  
And protect it with our might,  
For the sake of all who live,  
And all who seek its light.

# Participation and outcomes of the UN-Groundwater Summit, Paris, 7-8 Dec 2022

Summary by Christina Fraser

In December 2022, the UN-Water Summit on Groundwater was held in Paris. The purpose of the summit was to bring groundwater to the attention of political leaders and ministries at the highest international level. Sessions were dedicated to the SDG 6 accelerators with additional regional dialogues and thematic sessions on groundwater in Africa, transboundary aquifers, and the science-policy-practice. TBA Commission members Christina Fraser and Arnaud Sterckx supported the planning and preparation of the summit as staff members of the co-coordinating organization.

TBA Commission member Lucia Samaniego participated in a pre-summit event 'Transboundary Aquifers of the World', presenting on the advances in knowledge of transboundary aquifers in Latin American Countries (the ISARM Americas Program).



The official session on transboundary aquifers provided an overview presentation about the work that has been done in the field of transboundary groundwater over the past 20 years. The progress on transboundary aquifer cooperation under SDG 6.5.2 was then presented which was followed by a high-level panel discussion. Immediately following this session, the Transboundary Water Cooperation Coalition was officially launched.

On conclusion of the Summit, a **UN-Water joint statement** was released calling on actors to declare voluntary commitments and announce accelerated action for groundwater capacity development, data and information, innovation, governance, and finance as part of the Water Action Agenda of the UN 2023 Water Conference.



# SIWI seminar Water as a driver for peace and cooperation.

by Alfonso Rivera



The poster features a blue background. On the left, there is a circular icon of a dove with an olive branch. To its right, the text reads: "On peace and cooperation", "SIWI Seminar: Water as a driver for peace and cooperation (2/3)", "30 August, 2022 • 14:00 – 15:30", and "Room: 451". Below this text is a paragraph: "This session provides background on transboundary aquifers (TBAs) and describes implications for water security and peace. It focuses on three topics relevant for better understanding invisible TBAs and the benefits for international water security. Each topic includes a presentation and reactions from the panel and audience." On the right side of the poster is a circular image of a river flowing through a landscape with mountains in the background. At the bottom, there are logos for "World Water Week SEMINAR", "igrac International Groundwater Training and Cooperation Centre", "International Association of Hydrogeologists and Transboundary Aquifers Commission", and "unesco International Hydrological Programme".

On peace and cooperation

SIWI Seminar: Water as a driver for peace and cooperation (2/3)  
30 August, 2022 • 14:00 – 15:30  
Room: 451

This session provides background on transboundary aquifers (TBAs) and describes implications for water security and peace. It focuses on three topics relevant for better understanding invisible TBAs and the benefits for international water security. Each topic includes a presentation and reactions from the panel and audience.

World Water Week SEMINAR

igrac International Groundwater Training and Cooperation Centre

International Association of Hydrogeologists and Transboundary Aquifers Commission

unesco International Hydrological Programme

With support from UNESCO and in association with IGRAC, the IAHT-Transboundary Aquifers Commission organized one session of the SIWI-seminar “Water as a Driver for Peace and International Cooperation.”

The session provided background on transboundary aquifers and described implications for water security and peace. It explored three themes: 1 Understand invisible TBAs and their role in international cooperation; 2- discover the benefits of conjunctive surface /groundwater management; and 3 – assess current TBA cooperation and groundwater security.

Four members of the TBA Commission participated in the session: Alfonso Rivera and Laura Movilla in topic 1; Kevin Pietersen in topic II; and Christina Fraser in topic III.

<https://www.worldwaterweek.org/event/10645-siwi-seminar-water-as-a-driver-for-peace-and-cooperation23>

# International Conference “Groundwater, key to the Sustainable Development Goals”

by Marie-Amélie Pétré



INTERNATIONAL CONFERENCE  
**GROUNDWATER, KEY TO THE SUSTAINABLE DEVELOPMENT GOALS**  
**PARIS - May 18 -20, 2022**



ORGANIZED BY IAH-CFH, UNESCO-IHP, THE FRENCH WATER PARTNERSHIP, UNDER THE PATRONAGE OF THE FRENCH NATIONAL COMMISSION FOR UNESCO AND WITH THE SUPPORT OF THE MINISTRY FOR ENVIRONMENT, SEINE-NORMANDY WATER AGENCY, AND SORBONNE UNIVERSITY

The IAH-Transboundary Aquifers Commission (M-A Pétré, Christina Fraser and Moti Rijal) organized a session on transboundary aquifers, with UNESCO-IHP and IGRAC at the international Conference [“Groundwater, Key to the Sustainable Development Goals”](#) which was held in Paris, on 18-20 May 2022. During this hybrid session (Topic 4c) participants shared experiences on the assessment of TBA and illustrate through case studies the success stories and challenges of cooperation over TBA and how TBA are contributing to the Sustainable Developments Goals.



**Photo: M-A Pétré and Aurélien Dumont (UNESCO-IHP), co-chairs of the TBA session**



# ISARM Africa

## TBA News

Contributed by Kevin Pietersen

The SADC-GMI worked on developing a groundwater model for the Eastern Kalahari-Karoo Transboundary aquifer (EKK-TBA). The basis of the model was to (i) provide first estimates of sustainable abstractions (e.g., setting a limit to abstraction), which are essential in joint sustainable groundwater management, and (ii) contribute towards enhancing water security in the EKK-TBA. The USGS modular hydrologic model software MODFLOW-6 was used to construct the EKK-TBA groundwater model, and the USGS ModelMuse was used as the graphical user interface.

