

Climate change and food insecurity: Groundwater will be key

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Comment: Hotter and more unpredictable weather makes freshwater ever more vital to survival. Karen Villholth and Alvar Closas explore the problems and solutions for managing this precious resource.

In the arid regions of the Middle East and North Africa, freshwater resources are among the lowest in the world.

In the last 40 years, per capita freshwater resources have decreased by [two thirds](#) and are expected to fall over [50 percent](#) by 2050. Yet population figures, and demand for food, are going in the opposite direction.

Food production currently uses around [85 percent](#) of these dwindling freshwater supplies. As climate change advances, bringing hotter and more unpredictable weather, the need to ensure water and food security in the region is becoming critical.

Groundwater – water supplies found in permeable rocks and sediments underground – has historically been an important water source in the MENA region. In Bahrain, Jordan, Oman and Yemen, groundwater contributes more than 50 percent of total water withdrawals.

Groundwater supplies can serve as a lifeline to those inhabiting dry and arid areas. Traditional communities in the Northern Africa and Middle East region have historically depended strongly on groundwater due to its widespread availability and its reliability, even during drought.

However, quenching the thirst of growing populations and agricultural land with groundwater comes at a price.

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Over-extraction is leaving aquifers (underground water-bearing formations) severely depleted. A vast array of policy measures is in place across the region to attempt to tackle this problem.

Understanding which of these options might be feasible and successful can help decision-makers as they try to tackle the issue of over-extraction. The question the International Water Management Institute (IWMI) has recently asked in a [USAID-funded project](#) is: What is working, and what is not?

Aquifer contracts

Let us take the case of Morocco, host of the 2016 climate talks. Pressure on water resources has been increasing over the last few decades, due to successive droughts and increased water demand. As a result, over-extraction of several of Morocco's aquifers has been occurring at a rate of 248 percent, dramatically reducing groundwater supplies.

In a bid to harmonise use of groundwater by many competing actors, the Moroccan government has set up "[aquifer contracts](#)". These contracts are signed by all parties who extract groundwater; from farmers to water utility companies and local government, and agree on certain guidelines for use.

Community management of groundwater is now coming under threat

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Our analysis has shown that many challenges are still impeding the success of aquifer contracts in Morocco. Lack of reliable data, to determine whether or not over-extraction is taking place, is the first hurdle that needs to be addressed.

Unless this can be collected and shared with those involved, it is difficult to reach consensus on how the aquifer should be managed. Conflicts between small and large farms have also arisen, as they have unequal interests in the aquifer contracts, and unequal power in negotiation.

Encouraging dialogue between stakeholders of all sizes could be one important strategy to manage this.

Community-level management

Faced with declining groundwater tables, some communities in Yemen have responded to the challenge by implementing [local rules](#) that aim to reduce conflict and provide more reliable and equitable access to water. This continues a rich history of community-managed water systems across the Middle East and North Africa as a whole.

Farmer groups and villagers have begun to regulate groundwater abstraction by, for instance, limiting the depth and number of wells that can be drilled and prohibiting well development in sensitive areas.

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These local initiatives arise in part, due to the fact that formal rules aiming to control and reduce groundwater abstraction are not effectively implemented and enforced. The reach and success of these community experiences is however quite different in different local areas.

But community management of groundwater is now coming under threat. The spread of motorised groundwater pumping for irrigation is eroding traditional management systems, and the generational gap between older farmers and those that will take over the farms represents a risk that current practices will not be upheld.

Influence is also shifting towards rich farmers who have made large land purchases in recent years. Controlling large users, for example by using joint [smart water metering](#), ensuring that all farmers are subjected to the same, just systems of monitoring and control, is a solution that is now under consideration.

Recharging groundwater supplies

Another key strategy is to increase and manage the replenishment of aquifers with other sources of water, in addition to rainwater. This can serve as a way to store excess runoff, which otherwise could turn into flooding, or as intermediate storage of treated wastewater that can later be used for agriculture and industry.

Tunisia has been using this technique of "managed aquifer recharge" since the 1970s as a measure to improve groundwater quality and quantity. Now, wastewater in Tunisia actually represents around 30 percent of the country's agricultural water supply, directly or via aquifer recharge.

This has helped recover aquifer levels as well as preventing coastal aquifers from becoming saline by intruding seawater – a side effect of groundwater over-abstraction.

“ **Management of this precious resource must remain at the forefront of discussions on tackling climate change and food insecurity** ”

Our analysis has uncovered a range of lessons to be learnt, to bring effective groundwater management to the Middle East and North Africa.

The first is the need to encourage dialogue between those parties using the groundwater. In many cases, power imbalances need to be managed, which can only be achieved through formal discussions, to understand the diverse needs of all involved.

In particular, smaller farmer organisations need to be strengthened, to ensure they can challenge the arguments of larger users.

In addition to this, building trust and co-operation between various levels of government involved in groundwater management, at the local, national, and even international level will improve the ability to enforce policies that have been put in place.

Yet it is important to note that buy-in from farmers will be critical to successful policy implementation. Holding training programs with all levels of farmer groups can contribute to success.

Finally, rolling out appropriate technology, that will collect robust data on the status of groundwater supplies and use, will form the basis of effective management and legitimise regulations put in place.

Satellite imagery for example, is already being employed across the region for this purpose, but needs considerable political backing and funding to fulfil its potential role.

Management of this precious resource must remain at the forefront of discussions on tackling climate change and food insecurity in the MENA region. Groundwater can be a key ally in this fight, and prioritising its effective use will allow the region to thrive, even in times of climate uncertainty.

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