SCRATCHING THE SURFACE
GROUNDWATER STORIES FROM THE FIELD

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GUEST POST REFLECTION
to scratch the surface

[skratʃ • ˈdə,biː,diz • ˈsəːfɪs] idiom

1. to deal with only a very small part of a subject or a problem
2. to initiate the briefest investigation to discover something concealed:

“they have a boring image but scratch the surface and it’s fascinating”

To assure sustainable groundwater management on a global scale, it is important to raise awareness on the implications felt at grassroots-level.

The stories shared in this magazine are about personal experiences, community cultures, or local problems and solutions,

“but this only scratches the surface of the groundwater challenges and trends that are faced worldwide.

By giving a voice to those usually unheard, we will eventually gain a deeper understanding and sense of urgency.”

This magazine aims at giving voice to those who are usually unheard in the groundwater and climate change debate, but who do feel its impacts on a daily basis.
WATER TRADITION

The Foggara of Adrar

What ancestral groundwater systems and wisdom can teach us, connecting today’s challenges | ALGERIA

As the scorching sun bathes the Adrar desert with relentless heat, a team of geophysicists collects data in the middle of the vast, sparkling golden dunes that stretch as far as the eye can see. Not a single hint of green or blue to spot in this arid canvas composed of shades of yellow. Suddenly, from this barren landscape an old man appears. He offers sweet dates and invites the researchers to join him on a rare, placid place. Join them on their adventure on page 32.

Water that keeps tradition alive

BRAZIL

Imagine being taken from your homeland and losing your place of belonging. The residents of Quilombo de Bala Formosa, in Brazil, have not only lived through this tragedy once, but twice. This is a story about the descendants of those who set themselves free from slavery, about those being marginalized by both government and real estate market, about those regaining ancestral land and preserving a centuries-old tradition. And groundwater quality is at the heart of it. Meet this resilient community on page 28.

WOMEN IN GROUNDWATER

COMBATING GENDER-BASED VIOLENCE WITH GROUNDWATER

How improved water supply contributes to reducing physical and sexual Violence Against Women in the DRC | DRC

Access to clean water is one of the major challenges facing inhabitants in the DRC. Women and young girls, being the ones responsible for household water supply, are often exposed to sexual violence and other physical assaults in their quest for this scarce resource. With the intervention of humanitarian aid during the country’s crises, the rise of private initiatives increasing safely resorting to groundwater drilling offers a lifeline to women ones responsible for household water supply, are often exposed to sexual violence and other physical assaults in their quest for this scarce resource. With the intervention of humanitarian aid during the country’s crises, the rise of private initiatives increasingly resorting to groundwater drilling offers a lifeline to women Access to clean water is one of the major challenges facing inhabitants in the DRC. Women and young girls, being the ones responsible for household water supply, are often exposed to sexual violence and other physical assaults in their quest for this scarce resource. With the intervention of humanitarian aid during the country’s crises, the rise of private initiatives increasingly resorting to groundwater drilling offers a lifeline to women.

See her interesting discoveries on page 54.
NOTE FROM THE EDITOR

From global,
Although groundwater makes up most of the world's readily available freshwater, in many places we still don't know how much of it is located below feet or of what quality it is. Events like the World Water Forum, where the whole water world meets, are great opportunities to take steps or even leaps into a more water secure future. Organisations like my own, IGRAC, dedicate time and effort to mapping the world's transboundary aquifers, spotting global trends by analysing monitoring data and creating guidelines to assess groundwater quality. And it is indeed true that to get most out of conferences like this WWF10, where decision makers from all outskirts of the world gather, it is important to have a global picture of the status of groundwater resources.

to local,
But where does this data come from? From local wells in each of the countries that monitor groundwater. And who gathers this data? Local experts that know and care enough about their water resources to continuously go to these data points and thereby keeping track of both quantity and quality of their precious water supply.

It is important to give voice to these people who often don’t have a global platform to share their stories. They see what impacts are felt at community level, which challenges should yet be overcome, and which local solutions could maybe serve as an example for other countries who may be in a similar situation.

and back to global
Once you understand the impacts within the local communities, you also better understand the current and potential future challenges on a global scale. When you hear the story about Peter (page 8) and his upbringing in Kenya, not having a clue that some of his health issues actually originating from fluoride in his drinking water, and you then look at the global fluoride map showing equally high fluoride concentrations in big parts of North America, the Middle East, Scandinavia, South Asia and throughout Africa, you will have a much deeper understanding of scale of this groundwater quality problem than if you wouldn't have known the people behind the data they represent.

I hope the stories of our groundwater correspondents in this magazine will captivate you and inspire you to work together during the conference, with the aim of a sustainable groundwater future.

GROUNDWATER CORRESPONDENTS NETWORK
GLOBAL PLATFORM FOR LOCAL STORIES

The 1st of July 2023 marked the start of IGRAC’s new volunteer programme, the Groundwater Correspondents Network. This new programme tries to give a global platform to local stories and to elevate the voices of those who are usually not heard.

After receiving an overwhelming number of applications, 17 correspondents from 17 different countries were selected for this first wave of correspondents. This magazine has bundled the stories from these countries.

Want to become a groundwater correspondent? Go to page 91!
IN THE HEART OF TURKANA SOUTH, in the remote village of Katilu, Kenya, a silent struggle was unfolding, a battle against an invisible enemy that had plagued generations. It was a struggle for clean, safe water, a struggle that left its mark not only on the landscape but on the people themselves. This was the reality a little boy was born into, and early 2000’s marked the onset of a series of events that would reveal the harsh truth of their water crisis.

A DILEMMA OF TWO WATERS

Growing up, this little boy called Peter faced daily choices regarding water, the essence of life, with only two options, each laden with peculiar challenges. The first was Turkwel River, a majestic yet treacherous waterway that meandered through their region. It provided sustenance and despair in equal measure, its muddy waters reflecting the pollution contributed by the lands it touched.

To make matter worse, sharing this water with both domestic and wild animals was a common practice. People bathed in it, even though it was far from clean. The belief that the river could silently wash away their waste led to the unsanitary practice of defecating in its murky depths. Upstream, clothes were washed, while downstream, containers were filled with what they believed to be safer water. But was it really safe?

CLASHES OVER WATER AND LIVESTOCK

The greatest peril of relying on Turkwel River wasn’t just its discoloured waters or the unsanitary habits that tainted it. It was the ever-present threat of insecurity, a danger that loomed large over their lives. In 2004, on a day like many others, little Peter, 8-years old at the time, had taken his father’s cows to graze along the river, a routine weekend activity.

On that day, the riverside appeared unusually calm, and he and his friend were tending to their animals, waiting for others to join them. His friend, also 8 years old, had a gun, a startling reality of their upbringing. At a young age, their fathers had trained them in firearm use for self-defence. Fortunately, Peter’s father hadn’t given him the gun that day as he was supposed to come later.

Suddenly, the cows exhibited unusual behaviour. They sensed something was wrong and signalled it by not grazing and raising their heads towards home as if ready to flee. This was a
clear indication of danger, and the boys had to act cautiously. They decided to hide among the cows to observe what was amiss, as this provided a measure of safety.

“Suddenly, the cows exhibited unusual behaviour. They sensed something was wrong and signalled it by not grazing and raising their heads towards home as if ready to flee.”

From that hiding spot, they witnessed their tribe’s enemies, the Pokot community, and they had already laid an ambush. The Pokots had been hiding and watching for some time. They struck from behind armed with guns, first targeting Peter’s friend who had the gun. He was the key to alerting others if he fired the gun. The Pokots disarmed him and bound the boys to a tree, instructing them to remain motionless and silent, with the threat of death hanging over them if they disobeyed.

One Pokot man kept watch while the others herded the cows away at breakneck speed, heading for their own territory. Within moments, all the cows were gone, leaving the boys fatigued and dispirited. The boy’s father arrived soon after, though he couldn’t immediately locate the cows. He found the tied-up boys while scanning the area and sounded the alarm. The Pokots hadn’t strayed far, and the boy’s father engaged them, managing to both divert their attention and rescue some of the cows that hadn’t managed to escape. It was a chaotic and perilous ordeal, a race against time. Such encounters had been part of life along this river for decades, and they had exacted a heavy toll. Many had lost their lives, all their animals, or had been forced to migrate to evade the recurring clashes.

Peter’s narrative offered a poignant glimpse into the harsh realities they confronted. Fetching water or tending to cattle, simple tasks in other contexts, took on a life-and-death dimension in their world. The overarching question remained: how could they break free from this cycle of violence and insecurity that was inextricably linked with their quest for the life-sustaining waters of the Turkwel River?

“Fetching water or tending to cattle, simple tasks in other contexts, took on a life-and-death dimension in their world”

A DILEMMA OF TWO WATERS

The alternative option was a hand pump, conveniently close to Peter’s homestead. It seemed like a godsend, offering respite from the arduous trek to Turkwel River. However, this well had its own dark secret - the water it yielded was undrinkably salty. Locals, like him, had grown accustomed to the brackish taste, even relying on it for daily hydration. Remarkably, their school used this salty water for cooking, an ironic twist in their daily routine. This well, though convenient, was slowly becoming the source of a hidden calamity.

THE LEGACY OF DEFORMITY

It was only later, after years of sipping salty water, that the truth began to dawn upon them. Their community was plagued by an affliction, a legacy shrouded in myth. Their teeth, an astonishing four out of five, bore a deep brown hue. For generations, they were told that this was a familial trait, a genetic quirk passed down from their ancestors.

“Little did they know that their brown teeth were the result of an environmental issue, a hidden consequence of the water they had been consuming for years”

But in reality, it was the insidious work of fluoride, an element seeping into their lives unnoticed. Peter’s father embraced polygamy, a common practice in their culture. With five wives, he fathered a total of thirty siblings for Peter. Shockingly, 25 of them had brown teeth, including Peter himself. Their parents, like many others in the community, believed it was a genetic inheritance, a quirk that ran in the family. Little did they know that their brown teeth were the result of an environmental issue, a hidden consequence of the water they had been consuming for years.

AN UNAWARE COMMUNITY

In those days, and regrettably even in the present, government and non-governmental organizations would drill wells and provide water sources with well-meaning intentions. However, the community was often left in the dark about the water’s quality and whether it was truly safe for consumption or irrigation. Once the wells were drilled, the projects would conclude, and crucial information would disappear with those who initiated them. It was a recurring frustration, a cycle of uncertainty that plagued the community.

More often than not, the focus remained on removing excess chloride, while the issue of fluoride contamination largely went unaddressed. Astonishingly, both government agencies and NGOs were aware of the detrimental impacts, yet the lack of practical alternatives left
them with few choices. Alternative solutions, such as desalination plants or defluorination plants, were considered too expensive and challenging to implement at scale.

The consequences of fluoride contamination ran deep, affecting not only their physical health but also their social lives. A local joke prevailed, one that highlighted a distinct marker of their identity: aside from the national identity card, you could easily spot a Turkana local by their brown teeth. Those with teeth deeply stained brown were often assumed to hail from regions near Lake Turkana. However, this supposed marker of identity carried a heavy burden of self-consciousness, especially for the girls. The joke that girls shouldn't smile in front of men due to their brown teeth had far-reaching repercussions. It eroded their self-esteem, impacted their marital prospects, and hindered their social interactions. Many felt compelled to hide their teeth from the world, concealing their smiles and stifling their happiness.

**A HIDDEN IMPACT ON ARMED FORCES RECRUITMENT**

In a surprising twist, the impact of fluoride contamination reached even the doors of armed forces recruitment centers, casting an unexpected shadow over the aspirations of young men and women dreaming of serving their country. It was revealed that in some recruitment centers, not just in Turkana but rift valley region, a staggering 80 percent or more of the hopeful candidates failed their medical evaluations due to fluorosis.

Vice Chief of Defence Forces, Lieutenant General Jonah Mwangi, shed light on this issue during an interview on Kenya Citizen TV in August 2023. His words were clear and unyielding: one could not be accepted into the armed forces if they weren't physically and medically fit. While he acknowledged that recruitment officers sometimes overlooked minor teeth discolouration due to geographical factors, severe discolouration was a disqualifier: “From low to medium, that can be looked at by the medic. If you have severe discolouration, it’s an indication that you probably have a problem with the bone structure and you are prone to dental accidents. If you get into a dental accident, that will force them to put you in the hospital instead of training, so it’s a disadvantage to you.”

**“What do my teeth have to do with my dedication to serving my country? I am a patriotic Kenyan with a sincere desire to protect our nation. Am I supposed to bite the enemy?”**

In an interview, Esther Mwangi, the CEO of Executive Edge Consulting, further emphasized the impact of dental appearance on job prospects, particularly in disciplined forces like the police and military. She shared the story of a young Kenyan who took to social media to express his frustration after being rejected from military recruitment due to discoloured teeth. His poignant question resonated: “What do my teeth have to do with my dedication to serving my country? I am a patriotic Kenyan with a sincere desire to protect our nation. Am I supposed to bite the enemy?”

Esther added that such bias and discrimination related to teeth were uncommon in government positions, except within the military and the police.