The SADC-GMI organized an online session at SIWI “Strengthening groundwater governance in SADC: Making the invisible visible.” The session presented an overview of prevailing groundwater development and management challenges in the SADC region and discussed interventions that promote good groundwater governance through (i) improvement of policy, legal, and institutional frameworks; (ii) effective groundwater knowledge management, and (iii) mainstreaming groundwater governance into RBOs.

UNESCO also conducted a high-level vulnerability analysis of the Tuli-Karoo Transboundary Sub-basin and Etosha Basin. The analysis included (i) constructing maps to support actions towards groundwater quality protection, (ii) developing "Guidelines for RBOs to carry out to support groundwater quality protection", and (iii) conducting an online course on groundwater quality for RBOs.

The SADC-GMI is developing a groundwater strategy for the Limpopo River Basin Commission (LIMCOM), which aims to strengthen the legal and institutional frameworks for transboundary groundwater management. LIMCOM and SADC-GMI formalized a cooperation mechanism focusing on groundwater resource development and management. The strategy's overall objective is to promote the recognition of the strategic value, equitable access, sustainable use, and protection of groundwater in the Limpopo River Basin.



after SADC-GMI, 2020a; IGRAC, 2021) (© Open Street Maps, Own Elaboration)

### TBAs in Southern Africa south of Latitude 15° S

# ISARM Americas

## TBA News

Contributed by Lucia Samaniego

In 2022, the ISARM Americas Program participated in various initiatives and events.

During the World Water Forum 2022 in Dakar the program had two presentations: “Implementation of the Guarani Aquifer Strategic Action Program: Facilitating Regional Actions” and “Panel Exchange between transboundary aquifers in Africa, Europe and South America”.

Participation in the virtual meeting on the Integration and Management of Shared Water Resources in Latin America and the Caribbean in March 2022, a space for dialogue between LAC countries on governance of shared waters to identify progress and current challenges in the management of transboundary basins.

Two important advances on transboundary aquifers were made with the support of ISARM Americas:

- Compilation and systematization of information on the 7C Transboundary Aquifer System: Yucatán Peninsula-Candelaria-Hondo shared by Mexico, Belize, and Guatemala.

- Compilation and systematization of information regarding the Transboundary Aquifer Systems 1CB Masacre – 2CB Artibonito – 3CB Los Lagos – 4CB Pedernales, shared by the Dominican Republic and Haiti.

A new edition of the regional course "Governance of transboundary aquifers" was carried out. It is planned that in 2023 this course will be held again.

During the UNESCO-IHP National Committees meeting on October 2022, the UNESCO programs meeting was held where the report on the activities of the ISARM Americas working group was presented.

Groundwater Summit 2022, participation in the side event: Transboundary Aquifers of the world - Advances in knowledge of transboundary aquifers in LAC: ISARM AMERICAS Program.

In 2023, the ISARM-Americas network of 27 countries will hold an in-person meeting in the middle of the year.



# ISARM Asia

## TBA News

Contributed by Han Zaisheng

### **Transboundary water resources cooperation between China and Kazakhstan**

The three dominant rivers between China and Kazakhstan are the Yili River, the Ertys River and the Emin River. The main downstream flows of the rivers are from China into Kazakhstan; a small number of tributaries flow in and out between the two countries. Through dialogue and consultation, China and Kazakhstan have properly handled the problems arising from transboundary rivers and adopted a policy of responsible transboundary water resources without harming the interests of their neighboring countries.

In 2001, the two governments signed the common utilization and protection of transboundary rivers cooperation agreement, agreeing to establish "the use and protection of cross-border rivers joint committee". The first joint committee took place in Beijing in 2003, and by the end of 2013 it has held 12 meetings. The scope of the committee's cooperation mainly focuses on the implementation of the agreement, including the joint monitoring of hydrology and water quality of transboundary rivers, the review of water conservancy project results, and the emergency response to crises, and others. Cooperation provides an effective channel for the two sides to communicate the dynamics of transboundary rivers in real time. The task before the Commission is to put forward a fair and reasonable water allocation plan and implement it.

