TheNational

UAE lacks water but not technology to conserve it

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The late Sheikh Zayed said: "On land and in the sea, our fore-fathers lived and survived in this environment. They were able to do so because they recognised the need to conserve it, to take from it only what they needed to live, and to preserve it for succeeding generations." It is the hope of our research teams at Masdar Institute that our work in isotopic signatures in ions may help the UAE's residents do just that - preserving our environment and natural resources for succeeding generations.

Water scarcity and water security are two issues closely linked and are very much on the minds of leaders around the world. Last year on World Water Day, His Highness Sheikh Hamdan bin Zayed Al Nahyan, UAE Deputy Prime Minister and Chairman of Environment Agency–Abu Dhabi issued a statement revealing the limits of the emirate's own natural water resources, which saw an 18 per cent reduction in the groundwater supply since 2003. On top of that, he warned that Abu Dhabi's total consumption of water resources exceeds by 24 times its natural recharge capacity - due in part to the rapid social and economic development that the emirate has witnessed in the last four decades.

The UAE lies in a region with limited rainfall and few bodies of fresh water. Traditionally, those who call the UAE home have sourced the sweet water needed to sustain their families, livestock and farms mainly from groundwater, either using wells or spring-fed aflaj systems. Many of the wells and springs that bring up the ancient water deep beneath the earth have run dry over time. Aquifers - which are an underground layer of water-bearing permeable rock or unconsolidated materials - are being emptied of their precious cargo of natural fresh water. In the past, once an aquifer and the wells it sourced had run dry, there was nothing much that could be done to reclaim it.

Hydrologists have recently investigated recharging those aquifers with water from other sources. The benefit of artificially recharging an aquifer is that you return the source of water to the native plants and animals that depend on it and also, you provide your community with a water reserve in case of emergency. Currently, the UAE relies very heavily on desalinated sea water for domestic consumption - with some reports stating that upwards of 90 per cent of the water used in the UAE now originates in desalination plants. Still, there is great benefit in ensuring there is a ready supply of groundwater in case the desalination plants may not be able to operate - as seen during the First Gulf War. An aquifer can serve as a self cleaning, self maintaining water storage system.

But artificially recharging an aquifer comes with some challenges. Aquifers are the result of movement and linkages that occur below the earth's surface over a period of eons. Inserting a foreign body into a natural ecosystem can potentially have repercussions. It is often hard to know where water from an aquifer ends up, and the impact any trace contaminants present in it can have on the sensitive ecosystem around it.

With the help of isotopic fingerprinting methods that we are researching at the Masdar Institute of Science and Technology, scientists can track the flow of water through an aquifer by tracking tracers such as boron that remain in water after reverse osmosis desalination, a desalination process gaining popularity. We can also track the fate of any pre-existing ionic contaminants in the aquifer, such as bromate, nitrate, and perchlorate, which can have an adverse effect on the health of humans and animals consuming the water. We are currently pioneering the use of two different existing fingerprinting techniques (ion chromatography and triple quadruple mass spectrometry) in tandem, to produce the kind of results that only a few research laboratories in the world can achieve. Our method effectively "fingerprints" an element, and based on that, we can then track the water that carries the fingerprinted element wherever it goes.

The resulting water signatures can then be used to monitor the health of an aquifer and the impacts of artificial recharge. This method can potentially show the UAE how best to recharge its natural water tables, to returning its fragile desert ecosystems to sustainable health, as well as providing greater water security. Our research into isotopic signatures in ions has some other helpful applications. Desalination has allowed the UAE to reach its rapid levels of growth; water and power authorities in the UAE are always looking for ways to improve desalination systems. One application for our research into isotopic signatures is in tracking the flow and dispersal of brine from the discharge outfalls of desalination plants. By tracking the isotopic signature of the brine outflow, we can help ensure that no portion of the discharge area is oversaturated. The fingerprinting of the brine can show how long it takes for brine to disperse and where it goes, in order to ensure that it adequately mixes with the sea water.

Using these methods and others developed at Masdar, hopefully we can further Sheikh Zayed's vision of conservation and not only in the UAE but in the many parts of the world grappling with water challenges.

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