The issue wasn’t limited to military recruitment alone; it extended to various professions where appearance played a crucial role. Jobs like waiting staff or receptionists in hotels, acting, modeling, air stewards, hostesses, and TV anchors, all considered “customer-facing” careers, were equally affected. It was a stark reminder that in some industries, the state of one’s teeth could become an unexpected hurdle on the path to pursuing their dreams and livelihoods.

The story of fluoride contamination had taken an unforeseen twist, revealing its impact on careers and aspirations beyond health concerns alone.

**LAKE TURKANA, AN OASIS OR A MIRAGE**

In the vast expanse of Turkana, nestled in the northern part of the region, lies Lake Turkana - a magnificent body of water, renowned as the world’s largest permanent desert lake and the largest alkaline lake on Earth. One would think that such a colossal water source would be a blessing for the community, a lifeline in the arid desert. However, the reality was a bitter paradox.

For Peter and the other people of Turkana, the quest for access to safe drinking water has been an enduring, elusive
dream. Lake Turkana, with its seemingly boundless and abundant waters, harbors a dark secret within its depths. These waters are treacherous, tainted by high levels of fluoride and an alarming alkalinity that has inflicted severe deformities, especially to the bones. Moreover, this contamination renders the water utterly unsuitable for human consumption. The very source of life had become a silent threat.

Yet, in the absence of viable alternatives, the resilient residents of Turkana had little choice but to rely on this perilous water source for their survival. It was a cruel dilemma, a choice between dehydration and the insidious effects of fluoride. As they drank from the lake’s unforgiving waters, they unknowingly subjected themselves to a slow, silent battle against an invisible enemy.

“It was a cruel dilemma, a choice between dehydration and the insidious effects of fluoride”

The consequences of this desperate choice were evident in the deformities that afflicted their limbs. High salinity and fluoride levels in the water wreaked havoc on their bodies, causing limbs to contort and twist in unnatural ways. The anguish of deformity was a heavy burden carried by many; a visible reminder of the price paid for quenching their thirst.

DESPERATE NEED FOR CHANGE

Nevertheless, in the face of such adversity, even today Peter’s community display remarkable resilience. They grasp the urgent need for change, the imperativeness of breaking free from the clutches of fluoride-laden waters and the scourge of cholera. The pivotal question looms large: How can they usher in a transformation, secure a sustainable source of clean water, and shield their children from the relentless grip of disease?

In the short term, they have begun to explore innovative solutions. Sand rivers, abundant in this region, have become a lifeline, offering a means to supply water for their daily needs and enhance economic activities through farming. Solar-powered water pumps are used to treat this water before distribution, ensuring its safety for consumption. Practical Action has initiated projects in select areas, but there is a pressing need to expand these efforts to reach more people. To combat fluoride contamination, organizations like UNICEF have trained individuals in the use of defluoridation filters. However, this requires concerted efforts from county governments, the National Government, and NGOs to ensure that such filtration plants are accessible throughout Turkana, making safe drinking water a reality.

“Solar-powered water pumps are used to treat this water before distribution, ensuring its safety for consumption”

Additionally, Turkana could adopt a technique practiced by the Nakuru Catholic Diocese in Nakuru County, Kenya. By utilizing bones from animals such as goats, sheep, camels, and cows, which are readily available in this pastoralist community, they can treat fluoride in water effectively. This method involves the use of bonechar, derived from charred bones. Bonechar is processed under specific conditions, and when incorporated into filters, it attracts fluoride, leaving the water fluoride-free and safe for consumption. It’s an affordable and locally available solution that holds great promise for Turkana and other regions across Kenya.

Looking to the long term, collaborative efforts must be undertaken to harness Turkana’s groundwater resources. Extensive aquifers have been discovered, with the potential to serve the entire country for over seven decades. However, research has identified this groundwater as saline. To address both the salinity in the lake and groundwater, the implementation of a desalination plant emerges as a viable solution. Such an initiative would transform Turkana’s water landscape, making water scarcity a thing of the past.

THE LITTLE BOY WHO BECAME A GROUNDWATER CORRESPONDENT

The boy in this story is me, Etukutan Peter. When I was young, I didn’t know much about the water we drank. It wasn’t until I turned 20 years in my second year in the university in Kenya, where a teacher named Dr. Moses Mwangi explained something important to me during groundwater pollution module. He said the strange colour of my teeth was because of something called fluoride in our water.

This revelation inspired me to educate others about the occurrence and risks of groundwater contamination and led me to undergo postgraduate studies on groundwater and global change and to become a Groundwater Correspondent representing Kenya.
What ancestral groundwater systems and wisdom can teach us, combating today’s challenges.
As the scorching sun bathes the Adrar desert with relentless heat, our team of geophysicists collects data in the middle of the vast, sparkling golden dunes that stretch as far as the eye can see. Not a single hint of green or blue to spot in this arid canvas composed of shades of yellow. Suddenly, from this barren landscape an old man appears. First only a dot on the horizon, but soon close enough to reveal his weathered features, reflecting the wisdom of age. He offers us refreshments, sweet dates and fresh water, from his supplies. We accept gratefully, enjoying a brief break from long day of hard work.

Intrigued to know what brought a handful of scientists to such harsh environment, the old man listens attentively as we explain our pursuit of the groundwater hidden beneath the desert's surface. He smiles, and then starts to tell about a place where water flows in abundance, a hidden sanctuary in the middle of the shifting sands. "I could take you there if you’d like?", the old man suggests enthusiastically.

With our hearts filled with excitement and curiosity, and the mind occupied by this to us unknown lush oasis, we quickly completed our final measurements and packed up our equipment. Few moments later, we climbed into the old man’s car, ready to embark on the tour he had promised us.

**A MAZE OF MYSTERIOUS HOLES AND TUNNELS**

As we crossed the rugged terrain, the old man skillfully navigated the desert paths, each bump and turn adding to the thrill of adventure that filled our spirits. Along the way, we spotted several open pits, neatly placed at regular intervals. Intrigued by these honeycomb-like structures, we couldn’t resist asking the old man about their purpose. "They’re air shafts for the Foggara," he explains, eyes sparkling with knowing amusement as he senses our curiosity. A curiosity that encouraged the old man to weave a tale that transcends time. He spoke of a time long ago when lush wetlands stretched far and wide, teeming with diverse flora and fauna. However, incessant droughts soon engulfed the land, swallowing rivers, drying up lakes and reducing fertile soils to dust. When we asked why some people chose to endure such harsh conditions, he explained that their deep love of the land bound them to their ancestral home.

"In their survival struggle, the inhabitants engaged in a remarkable journey to secure their water supply", the man continues. He describes how they traced rivers up to the Tidmelt plateau to the east, widening their beds to increase the flow of water - a short-lived solution due to overexploitation. However, not discouraged, they turned to a more lasting approach: digging tunnels in the hard sandstones using their bare hands. He pointed out the pits we had seen earlier, explaining their role as a source of air and light for those digging the intricate tunnels that meander under the surface of the desert.

Continuing his fascinating tale, the old man reveals the ingenious hydrological principles behind the Foggara’s water supply. In these hidden tunnels, he explains, flows water from a shallow Albian aquifer. By taking advantage of the terrain’s topography, the constructors ensured a steady flow of water through the tunnels over long distances in the middle of the desert. An additional advantage such tunnels provide, over for example superficial canals or streams, is that they protect the water from the burning sun and the effects of evapotranspiration.

"He speaks of the historical origins of the foggara systems, crediting their first development in the 11th and 12th century.”
He speaks of the historical origins of the foggara systems, crediting their first development to El Malik El Mansour Ben Youcef Tafit El Korichi in the 11th and 12th century. According to researchers, the first foggara was dug at Tamanrit, 15 kilometers from Adrar. Others believe, it is the work of Muslim converts, former Buddhists from the Iranian plateau who were expelled from their village of El Kouline during the Egyptian regency, who came to settle in Tamanrit after its foundation in the 7th century. Later, foggara systems were developed in the Touat and Gourara regions by Arab-Berber tribes such as the Zenati.

AN EMERGING OASIS

As the car made its way over the rugged terrain, a pulsing sense of anticipation filled the air, reinforced by the distant vision of a thriving oasis. It emerged as a tangible symbol of the life-giving water we were looking for. After a brief pause and a moment of shared wonder, we stepped out of the vehicle, greeted by the old man who led us into the vibrant oasis garden.

The soothing sound of flowing water surrounds our senses as we follow the old man’s footsteps further into the heart of the oasis. In the middle of the lush greenery, we discover a triangular basin featuring a comb-like structure at its edge, allowing the water to cascade gracefully through its interstices. "This is the Kasria," explains the old man, "the initial station where the water is gathered after its long journey through the tunnel."

Intrigued by the design, I asked about the different widths of the openings. "Ah, that’s where the brilliance of these structures lies," he remarked, with a smile on his face that hinted at the sophistication hidden in these apparently simple constructions.

Our curiosity grew as we were guided deeper into the oasis, eventually arriving at a gathering of five men engaged in the ceremonial preparation of tea. Respectfully, they all stood up to greet us. After introductions, we sat down together, exchanging stories over steaming cups of tea in the serene atmosphere of the oasis.

"He then asked one of the men gathered nearby to bring something back."

The old man continues his story after a sip of hot, bitter tea. He explained that while the foggara is technically the property of its constructor, a task of such monumental dimensions required a collective effort. It is often carried out by a group of individuals, whether or not they belonged to the same family. Each owner’s water share was meticulously calculated according to their contribution to the construction and maintenance of the foggara. He then asked one of the men gathered nearby to bring something back. The man returned with a fascinating artifact that piqued our curiosity.

RICH HISTORY OF WATER MANAGEMENT

He mentioned a time when water shares were distributed through a time-based scheme. Each owner had access to water for a fixed period of time, before it was redirected to the next owner. This complex system was overseen by...
individuals known for their knowledge of celestial observation - they meticulously tracked the position of the stars and sun to measure time with exceptional precision. However, the Zenati tribe introduced an innovative technique allowing owners to irrigate their gardens simultaneously.

The old man's eyes sparkled with pride as he proudly displayed the rectangular piece of metal brought by his companion. The surface of the copper plate was decorated with intricate Tifinagh (a Berber script) engravings and precise circular openings of varying diameters, reflecting exquisite craftsmanship and ingenious design.

“This is believed to be the first flowmeter that has ever existed”, said the old man, his voice ringing with reverence and anticipation as he introduced us to this antique artifact. “We call it ‘El Abbara’, our ancient measure of water quantities”. He explains that each circular opening on the plate represents a unit called ‘Habba’, equivalent to 24 karat. “Karat, as in gold?” I asked. The old man's nod confirmed the symbolic meaning attributed to water - a precious and vital resource comparable to the most precious of metals.

“Who oversees distribution?” we inquired. “Three men are charged with this essential responsibility,” began the old man, “They are chosen for their impeccable ethics and honesty”. He then detailed their respective roles: the measurer (Kiyal Lma), responsible for monitoring water levels and shaping the construction of the distribution pond; the accountant (El Hassab), in charge of performing complex calculations to determine each owner’s share; and the scribe (Saheb el Djrida), entrusted with documenting and reporting on the distribution process.

“...Water levels and shaping the construction of the distribution pond; the accountant (El Hassab), in charge of performing complex calculations to determine each owner’s share; and the scribe (Saheb el Djrida), entrusted with documenting and reporting on the distribution process.

ADAPTING TO CHANGE

Whenever a new foggara was built, or changes in flow occurred due to seasonal variations or changes in ownership, the three designated men, together with the foggara owners, would gather near the Kasria - the heart of the distribution system and our first stop when we entered the oasis. The measurer's first task is to assess the level and flow of incoming water through the main channel called 'Aghesrou'. The accountant, on the other hand, performs complex calculations, taking into account the water level, each owner's contribution and agreed shares to determine their respective water rights.

“The culmination of this meticulous process [of water distribution] is reached when the measurer, equipped with El Abbara, adjusts the width of the Kasria openings for each owner”

The culmination of this meticulous process is reached when the measurer, equipped with El Abbara, adjusts the width of the Kasria openings for each owner, thus shaping the final form of the foggara distribution system. The water then flows through an open channel called...
the Saguia (sagya) until reaching the gardens or a storage reservoir.

Once the new distribution is complete and the shares allocated, the scribe records the assigned shares on two small slabs of mud - one given to the owners of the foggara and the other kept by the mosque's imam. "Why call in the imam?" we asked, puzzled by this additional step. He explained that this practice guaranteed the presence of a neutral mediator in the event of a dispute, helping to adjust and settle differences while maintaining peace and harmony within the community.

'THIWIZA': CELEBRATING HERITAGE

As we enjoy the warmth of our third or fourth cup of tea, the old man continues: "Although the Foggara is a private property," he points out, "it plays an essential role in the daily lives of all the inhabitants. He describes a long-awaited tradition, the Thiwiza, an annual festival filled with history and community spirit. Generations come together in the open space of the town. The wise words of elders echo ancestral wisdom, passing on to younger generations lessons in stewardship and harmony with nature. The laughter blends with shared stories, building a sense of unity and resilience through communal meals and rhythmic dances that resonate in the desert night.

