The Looming Global Water Crisis: An Update
By Angelo Katsoras

Introduction

In a January 2020 report titled “The world’s looming water crisis,” we argued that the world’s water reserves were being squeezed at both the demand and the supply ends of the curve. This meant that many countries would eventually be forced to raise water prices in order to moderate demand and face the reality that their water reserves were nowhere near sufficient to attain many of their long-term economic objectives. Among other things, this would force certain countries to choose between focusing more on industry or on agriculture.

In this follow-up report, we examine how recent developments strengthen our original findings. There will be a particular focus on four countries—China, India, Brazil and the United States—and on two sectors—agriculture and mining.

United States: Water scarcity worsening in southwest

While the United States is much better positioned than many other countries when it comes to water scarcity, it still faces serious challenges in certain regions. The American southwest, which has endured years of lighter-than-usual rain and dry winters, is the most prominent example. The situation even forced the Bureau of Reclamation to recently declare the first-ever water shortage for the Colorado River, which serves 40 million people.

It also caused many of the reservoirs in the southwest to drop to below half their holding capacities. Lake Mead, the nation’s largest reservoir, is in particularly dire straits. Its water level has fallen from 1,229 feet in 2000 to 1,069 feet today (35% capacity),1 the lowest point since it was first filled in the 1930s.

Lake Mead’s troubles also put at risk hydroelectric power used by about 1.3 million people across California, Nevada and Arizona. Although the hydraulic turbines can operate until the reservoir’s water level falls to 950 feet, the more that the water level drops, the less pressure there is to drive the turbines.

Source: “Reservoirs are drying up as consequences of the Western drought worsen,” Washington Post, July 9, 2021

1 Severe Drought Could Threaten Power Supply in West for Years to Come,” Wall Street Journal, August 14, 2021
As goes California’s agriculture sector, so goes America’s food prices

California’s $50-billion agricultural sector supplies two thirds of the country’s fruits and nuts and more than one third of its vegetables. It also accounts for about 20% of the nation’s milk supply. This arid region was able to develop into an agricultural powerhouse thanks to extensive irrigation. Agriculture accounts for about 80% of all the water used in California.

In 2020, thousands of California farmers were allocated only 20% of the water they were originally supposed to receive from Lake Mead. This year, the percentage for many of them plunged to near zero. These farmers were forced to either abandon production or purchase water on the private market at approximately four times the price typically charged by the federal government.

Not surprisingly, the Nasdaq Veles California Water Index, which represents the weighted average price of water-right transactions across five major markets in California, has risen significantly. The unit of measure represents the dollar amount of water needed to cover one acre of land in one foot of water, the equivalent of about 325,851 gallons.

Is the water bill for China’s economic growth finally coming due?

China’s economic growth trajectory has come at the expense of its limited water resources. The country accounts for 20% of the world’s population but holds only 7% of its freshwater reserves.

This problem has been exacerbated by China’s artificially low water prices (see page 8), which encourages over-consumption. In a recent report, Barclays estimated that about 50% of China’s industrial output and 40% of its water-intensive agriculture products are produced in 11 of its most arid regions.

We feel that ever tighter water reserves will ultimately force China—already the world’s largest importer of food—to increase food imports even more. In 2020, these totalled $157.8 billion, up from $133.1 billion in 2019.

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3 “The Future of Water Is Recycled Sewage, And We’ll All Be Drinking It,” Bloomberg, May 19, 2021
4 California Department of Water Resources, 2021
5 “Drought Imperils Economy in California’s Farm Country,” Wall Street Journal, May 21, 2021
6 “Water: The ‘True Cost,’” Barclays, June 1, 2021
These demand and supply pressures have left China’s agriculture sector overly vulnerable to unexpected shocks. This has been proven by recent events, such as the African swine flu, COVID-19, floods in the south, droughts in the north, and electricity shortages.

**India’s increasingly unsustainable water consumption**

India has even less readily available water reserves than China does. India has 16% of the world’s population but holds only 4% of its available freshwater resources.7 Agriculture alone accounts for more than 80% of its demand for water.8

While India is currently self-sufficient in most types of food production, many analysts worry this independence is built on an unstable foundation of cheap water prices, which encourages over-consumption.

Despite India’s limited supply of water, its citizens pay among the lowest water prices in the world (see page 8). This is particularly the case for farmers, who also benefit from free or heavily subsidized electricity to pump groundwater. The World Bank estimates that groundwater accounts for "about 85% of domestic water supply in rural areas, 45% in urban areas, and over 60% of irrigated agriculture."9

Experts warn that this combination of cheap water and electricity prices could soon threaten India’s ability to produce food. UNSECO estimates that groundwater levels have already declined 61% from 2007 to 2017.10 Another study published in the journal *Science Advances* warned that, at the current pace, declining groundwater levels could decrease harvests 20% on average nationwide and 68% in the most severely impacted regions by as early as 2025.11

We feel that similar to China, India will ultimately have little choice but to increase water prices in order to encourage more efficient practices that include utilizing irrigation systems, switching to less water-intensive crops, and increasing food imports.