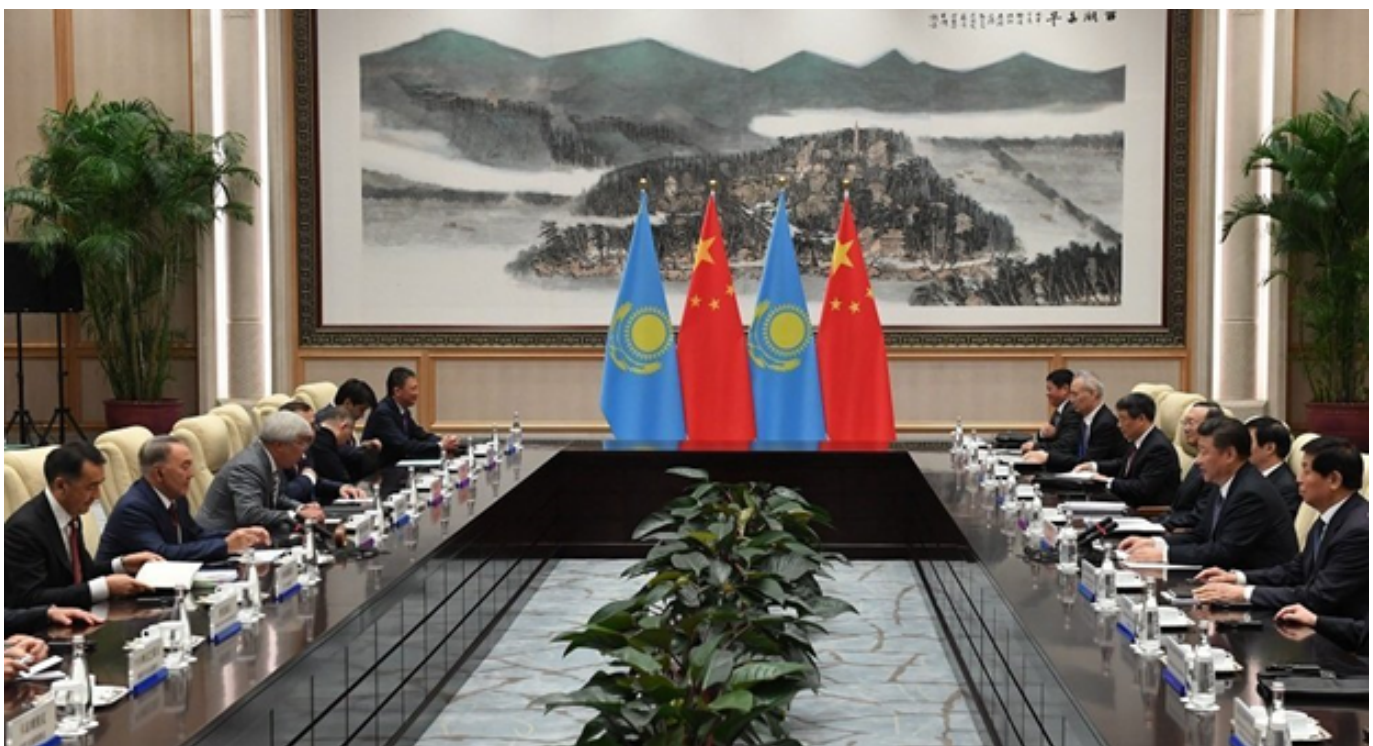
In 2006, the two parties signed the Agreement on Research Cooperation of Transboundary Rivers and the Agreement on Exchange of Hydrological Water Quality Data of Major River. Further, between 2010 and 2011, the two parties signed the Key Implementation Plan of Technical Work, and the Agreement on Water Quality Protection of Transboundary Rivers; they made arrangements for joint scientific research and technical exchange between China and Kazakhstan in the cross-boundary river basin.

Since 2009, China has cooperated with Kazakhstan to carry out transboundary river protection and transboundary water body monitoring. China has actively introduced the strategic planning of economic development and water use to Kazakhstan. In the development and utilization of water resources, China has also adopted the policy of both protection and utilization of cross-boundary rivers.

The Khorgos River Friendship Joint Water Diversion Project, jointly invested by China and the Republic of Kazakhstan in 2015, was officially accepted by both sides and put into use. The combined water diversion project is designed to have a water flow rate of 50 cubic meters per second. It is a full manifestation of the high degree of mutual trust and sincere cooperation between China and Kazakhstan.

The joint statement on the 30th anniversary of the establishment of diplomatic ties between the People's Republic of China and the Republic of Kazakhstan was signed in September 2022 by the President of the People's Republic of China and the President of the Republic of Kazakhstan. The statement pointed out: "The two sides are willing to further deepen practical cooperation in earth sciences, continue to carry out investigations and research on geological and mineral cooperation, tap the potential of mining investment cooperation between the two countries, and serve their economic and social development." The two sides keep a high-level communication on the practical and effective cooperation between the two countries in the field of transboundary rivers. The two sides are willing to actively promote the consultation on the draft Agreement between the Government of China and the Government of the Republic of Kazakhstan on the Water Distribution of Transboundary Rivers, taking into account their respective water resources rights, development interests and ecosystem protection.

For transboundary aquifers in countries along Belt and Road, peace and cooperation openness and inclusiveness, mutual learning and mutual benefit are revealed on Silk Road Spirit. The Illi River aquifer between China and Kazakhstan is considered as an inspiration for dealing with transboundary groundwater.



# ISARM Europe

## TBA News

Contributed by Momčilo Blagojević

New Project Approved **“Implementation of the Strategic Action Program (SAP) of the Dinaric Karst Aquifer System: improving groundwater governance and sustainability of related ecosystems” – DIKTAS II**

DIKTAS II is a Global Environment Facility (GEF) funded regional project, and it will be implemented by the United Nations Development Programme (UNDP) and executed by the International Hydrological Programme of the UN Educational, Scientific and Cultural Organization (UNESCO IHP).

