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Water Conflict and Cooperation in Yemen

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Yemen is one of the oldest irrigation civilizations in the world. For millennia, farmers have practiced sustainable agriculture using available water and land. Through a myriad of mountain terraces, elaborate water harvesting techniques and community-managed flood and spring irrigation systems, the country has been able to support a relatively large population. Until recently, that is. Yemen is now facing a water crisis unprecedented in its history.

The Middle East is an arid, water-stressed region, but Yemen stands out for the scale of its water problem. Yemen is one of the world's ten most water-scarce countries. In many of its mountainous areas, the available drinking water, usually drawn from a spring or a cistern, is down to less than one quart per person per day. Its aquifers are being mined at such a rate that groundwater levels have been falling by 10 to 20 feet annually, threatening agriculture and leaving major cities without adequate safe drinking water. Sanaa could be the first capital city in the world to run dry. Even today, many wells have to be drilled to depths of 2,600 to 3,900 feet, extremely deep by world standards. Yemen also differs from several Arabian Peninsula countries in that the government lacks legitimacy and the people strongly resist regulations and laws imposed from the top down. For these reasons, the Ministry of Water and Environment, supported by international donors including Germany through the German Technical Cooperation, have adopted a strategy of decentralized water resource management by encouraging stakeholder and community participation. Provinces, water basins and villages have acted to conserve local supplies of the life-giving liquid, but it is uncertain how long these efforts can stave off disaster.

Race to the Bottom

Agriculture takes the lion's share of Yemen's water resources, sucking up almost 90 percent. Until the early 1970s, traditional practices ensured a balance between supply and demand. Then the introduction of deep tube wells led to a drastic expansion of land under cultivation. In the period from 1970 to 2004, the irrigated area increased tenfold, from 37,000 to 407,000 hectares, 40 percent of which was supplied by deep groundwater aquifers. The thousands of Yemenis

working abroad often invested their remittances in irrigation. Other incentives to expand farmland came in the form of agricultural and fuel subsidies. Farmers began growing less of the local, drought-resistant varieties of wheat and more water-intensive cash crops such as citrus and bananas.

The emerging cash economy also led to a dramatic increase in the cultivation of *qat* -- the mild stimulant whose leaves are chewed in Yemen. It is estimated that *qat* production now accounts for 37 percent of all water used in irrigation. In the water-stressed highland basins of Sanaa, Sa‘da, ‘Amran and Dhammar, *qat* fields now occupy half of the total irrigated area. Groundwater levels in these highlands have fallen so precipitously that only the lucrative returns from *qat* justify the cost of operating and maintaining a well.

Qat is a major factor in the national economy, with about 15 percent of the population directly or indirectly benefiting from its production, transport and trade. One third of the agricultural gross domestic product and 6 percent of the overall GDP come from the plant, which also composes 10 percent of family expenditures. For these reasons, and because Yemenis enjoy chewing it, *qat* is a very politically sensitive topic. Even though cultural norms give priority to drinking and other household water needs, the importance of *qat* and other cash crops to the economy means that cities, in particular, often lose out to agriculture in the competition for resources.

Qat is grown as well in the Sanaa basin, where the capital is located and 10 percent of the Yemeni population lives. A total of 13,500 wells have been inventoried in the basin. The vast majority of them serve farmers, but the water is disappearing. In the mid-1990s, extraction in the catchment area exceeded recharge from rainfall by over 400 percent. Available data give the Sanaa aquifer two decades of life, after which irrigated agriculture in the basin will end.

One third of the 125 wells operated by the state-owned Sanaa Local Corporation for Water Supply and Sanitation for supply of the capital have been drilled down to 2,600 to 3,900 feet. The combined output of all these wells barely meets 35 percent of the growing city’s need. The rest is supplied either by small, privately owned networks or by hundreds of mobile tankers. In recent years, as water quality has deteriorated, privately owned kiosks that use reverse osmosis - a water filtration method -- to purify poor-quality groundwater supplies have mushroomed in Sanaa and other towns.

Future supply options include pumping desalinated water from the Red Sea over a distance of 155 miles, over 9,000-foot mountains into the capital, itself located at an altitude of 7,226 feet. The enormous pumping cost would push the price of water up to \$10 per cubic meter (roughly 35 cubic feet). Yemen may be willing to pay this price for household demand. For agricultural water, however, the elevated cost is out of the question since the quantity required per capita is at least one hundred times greater. Other options to supply Sanaa from adjacent regions are fraught due to perceived water rights. Islam teaches that water is a gift from God and cannot be owned. Land, however, can. When a person digs or drills a well on his own land, he obtains the right to extract and use as much water as he can draw. The increasing awareness of the country’s water scarcity has resulted in a race to the bottom -- every man for himself. Well owners are trying to capture what remains of this valuable resource before the neighbors do.