"United by a common goal, community members commit to a collective effort to clean and maintain the Foggara system, ensuring the sustainability of their shared heritage"

Thiwiza symbolizes the collective commitment to preserving the Foggara legacy. As festivities gradually fade, a new day paves the way for a different kind of work. United by a common goal, community members commit to a collective effort to clean and maintain the Foggara system, ensuring the sustainability of their shared heritage.

OLD SYSTEMS TO SOLVE NEW WATER CHALLENGES?

The journey back to the hotel took place in contemplative silence, each of us immersed in our own thoughts as we processed the profound experiences of the day. The unexpected encounter with the old man and the rich history and tradition he shared left an unforgettable mark on our minds and hearts.

On the desert roads, the image of our ancestors working tirelessly to dig tunnels with their bare hands in such hard conditions remained in our memories. It was a humbling reminder of human resilience and ingenuity in the face of adversity, a testament to the enduring spirit that has shaped civilizations in these arid lands for centuries.

For me, what resonated most deeply was the meticulous system of water distribution implemented by the Foggara community. It was a marvel of fairness and efficiency, rooted in merit yet designed to avoid conflict and foster a sense of belonging and responsibility among its members. The careful calculations, equitable shares based on contribution, and safeguards against disputes showcased a model that transcended time — a model we could learn from in our modern-day challenges.

The looming specter of water scarcity and potential conflicts over decreasing resources weighed heavily on my mind. I couldn't shake off the unsettling thought of global unrest fueled by the scarcity of water. It was a stark contrast to the harmony and cooperation we witnessed among the desert dwellers, united in their shared commitment to sustainably manage their water sources.

As we reached the hotel and prepared for the mission ahead, I couldn't help but ponder: How can we, in our modern world, draw lessons from our ancestors to navigate the challenges of water scarcity and ensure a sustainable future for all? The wisdom embedded in ancient traditions and practices, the spirit of cooperation and equitable distribution, held answers that resonated with urgency in the face of contemporary dilemmas.

The day’s revelations sparked in me a desire to explore solutions that honor the heritage of the past while opening the way to a more sustainable and peaceful coexistence with our planet and its precious resources.
ANCIENT GROUNDWATER SYSTEMS
VALUING ANCIENT WATER CULTURES

The Foggara of Ardjar not only represents the ancient groundwater tradition in Algeria, but a long history of groundwater management all over the world. The Persian empire was the birthplace of these systems based on sloped underground aqueduct and airshafts connected to the surface, and these Qanat can still be observed in modern-day Iran. This technique was later introduced towards the east, with still existing systems to be found in China, while the Arab empire introduced it to towards the west, with Foggaras and Khettaras as a result. The Spanish got acquainted with these groundwater management techniques during the Arabian conquest of the Iberian peninsula and later introduce them in their overseas colonies.

Foggara
ALGERIA
Similar to the Qanats, the Foggara is an underground system with a gently sloping tunnel and a series of vertical air shafts. These shafts allow for maintenance works in the tunnel.

Khettaras
MOROCCO
The term khettara means “which makes water flow by gravity in small flows”. In the Middle Ages, during the Islamic conquest, it spread throughout the southern Mediterranean.

Stepwells
INDIA
There are more than 3,000 stepwells built between the 7th and mid-19th centuries which dot the semi-arid landscape of Gujarat and Rajasthan in western India, and several are located along trade routes that carry into Central Asia.

Puquios
PERU
‘Puquios’ stems from ’pukyu’ in Quechua, meaning source, spring, or water well. These subterranean aqueducts are found in the coastal deserts of Southern Peru.
Imagine being taken from your homeland and losing your place of belonging. The residents of Quilombo de Baía Formosa, in Brazil, have not only lived through this tragedy once, but twice. This is a story about the descendants of those who set themselves free from slavery, about those being marginalised by both government and real estate market, about those regaining ancestral land and preserving a centuries old tradition. And groundwater quality is at the heart of it.

**REFUGE FOR THE RICH AND FAMOUS**

Our story begins in the countryside of the state of Rio de Janeiro, about 177 km from the state’s capital city of the same name. Armação dos Búzios, commonly known as Búzios, is a municipality located in Região dos Lagos (the Lake’s Region), east of the city of Rio de Janeiro. This small town, which had always been merely a fishing village, suddenly gained world fame when, in the 1960s, cinema superstar Brigitte Bardot fell in love with the region after fleeing persecution from the paparazzi in Rio de Janeiro. Today, Búzios has Orla Bardot, its famous boardwalk, as the city’s postcard, in honour of the actress. With a bucolic atmosphere, the waterfront offers walks on the boardwalk, wooden decks, sculptures of famous visitors, bars, restaurants and inns. All this with a view over a sea full of charming small fishing boats. All this beauty attracted the attention not only of Bardot, but also of Brazilian celebrities like football superstar Neymar, fashion model Gisele Bundchen and singer/songwriter Caetano Veloso, as well as international icons, such as Mick Jagger, Madonna and Leonardo DiCaprio.

Decades after being expelled, a small community can finally return to its ancestral lands in Búzios, within the Rio de Janeiro state. However, being located near the coast, the question remains if the groundwater needed for agriculture isn’t too saline. A project of the Federal University of Rio de Janeiro should offer clarity.
Behind this façade of luxury and hype, Búzios hides an obscure story, which tarnishes the history of the construction of Brazil as a country. In its rural region, there are remaining communities of enslaved people, the so-called quilombos. A quilombo is a community originating from those who resisted the brutality of the slavery regime and rebelled against those who believed to be their owners. Thus, the first expulsion that these people suffered was from their homeland, in Africa. During the slavery regime in Brazil, which lasted 350 years, quilombos were a refuge for enslaved Africans fleeing coffee and sugar cane farms, where they could preserve their culture, help each other as a community, and build a free life. There are many of these quilombos in Brazil, primarily towards the coast, where colonisation and human trafficking began.

**“During the slavery regime in Brazil, quilombos were a refuge for enslaved Africans fleeing coffee and sugar cane farms”**

**PUSHED OUT FOR TOURISM**

Centuries after their first expulsion, these people suffered yet another expulsion. Quilombo members were illegally expelled from their land in the 1970s, dividing the community into small, scattered groups. And it is no coincidence that this happened around the same time that the rich and famous started to flock to coastal town. Their pushing out was carried out to promote tourism, with the idea of building luxury hotels. It was to be imagined that, after the popularisation of Búzios among the Rio de Janeiro elite, the untouched village would become a target of the real estate urbanisation of Búzios among the Rio de Janeiro elite, the quilombo people use agriculture also to supply food in the Búzios region, as its products are sold at popular fairs in the city and are used in its restaurant Cozinha Quilombola, which means ‘quilombola kitchen’. The people feel a great connection with the agricultural land they were expelled from, as it has provided the resources that allowed the group’s survival since the moment their ancestors fled the plantations and settled there.

**RETURN TO ANCESTRAL LANDS**

Agriculture plays an important role for this community, not only for subsistence but also in cultural and tourist activities. The quilombo people use agriculture also to supply food in the Búzios region, as its products are sold at popular fairs in the city and are used in its restaurant Cozinha Quilombola, which means ‘quilombola kitchen’. The people feel a great connection with the agricultural land they were expelled from, as it has provided the resources that allowed the group’s survival since the moment their ancestors fled the plantations and settled there.

**“For the community, this is very important, because it is our life, our history, our roots, our struggle. We fought for ten years to be able to be here today”**

Last year, after ten years of fighting to regain their right to their lost territory, the Public Ministry agreed to allow families to return to the area from which they had been expelled. “We’re going to live here”, starts Elisabeth, one of the leaders of the quilombo, about their return to their former territory. “We are starting with some farms in some places but, in the future, these plantations will supply the community and also the ‘Cozinha Quilombola’, which is the name of our restaurant”, she says while pointing at the corn and mandioca plantations. “For the community, this is very important, because it is our life, our history, our roots, our struggle. We fought for ten years to be able to be here today”, she continues her moving speech. “Today, being here is very important, because it brings back memories of the ancient past. And this territory, for agriculture, needs water and clean and cared for soil.”, Elisabeth points out. “More than anyone, the quilombolas are aware of the water challenges that this region presents to those who live there, since we have fought against it for centuries to survive.”

**“Could it be that the water underneath the quilombo will not allow the community to go back to their old life of agriculture?”**

The fact that even on a glorious and festive day for the quilombolas, Elisabeth decides to underline the importance clean water, gives an insight into the worries that hang over their return to their ancestral land. After two expulsions, ten years of awareness raising, negotiations and legal proceedings, the quilombo finally return to their ancestral land. However, this land is located close to the coast, which comes with groundwater quality risks. In such areas, salty seawater can intrude the aquifer, making the originally freshwater unfit for irrigation. Could it be that the water underneath the quilombo will not allow the community to go back to their old life of agriculture?

**THE SALT PROBLEM**

What was previously expected, and feared, was indeed found by the researchers. Brackish water was springing in the wells. The region of Búzios Formosa is a rural area, with out rivers and with only few small lakes and is subject to the action of the resurgence of cold waters from the Falkland Current. This results in a semi-arid climate. This causes the few surface water bodies like ponds, lakes and artificial ravines, but also the aquifers to be salinized. This is further exacerbated by the low local rainfall. “Búzios is a region where, often, the water does not have the quality necessary...”
for you to drink”, says Professor Gerson Cardosa, highlighting the problem. Drinking water access is mainly provided by water trucks. “You cannot drink water that has a lot of sodium and, as there is a lot of influence from the sea here, groundwater often has a sodium problem”, he explains to the community. Although he also offers more encouraging words for the farming community. “There are techniques and solutions that allow us, even if we can’t drink the water, to use it to grow crops.”

While the researchers of UFRJ continue analysing other bodies of water in the territory’s plain, they detect high electrical conductivity. This indicates that the water has a larger concentration of salt ions, since the salt elevates the conductivity of the water. Another conclusion obtained was that, the closer to the sea, the higher the salinity of the water, both underground and at the surface. Fortunately, while the lakes and springs belonging to another quilombola territory called ‘Zebina’, has higher salinity, the shallow wells, artificial ravines, and springs within the area where the population will return, has lower salt concentration. In fact, although this water is unfit for human consumption due to the salt, the signs of possible use for plantations were good to the excitement of the researchers.

“Zebina is a little more complicated. Maybe the solutions will have to be different from one place to another, but we can’t say yet”

Drawing from these outcomes, the Zebina area is now considered a secondary option, while the return area is seen as having the greatest potential for success. “In the case of the original area, we see [access to] water much more clearly than in the Zebina area”, says project leader Prof. Kátia Mansur. “Zebina is a little more complicated. Maybe the solutions will have to be different from one place to another, but we can’t say yet.”
A CRYSTALLINE SHIELD

Besides the salinity challenge, there is also a geological one. “We have an area with a crystalline shield”, explains Professor Cardoso. “We have the challenge of obtaining groundwater, since surface water is practically unavailable for agricultural use”, he states as a goal, before focusing on the difficulties. “Crystalline rocks are rocks with low capacity of water storage, since they have low porosity”, Cardoso explains. “We are trying to use the tools at our disposal, like geological maps, fieldwork, and a survey of existing wells, to obtain the most optimal location for a water catchment. We have some existing water points, a few wells. With this, we intend to select the best location for using groundwater.”

THE SACRED SPRING

One site with particularly high significance to the community is a fountain, said to be sacred, which springs from a crystalline rock. This crystalline rock is a gneiss with an age of 2 billion (!) years, located in the area to where the Quilombo will return. It takes a 4 km walk across the plain terrain towards a dense forest region to reach this source and it’s an interesting natural phenomenon. Rainwater infiltrates the sands of the great plain and migrates through the pores until it reaches the basement rocks, percolating along its fractures. This water then circulates through those fractures until it reaches a fracture that is connected to the surface. The erosion caused by water generated two cavities, one measuring 3m and the other measuring 30cm, where water flows which, according to the quilombolas, never dried up.

“Before the expulsion, their ancestors used this spring as a supply for their village and, because of that, it’s important for today’s quilombolas preserve it”

The analysis of this water indicated a neutral pH and low salinity, a great surprise! However, the researchers do not know the exact flow rate of that spring nor the amount of water it can supply without it reaching exhaustion, precisely because the source is located on crystalline basement rocks. Added to this, it is likely that the data obtained from this water is less saline due to rain, which may have accumulated in the cavities. Therefore, it is unlikely that this source will be an alternative for water supply to crops. However, the fountain still represents the preservation of the memory of the quilombo people and is a symbol of local tradition and cultural heritage. Before the expulsion, their ancestors used this spring as a supply for their village and, because of that, it’s important for today’s quilombolas preserve it. They are set to continue cultural projects related to this spring, using the beauty of their preserved natural reserve and their cultural history as an attractive addition to their tourist itinerary.
THE FUTURE OUTLOOK

“We still have to complete some field work beyond what we have already done”, says Kátia Mansur when being asked about the future outlook. “But it seems that the project is heading towards the possibility of serving small plantations, as is the case of Baía Formosa.”

“It seems that the project is heading towards the possibility of serving small plantations, as is the case of Baía Formosa”

A reason behind this preliminary assessment is that the community cultivates local fruits and vegetables, such as bananas, corn, peanuts, and cassava, which tolerate the saline proportions of this water. These vegetables are also part of a local culinary menu, composing dishes like corn cake, roasted cassava, cassava ‘farofa’, toasted cassava flour with butter and pork, and banana ‘moqueca’ - a type of banana stew.