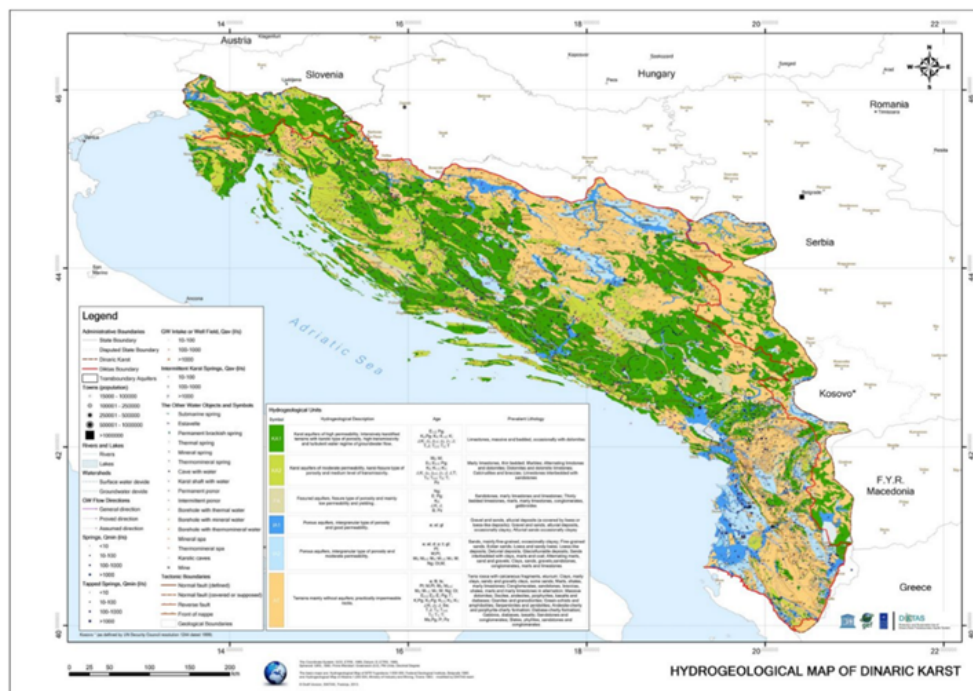
DIKTAS II is a continuation of the successful DIKTAS (I phase) project implemented from 2010 to 2015. DIKTAS (I phase) project's main outputs include the Transboundary Diagnostic Analysis, the establishment of cooperation mechanisms at the national and regional level, and the adoption of a regional Strategic Action Plan (SAP) and corresponding National Action Plans (NAP) for each of the countries involved.

The DIKTAS II builds on the results of the DIKTAS (I phase) to provide a comprehensive approach to improving groundwater management and protection in the region and will have far-reaching benefits for the communities that rely on this vital resource. This vision perfectly adheres to the conclusions reached by the countries (Albania, Bosnia–Herzegovina, Croatia, Montenegro) sharing the Dinaric Karst Aquifer System (DIKTAS), enshrined in the Strategic Action Program prepared by the countries and endorsed at the ministerial level. Albania, Bosnia–Herzegovina, and Montenegro, with the full support of Croatia, will cooperate to advance the sustainable management of the Dinaric Karst Aquifer System and its ecological resources and will enhance their national and regional groundwater governance frameworks and institutional capacities.

The project also intends to assist the countries to acquire following project outcomes:

- 1) Institutionalization of periodic multi-country expert consultations and information exchanges, and creation and strengthening of bilateral/multilateral conflict resolution mechanisms, provide the transboundary cooperation framework crucial for the sustainable utilization of shared karst waters, and for the protection of the Dinaric Karst ecosystems,
- 2) Adoption of sound groundwater governance principles and frameworks, including emphasis on sanitary protection zones, harmonized across the Dinaric Karst Aquifer System, facilitated through the application of the methodology developed by the Groundwater Governance GEF project,
- 3) Modern multi-purpose monitoring of karst groundwater enables responsible entities at the local and at the regional level to effectively manage the shared karstic waters and dependent ecosystems,
- 4) Agreement on real-time harmonized data sharing enables effective transboundary cooperation,
- 5) Definition of national and/or binational Action Programmes and of DIKTAS wide guidelines for reversing degradation trends in highly,
- 6) Increased awareness at all levels, dissemination of project's achievements and lessons learned, and strengthened gender equality and women empowerment, facilitate replication of good practices and policies.

We look forward to seeing the results of this important groundwater project for the SEE and hope that it will pave the way for improved groundwater governance and sustainability across the region.



**Hydrogeology map of the Dinaric karst (DIKTAS project- and adjacent area)**

# GGRETA PROJECT COMPLETED

Contributed by Oleg Podolny

On December 13-14, 2022, the final meeting on the GGRETA project was held in Paris at UNESCO Headquarters. The project was funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by UNESCO-IHP with the support of the IUCN.

The meeting reviewed the results of Phase 3 (2019-2022) and the Project as a whole. Three transboundary aquifers, one in Africa (Stampriet TBA, shared by Namibia, South Africa and Botswana), one in Central America (Ocotepaque-Citala TBA, shared by El Salvador and Honduras), and one in Central Asia (Pretashkent TBA, shared by Kazakhstan and Uzbekistan ) were included in the project as case studies. All of them are located in different climatic zones and differ in hydrogeological structures with various aquifer top's depth and recharge and discharge conditions.

Countries that share these aquifers differ in economic and social status, and use groundwater with various intensities and for different purposes. The institutional structures of groundwater management are also different. However, despite the noted complexity of the objects of study, the goals and objectives of the project, in general, were achieved. The main summary presentation by Luciana Scrinzi summarized the main results of all three case studies.

## **Capacity development of stakeholders through trainings and workshops**

Capacity-building workshops in the area of groundwater management were held, covering the principles of groundwater management, joint management of surface and groundwater resources, etc. Attention was focused on groundwater quality in transboundary aquifers and their monitoring. Higher education problems of water specialists, especially for groundwater, were considered. In all three TBAs, as a result of project activities, there is a strengthening of cooperation with regional stakeholders.

## **Technical tools to inform policy, decision-making, and knowledge development**

For all three case studies, conceptual hydrogeological models were developed and have been updated, numerical models of TBAs were built for all three. Recommendations have been done to improve data exchange protocols (Stampriet and Pretashkent TBAs), protocols and templates for data exchange and improved information management systems (Ocotepaque-Citala TBA). Evaluations of higher education programs in the field of groundwater resources management have been carried out.