Top-Down Conservation

Today, there are between 45,000 and 70,000 wells in Yemen, the majority of which are under private control. No one can be certain of the exact number, as almost all were drilled without license.

Only since 2002, when the national water law was promulgated, has it been mandatory to apply for a permit to drill a new well, or even deepen or repair an existing one. Efforts to register wells that were drilled before the legislation came into effect have been unsuccessful. Farmers are suspicious that registration will gradually lead the state to metering how much water they extract. Moreover, they are alarmed at the prospect that extraction rights might eventually be defined by the amount of land they own and historically cultivate. A farmer who has several wells on a small plot of land would have less extensive water rights than one with no wells on a larger plot.

2003 saw the establishment of the Ministry of Water and Environment, which was vested with a mandate to supervise resource management, as well as rural and urban water supply and sanitation. But responsibility for the biggest water consumer -- agriculture -- has remained with the Ministry of Agriculture and Irrigation, whose focus has largely been on irrigation efficiency, dams and watershed management. The rate of consumption itself remains unaddressed in the agricultural sector. In February 2007, a draft law was proposed that would, among other things, ban new *qat* cultivation in the fertile highland plains. Parliamentary debate has been delayed indefinitely, however.

A major step forward was the adoption of a National Water Sector Strategy and Investment Program in 2005. The strategy strongly emphasizes decentralized water management. It transfers a certain degree of authority to local level entities, such as water user associations and basin committees, especially with respect to the formulation and implementation of local action plans. One important result has been closer cooperation between the Ministries of Water and Agriculture. Through the process of joint annual review, these ministries and their agencies evaluate progress. While the building of dams and improvement of irrigation systems remains in the hands of the Ministry of Agriculture and Irrigation, the ministry is now required to conduct an impact assessment to prevent any further skewing of the country's water balance and ensure local participation from the beginning.

‘Amran

The ‘Amran basin is located 30 miles north of Sanaa at an altitude of 6,560 feet. In 2008, the province established the ‘Amran Basin Committee, headed by the governor, to regulate water use. Other members include the directors of the districts that make up the basin, representatives of ministries and authorities concerned with water and agriculture, the local police chief and, importantly, farmers and local interest groups. Meetings are held every two months to discuss water-related issues and consider new applications for drilling wells.

Dwindling water resources are cause for alarm among both basin committee members and area farmers. Over 2,600 pumps now tap the catchment's meager groundwater deposits. As a result, wells are being drilled to prohibitive depths, as low as 1,200 feet in places. Between 1991 and 2005, most wells had to be deepened by an average of 295 feet. At the same time, well yield -- the quantity of water obtained per second -- has plummeted. The period between 1991 and 2005 saw the number of wells increase by 120 percent, while the water supply rose by only 26 percent.

Villagers, increasingly aware of the need for collective action, are angered by the discovery that over 100 new wells were drilled in 2009, almost all of them without a permit. The arrival of a drilling rig sows tension between the farmer and the villagers, who raise their concerns with the basin committee. Bakr ‘Ali Bakr, the deputy governor and tribesman who handles the day-to-day operations of the committee, has been a key negotiator defusing water crises in the ‘Amran basin.

Perched on the crest of an inactive volcanic cone is the village of Bani Maymoun. It belongs to the district of Iyal Surayh, home to the Bakil tribe and the watershed between the Sanaa and 'Amran water basins. The predominantly volcanic soil is ideal for growing high-value *qat*, cultivation of which has boomed. Bulldozers can often be seen leveling slopes for new fields, while truckload after truckload of additional soil is then hauled from afar to fill in the reclaimed terraces. With the unpredictable rainfall often not exceeding six inches per year, irrigation water has to be transported over rough tracks by Mercedes tankers. The result has been new water markets just for the cultivation of *qat*. Early in 2007, the price increase for irrigation water sparked a conflict that tested the community. Well owners from the village were starting to charge 5,000 riyals (\$25) for a one-hour share of irrigation water. Up to that point, the commonly accepted rate paid by farmers with no well of their own had been just half that -- 2,500 riyals. The well owners, however, argued that new demand from water tankers cueing up at their wells justified the increase. They had become water traders adjusting to emerging markets.

The dispute soon reached the ears of Bakr 'Ali Bakr. He called the tribal elders, who summoned the village men to reach a tribal consensus. It was agreed that well owners from the community were no longer allowed to fill up tankers for *qat* fields outside their immediate territory. Also, the price for a one-hour share was fixed at its previous level. "Such regulations reached by consensus are usually honored by all community members," said Bakr. "Later, when one of the well owners tried to breach the decision, men from Bani Maymoun just aimed a couple of bullets at the tires of the water tanker. That put an end to the water business."

