Ancient system could bring water to dry areas

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Credit: George Hodan/public domain

Some of Africa's dry areas face serious water shortages due to minimal rainfall. An ancient system of drawing water from aquifers, the "qanat system," could help. Gaathier Mahed, an environmental scientist and

expert on the management of groundwater, has studied the feasibility of these systems. He tells us more.

How does the qanat system work?

There are bodies of water underground known as aquifers, some of which can be found at the tops of valleys or near mountains. A qanat system taps these aquifers and, using underground tunnels, moves the water, using gravity, over many kilometers. The tunnel then exits at a lower-lying area.

When the water exits the tunnel, farmers can use it to irrigate their crops. People can also access the water along the stretch of the tunnel using wells.

It's a system that's managed by everyone, and its benefits are shared. Everybody has a vested interest and a role to play. Community bonds can be strengthened—in stark contrast to tensions we see over water resources today.

It's a highly complex communal system to manage. Laws governing the system have existed since the 9th century. These laws relate to the construction and proximity of qanat tunnels to each other. They also govern the exits of the qanats. For instance, land owners at the exits can use the water first and must aid in managing them.

Where did it come from and where is it used?

The qanats have been used for centuries in arid and semi-arid parts of north Africa, the Middle East and Asia, where water supplies are limited. It's known by a variety of names, "foggara" in north Africa, "falaj" in Oman and "qarez" in parts of Asia.

It's thought to have been developed in Persia in the first millennium BC. As the Islamic Empire spread across the Arabian Peninsula, the Levant, north Africa, and parts of Europe from 661 to 750 CE, so did knowledge about qanats.

Today, some of the region's qanat systems, like those in Iran, are protected under heritage status. Some of these qanats, although declining in number, are still used. They are largely protected for historical and cultural reasons.

Why is it not being more widely used?

There are several reasons why the tunnel system is not more widely used in Africa.

Qanats need to be built somewhere with the right geological formations. These generally seem to be fractured sandstones. The level of groundwater is also important for the flow of water in the qanat. The volume of water in the aquifer stems from the rainfall in the mountainous regions.

Qanats can only be built where there's a slope, like a mountain or a valley. And the slope must have a specific angle. If it's too steep, erosion of the qanat will occur and it will collapse. If it's not steep enough the water will not flow fast enough and could become chemically altered due to interaction with minerals in the ground.

The digging of the tunnel and development of the system over large areas of land is labor intensive and can take many years. The qanats cover many kilometers and need to be maintained every year, by cleaning out the silt build-up.

Knowledge of building qanats and maintaining them is being lost. People

have migrated from rural areas to cities and adopted boreholes in certain areas instead.

Some qanats are drying up due to over exploitation of the water resource.

Why should the system be used more widely?

In most instances people in arid areas drill wells to access groundwater. These boreholes have a lifespan and eventually new wells have to be drilled. Pumps and materials don't last forever, and wells can get clogged by microbial organisms and fine material in the subsurface.

First, the qanat is sustainable as it works with gravity and no electricity is needed. It can even be used to create clean energy. For instance, in Iran cold air that comes out of qanat tunnels is used to cool the interior of large buildings.

Second, water lost to evaporation is minimal in comparison to surface water supplies.

Third, it can have a wide scale impact. Qanats are multiple kilometers long and once this water hits a floodplain, it can irrigate multiple hectares of land.

Fourth, it fosters social cohesion. Many people, with different skills, are involved in maintaining the system.

Fifth, the lifespan of the system extends beyond that of a deep water well, which is only about 20 years. Tunnels do not clog as easily as wells.

Finally, the quality of water coming from the mountains is much better than water on the plains. It'll have lower salinity and be better for crops

and people.

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