For all three case studies, conceptual hydrogeological models were developed and have been updated, numerical models of TBAs were built for all three. Recommendations have been done to improve data exchange protocols (Stampriet and Pretashkent TBAs), protocols and templates for data exchange and improved information management systems (Ocotepeque-Citala TBA). Evaluations of higher education programs in the field of groundwater resources management have been carried out.

Support to long-term cooperation between countries sharing transboundary aquifers

Roadmaps developed under GGRETA. One to coordinate the shared management of the Ocotepeque-Citala TBA (transboundary cooperation in coordination with stakeholders of Plan Trifinio and improvement of groundwater management frameworks). A second one, for the protection and sustainable use of the Pretashkent TBA (agreements signed for joint development of the numerical model to continuous operating model based on joint groundwater resources management, with working groups organized to decide the way forward). A third one, to support the Stampriet TBA multi-country Cooperation mechanism in ORASECOM, and to provide support to strengthen institutionalized cooperation in LIMCOM and CUVECOM.

As a result, all participating States expressed their satisfaction with the achieved results of the project and promised to continue cooperation for the joint management of groundwater resources of the TBAs.

*1 ORASECOM - The Orange-Senqu River Commission*

*1 LIMCOM - The Limpopo Watercourse Commission*

*1 CUVECOM - The Cuvelai Watercourse Commission*

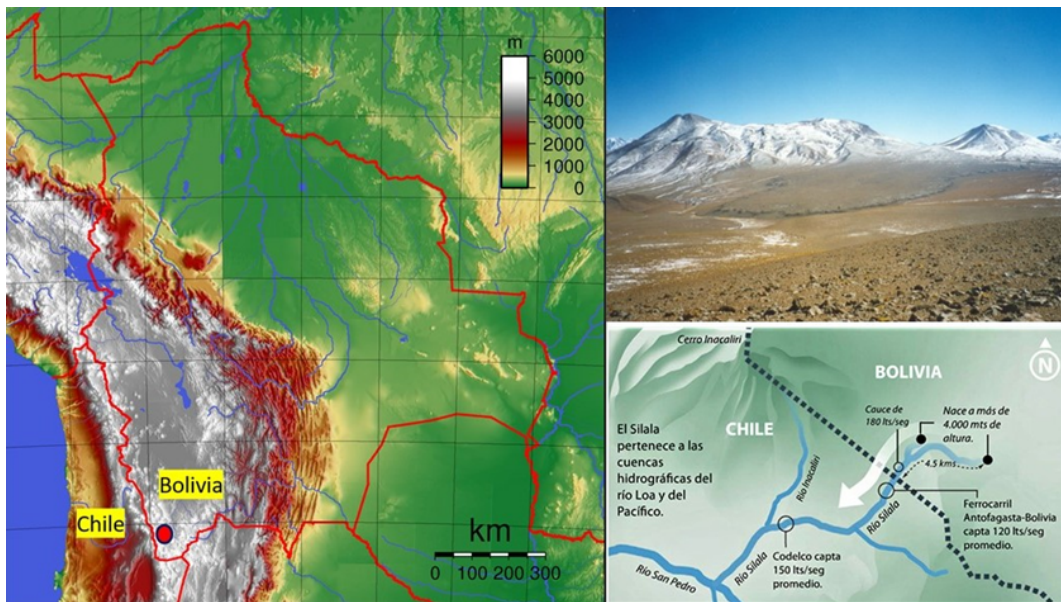
### **GGRETA-3: In the 3 project regions: Africa, Central Asia, Central America**





# OPINION - THE SILALA STORY, EVERY LITRE COUNTS

Contributed by Alfonso Rivera



This is an interesting case on the dispute of transboundary groundwater as a trigger or root cause of conflict, and a dispute over the control of water, where the economic or physical access to water, or scarcity of water, threatens peace and cooperation. I am familiar with this case because I participated as an international expert (in hydrogeology) in a field campaign in 2016. This campaign took us all the way up to the very sources of the Silala, in the altiplano of Bolivia, at 4500+ m above sea level.

It became clear to me that the Silala was not a river, it is an aquifer. I “saw” it first hand when I walked all the way up to the very sources where groundwater outcrops out of the aquifer in six springs. I made estimates and calculated various parameters and metrics including groundwater-flow directions, storativity, and others.

A spring may be the result of an aquifer being filled to the point that the water overflows onto the land surface, where water moving underground finds an opening to the land surface and emerges. Or, it may be just a trickle, only after rain. The springs of the Silala have a continuous flow of circa 190 L/s. So, given that the region is practically dry (average 59 mm), these springs are the result of groundwater finding its way to the land surface. The residence time of groundwater in the Silala aquifer is estimated to be a maximum of 11'000 y using 14C.

Groundwater from the Silala fractured ignimbrite aquifer supports bofedales. A bofedal is a high-altitude wetland considered a small natural pasture but with permanent moisture. The bofedales form in areas such as the Puna grassland in the Andes Mountain range located between 3800 and 4100 meters above sea level. They feed the fauna (Llama, Vicuña) during the long months without rainfall. The water that feeds the bofedales comes from rain, melting glaciers and springs or surface outcrops of groundwater.

Groundwater flowing out of the springs in Bolivia flows northeast, then west, following the topography creating a small creek with a flow of approximately 190 L/s, the creek then flows through the international border and into Chile.