“Our attempt to make this amount of water viable comes as a solution for family farming and subsistence”, Mansur says. “We see that what they plant is exactly the same as what they have always planted in this region. These are resistant, robust plantations that can also withstand the lack of rainfall.”

CELEBRATING BOTH ANCESTRAL PAST AND BRIGHT FUTURE

It’s the 18th of November 2023, and the researchers witness the first event of the Associação dos Remanescentes do Quilombo de Baía Formosa in its new territory. This break-fast under a mango tree is more than a party; it was a public exhibition of their traditions. Self-produced, local food, songs, and dances. The community members celebrate the return to their land and the hope of new directions for the community. From the elders to the children, everyone is happy and celebrates their community, the colour of their skin, the survival of their families and their tradition. All of this represented in the news of, finally, returning to their old land — and now, with the possibility of growing not only their plantations, but also their life, their children and their habits passed through generations.

“Never in the history of the country, a farmer regained land that belonged to remaining descendants of black people enslaved in our country”

Dona Cásia, one of the elderly matriarchs of the quilombo, starts a ‘ciranda’, a circle of popular songs and dances. At the sight of this joy, the researchers grasp the weight of the work they are doing for and with the community. “It is an incredible emotion, because we didn’t expect that during that fieldwork, we would have the opportunity to watch them return to the original area”, says Mansur with Dona Cásia singing in the background.

Ricardo Bemquerer, president of the quilombolas association, added even another layer to this already historical moment. “Today we are celebrating Black Consciousness Day and we chose this place here, in our territory, under this beautiful, ancestral mango tree! We’re here! It’s a huge area, 800 thousand square meters”, Bemquerer says exuberantly. “Never in the history of the country, a farmer regained land that belonged to remaining descendants of black people enslaved in our country”, he highlights the gravity of this moment. Bemquerer considers this feat part of a bigger movement against inequality and in support of marginalised groups in Brazil. “Because everyone had the right to land in our country, except us. So, we are here celebrating this day in this wonderful way!”
Reflections of a Hydrogeologist

TO FLY OR NOT TO FLY, THAT’S THE QUESTION

Searching equilibrium between impactful projects and reduced environmental footprint

TEXT: CLAUDIA RUZ VARGAS

FOR THE PAST 6 YEARS I HAVE BEEN WORKING AS A GROUNDWATER SPECIALIST AT IGRAC. One topic that interests me a lot is groundwater monitoring at national and global scale to support informed groundwater management, and lately, I have been involved in projects that intend to establish or improve a national groundwater monitoring network. At the beginning of a project like this, you normally conduct desk research. But then, there is also a field visit.

I spend a large part of my time behind the computer. On an average working day, you would see me reading, finding out who does what, and getting in contact with people. Sending emails and having video calls are things I do almost every day, interacting with the locals. And these pieces of information are crucial if you want to be able to carry out a successful project.

But in this day and age, when you work within this environment and get the opportunity to go to the field, there is always a bit of mixed feelings. Yes, it’s amazing to go to the other side of the world to see new places and meet new people and cultures, but is it really necessary to take an intercontinental flight, spending only 5 days in the location? Does the visit of a couple of wells outweigh all the CO2 emissions and financial expenses involved? The answer is yes, for now. But it doesn’t have to be like this.

The issue is that there are things that you will never learn from a book or online resources, and there are questions that will never occur to you to ask, unless you are there, interacting with the locals. And these pieces of information are crucial if you want to be able to carry out a successful project.

For example, let’s say that the project involves installing solar-pumped monitoring stations. Usually, I would just leave it there, but during a recent field visit I learned that in some particular areas it might be necessary to consider having a person around the whole day protecting the wells. Not against vandalism as you would normally imagine it, but to protect it from large groups of little kids playing in the surrounding fields that just want to throw pebbles to the panels and into the well for fun. I wouldn’t have thought of it if I didn’t see it myself.

Or for instance, as one of my first assignments at IGRAC I was asked to come up with an app to support groundwater monitoring in the field. Recently, I got the golden opportunity to ask field technicians in Guyana: would you use such an app? And the answer was “no”. Instead, they prefer to use a GPS that uses AA batteries that are easily replaceable in the field. Plus, the GPS signal in cellphones is not very trustworthy in remote areas. I wish I had their input before designing my app.

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Going to the other side of the world to meet your new colleagues in a project also makes the following online interactions much more smoother. Now you understand why they, for example, ask you to join a call in 20 min, or why they do not show up to a meeting scheduled 2 days ago, or to your workshop when they say they will do it (not the same person by the way). That is the way their country works: you are expected to drop anything you are doing and be somewhere else if you are asked to do so. And this is not the way I am used to work in the Netherlands, where yours and everyone else’s time is highly respected, and scheduling activities in your agenda is a national sport.

But, to be honest, it is not as if every single mission I have gone to has been of added value (apart from the fun of travelling). This tends to happen in the case of trainings, especially when they are focused on the use of a tool instead of understanding what problems need to be solved first or why they are generated. In these cases you wonder: are they going to continue using this tool (e.g. software) when we leave, beyond the training? Or more specifically, is this really a problem of not knowing the right software, or could this problem actually be solved by learning some basic practices of data management?

To me, it makes no sense that somebody living in Europe has to go to the other side of the world to take note of all these details and then come back to write a project. Is it really possible that there is absolutely nobody over there able to do this exact activity? But this will continue being the case as long as informed groundwater management is not a priority for so many countries, as this translates in a very limited number of professionals able to grow an expertise in groundwater monitoring, which includes not only hydrogeology skills but also data management, interpretation and reporting. In many countries, suitable professionals (e.g. hydrogeologists) work in the private sector because it is better paid, and the ones that work in government positions, usually fewer in number, are overwhelmed with tasks, which are usually more in the administrative side. This is also something I learned from my visits.

I will continue supporting countries with the sincere hope that one day my job becomes obsolete, because there is enough in-house knowledge to improve groundwater management in each country. And surely, I will continue enriching our projects with the experience and insights from the professionals that are working in the field and in the local community.

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How improved water supply contributes to reducing physical and sexual Violence Against Women in the DRC
A ACCESS TO CLEAN WATER IS ONE OF THE MAJOR CHALLENGES FACING INHABITANTS IN THE DRC.

Women and young girls, being the ones responsible for household water supply, are often exposed to sexual violence and other physical assaults in their quest for this scarce resource. With the intervention of humanitarian aid during the country’s crises, the rise of private initiatives increasingly resorting to groundwater drilling offers a lifeline to women and young girls in various parts of the DRC. However, the rate of water supply remains low.

DANGEROUS, NIGHTLY QUEST FOR WATER

Generally, the task of fetching water falls upon the shoulders of the women in the household. This is no different for Kavugho Aline, a young girl in her early teens and living with her parents in the city of Beni, in the eastern part of the Democratic Republic of Congo. She was supposed to be in class by now. In fact, it has already been more than two hours after the scheduled start time at her school located in Kasanga-Tuha, one of the western outskirts of the city.

"But we have had no water since yesterday", Kavugho says. "The small remainder served to cook dad’s food and wash the baby. My two brothers have already gone to school, and mom has tasked me with finding water," she says with a worried expression.

What seems like gender-based discrimination is generally tolerated within the local community. And Kavugho’s worries don’t even stem from missing yet another day of school, because, unfortunately, educational inequalities pale in comparison to the dangers faced by women in their quest for water in this part of the DRC. Further away in Mambango, women testified to numerous cases of rape that their peers fall victim to while searching for water here, at the only water point in the neighborhood located near a military camp of the DRC army.

With the nearest water point being far away, women have to leave home before daylight, with all the risks that come with such an expedition. "To hope to fetch water, you have to wake up very early in the morning, often between 3 a.m. and 4 a.m. to return around noon", testifies Nziavake Joice, a resident of Mambango. "This exposes us to risks. Unfortunately, some of us have been targeted by rapists."

"To fetch water, you have to wake up very early in the morning, often between 3 a.m. and 4 a.m. to return around noon. This exposes us to risks."

Sadly, these cases mentioned Nziavake are no stand-alone cases of assaults targeting women and young girls who travel long distances in search for drinking water and doing laundry. It is also the case in the Bwito chiefdom in the Rutshuru territory, where the organization Dynamic Women Engaged for Change and Self-Empowerment (DFCA) dedicated that out of the 10 cases of sexual violence recorded in November 2023, 6 were due to the quest for water. "In some places here in our Rutshuru territory, a woman has to travel between 1, 3, or more kilometers to reach a water source", explains Clarisse Kivunda, coordinator of this women’s organization based in Rutshuru-Center. "And even in places where water supply..."
exists, the taps are insufficient or outdated, which still exposes young girls and women to danger.”

**CASES OF RAPE EXACERBATED BY ARMED CONFLICTS**

These dangers that challenge these women in the northeastern part of DRC everyday, are happening against the backdrop of the armed conflict that has gripped this region. A conflict that is probably one of the most underexposed in global media, but that already took a heavy toll on millions of people.

The Northeastern part of the country, rich of minerals like cobalt, gold and copper, has a decades-long past of unrest. However, violence has intensified in recent years. Approximately 1.5 million people have been displaced over the past two years of devastating conflict between the armed group M23, which (according to the UN security council report S/2012/348/Add.1) is backed by Rwanda on one side and the army of the Democratic Republic of Congo, supported by foreign states and local militias on the other. UNHCR has even reported that, in total, more than 6.2 million people are displaced within the DRC, placing the country at the top of the list of countries with the largest population of internally displaced persons in the world.

The conflict particularly left its mark on women safety. NGO CARE International note that reports of gender-based violence are increasing, with women and girls likely to face additional risks of assault, exploitation, and sexual abuse. Deprived of everything, including access to food, clothing, and water, women and young girls may resort to mechanisms such as transactional sex and begging for food, further exposing them to the risk of exploitation and abuse. Since the recent escalation of violence in 2023, the number of people affected by sexual violence has increased.

According to a rapid gender analysis report by CARE International, the number of people affected by sexual violence is dramatically increasing in the DRC. Between 2021 and 2022, the reported cases of gender-based violence doubled, from 40,000 to over 80,000. In the first three months of 2023 alone, over 31,000 cases were reported.

“At the backdrop of armed conflict between M23 and government army forces, sexual assaults are on the rise in North-East Congo

**Right**

**M23 TROOPS**
**BUNAGANA**
**AL JAZEERA**
**ENGLISH**

**Below**

**BULENGO IDP CAMP IN NORTH KIVU, AS REFUGE FOR PEOPLE FLEEING ARMED CONFLICT**
**AUBREY GRAHAM [IRIN]**

“Between 2021 and 2022, the reported cases of gender-based violence doubled, from 40,000 to over 80,000.

In the first three months of 2023 alone, over 31,000 cases were reported.”
A MEMBER OF THE FORCE INTERVENTION BRIGADE INSIDE AN ARMORED VEHICLE DURING PATROL JOINT MONUSCO-FARDC OPERATION NEAR BENI.

SYLVAIN LICHTI [UN PHOTO]
ABOUT 33 MILLION PEOPLE WITHOUT CLEAN WATER

The DRC possesses more than 50% of the water reserves on the African continent, but despite this fabulous potential, 33 million people in urban areas as well as in rural areas do not have access to quality water.

According to UNICEF, the rate of chronic malnutrition affecting 43% of children aged 0 to 5 across the entire Congolese territory also results from the low rate of access to clean water, sanitation services, and the non-adoption of basic hygiene practices.

PROGRESS, BUT STILL A SLOW PROCESS

Meanwhile, REGIDESO, a public establishment responsible for distributing and commercialising water in the DRC, indicates that access to drinking water across the national territory increased by 6 percent in the year 2023. "The rate of access to drinking water from the Regideso in the Democratic Republic of Congo has increased from 30 to 36%, within a year," reads an account from the Congolese Press Agency.

In the city of Beni, the access rate to drinking water is estimated at around 30%, according to Amédée Kamala, supervisor at the urban office for hydrocarbons and electricity. This is a slight improvement compared to the past five years, during which the water supply rate was 17%, added this public official.

Solidarités International has been working on the construction of drinking water infrastructure in the city of Beni for several years. This French organisation estimates that it has provided drinking water to the majority of Beni’s population permanently and sustainably, i.e., providing a minimum of 10 liters of water per day to 170,000 people between 2003 and 2005. However, today, the population has grown towards 600,000 inhabitants, according to civil registry statistics, making this effort relative.

In the neighboring city of Butembo, with a population of over 1 million inhabitants, the access rate to drinking water has increased to approximately 30%, according to Alexandre Kita from the urban service for energy and hydrocarbons. This improvement is largely attributed to the Ebola epidemic. The deadly virus first occurred in the North Kivu province, particularly in Butembo between August 2018 and June 2020, and to combat this epidemic, clean water was required for hand-washing. Yet, water was not accessible. Thus, humanitarian organisations invested in projects for supplying clean water.

GROUNDWATER, A LIFELINE!

