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Groundwater can prevent drought emergencies in the Horn of Africa. Here's how

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Millions of people in the Horn of Africa lack safe, reliable and affordable water throughout the year. Credit: DAI KUROKAWA/EPA

Millions of people living in the arid regions of the Horn of Africa lack safe, reliable and affordable water throughout the year. This is because of recent decreases in rainfall in the drought-prone Horn of Africa, rising water demands and persistent challenges in maintaining water supplies.

Historically, responses to drought have been reactive. International emergency assistance is dispatched once the emergency happens in a bid to save lives and livelihoods. It then disappears when the immediate crisis dissipates.

This reactive emergency assistance occurs despite the reality that drought in the Horn of Africa is cyclical and increasing.

One way to improve drought resilience is to improve the management of groundwater. Groundwater exists beneath the earth's surface and is stored in aquifers. These are bodies of permeable rock, like gravel or sand. Electrical pumps can be used to retrieve this water, which is then stored and distributed through pipes.

An estimated 400 million people in Africa use groundwater. In the past decades, throughout the Horn of Africa, millions of dollars have been spent on the installation of borehole pumps so people can access groundwater.

However, evidence shows that local communities and regional governments are not yet able to manage the operations, maintenance and service delivery of groundwater. This is because they lack funding and professional capacity—such as maintenance training, asset management tools, supply chains, and financially viable service contracts.

As a result there have been a high number of water point failures. For example, in Kenya about 35% of rural water supplies were broken before the 2016 drought. This increased to over 55% during the drought because of mechanical failures or depleted groundwater.

Research we conducted in Rwanda showed how data and management systems can improve how quickly maintenance providers respond. Using electronic sensors to remotely monitor handpumps over cellular networks, we showed that there could be a 10-times reduction in water system downtime, from 200 days to 20 days.

There are efforts underway to replicate this approach in the region. The idea is that drought-driven humanitarian emergencies can be prevented if groundwater is reliably made available at strategic locations.

Drought resilience through monitoring and action

At the University of Colorado Boulder, we are working to guarantee year-round water services at strategically selected groundwater pumps. To do this, we work with local, regional and national government institutions in Kenya, Ethiopia and Somalia, along with non-profit and multilateral partners—including the Millennium Water Alliance, Development Transformation Global and IRC WASH.

Our approach is called the Drought Resilience Impact Platform. Supported by the United States Agency for International Development, we use satellite and cellular connected sensors to remotely monitor over 3 million people's groundwater pumps.

We currently monitor all of the government designated drought response groundwater pumps in northern Kenya and nearly all motorised boreholes in Afar, Ethiopia. We are now expanding into the Somali Region of Ethiopia.

These boreholes all tap into aquifers, about 100 metres underground. The region has relatively deep aquifers which fluctuate based on natural and human factors. The major driver is rainfall, which influences access to surface water and aquifer recharge.

Sensors, powered with small solar panels, detect when the pumps are operating and transmit this information over cellular and satellite-based networks to the internet. This data is then interpreted with online algorithms and put onto a website. Users are able to access the website to see when pumps are being used and not being used.

We also use satellite-based rainfall estimates to predict if a non-used pump is either broken, or simply not being used because surface water is available.

Our data is being used by local communities, regional governments, and national and international donors to reduce repair intervals. This means communities have more reliable access to water during dry seasons.

In Kenya, the National Drought Management Authority reviews our dashboard weekly and, using the data, works with county governments in northern Kenya to prioritise pump repairs. In Ethiopia, our partners—including DT Global, IRC WASH and mWater—are working with the Afar and Somali regional water bureaus to adopt the use of this data to better manage water systems.

There have been some challenges. This includes reconciling the added cost of these technologies and pump repairs with how governments and donors prioritise new borehole drilling.

Working with the Millennium Water Alliance—a consortium of 14 of the most prominent water and sanitation non-profits—and with governments in Somalia, Ethiopia and Kenya, we hope to expand this network to reach 20 million people over the coming years.

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