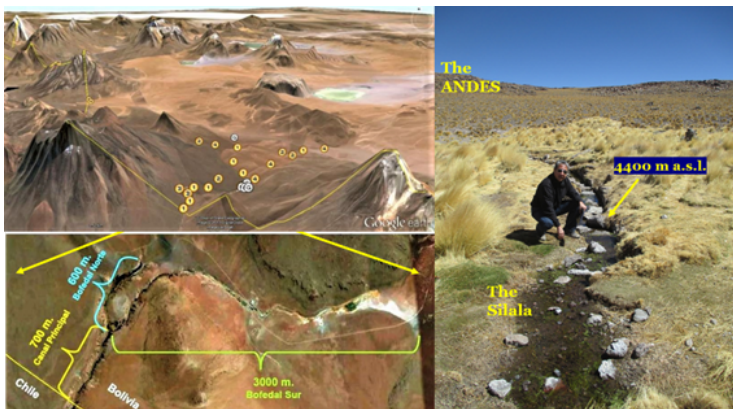
Water from the Silala has been the object of long-term disputes between Bolivia, where the water originates, and Chile, which uses that water for mining and other economic activities.

In June 2016, Chile filed a lawsuit calling on the International Court of Justice (ICJ) in the Hague to declare the

Silala an international waterway, after Bolivia indicated it would charge for use of its waters. The dispute was over the status and use of the waters of the Silala. Mining operations on the Chilean side of the border rely, in part, on the Silala's waters, which flow through the Atacama Desert, one of the driest places on earth. This is one of several water-related issues that have spurred tensions between Chile and Bolivia for years.

With its lawsuit, Chile sought the application of the customary international law by declaring the Silala an international waterway. Whereas Bolivia asserted that the water's flow had been created by means of "artificially enhanced" channels and draining mechanisms.

Six years later, on December 1, 2022, the IJC delivered its judgement in the case Chile v. Bolivia. It was a NO decision. The ICJ declined to issue a decision on most of the points raised by the Parties during the proceeding due to the final convergence of positions between them. The key points of the ICJ decision are that groundwater and surface water should be treated as "a whole." So, the Silala was treated as a surface-water river, not as groundwater from an aquifer. Since neither State is a party to the 1997 United Nations Watercourses Convention (UNWC), the Court decided the case based on customary international law on surface water.



While this is a wise decision – to cooperate – it leaves a void on the fate of international solutions on transboundary groundwater disputes. I guess that, because there are no international laws on groundwater, the IJC treated the Silala as surface water (only), which is not. It is groundwater originated in Bolivia emerging from six springs in a local ignimbrite fractured aquifer.

It is remarkable in such a unique case, that reference to the science or experts in the Court’s decision was virtually absent, as pointed out by Sindico, Movilla, and Eckstein (2022). This is a very important issue for future transboundary groundwater cases; as it remains to be seen whether scientific knowledge is indeed considered in legal decisions.

One of the three experts who served as Counsel for Bolivia in this IJC case is current member of the IAH-Transboundary Aquifers Commission; the other two were members of the previous TBA Commission.

#### Sources:

- IJC decision: <https://media.un.org/en/asset/k1y/k1yyfx5m59>
- Neumann-Redlin y Torres, J., 2003. Investigaciones hidrológicas, hidroquímicas e isotópicas en el área de los manantiales del Silala.
- Ramsar report, 2018.  
[https://www.ramsar.org/sites/default/files/documents/library/ram84s\\_bolivia\\_los\\_lipez\\_2018.pdf](https://www.ramsar.org/sites/default/files/documents/library/ram84s_bolivia_los_lipez_2018.pdf)
- Sindico, Movilla and Eckstein 2022 : <https://www.ejiltalk.org/preliminary-reflections-on-the-icj-decision-in-the-dispute-between-chile-and-bolivia-over-the-status-and-use-of-the-waters-of-the-silala/>
- SERGEOTECMIN, 2004. Investigaciones en los Manantiales del Silala, Diciembre 2004.



# EVENTS



The IAH is celebrating its 50th Anniversary with the World Congress in Cape Town, South Africa.

The Congress theme for IAH-50 is Groundwater: A Matter of Scale. This theme combines scientific advances through local to global scale experiments and case studies, with those extending over various temporal scales. Kevin Pietersen, member of the TBA Commission is the Chair Person of the congress scientific committee.

The organisers of the event requested the IAH Commissions and Networks to explore topics under the subthemes. One of the conference's subthemes focuses on "Improving shared sustainable use of groundwater resources that cross two or more jurisdictional borders". We invite the TBA commission to convene a special session.

Abstract submission is open until March 31, 2023. Find out more: <https://iah2023.org.za/>

## TWCC Roadmap Coalition (Contributed by Arnaud Sterckx)

On December 8th 2022, the Transboundary Water Cooperation Coalition (TWCC) was officially launched at the Groundwater Summit, in Paris. This Coalition is a multistakeholder partnership of over 30 governments, intergovernmental organizations, regional integration organizations, international financial institutions, academic institutions, and civil society organizations. With the second ever United Nations conference on water to take place on 22–24 March 2023, the Coalition aims at inspiring concrete actions and commitments to advance transboundary water cooperation worldwide. Through its incredibly diverse set of members that support transboundary water cooperation on policy, governance, capacity development, technical support and finance, the Coalition aims to:

- Lift the voice of the transboundary water community in a unified manner
- Demonstrate and communicate the benefits of transboundary water cooperation, both for upstream and downstream countries and in the adaptation to new climate challenges
- Provide impetus for concrete commitments related to transboundary water cooperation
- Catalyze support to initiate, sustain and further transboundary water cooperation

The Coalition will encourage concrete commitments to support the advancement of transboundary water cooperation by countries and organizations from around the world to be submitted as contributions to the Water Action Agenda, one of the main outcomes of the United Nations 2023 Water Conference.