In 2015, a law reform ended the monopoly in water production, distribution, and commercialisation held by REGIDESO, a state-owned company. This law stipulates that "the permanent right to use water from the public domain for general interest purposes, including the production of electricity and the distribution of drinking water by network as well as agricultural, mining, industrial, and tourist activities is granted, as appropriate, by the government or provincial government to any natural or legal person, public or private, by a concession contract..."

"In the neighboring city of Butembo, with a population of over 1 million inhabitants, the access rate to drinking water has increased to approximately 30%"
In June 2023, we recorded two cases of sexual violence in the Beni territory. The victims were searching for water in a valley because the few taps installed in their village had dried up, explains Marie-Dolorose Kavira, executive secretary of FEPSI. “This is a significant decrease compared to the dozens of cases we used to record five or ten years ago”. When asked for her perspective on this decrease, Marie-Dolorose sees one major actor. “We believe that it is thanks to the contribution of humanitarian organisations and the use of private drilling that many households access water and that the cases of sexual violence resulting from it are decreasing”, she assures.

Given the rapid urban population growth and the Congolese government’s inability to meet the water needs of its population, several private structures have emerged to address the water shortage through sectoral supply systems. According to Amédée Kamala from the urban service of energy and hydraulic resources in the city of Beni, efforts to promote the 2015 water law must be intensified. “This could completely put an end to water-related sexual violence”, he advocates. “In this regard, the Beni municipality plans to establish a permanent water office whose responsibilities will be to assess the water needs of the population and seek partners to help meet the state’s needs.”

Nevertheless, it should be noted that the price of a 20-liter jerrycan of water from a private drilling varies between 100 and 500 Congolese Francs (equivalent of $0,04 and $0,18), depending on whether it is the rainy or dry season. To put this in perspective, the average monthly income in North Kivu is only $17, and a standard household of 4 people needs about 8 jerrycans per day. This means the total costs are about $9,92 in the rainy season, which would constitute 58% (!) of the monthly income. With the increased prices in dry season, total spending for water would rise to $44,64, more than twice the average monthly income. Needless to say, there is still work to be done to make also these private water solutions more accessible.

In addition, Clarisse Kivunda from the DFEA organization believes that efforts should be made to combat the feminization of water search within households. “Fetching water should not be considered solely the responsibility of women or young girls in the community”, declares the women’s rights advocate. For her, these cases of violence could have been avoided if men were involved in household water supply on an equal footing with women, or at the very least, if young girls were accompanied by their brothers to the various water points.”

If water can become even more accessible and the collection of water becomes a shared responsibility, girls like Kavugho Aline no longer need to live in fear and can join her two brothers in class.
ROCKY ROAD OR FLUID PATH
Women in Geological Sciences in Argentina

How water brings together and promotes the integration of women in science

TEXT: VERÓNICA LUTRI

VERÓNICA LUTRI, Groundwater Correspondent for Argentina, has a PhD in Geological Sciences and is currently holding a postdoctoral fellowship from CONICET.
Every year, the 11th of February marks the International Day of Women and Girls in Science. With more than 105,000 events organised worldwide and supported by 163 member states, the spotlight is firmly directed to the role of current and future female scientists.

But how much empowerment work is actually still needed to be done? Is gender discrimination even still an issue in present-day working environment? Argentina Correspondent Verónica Lutri decided to take a deep dive into this topic in relation to the geology sector in her home country.

**First Encounter with Gender Bias: A Journey to the Heart of Patagonia**

This story, however, starts over a decade ago, when memorable field trip intended for a comprehensive exploration of Patagonia, stretching from the Andes to the Atlantic Coast, marked the beginning of an educational journey fraught with unexpected lessons for a group of ambitious geology students. The destination was a globally significant iron mining project in the province of Río Negro, an experience that promised to bring the underground world they had only seen in books and photographs to vivid reality.

The excitement among the students was palpable. For many, this would be their first encounter with an underground mine, a remarkable opportunity to witness first-hand the subterranean processes, exploitation methods, and mineral veins that had until then been mere theoretical concepts. Upon arrival at the mining project, they were welcomed into a meeting hall where the history, evolution, and operational methods of the mine were discussed, along with introductions to the personnel who worked there. “However, the anticipation quickly turned to disbelief when they were informed of a disheartening policy: only men were permitted to descend into the mine.”

The news was met with incredulous blinks and expressions of disappointment and suspicion among the women in the group. The reason behind this exclusion was both archaic and perplexing, rooted in legend and superstition. It was said that the presence of women in the mine would incite jealousy in Pachamama (Mother Earth), leading to accidents. At least half of the group was made up of women. And after this bad news, we realised that our capacity to protest was limited. This refusal stemmed from ancient legends deeply ingrained among the miners, most of whom hailed from the northern regions of Argentina and Bolivia. In these areas, the worship of Pachamama is a way of life. These were the rules of the game, and we had to accept them.

Among those women, who were denied access to the mine, was me. And this incident marked a profound and unsettling introduction to the realities faced by women in geological work. While standing there, waiting for the men to return from their descent into the mine, one question kept circling inside my mind: Will this gender-based barrier be a recurring obstacle in my future career?

Embarking on this project to re-evaluate the role of women in the geological sciences, I was met with conflicting viewpoints... Some confronted me, arguing that men and women are inherently different, possessing distinct abilities, and it was unrealistic to expect women to undertake the same physical tasks as men. It’s indeed undeniable that we have different physical capabilities. However, if this would be the
sole reason behind the disbalance, how come that in areas where physical strength is not a requirement at all, namely decision-making roles, women still find themselves heavily underrepresented?

In search of information related to the topic, I stumbled upon an article highly recommended, published in 2021 by the Argentine Geological Association, edited by Guereschi, Martino, and Ramos. This piece compiles 17 stories of pioneering women in Argentina and Chile who made their mark in the 19th, 20th, and early 21st centuries. These women were dedicated to teaching and research, as well as fieldwork.

All the articles underscore that from the outset, women's roles in the field were minimal, as they were almost exclusively reserved for men. One story, about María Casanova, who worked at the Fiscal Oil Fields in the late 1920s, immediately caught my attention. In a letter to the administrator of the Comodoro Rivadavia field, María's hiring is mentioned, highlighting a comment that strays from the professional realm: “We have hired, upon the geologist Dr. Fossa Mancini’s recommendation, two new geologists and one petrographer (the latter, fortunately, as the recommender informs me, is unattractive enough to work in the field without causing major discomforts), staff that he has recommended as they are individuals he knows to be very competent and suitable for the tasks we assign them.”

A letter from 1920, about the hiring of María Casanova

Reflecting on all these questions, I first turned inwards and reflected on my own path towards becoming a geologist. I never fit the stereotype society imposes on women, being feminine and proper. I was always disheveled and barefoot, playing in the mud and collecting stones. I could never keep a dress clean or maintain a neat appearance. My life was about chasing the wind, the earth, the water. How did I choose to study Geology? I don’t quite remember, but I suppose I was drawn to Earth’s most striking and provocative features: volcanoes, earthquakes, gold and silver deposits, dinosaurs.

Then, I came across a degree at the National University of Río Cuarto, something I had never heard of before. I didn’t know any professionals who could enlighten me about the field; it was a mystery, yet it captivated me without even knowing it. But, in the end, they were a reflection of my inclinations towards nature since I was young. There, I met my classmates, with whom I shared and grew together on this journey. From day one of starting Geology, I fell completely in love, even though the beginning was a tumultuous relationship with calculus, chemistry, and physics. Geology... it was a balm... I could spend hours talking about volcanoes... Rocks, minerals, and processes, rivers, and glaciers... It was endless! A dream come true. But that wasn’t all, and I was about to immerse myself even more in this incredible world.
GROUNDWATER

By my fourth year in the programme, I had already tackled subjects like sedimentology, mineralogy, and petrology, but it was then that I encountered water. The classes on Hydrogeology overwhelmed me. Discovering a hidden world of water was too beautiful to overlook. Understanding how groundwater is studied brought me immense joy. The water! The blue of the Earth. Something so simple...and yet so complex. Water signifies life, it carries evolution. Water is involved in all of Earth's processes, water completely. The water! The blue of the Earth. Something that can also pose problems: flooding, inundations, contamination.

Students Side of the Story

This helped me finding my place in the geological sciences and it reinforced my belief that indeed, women have played, are playing, and will continue to play a prominent role in the geological sciences. However, it made me wonder if this vision also resonates with young female students or if they hold a different perspective, and if they encountered any gender-related issues.

With this in mind, I decided to seize an opportunity where I was invited to give a lecture: the "15th Argentine Congress of Geology Students" (CADEG). It was there that I developed a questionnaire, which I shared and requested to be disseminated, aiming to gather information and create an approximate statistic regarding the role of women in the Geological Sciences, from the perspective of students in these fields who have not yet entered the workforce.

Half of the respondents believe that women face greater difficulties in securing jobs in geology, while 14% disagree. 32.4% say it depends on the area of application. I believe it is not harder to get a job, but it is harder to reach higher positions as a woman”, says one of the respondents. In this regard, nearly 55% of responses suggest that women are more likely to find employment in the academic/scientific field and teaching than in the private sector.

When being asked about the branches of geological sciences that are considered to have more job opportunities, nearly 82% of the respondents indicated that extractive tasks, such as mining, oil, and lithium, will dominate the professional outlook for the future. However, there was a notable shift in percentages when asking which of these branches are assumed to offer greater access and retention for women. The same respondents believe that tasks like research in public institutes and teaching at universities are where women have greater access and retention, accounting for 69% of the responses, followed by work in hydrogeology (12.7%) and environmental studies (9.9%).

Extractive activities, the ones that are believed to have best future job prospects in general, was only by 4.2% considered as a work environment that offers opportunities to women.

Also related to family planning, women reported being treated unfairly. “I'm almost 30 years old, and during interviews, I'm always asked if I plan to have children, a question that is not posed to any of my male colleagues” says one respondent. And job applications were in general a recurring issue in this study. “I was not selected because of doubts about my ability to spend days on campaign and my strength for fieldwork”, one says, while another gave an even more blatantly gender discriminative reason for turning her down. “I was told that the mining company did not have a section of the camp for women' enabled’. There were also those who felt undervalued by some of their professors. “As a student, I can't speak about the workplace, but there is a clear preference from professors towards male students, especially regarding opportunities for fieldwork and work experiences” adding that “It's something I discuss with almost all my female classmates, and we all have similar experiences”.

All the responses point in the same direction, one in which, even today, there exists a type of discrimination that is invisible yet palpable across the professional field of geology, especially in extractive activities. And the female students who are studying to become future geologists are seeing and feeling it.

The respondents of the questionnaire were predominantly students, without much working experience. A logical next step in my quest was to interview a geologist who has already tackled subjects like sedimentology, mineralogy, and petrology, but it was then that I encountered water. The classes on Hydrogeology overwhelmed me. Discovering a hidden world of water was too beautiful to overlook.

SCRATCHING THE SURFACE

MAY 2024

VERONICA LUTRI

DEMOGRAPHICS |
VERONICA LUTRI

Job prospects in general, particularly for women

“I was not selected because of doubts about my ability to spend days on campaign and my strength for fieldwork”

Above information about the demographics of the respondents.

Fields of work

O&G
Mining
Environment
Geophysics
Research
Other

*Each icon represents 1%.

WOMEN IN SCIENCE

ARGENTINA | WOMEN IN SCIENCE

61
ready been working in mining for over 8 years, to test if she would confirm these views.

SOLE WOMAN AMONG 100 MINERS

As freshly graduated geologist, Deborah started her career in the province of Santa Cruz, Argentina. In a town, 2,000 kilometres away from home, she joined a gold and silver exploration project, where she was responsible for field mapping, drilling core mapping, trench mapping, sections, and interpreting results.

The distance from her home, her family and friends was, however, not the only challenge that she had to face. During the early stages of her career, being the sole woman among a group of 100 (!) individuals in a project left her with a sense of unwelcomeness.

“I encountered instances of symbolic gender-based violence, particularly when a colleague, aware of my dislike for bats, deliberately placed a dead specimen at my workstation”, Deborah recalls.

Also after the incident had happened, she felt somewhat isolated at first. “Despite seeking support from colleagues, I found it challenging to directly address the individual responsible for this ‘prank’, she admits.

Nevertheless, this lack of support did not stop her from speaking out against what makes her feel uncomfortable. “With an increasing demand for field mapping, drilling core mapping, trench mapping, sections, and interpreting results.

“With an increasing number of women joining, both the company and peer support expand, enriching perspectives on conflict resolution in demanding scenarios.”

When being asked about any advice she would give to girls that consider pursuing a career in science in general, and geology in specific, Deborah says: “Focus on enhancing your emotional intelligence. It is essential for all students in the geosciences to be instructed or motivated to integrate, alongside their technical geoscience skills, values such as respect for diversity, mutual support, and empathy.” She considers that for women, a geosciences career serves as a platform for empowerment, the cultivation of self-esteem, and comprehensive professional and personal development. “Be courageous in overcoming fears, embracing challenges, and refining conflict resolution abilities. Acknowledge that, akin to any profession, confronting challenges might seem daunting, but with well-defined objectives, one can advance and flourish both in their career and personal life”, she concludes.