Bottom-Up Conservation

Bani Maymoun is small and homogeneous, and in its case a verbal agreement on groundwater trade sufficed. In other conflicts over water resources, tribal communities increasingly resort to a written consensus-based form of regulation, known in Arabic as a *marqoum*. Hijrat al-Muntasir, a village located at an altitude of 9,842 feet at the western watershed of the 'Amran basin, is one such place where drilling imperiled vital drinking water resources.

The drilling rig was blocking the narrow mountain track when I visited Hijrat al-Muntasir in 2007. *Qat* farmers had gathered around the heavy equipment as if to protect it. On the escarpment above, more than 50 tribesmen had positioned themselves, several with AK-47 machine guns. It appeared as if both groups had been awaiting our arrival. The tension eased, and some of the tribesmen climbed down from the ridge to make their views heard. The *qat* farmers, desperate after yet another of their wells had run dry, were about to drill deep into the limestone. The villagers of Hijrat al-Muntasir feared that more groundwater extraction would wipe out their small spring, the sole drinking water source for the 700 inhabitants. They had mobilized their men to prevent the drilling. They accused the *qat* farmers and the rig owner of lacking a valid permit.

A short but bumpy drive took us to the village. Women and children with dozens of empty water containers lined the route to the nearby spring, displaying an impressive array of protest banners prepared by the schoolchildren. "We hold you responsible for our future," one of them read in Arabic.

A quick survey revealed the gravity of the situation. The water from the spring was carefully rationed. Salih al-Muntasiri, a village elder, brought out the document that listed the water allotments for each family -- roughly ten quarts per person per day. Each quantity taken from the roofed cistern fed by trickle from the mountain spring was meticulously recorded and monitored by 'Ali, the gatekeeper of the cistern.

Trouble for the *qat* irrigators had started when the people of al-Qarin, a village nearby, banned the sale and trade of groundwater from their local wells to outsiders. A *marqoum*, signed by the village elders, was written to regulate the details of this social contract. Groundwater levels around al-Qarin had fallen

noticeably over the previous years, sparking fears about the future. At the same time, influential families from the village had been drilling new wells and were selling water to tanker owners who would then take it to new qat farms in other areas -- including the fields near Hijrat al-Muntasir. As the ban came into effect, the qat farmers decided to give drilling one more try. On hearing the news, the men of Hijrat al-Muntasir sent a delegation to Bakr ‘Ali Bakr.

After several weeks of negotiations, both parties finally agreed to accept the outcome and recommendations of a government technical study. The various parties to the dispute met several times at the site of the drilling rig. Gradually, the focus of their discussions shifted from technicalities to sustainable management of the village’s water resources.

In the spring of 2009, I was invited back for the inauguration of a small village project. It was the first visit for the vice governor and other dignitaries. Hijrat al-Muntasir had slaughtered two oxen for the occasion. Banners leading up to the village welcomed the guests. There was good news -- the drilling had been stopped. In addition, each household had built a cesspit to improve overall sanitary conditions. Community organizers working for the Social Fund for Development had paid the village a few visits, teaching the benefits of better hygiene.

But there was also bad news. As ‘Ali, the gatekeeper, unlocked the screechy iron access gate to the cistern, a number of village women came rushing down a steep path, each carrying a number of empty bright yellow containers. “No water today -- go back home!” shouted ‘Ali. “Tomorrow morning, inshallah.” The daily flow of the spring had been reduced to a trickle -- from ten to just five quarts per person per day. Whether the reduction was due to a temporary lack of rainfall or to permanent climate change, no one can say. “One thing is certain, however,” said Salih al-Muntasiri. “Without your support in preventing the drilling two years ago, we would blame the slow drying-up of our spring on the *qat* farmers. There would be trouble and strife and God knows what.”

Which Scarcity?

Communities such as Hijrat al-Muntasir are coping admirably with their diminishing spring. In social science terms, they retain a strong adaptive capacity, defined as the sum of social resources available to counter an increasing natural resource scarcity.

Social scientists now make a clear distinction between “first-order” scarcity of a natural resource and “second-order” scarcity of adaptive capacity. The latter, according to Tony Allan of the University of London, one of the world’s leading water experts, is much more determinant of outcomes. Developing coping mechanisms at the community level is a step in the right direction.

Coping mechanisms will not be enough to solve Yemen’s water crisis, however. The structural problems -- among them, the draining of aquifers to irrigate fields of cash crops like *qat* -- must be addressed. As has been stressed by Christopher Ward, a long-time analyst of water issues in Yemen, “a decentralization and the partnership approach can only be viewed as elements of a damage limitation exercise aimed at slowing down the rate of resource depletion, to allow Yemen time to develop patterns of economic activity less dependent on water mining.” In other words, Yemen needs to demonstrate adaptive capacity at the national level. A national debate on water is planned for late 2010, involving the president as well as other top opinion and decision makers. This conference will be a crucial test of political will: The Yemeni political class will need to place a high priority on the development of viable alternatives to agriculture in order to prevent the country from slipping into Malthusian catastrophe.

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