Within the Coalition, TBA Commission members from IGRAC and CeReGAS will promote additional efforts in transboundary groundwater assessment and management.

<https://www.un-igrac.org/news/launch-transboundary-water-cooperation-coalition>

## **New York Water Conference (by Arnaud Sterckx)**

On 22–24 March 2023, the second ever United Nations conference on water to take place in New-York. This conference, (the United Nations Conference on the Midterm Comprehensive Review of the Implementation of the Objectives of the International Decade for Action, “Water for Sustainable Development”, 2018–2028, or the “United Nations 2023 Water Conference”) is mandated by the UN General Assembly resolutions 73/226 and 75/212, and will be structured around 5 interactive dialogues. One of the interactive dialogues will be devoted to “Water for Cooperation”, including the topics of Transboundary and International Water Cooperation, Cross Sectoral Cooperation, including Scientific Cooperation, and Water Across the 2030 Agenda. Key outcomes of the UN 2023 Water Conference will include the Water Action Agenda – a set of voluntary commitments taken by governments and stakeholders to accelerate implementation towards achieving the Sustainable Development Goal 6 and other water-related goals and targets.

<https://sdgs.un.org/conferences/water2023>

SDG indicator 6.5.2 shows that the current level of cooperation in transboundary aquifers is inadequate. This conference is a unique opportunity to raise this issue and trigger further actions. It is worth noting that commitments can be registered by all kind of organizations. Will you register one?

<https://sdgs.un.org/partnerships/water/register>

# PEOPLE IN THE NEWS

(by A. Rivera)

## Professor Emil O. Frind - Rest in Peace



The University of Waterloo (Canada) Department of Earth and Environmental Sciences, and the groundwater community at large, is mourning the recent passing of Dr. Emil Frind, Distinguished Professor Emeritus. He passed away on Sunday, December 25, 2022, at the age of 90.

Emil Frind, a hydrogeologist and groundwater modeller, pioneered the field of quantitative groundwater science and was a leader in the development of modelling methodologies for groundwater processes. Emil was very active in the community of modelers in Europe too. I recall his input when we were working with different approaches to model variable-density fluids in strongly coupled groundwater-brine flow and transport at radioactive waste sites in Switzerland and Germany, back in the 90s. He joined our groups and provided valuable insight.

I was very honored when he invited me to visit his teams in Waterloo, without knowing that I would move to Canada later; I kept in touch with him and some of his students.

This is the TBA Commission's respect to another hydrogeologist who left a mark and influenced in our times.

Learn more about his time at UWaterloo: <https://lnkd.in/gAqhiqX8>

### Dr. Alfredo Granados Olivas

Alfredo is professor at the UACJ, Universidad Autónoma de Ciudad Juárez, Mexico

Alfredo is expert in transboundary groundwater issues between Mexico and the USA in the El Paso del Norte Region. He has extensively worked and contributed to the knowledge of TBA across the Mexico/USA border.

His most recent contribution is the book: Hydrological Resources in Transboundary Basins between Mexico and the United States: El Paso del Norte and the Binational Water Governance. Alfredo was the main coordinator of this 324-page book with a collaborative effort among scholars on both sides of the border; a substantial contribution indeed.



# OTHER SHORT NEWS

## **TBA Commission ESSAY**

Among the many initiatives for the 2022 international Year of Groundwater, the IAH Executive Council, with the Hydrogeology Journal Editor-in-Chief Cliff Voss, launched the initiative to publish a special HJ Topical Collection with selected Essays dedicated to relevant topics and novelties in hydrogeology.

Our Transboundary Aquifer Commission was invited to submit one of those Essays and we accepted the challenge. A short group of seven members of our commission produced an Essay titled: Why do we need to care about transboundary aquifers and how do we solve their issues?

In this essay, we build on 20 years of TBA experience, using a three-pillar framework (assessment, cooperation-collaboration, shared management), to identify the key elements to solve TBA's issues. Our analysis includes a multidisciplinary approach, identification of hotspot zones, local vs border-wide approaches, appropriate funding models, and an increased recognition of the role and value of TBA.

Our essay was accepted and published as open source in November 2022 (full citation below).

## **The First Binational Water Summit US-MX in Cd Juárez, September 2022** (by Rosario Sanchez)

The First Binational Water Summit US-MX (Primera Cumbre Binacional de Agua) took place on September 21-23, 2022 in Ciudad Juarez, Mexico. Experts and academics from both sides of the border presented issues related to drought, sustainable agriculture, human rights to water, and the 1944 Water Treaty, among others. A high-level panel led by the Governor Maria Eugenia Campos was also highlighted as a clear message of commitment and interest in the topic. Being the State of Chihuahua an intensive and extensive water consumer for agriculture, local farmers and other stakeholders attended the meetings, made presentations, and provided an open space for discussion, networking, and engagement. It is expected that the next Binational meeting will take place in 2024.





## Case Study of the transboundary aquifers data and information exchange between the United States and Mexico by the Binational Groundwater Task Force

(by Alfonso Rivera)

A new publication on good practices and lessons learned in transboundary data exchange is currently being prepared by the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UN Water Convention). The publication will be a collection of cases accompanied by text that highlights the lessons learned with reference to good practices on the data and information exchange as collected in the cases.

The IAH Transboundary Aquifers Commission was invited by the Water Convention to submit a case (or cases) about current practices on transboundary data exchange using a predesigned template and contribute to the development of the publication. The purpose of the cases is to learn from real life examples, including both the difficulties and challenges that countries face and good solutions and ways of organization that countries and joint bodies have found useful. Ongoing or finished examples could be submitted; these might include successful and failed stories.