GRADUAL, BUT NOTICEABLE IMPROVEMENTS

Despite these bad experiences and the constant challenge, Deborah also notices considerable, positive, change in the working environment. These positive changes have also affected her personally. “For more than 5 years, I have been employed in Chile as a Senior Project Geologist, specialised in copper and molybdenum, and I’ve had the opportunity to progress towards Team Leader within this company that champions a culture of continuous improvement”, she says proudly.

Meanwhile, she states that her company also embraces policies that actively involve women in the mining sector, which in turn has a positive effect on the position of women in the workplace “With an increasing number of women joining, both the company and peer support expand, enriching perspectives on conflict resolution in demanding scenarios.”

“I confronted and established boundaries with men who routinely made inappropriate comments, instigating changes in their behaviour to avert similar incidents”

In terms of woman empowerment, we have come a long way since María Casanova, who in the late 1920s, was deemed ‘unattractive enough to work in the field without causing major discomforts’. And honestly, the presence of women in the various branches of the geological sciences can only continue to grow. The excuse concerning the physical differences and abilities of women and men may hold some validity in physically demanding operations is an argument that loses all relevance in the higher echelons of organisations and institutions where physical exertion is not required. It is imperative to persist, to not give up, and to recognise that although it is difficult, it is not impossible to achieve equity and respect in this field or any other where gender discrimination exists. Today, women demand, claim, and assume their significant role in their workplaces, seeking the recognition they deserve.

When being asked about any advice she would give to girls that consider pursuing a career in science in general, and geology in specific, Deborah says: “Focus on enhancing your emotional intelligence. It is essential for all students in the geosciences to be instructed or motivated to integrate, alongside their technical geoscience skills, values such as respect for diversity, mutual support, and empathy.” She considers that for women, a geosciences career serves as a platform for empowerment, the cultivation of self-esteem, and comprehensive professional and personal development. “Be courageous in overcoming fears, embracing challenges, and refining conflict resolution abilities. Acknowledge that, akin to any profession, confronting challenges might seem daunting, but with well-defined objectives, one can advance and flourish both in their career and personal life”, she concludes.

LAST, BUT NOT LEAST

But although much progress was made, it remains crucial to promote equality and break down gender stereotypes in all work environments, including geology.

What remains is to continue supporting each other and not to take even a single step back. Happy International Day of Women and Girls in Science!
A plea for applying the Youth Generational Test to make policies truly futureproof

TEXT | JAKOB OLLIVIER DE LETH

The work force in the Dutch water sector is aging fast. In 2020, about 40% of the employees was older than 55, a lot older than other sectors. The aging work force can clearly be seen in the technical professions, such as mechanics and technicians, and due to approaching pensions, personnel shortages will increase greatly. However, the executives are often just as grey.

Because it lasts such a long time for a younger colleague to rise through the ranks of a company, especially in the more conservative and slow-moving water sector, an important voice is missing among those executives: the voice of the younger generation.

There is an increasing amount of awareness about the importance of diversity in decision making. According to the Dutch Social-Economic council, there should be, keeping the diversity within “the younger generation” in mind, put specific attention towards including younger people in decision making. To increase transparency, integrity and effectiveness of decision and policies, for example. It helps to remove the broadly echoed feeling of “younger generations having to clean up the mess of their parents”.

The influence of younger generations can be implemented in many ways. The Dutch Youth Climate Movement (JKK) published, together with other Dutch youth organizations, the Young Watervision. An extensive document for the future on sustainable and adaptive water management, and the role of water in the built environment, nature, and the economy. These documents are valuable, because they don’t just represent younger voices, but also refreshing and inspiring ideas our unstable future needs.

Dutch water authorities and utilities create policies and visions for the long term, sometimes up to 2050 or later. But how effective can these truly be if the effects on future generations are not considered?

The added value of young voices is slowly more appreciated on a strategic level. One Dutch water utility announced the creation of a Young Board, existing of six young employees who give advice to the board on long-term policies. A promising first step, but it is yet to be seen if this will lead to concrete reforms in the policy making process, rather than the creation of the Young Board being performative and their advice is disregarded.

Since 2020, the Dutch government has considered developing a Youth Generational Test. And last year, the Delta Programme Commissioner, advised to apply the Youth Generational Test in decision making about the spatial design of the Netherlands. Big institutions, such as ABN Amro, Rijkswaterstaat and ProRail have already kicked-started the development of the test themselves. It is up to the new Delta Programme Commissioner, Co Verdaas, and the new Dutch government coalition, to not fall for crisis management and keep working on future proof policies.

So, with the Youth Generational Test, several problems are tackled: the reputation of the water sector as a conservative employer, the lack of intergenerational dialogue and the absence of futureproof thinking.

Directors: start now, or the Netherlands will lose their position as global leader on water management. Because this crisis will hit us very soon.
CAMEROON’S HUMANITARIAN FALLOUT:
How internal migration increases pressure on already scarce resources of Buea and Limbe

TEXT | ELVIS KANG

THE SOUTHWESTERN PART OF CAMEROON IS BURDENED UNDER THE WEIGHT OF AN ARMED CONFLICT, that is increasingly leaving its mark on the country. Besides the obvious safety implications, the Anglophone Crisis also puts pressure on the water resources in the urban areas of Buea and Limbe. And once resources become scarce, usually the most vulnerable people are the first to pay the price. And who are more vulnerable than the people who had to leave their home and belongings to settle in a new environment?

ANGLOPHONE CRISIS: A RECENT OUTBURST WITH COLONIAL ROOTS

Cameroon has two official languages, namely French and English, and the ongoing conflict is roughly following these linguistic borders as well. Both the origin of the language barrier itself and some of the divides between the two side, are rooted in the colonial past and some decisions made in the independence process. During the ‘Scramble for Africa’, a period in which European countries roughly divided the continent among themselves, Cameroon (as well as parts of modern-day Nigeria, Gabon, Republic of the Congo, Chad and Central African Republic) was claimed by Germany under the name ‘Kamerun’ in the late 19th century. In 1919, however, the Treaty of Versailles divided Cameroon into two parts with the eastern side being administered by the French and the western strip by the English. Today’s language barrier still, roughly, follows these old colonial lines.
“The Treaty of Versailles divided Cameroon into two parts with the eastern side being administered by the French and the western strip by the English. Today’s language barrier still, roughly, follows these old colonial lines.”

During the wave of independence in the 60’s, French Cameroon was the first to gain independence (becoming the Republic of Cameroon) and so did Nigeria on the other flank of English Cameroon. In 1961, British Cameroon was presented with two options: joining the English-speaking northern Nigeria or the French-speaking Republic of Cameroon (note that the option of full independence was not on the table). The northern part voted to join Nigeria, while the southern part, which includes the cities Buea and Limbe, decided to join the recently formed Republic of Cameroon. This now became the Federal Republic of Cameroon, comprised of two states allowing the newly joined English-speaking region a certain autonomy. When in the following decades, this federal system was gradually reversed and the country returned to its initial name of Republic of Cameroon, this fuelled grievances in the Anglophone region.

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Apart from linguistic differences, the two parts of Cameroon inherited different legal systems from their former colonisers. And the imposition of the French one, among other grievances, resulted in protests and strikes. The government response to these were the spark that lit the fuse, which resulted in a spiral of violence as part of the ‘Anglophone Crisis’. The latest estimate of UNHCR indicates that 622,000 people got displaced by this conflict.

INTERNAL MIGRATION AND WATER SCARCITY

The socio-economic impact of the Anglophone crisis in Kumba, has forced many inhabitants to flee their comfort zone to settle in Buea or Limbe, where the crises are not intense. Many of these internally displaced people are seldom found in city centres but rather settled in small villages like Bova, Bonakanda, Bokova, Woteva, Ewonda, Bokwango, and Bwassa and are unable to meet their basic requirements potable water, which is relatively scarce.

Due to the growing population of incoming migrants in these areas, and the pressure this puts on the already scarce water resources, many travel down the slope in search of water for daily survival. Many do this partly because they can’t financially afford to dig a well or borehole.

“Due to the growing population of incoming migrants in these areas, and the pressure this puts on the already scarce water resources, many travel down the slope in search of water for daily survival”

Despite increasing efforts to resolve the problem of water scarcity in these areas, the conductivities of the younger and recent basanites are very low, which coincides with moderate to poor groundwater potential and occurrence. The groundwater table of Buea varies immensely and is directly proportional to the slope and elevation.

As such, these displaced people find it difficult to get potable water despite the availability of groundwater due to a lack of finance for the drilling of the boreholes

AN UNFORTUNATE MIX OF INADEQUATE MANAGEMENT PRACTICES

Over the last ten years, the cities of Buea and Limbe have been suffering from a severe water crisis. This is caused by an unfortunate mix of inadequate management practices, a lack of national water policies, poor maintenance and deterioration of infrastructure and corruption. A lack of adequate funding is another problem in Buea and Limbe that has resulted in water scarcity.

Due to this scarcity, the population of both cities now depend on groundwater as an alternative and most reliable source of potable water. In the absence of springs, the only other access to groundwater is through wells and boreholes. Nevertheless, the distribution of groundwater is very uneven, especially in active volcanic terrains where there is constant deformation and change in landforms. Additionally, the groundwater table varies extensively even within small regions like Buea. These are some of the causes of dry boreholes and deeper water levels in certain boreholes in Buea.

Buea is situated on the active Mount Cameroon volcano and is noted for water scarcity, especially in the upland villages of Bova, Bonakanda, Bokova, Woteva, Ewonda, Bokwango, and Bwassa, with ever-expanding populations.

“Only the rich can afford to have boreholes as one can spend up to three million francs cfa (equivalent of $4,905,-).”

To put this in perspective, the average monthly income in this area ranges between 30,000 and 46,000 francs.

DETERMINATION OF GROUNDWATER POTENTIAL ZONES IN BUEA AND LIMBE PRACTICES

To solve the water scarcity problem, individuals have been extracting groundwater through boreholes. However, even with the practice of site-specific geophysical surveys, there have been drilling failures with many existing dry boreholes. These frequent drilling failures are due to the geological complexity of the volcanic terrain, the lack of detailed geological and hydrogeological studies, and insufficient geo-

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Despite many inhabitants, today benefiting from groundwater exploitation through boreholes in Buea, some still have difficulties in acquiring such service as only the rich can afford to have boreholes as one can spend up to three million francs cfa (equivalent of $4,905,-) for such, which is relatively expensive for the poor and less privileged like the internally displaced persons. To put this in perspective, the average monthly income in this area ranges between 30,000 and 46,000 francs.

DETERMINATION OF GROUNDWATER POTENTIAL ZONES IN BUEA AND LIMBE PRACTICES

To solve the water scarcity problem, individuals have been extracting groundwater through boreholes. However, even with the practice of site-specific geophysical surveys, there have been drilling failures with many existing dry boreholes. These frequent drilling failures are due to the geological complexity of the volcanic terrain, the lack of detailed geological and hydrogeological studies, and insufficient geo-
physical data. Geophysical surveys are more effective when used with a good understanding of the geology and hydrogeological conditions of the area to be exploited. Hence, the assessment and zoning of groundwater potential and the planning and management of groundwater resources are fundamental.

To help solve the water scarcity problem in Buea, a study has been conducted to integrate remote sensing, geospatial techniques, and geophysical surveys to demarcate the different groundwater potential zones. This was achieved by using factors influencing groundwater recharge potential in the area, which are lithology, slope, drainage density, lineament density and land use. Each thematic map, including lithology, slope, drainage density, lineament density, and land use, provides a firm indication of the occurrence of groundwater and its potential. Further validation of the groundwater potential zones was done using existing springs and boreholes and their static groundwater level data. The results obtained from this study will serve as a guide and tool for siting boreholes and will aid decision-makers and local authorities in future planning projects such as the zoning of new settlements and groundwater resource management.

And then there is the water quality matter. Groundwater from boreholes, is vulnerable to both microbial pollution and unsuitable physical characteristics. An assessment of the microbial quality and the physical properties of groundwater from boreholes was accordingly carried out by the Cameroon Academy of Science in Buea and Limbe. In particular, the presence faecal contamination indicators like coliform bacteria, and the eventual isolation of E. coli and Salmonella was investigated. A total of 46 samples were collected from 29 randomly selected boreholes and their physical parameters (temperature, pH, EC, TDS and turbidity), and microbial content were analysed.

When the results came back from the lab, they indicated that most physical characteristics were within WHO guidelines for potability, except for the turbidity with barely two samples that fell within the acceptable range. Moreover, also the microbial analysis identified serious quality issues, with 72.41% of the samples exceeding the WHO standard for Coliform bacteria, 76.47% for E. coli and even 82.35% for Salmonella spp. In conclusion, this pioneering study reveals that the water is vulnerable to bacteriological pollution and therefore, currently, not potable. This necessitates awareness creation in the community on the regular disinfection of groundwater from boreholes.

The issue of the internally displaced people in Cameroon is not only a water access issue (above), but also a water quality issue (left). One plausible cause for this groundwater quality deterioration could be waste management. An increase in waste production is inextricably linked to population increase and increasing civilisation, and depending on the waste management approach, groundwater can be seriously affected.

