

China faces up to groundwater crisis

Researchers call for effective monitoring and management of water resources.

A crisis is developing beneath China's thirsty farms and cities, but no one knows its full extent. With about 20% of the world's population but only about 5–7% of global freshwater resources, China draws heavily on groundwater. Those reserves are being depleted at an alarming rate in some regions and are badly polluted in many others, warned experts last week at the International Groundwater Forum 2010 conference in Beijing.

The scientists also warned that confronting the crisis will require dealing with other shortages: of knowledge and regulation. They say that a nationwide network to monitor groundwater levels is urgently needed, and that the government should improve data sharing, cut water waste and help farming become more efficient. "The water crisis is not unique to China," says Frank Schwartz, a hydrologist at Ohio State University in Columbus, who was at the meeting. "But the problem here is orders of magnitude bigger than anywhere else."

Groundwater is used to irrigate more than 40% of China's farmland, and for about 70% of the drinking water in the dry northern and north-western regions. According to *Opportunities and Challenges in the Chinese Groundwater Science*, a 2009 report sponsored by China's National Natural Science Foundation and China Geological Survey (CGS), part of the Ministry of Land and Resources (MOLR), the past few decades have seen groundwater extraction increasing by about 2.5 billion cubic metres per year to meet these needs. Consequently, groundwater levels of the arid North China Plain have dropped as fast as 1 metre a year between 1974 and 2000, forcing people to dig hundreds of metres to access fresh water, according to research presented by Bridget Scanlon, a hydrogeologist at the University of Texas at Austin.

Already, water is scarce for two-thirds of China's 660 cities, according to a survey by the Ministry of Water Resources (MOWR). And as China's economy expands, so will its demand for water. The country will consume 750 billion cubic metres of water a year by 2030, about 90% of the total amount of usable water resources in the country, projects the MOWR.

Pollution is also putting the system under pressure. In southern and southeastern China, which have seen rapid economic development, groundwater is now laden with heavy metals and other pollutants. A CGS survey presented at the conference shows that 90% of groundwater is polluted, 60% of it seriously so.



Groundwater is an essential source of irrigation for much of China's arid land.

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The government hopes that a massive system of canals and pipes, to funnel 45 billion cubic metres of water a year from China's moist south to its arid north, will alleviate groundwater depletion once it is completed in 2050. The government also plans to reduce groundwater use in Tianjin municipality, Beijing and Hebei province to 65% of current levels by 2023, says Li Guomin, a hydrogeologist at the Chinese Academy of Science's Institute of Geology and Geophysics in Beijing. Li and his colleagues presented a simulation of the effect of this policy and say that it could boost groundwater levels. But the team assumed that groundwater use will not increase as more surface water becomes available, an assumption that was debated at the meeting. "As new resources become available, people will just use it more," argues Schwartz.

Network need

Efforts to understand the scale of the problem are often stymied by the lack of a national water-monitoring network, researchers say, and even when data exist, researchers are often unable to get hold of them. Groundwater and surface water are managed separately, by the MOLR and the MOWR respectively. This can lead to poor communication, and means that water is sometimes counted twice — when it flows underground, and again when it reaches the surface — inflating estimates of the size of the resource.

A more holistic approach "could provide a baseline to assess the impact of climate change and human activities on water resources", says Zheng Chunmiao, a hydrologist with a joint position at Peking University and the University

of Alabama in Tuscaloosa, who chaired the Beijing meeting. The central government has earmarked about 1.8 billion renminbi (US\$265 million) to set up a groundwater observation network to take measurements from tens of thousands of wells across the country. However, after years of ministry infighting, the project has still not been fully rolled out.

The network could also help to pin down the causes of freshwater depletion across the country. Climate change is often blamed, for example. But a team led by Gao Zhanyi, of the Beijing-based Institute of Water Resources and Hydro-power Research, found that climate contributed only about 10–30% of the water-table depletion in three regions of China. The majority of the depletion was down to poor practice: "There is much room for improvement in terms of more effective water management," says Gao.

Arguably, the biggest improvement could come in the agriculture sector, which already uses 70% of the country's fresh water. To boost grain production, for example, China has a double-cropping system of growing wheat in winter and maize in summer. But because there is very little precipitation on the North China Plain in winter, this draws deeply on groundwater supplies. "China may want to rethink its food-security issues because the current strategy is completely unsustainable," says Scanlon. The country could import grain, and synchronize crop production with the climate by ending the cultivation of winter wheat and growing maize for more of the year, she says. "If we continue the current path of economic development, we will hit the wall very soon." ■

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