The TBA Commission accepted the invitation and submitted the template using data and information of the Binational Groundwater Task Force (BGTF) of the Permanent Forum of Binational Waters. Two members of the TBA Commission are also members of the BGTF, Rosario Sanchez and Alfonso Rivera. The study case is based on the main objective of the BGTF, namely to identify the main common transboundary groundwater issues –or effects– for each TBA located along the Mexico/U.S. border, using a quantitative conceptual framework.

The BGTF study is still incomplete, but it is already a success story and a great example of volunteer cooperation in good faith, between scholars, government institutions and private sector in the two countries. We believe, this type of collaboration may be used as inspiration for other TBAs in the world.

If interested, a copy of the template may be obtained by a simple request to Alfonso Rivera at [aguasub7@gmail.com](mailto:aguasub7@gmail.com)





## Facelift: a new website for the TBA Commission (by Arnaud Sterckx)

The TBA Commission has been using a dedicated section of the ISARM for its communication (<https://isarm.org/IAH-TBACommission>). As of June 2023, the ISARM website will no longer be supported, which is an opportunity for the Commission to develop its own website within IAH domain, like other IAH commissions and networks do (<https://iah.org/groups/commissions-networks>). This new website will be developed in the upcoming months and will be duly disseminated once ready.

# KNOWLEDGE CAPSULES ON TBA

In the previous issue of the Newsletter, we defined the terms Hydrogeological Unit – HGU  
Hydrostratigraphic unit – HSU

In this issue, we add other interrelated terms to narrow the scope of our main goal on knowledge of TBA: the meaning of TBA mapping and TBA assessment.

## Transboundary Aquifer Mapping

The mapping of a transboundary aquifer is no different from the mapping of a “normal” aquifer. In general, geology and hydrogeology are used to map an aquifer, mostly by defining its natural boundaries (or boundary conditions) in two horizontal dimensions. More advanced mapping of aquifers includes the vertical dimension too with detailed hydrostratigraphy. Further, a map of an aquifer may include connections with surface bodies of water (rivers, lakes, wetlands), although this is not always the case. In the case of a transboundary aquifer, the mapping includes the jurisdictional, not natural, boundary, mostly in two horizontal dimensions (what we “see”).

Many of the 468 TBAs inventoried by ISARM include maps of TBAs only in the 2D-horizontal dimensions.

## Transboundary Aquifer Assessment

Contrary to aquifer mapping, aquifer assessment is a full characterization of the aquifer in three dimensions including the dynamics of groundwater through the aquifer and groundwater stored in the aquifer. In this context, transboundary aquifer assessment is more quantitative than mapping. The minimum number of tasks that should be covered by a full transboundary aquifer assessment are: hydrogeological boundaries, hydrological boundaries, groundwater flow rates, groundwater volume in storage, groundwater use, aquifer recharge and aquifer discharge, groundwater flow regime (steady state and transient state), groundwater residence time in the aquifer, groundwater quality, sustainable aquifer yield, and a 3D hydrogeological model.

These are the attributes that should be covered in the assessment of any aquifer, transboundary or not. However, if the aquifer is transboundary, transboundary fluxes need to be added, and a jurisdiction boundary condition should be added to the 3D hydrogeological model. Currently (2023), this type of boundary condition does not exist in numerical models. So, countries sharing the TBA should decide on how to include this boundary condition in the numerical model.

# Previous TBA-Commission's Newsletters can be accessed [HERE](#)

## RECENT PUBLICATIONS

Coronado, I. et al., 2022. White paper: “Water management on the U.S.-Mexico border: Achieving water sustainability and resilience through cross-border cooperation” Access the PDF version [here](#).

Granados A., editor, and co-author, 2022. Book: Hydrological Resources in Transboundary Basins between Mexico and the United States: El Paso del Norte and the Binational Water Governance. Universidad Autónoma de Chihuahua: Universidad Autónoma de Ciudad Juárez, 2022. 324 pp. ISBN 978-607-536.

Rivera, A., Pétré, M.A., Fraser, C., Petersen-Perlman, J., Sanchez, R., Movilla, L., and Pietersen, K., 2022. Why do we need to care about transboundary aquifers and how do we solve their issues? Hydrogeology Journal <https://doi.org/10.1007/s10040-022-02552-y>

Sanchez, R. editor and co-author, 2022. Book: Challenges and the way forward by UNESCO, 2022; ISBN 978-92-3-100563-3 <https://unesdoc.unesco.org/ark:/48223/pf0000383775>

Stephan R.M., Nickum J.E., and P. Wester, P., editors, 2023. Groundwater: Recent Advances in Interdisciplinary Knowledge. Book 370pp, Routledge; ISBN 9781000837629 (ISBN10: 1000837629).

Binational reflections on pathways to groundwater security in the Mexico–United States borderlands. By Rosario Sanchez, José Agustin Breña-Naranjo, Alfonso Rivera, Randall T. Hanson, Antonio Hernández-Espriú, Rick J. Hogeboom, Anita Milman, Jude A. Benavides, Adrian Pedrozo-Acuña, Julio Cesar Soriano-Monzalvo, Sharon B. Megdal, Gabriel Eckstein and Laura Rodriguez. Chapter 17 in Stephan et al., 2023.

Varady, R., 2023. Transboundary Water Governance Scholarship: A Critical Review, February 2023 Environments 10(2):27. DOI: [10.3390/environments10020027](https://doi.org/10.3390/environments10020027).