Field visits and observations have indicated that the method of waste disposal used in Limbe by LUC (until 2006) and HYSCAM (from 2006) have shown negative effects on groundwater. The results of microbial analysis showing levels of coliform and E. coli way beyond the standards of Cameroon, WHO and ISI 10500-91, confirm these observations. These excessively high values imply that water is highly contaminated biologically and so groundwater wells in Limbe are not good for human consumption.

Since you can’t manage what you don’t measure, these groundwater potential mapping and groundwater quality assessments are crucial steps towards access to safe drinking water.

However, with the population growth in Buea, Limbe and their surrounding area, and the rise of internal migration towards these cities, it will be crucial to swiftly take the follow-up steps as well.
DEGROWTH. It’s a somewhat radical economic theoretical concept that prescribes shrinking rather than growing economies in order to use less of the world’s dwindling resources. It requires a lifestyle that encourages consuming less and instead prioritises quality over quantity. It prompts mastery of the art of relinquishing the unnecessary today to prevent lacking the essential tomorrow.

This concept was born in the 1970’s but has picked up support in recent years with the energy crisis, (over)exploitation of natural resources and planetary limits playing an increasingly important role in the public debate. However, when it comes to water, especially drinking water, the stakes are significantly high. The critical question arises: How can we effectively confront this challenge? How do we collectively and individually manage our consumption to ensure the sustainability of groundwater resources?

For this story we go to France, the country of André Gorz, the founding father of the degrowth theory. Because it is there, where a province managed to welcome 300,000 new residents without extracting an additional drop of water. High time for a deep dive into this fascinating groundwater case.

A WATER RICH COUNTRY, RIGHT?

Like many children in France, I never truly pondered the source of the water that flowed from my tap during my early years. Water was ubiquitous in Bordeaux, the world capital of wine and the city of my upbringing. During leisurely strolls along the flower-lined quays of the Garonne River, the third-largest river in France, I would notice its distinctive brown hue resulting from elevated levels of suspended matter in the water. The thought of drinking this water never crossed my mind.

However, this brown water, unappealing to my younger self’s eyes, has long been considered as one of the possible solutions to meet the city’s water demand. Because from the Middle Ages to the early 20th century, Bordeaux faced recurrent issues with the supply of drinking water. The water sources within the city had an insufficient flow to meet the water demand and were highly vulnerable to pollution. Unfortunately, due to the proximity of the ocean, the water from the Garonne River is too saline to be used. To secure water supply, extensive aqueducts were thus constructed. They transport spring water from sources located in neighbouring communities. The largest of these is the Budos aqueduct, extending over 41 km.

THE DEEP AQUIFERS, A HIDDEN TREASURE EXPLORING IN 20TH CENTURY

The technological advancements of the 20th century made it possible to drill wells capable of tapping into deep aquifers. These extraordinary “windows” into the subsoil discharged pure water throughout the year. Thanks to the pressure within the aquifer, the water naturally flowed to the surface without the need for pumping. These high-quality waters came from high-inertia confined.
Spring water transport 
concerns about risk of 
Overexploitation, and 
In the face of this exponential exploitation, Professor Schoeller, a hydrogeologist at the University of Bordeaux, raised concerns with local stakeholders regarding the risks of overexploitation. As early as 1955, he highlighted the dangers associated with the decline in the piezometric surface resulting from the exploitation of the Eocene aquifer and the consequent risk of saline intrusion.

A SALTY TRUTH, THE END OF ABUNDANCE

After several decades of exploitation, the once-abundant gushing wells started to diminish. The water table levels decreased, necessitating not only collection but also the pumping of water.

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“As early as 1955, he [Prof. Schoeller] highlighted the dangers associated with the decline in the piezometric surface resulting from the exploitation of the Eocene aquifer and the consequent risk of saline intrusion.”

It will take 40 years to confirm this concern, with the necessary time for acquiring knowledge, conceptualizing the functioning of deep aquifers, and developing the initial numerical flow models. By 1996, the verdict was delivered. As I was getting ready for my first day of school, the region where I was raised was realizing that these aquifers were, in fact, being overexploited.

LESS IS MORE, A PARADIGM SHIFT

Confronted with this overexploitation of deep groundwater, the decision was made in 1998 to initiate the development of a water development and management plan. One year later, a local water commission responsible for defining the strategy for managing deep groundwater was established.

Middle Ages
Spring water transport via extensive aqueducts to fulfill the water needs

Early 20th century
Wells drilled tapping into deep aquifers for agriculture and industry

1950
Bordeaux begun to rely on groundwater for its drinking water supply

1955
Professor Schoeller was the first to raise concerns about risk of overexploitation

1996
Overexploitation, and subsequent saline intruision, is confirmed

1998
Process of developing the Water Development and Management Plan is started

1999
Local water commission, responsible for managing deep groundwater, established

2003
Water Development and Management Plan received unanimous approval

AQUIFER FORMATION
DEEP AQUIFER

The deep aquifers consist of several layers stacked one another. Below is shown the impermeable geological formation, such as clay, and an aquifer formation capable of storing and facilitating the flow of water, such as sand. The water trapped in these deep aquifers infiltrated thousands of years ago. As a result, this groundwater is of excellent quality and free from any pollution of human origin.

The water table levels decreased, necessitating not only collection but also the pumping of water.

In the face of this exponential exploitation, Professor Schoeller, a hydrogeologist at the University of Bordeaux, raised concerns with local stakeholders regarding the risks of overexploitation. As early as 1955, he highlighted the dangers associated with the decline in the piezometric surface resulting from the exploitation of the Eocene aquifer and the consequent risk of saline intrusion.

“As early as 1955, he [Prof. Schoeller] highlighted the dangers associated with the decline in the piezometric surface resulting from the exploitation of the Eocene aquifer and the consequent risk of saline intrusion.”

It will take 40 years to confirm this concern, with the necessary time for acquiring knowledge, conceptualizing the functioning of deep aquifers, and developing the initial numerical flow models. By 1996, the verdict was delivered. As I was getting ready for my first day of school, the region where I was raised was realizing that these aquifers were, in fact, being overexploited.

LESS IS MORE, A PARADIGM SHIFT

Confronted with this overexploitation of deep groundwater, the decision was made in 1998 to initiate the development of a water development and management plan. One year later, a local water commission responsible for defining the strategy for managing deep groundwater was established.
The exemplary behaviour of these authorities was considered receiving unanimous approval in 2003. Years of reflection and collaboration, was comprehensively strengthened regulations. This strategy, born out of four age and preserve it. Therefore, it was decided to work on those that are overexploited as entrusted to the newly created joint syndicate for the study and management of water resources (the SMEGREG) has thus seen its missions evolve to include citizen awareness initiatives.

As an experiment in 2003 and then on an operational basis in 2008, the Espaces info économie d’eau emerged. This initiative provides the general public with information on deep groundwater, raises awareness about its preservation and offers practical advice on choosing and installing water-saving equipment. Information is provided to individuals upon request or during open hours. Information booths on water resources and consumption management are also set up at events (local events, fairs, etc.). This initiative reaches approximately 10,000 people per year. Additionally, a website “jereconservelepau.org” was created in 2005. It allows sharing of water-saving tips with communities, professionals, and the general public.

Then, water-saving initiatives were also introduced in schools. The SMEGREG, under an agreement with the Ministry of National Education, has developed educational materials for students, from kindergarten to middle school, as well as training sessions for teachers. Accredited associations are then tasked with interventions in classrooms or hosting children at dedicated sites. The objective is for all students in the department to have been sensitized at least once to deep groundwater resources. Over time, the programme has grown and achieved great success. Today, no fewer than 12,000 students are educated each year.

Public awareness campaigns were also carried out in public spaces, as well as brochures or technical guides for citizens, municipalities, or economic actors. All the efforts invested in water savings have enabled accommodating 300,000 new residents without increasing water extractions. Currently, La Gironde is among the departments with the lowest average consumption of drinking water per capita. Besides water resource preservation, it’s also a significant economy for the region. The investment costs associated with the search and exploitation of new resources to meet water needs would have amounted to around 100 million euros without the water-saving policy.

However, some aquifers continue to be overexploited and the demographic pressure implies that water savings alone are no longer sufficient. Annual abstraction volumes are once again on the rise essentially due to drinking water demand. With climate change and the decreasing availability of surface water resources, adapting may now require changing our practices more than ever.

**A SHIFTING PERSPECTIVE ON WATER RESOURCES**

France has recently experienced the two hottest years on record - 2022 and 2023. This summer, nearly 200 municipalities faced potable water shortages. The island of Mayotte is grappling with an unprecedented water crisis. Major European cities, such as Barcelona, find themselves without running water. These situations, once seemingly unimaginable, are becoming the norm due to the impacts of climate change.

Suggestions to enhance water availability are burgeoning. From wastewater reuse and rainwater harvesting to sea water desalination and the establishment of alternative reserves, the options abound. However, each poses questions of feasibility, both technically and economically, as well as environmental repercussions, which can at times be substantial for ecosystems. Additionally, considerations of public reluctance and acceptability further complicate matters.

**“With each passing, these fountains prompt me to reflect on our perception and utilization of water resources”**

Each day, I stroll past the familiar fountains where, in my youth, I enjoyed carefree picnics. And with each passing, as a hydrogeologist and a citizen, these fountains prompt me to reflect on our perception and utilization of water resources. Even if we could increase our access to water, what would we do with it? What we’ve always done so far? Even if climate change permanently alters and challenges everything we’ve known?

**More than just an adaptation of practices, we need to transform our relationship with the resource. Keeping in mind that by collectively choosing, programming, and planning frugality, we could forego today’s excesses to ensure everyone’s essential needs for tomorrow.**
Plans for uranium in-situ leach mining in Namibia’s largest transboundary aquifer

Does economic development and 500 jobs for a relatively small community outweigh the potential for widespread contamination of the only source of drinking water for the commercial and communal farming communities that live on a huge transboundary aquifer system underlying three countries?

That is exactly the question that the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism will have to grapple with.

TEXT | STEFAN SIEPMAN

STEFAN SIEPMAN, Chief Editor of Scratching the Surface & Senior Communication Officer at IGRAC
In 2021, the Uranium One Mining Company, through its local subsidiary Headspring Investments, announced its intentions to extract uranium in the Stampriet Transboundary Aquifer System (STAS) at farm Tripoli, near the small town of Leonardville, through in situ leaching methods. This has divided both parliament and public opinion ever since, culminating in a public participation process that ended in February.

When thinking about Namibia, one may think of the incredible landscapes of Sossusvlei or the Namib Desert and their distinct orange colour palette. ‘Uranium’ would probably not be the first association that would come to mind. Nevertheless, with a production of 5,613 tons of uranium in 2022, it accounted for 11% of the world’s total production for that year alone. This ranked Namibia the third biggest producer, right behind, respectively, Canada (15%) and Kazakhstan (43%). Considering the current scale of Namibian uranium production is already among the highest, one may wonder why a new mining site near a town with only 432 inhabitants is suddenly catching so much attention. To fully grasp the importance of the decision that is on the table today, it is important to first look into the type of deposit, the proposed mining method and the potential risks involved for this particular case.

“This ranked Namibia the third biggest producer, right behind, respectively, Canada (15%) and Kazakhstan (43%).”

The deposit near Leonardville is referred to as sandstone-hosted uranium. Such deposits form underground in porous sandstone aquifer layers that form part of thick accumulations of sediments in marine or lacustrine basins. Conventional mining is not possible due to the relatively low grade of the ore and the associated costs of conventional mining, which would make the deposit uneconomic to mine.

“In Kazakhstan, USA and Australia, in situ leaching methods are indeed being used to extract uranium, but in none of those countries it concerns potable water”, says one of the driving forces behind the Namibian Stampriet Aquifer Uranium Mining Association (SAUMA) who, for security reasons would like to remain anonymous. SAUMA has, with assistance from geological, hydrogeological, environmental and legal experts, united farmers, game ranchers and lodge owners in opposing the mining project in Leonardville. “In Australia, no mining is allowed at all in sources of drinking water”, the SAUMA representative details. “And to be clear, we are NOT against mining development per se, but we need to protect our resource in this desert and semi-desert country, right?”

“And to be clear, we are NOT against mining development per se, but we need to protect our resource in this desert and semi-desert country, right?”

During in situ leaching, chemicals like sulfuric acid or ammonium carbonate and oxidants are injected into the aquifer through dedicated injection wells (e.g. boreholes). These chemicals, so-called ‘lixiviants’, dissolve the uranium. The resulting mine solution is pumped to the surface through ‘production wells’. Nowadays, in-situ leaching, also known as solution mining or in situ recovery, is employed extensively worldwide. Certain segments of the mining industry label it the most cost effective and environmentally acceptable method of mining. The method is used in Kazakhstan, USA, Australia, China, Uzbekistan and Russia, so in that sense the plans for Namibia are no novelty.

In situ leaching: Chemicals in, Uranium out

Windmills are crucial for powering farms and pumping water in Namibia’s desert areas as they provide a sustainable and reliable source of energy

THE LIFE GIVER | FREDRICK LEICA
The resource that is being alluded to is the groundwater stored in the Stampriet Transboundary Aquifer System, also known as Stampriet Artesian Basin (SAB). And the importance of this aquifer cannot be understated. In the entire area of this ‘STAS area’, the two main rivers, the Auob and Nossob, flow only about once every ten years during exceptionally good rains, and then only briefly. There is no permanent surface water. It is the drinking water in the underground sandstone aquifers that is the lifeblood of the whole region, for the people, their animals, the economy and the ecology. Between 92 and 95% of this underground water is used for town supply and irrigation. Farm boreholes and some guest lodges account for the balance. Irrigation produces fruit and vegetables for the Namibian people and fodder for animals. Total annual abstraction from all aquifers was 20 million m³ in 2015 and has been increasing steadily since then.

Although almost three quarters of the total area of 86,647m² that is covered by Stampriet aquifer is in Namibia, this can by no means be considered a national matter: This is primarily due to the topography of this area. With the Namibian side having a higher elevation than its two neighbouring countries, the groundwater flow is in the direction of Botswana and South Africa. There are about 7000 boreholes in the Namibian sector. The 2016 GGRETA report on the STAS, with IGRAC involvement, pointed to a very gradual fall in the water table level over time but an almost complete recovery approximately every ten years after the summers with exceptional rains. This suggests there is tremendous interconnectivity right across the basin. Some irrigation schemes pump up to 100 m³ per hour out of the aquifer. This induces a groundwater flow rate many times higher than the in situ leaching flow rate between injection and production wells over an area several kilometres in diameter. Irrigation, consequently, has the potential to draw polluting mine solution out of the mine area and into the rest of the aquifer. This mine solution has uranium concentrations thousands of times above the WHO standard for safe drinking water.
Beyond the impacts that this would have on household water supply and livelihoods throughout the whole region, a deterioration of the groundwater quality could have severe consequences for wildlife as well. Significant portions of the aquifer underlie the Wildlife Management Areas of Botswana and the nature and wildlife preservation park of the Kgalagadi Transfrontier Park that covers both Botswana and South Africa. These pristine environments with only few developments are at the end point of the Nossob River as well as the groundwater flow of the Stampriet aquifer. Considering these risks for South Africa, the Department for Water and Sanitation was asked a statement about the planned activity of its neighbour.

“...the general groundwater flow direction is from north-west in Namibia to south-east into the Northern Cape Province of South Africa, making it a downstream country. Even though South Africa mainly uses the unconfined Kalahari aquifer, groundwater is presumed to seep upwards from the confined Auob and Nossob aquifers and discharges into the Kalahari formations, according to the study of 2016. This study did not cover potential impacts due to mining activities in the area since these activities did not exist; however, it did identify groundwater pollution and salinisation as problems in this transboundary aquifer, with groundwater quality generally decreasing towards Botswana and South Africa. The STAS-wide Strategic Action Plan which was endorsed by the Orange-Senqu River Commission (ORASECOM) for implementation identified four Strategic Objectives, one of which is to “Maintain current groundwater quality by limiting anthropogenic and geogenic concentrations”. Two of the Actions under this objective are:

1. ‘to safeguard groundwater from mining activities’, and
2. ‘to develop groundwater protection zoning measures’.

For South Africa, this groundwater resource is not only crucial for tourism and domestic purposes, but also valuable for sustenance of groundwater-dependent ecosystems within the KTP and some agricultural economic activities in the vicinity. Hence, its protection and pollution prevention are of paramount importance.”

Statement: Department for Water and Sanitation, South Africa

FINANCIAL FOREIGN INVESTMENTS

With all this in mind, it makes one wonder why Namibia even considers this project. It can’t be driven by an increasing need for sources of energy, because despite 11% of the world’s uranium production originating from Namibia, this southern African country does not produce any nuclear energy itself. Indeed, all extracted uranium ends up abroad. The main incentives for these mining operations are, therefore, economically driven. Besides any profit from the export of uranium itself, this proposed mining project offers job opportunities to the local community, about 500 jobs according to Headspring Investments. And this is where the dilemma becomes more complicated. How does one balance the short-term benefits of employment options with the long-term threats to groundwater looming over this project.

“I am deeply convinced that all criticism comes from ignorance of the fact that people are not familiar with this method and are afraid of it”

Headspring Director Kirill Egorov-Kirillov

The local community living in close proximity to the mining site has already seen some of those short-term benefits. “Headspring Investments has already spent over $3.8 million Namibian Dollars (€183k) on social projects”, says Director of Mines Kirill Egorov-Kirillov in an interview with Namibia Daily News. “These investments include the purchase and repair of vehicles for police and medical services, improvement of the city park, which has become a favourite place for recreation and events for adults and children, supply of food to the city school, and the construction of a school kitchen”, says Director Kirill Egorov-Kirillov.

“...I am deeply convinced that all criticism comes from ignorance of the fact that people are not familiar with this method and are afraid of it”

Headspring Director Kirill Egorov-Kirillov

CAN URANIUM BE MINED SAFELY?

When being asked how he reflects on the criticism to Headspring Investment’s plans, Egorov-Kirillov believes it’s mainly a matter of ignorance. “I am deeply convinced that all criticism comes from ignorance of the fact that people are not familiar with this method and are afraid of it, and this creates conditions for spreading unconfirmed or unreliable information, thus creating conditions for the substitution of concepts and various kinds of speculations.” But is it indeed just a matter of the critics being unaware and unknowing of the environmental friendliness of this procedure? “It is actually the other way around, it is because we understand the consequences of being downstream that we can look beyond the short-term economic benefits”, says one of the experts associated to SAUMA. “SAUMA understands in situ leaching and its problems very well and Headspring Investments employees have attended more than one of our presentations on it, and even have a copy of it”, the expert stated. “They completely ignore it.”

To increase goodwill within Namibia, Headspring Investments organised field visits for Namibian public and media representatives (including SAUMA representatives) to the operating enterprises in Russia and Kazakhstan. “Here
they can see for themselves how environmentally friendly the production is, how many jobs the enterprise gives to local residents, and what good harvests their neighbours farmers gather in the nearby fields," Director Egenov-Kirillov says.

**Controlled by a heavy PR team, reporters were not allowed to make any form of recording, whether audio or visual**

NBC Digital News about fieldtrip to uranium plants in Kazakhstan

However, these trips did not produce the (for Headspring Investments) desired effect on everyone. In his report for NBC Digital News, journalist Emil Seibeb reported on the heavy restrictions posed on invited media during a trip to Kazakhstan. “Controlled by a heavy PR team, reporters were not allowed to make any form of recording, whether audio or visual”, Seibeb of NBC Digital News states. “This left the media confined to visuals provided by the company’s PR team.”

Three SAUMA representatives attended a different field visit in the STAS area, it is interesting to look into the decision mechanisms and legal structures when it comes to mining activities in Namibia. And these are interesting, to say the least, with multiple ministries involved. A strong opponent of the planned mining activities is Calle Schlettwein, the Minister of Water, Agriculture and Land Reform. In 2022, the ministry suspended two multi-hole drilling permits that had been issued to Headspring Investments and refused another for more boreholes, primarily because the strict conditions of the drilling permits had not been adhered to but additionally over groundwater quality concerns. “The permits that we’d given had conditions to make sure that we can monitor the activities and that we can ensure ourselves continuously that no risk to the aquifer is happening,” Minister Schlettwein said back then. “Now, unfortunately, the company did not conform to the conditions and we have now suspicion that the mining operation, which is called in situ leaching ... mining, in fact, I see there is risk to the aquifer by polluting it”, he said after about the refusal to grant mining permits.

**“Now, unfortunately, the company did not conform to the conditions”**

Minister Schlettwein on mining permit refusal

Initially, Headspring Investments filed an appeal against the ministry at the High Court of Namibia. This appeal, however, was withdrawn in November 2023 after the coming into force of the Water Resources Management Act. This act does not permit anything to be discharged or pumped into water that is not of the same quality of the receiving water resource. Notwithstanding the above developments, the company submitted at the end of December 2023 an application to Environmen tal Commissioner in the Ministry of Environment, Forestry and Tourism. This application is for an Environmental Clearance Certificate to start in situ leach test mining on the farm Tripoli. An environmental impact assessment, an environmental management plan and a radiation management plan by Kazakhstan and Zimbabwe authors supported this application. The deadline for submission of public objections to the application and comments on these three documents was last Friday. Besides SAUMA, IGRAC has also submitted an official letter of objection. The application is currently under review by the Environmental Commissioner, who will take a decision within the forthcoming seven working days.

**COMMISSIONER HOLDING THE CARDS**

If the Environmental Commissioner agrees with the expressed concerns and, like Minister Schlettwein did previously, declines the request, this would be a big blow for the mining company. However, the consequences of an approval of the request would be vastly more complex. With the previously mentioned Water Resources Management Act and the Constitution of Namibia on their side, SAUMA could appeal the decision in court, with even a fairly good chance of winning the case. Nonetheless, the mining company has no obligation to postpone its operations until after this court ruling. The in situ leaching can, therefore, start as soon as the commissioner gives his approval and it can continue until a judge brings a halt to it. This could mean weeks, months or even years during which potential contamination could take place. And this is only considering a scenario in which it will even come to a court case. Legal costs involved in a case like this can easily amount to ten millions of Namibian Dollars or more, a fee an NGO like SAUMA will not be able to afford.

**Thus, it is safe to say that the commissioner is tasked with a decision that can shape the future of an entire region. ’White smoke’ may be expected soon.**
A retired school head teacher, served for 37 years and retired in 2020. He has been contributing to his local community by providing access to clean water. He has taken the initiative of tapping and pumping groundwater to four villages, which has helped combat the water needs of these communities in Biharwe.

The town is predominantly covered by lush green hills that give it a mesmerizing appearance. The hills provide a perfect backdrop for the town’s picturesque landscape. Biharwe is famously known for the 1520 AD Biharwe Eclipse, a significant historical event in the town’s history.

However, it is unfortunate that the town lies within Uganda’s driest corridor, an expansive zone stretching from South-Western Uganda in the Mbarara District to North-Eastern Uganda via Kiruhura, Lyantonde, Sembabule, Mubende, Kiboga Nakasongola, Amolatar, Kaberamaido, Soroti, and Katakwi Districts. The region is predominantly characterized by pastoral range lands.

It is worth noting that the dry conditions in this region impact the local economy and the livelihoods of those farmers and pastoralists who live in Biharwe. Additionally, dry conditions continue to negatively impact the availability of resources, such as water, which are essential for the survival of the residents and their livestock.

**School Teacher Turned Well Driller**

Martin Kananura, a retired school head teacher, served for 37 years and retired in 2020. He has been contributing to his local community by providing access to clean water. He has taken the initiative of tapping and pumping groundwater to four villages, which has helped combat the water needs of these communities in Biharwe.

“Martin’s efforts have positively impacted the food production of the locals, and his services were appreciated last year when he was voted the best farmer by the leading daily newspaper, NewVision”

Martin’s efforts have positively impacted the food production of the locals, and his services were appreciated last year when he was voted the best farmer by the leading daily newspaper, NewVision.

**Years of Water Struggle**

While commenting about groundwater as a resource, Martin describes groundwater as a miracle. He reflected on the hard times of finding water in the past.

“We used to go and look for water. I remember we walked about 100km away from here for water. Our animals died from the spread of diseases because we were grazing alongside these animals from the national park, so we had a lot of challenges.”

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**Taking Matters in His Own Hand**

Martin, a dedicated teacher at Mbarara Municipal School, retired from his profession and ventured into farming. However, he quickly realized that water scarcity was a significant challenge in his new vocation. To address this issue, Martin sought collaboration with the Agricultural Business Initiative (ABI), a reputable organization dedicated to enhancing dairy production during the dry season in Mbarara City.

With ABI’s help, Martin hoped to overcome this daunting challenge and make a success of his new venture. ABI offered technical support for the evaluation and installation of a groundwater system that now supplies four villages and a vast farm of 15 acres belonging to Martin, who was faced with the challenge of water shortage.

“I have ten acres of banana plantation with an irrigation system. When we talk of matooke, we are looking at 200 bunches of bananas in terms of monetary value, at a minimum...”
not only supplies his farm but also four nearby villages. In contrast, he is obligated to pay 36.72 Euros per month for the water supply to his homestead to the National Water and Sewage Corporation.

The affordability of groundwater compared to tap water in Martin's area makes it a more practical option for farmers who want to optimize their resources without breaking the bank. Martin's experience with groundwater pumping highlights the importance of exploring alternative sources of water for farming and other purposes.

Martin's farm is adjacent to two hills. To ensure proper irrigation, he has installed two large tanks on each of the two hills with a capacity of 100,000 liters. The tanks pump water up the two hills, providing a steady water supply for his crops. This setup has proven to be highly effective. Martin utilizes the land to optimize his farming practices.

"Four communities are beneficiaries of this water, which we have drilled 200ft underneath in a small area. It's doing wonders in my village." Martin attaches this success story of groundwater supplying four villages to one of the reasons why he was nominated as one of the best farmers in this country, knowing that there are very many farmers with good cows, good animals, "...but I don't think that anyone has done this to the community. I would be the first person to have done this in this country."

Martin now ensures that the water is flowing and the lives on his farm are thriving. He takes responsibility for any technical issues in the system, as well as plumbing repairs.

To streamline operations, Martin has hired a manager who oversees all activities on the farm and closely monitors the pumps and pipes.
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