More efficient water usage will become all the more crucial as demand rises the more people get connected to water networks. Currently, only 43% of rural households in India, which account for 65% of its total population, have water connections. This is nevertheless up from only 17% in 2019.12 Growing demand for water will also necessitate an upgrade in sewage treatment capacity. According to government figures, less than half the sewage in urban areas is treated.13

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7 World Bank, 2021
8 “India’s water crisis is already here. Climate change will compound it,” MIT Review, April 24, 2019
9 "Addressing groundwater depletion: Lessons from India, the world’s largest user of groundwater,” World Bank, August 23, 2021
10 "The ancient stepwells helping to curb India’s water crisis,” BBC, October 12, 2021
11 "Groundwater depletion will reduce cropping intensity in India,” Science Advances, 2021, and “India’s groundwater crisis threatens food security for hundreds of millions, study says,” CNN, February 24, 2021
12 “For Narendra Modi’s re-election prospects, clean water in India is liquid gold,” South China Morning Post, October 11, 2021
Brazil’s drought endangers global food production

Brazil is among the world’s leading food producers. It accounts for four fifths of the world’s orange-juice exports, half of its sugar exports, one third of coffee exports, and one third of the soy and corn used to feed the world’s livestock.\textsuperscript{14}

Unfortunately, Brazil has recently been hit by one of the worst droughts in almost a century. In October, the country’s water reservoirs had fallen 25% below their five-year average.\textsuperscript{15} This has hurt crop yields and contributed to the global rise in the price of certain agricultural commodities. It also weakened Brazil’s ability to generate hydroelectricity, which typically covers about 65% of its power needs.

Many people wonder how a country with the world’s most freshwater resources could be experiencing a shortage. One reason, as the map below illustrates, is that much of its water is located in Amazonia, the northwestern part of the country, far away from the agriculture producing regions and major cities located in the southeast. Another reason is the lack of water-related infrastructure: 100 million of Brazil’s 212 million people are presently not connected to sewage systems.\textsuperscript{16}

Some environmentalists claim the recent drought is being exacerbated by deforestation in the Amazon, which last year surged to its highest level in more than a decade. They claim that the more rainforests are cut, the less they are able to play their crucial role of recycling vast quantities of rainwater to the atmosphere.\textsuperscript{17}

\textsuperscript{14} Climate Change in Brazil: Fire, Frost, Drought Upends Global Markets,” Bloomberg, September 28, 2021
\textsuperscript{15} “What is behind soaring energy prices and what happens next?” International Energy Agency, October 12, 2021
\textsuperscript{16} “Brazil government privatizes Rio’s water treatment for $4 billion,” Deutsche Welle, May 1, 2021
\textsuperscript{17} “The Amazon’s Little Tipping Points,” Reuters, October 21, 2021
Transitioning to green energy means a surge in mineral demand

The World Bank projects that demand for minerals, such as graphite, lithium and cobalt, could increase nearly 500% by 2050 to reach net-zero emissions by 2050.\(^\text{18}\) This transition to a green economy includes a surge in demand for copper. Goldman Sachs has estimated that an electric vehicle contains five times as much copper (60–83kg) as does a car with an internal combustion engine, while a 3-megawatt wind turbine includes up to 4.7 tonnes of copper.\(^\text{19}\)

In all, the typical electric car requires six times as many minerals to build as does a combustion-engine car and an onshore wind plant requires nine times as many resources to build as does a gas-fired plant.

The rapid deployment of these technologies as part of energy transitions implies a significant increase in demand for minerals

The water required to extract these minerals another challenge

Mining is a particularly water-intensive process. Extracting lithium from South America’s Lithium Triangle—a region that covers parts of Argentina, Bolivia and Chile—involves pumping large amounts of water underground and pushing up a salty mud known as brine, which contains lithium. The brine is left in large pools until the water evaporates. After 12 to 18 months, the process is complete and lithium carbonate can be extracted and processed.\(^\text{20}\)

Copper mining involves crushing copper-rich rocks to dust and mixing it with water to be transported through giant pipes. The liquid is then further mixed with chemicals to separate the copper from other mineral residue.\(^\text{21}\)

The water intensity of the mining sector is further complicated by the fact that approximately 50% of today’s lithium and copper production is concentrated in areas with high water-stress levels.\(^\text{22}\)

\(^{18}\) "Mineral Production to Soar as Demand for Clean Energy Increases," World Bank, May 2020
\(^{19}\) "Copper boom: how clean energy is driving a commodities supercycle," Financial Times, June 7, 2021
\(^{21}\) "Saving the Planet With Electric Cars Means Strangling This Desert," Bloomberg, June 11, 2019
One solution being increasingly adopted to alleviate growing water stress, particularly in Chile, is desalination. It is important to note, however, that this necessary measure adds significantly to operating costs.
The underpricing of water

Solutions do exist to tackle some of the world’s water challenges. These include recycling wastewater, desalination, and using drip irrigation in agriculture to deliver just the right amount of water to crops.

The bad news is that these fixes are expensive and must contend with the fact that water is significantly under-priced in many countries. On the demand side, this means consumers often have little incentive to conserve water. On the supply side, investors have little incentive to lay pipes and build treatment plants. Also, low prices encourage production of water-intensive products in water-scarce regions.

For example, the following charts illustrate that, despite their relatively scarce water resources, China and India have among the world’s cheapest water prices.

Lowest prices of tap water in selected cities worldwide in 2021* (in U.S. dollars per cubic meter)

Most expensive prices of tap water in selected cities worldwide in 2021* (in U.S. dollars per cubic meter)
Conclusion

Since importing water from overseas is not viable from an economic or logistical perspective, once a region’s water use exceeds its natural rate of replenishment, the best solution is to reduce water consumption to more sustainable levels by increasing its price and/or importing more water-intensive products from abroad. This, among other things, will force countries such as India and China to choose between focusing more on industry or on agriculture. (For the amount of water required to produce various goods please refer to our January 2020 report titled “The world's looming water crisis.”)

Given that higher water prices could trigger significant political backlash, we can expect some countries to introduce measures to financially cushion the blow. It will be politically tempting also to impose even sharper price increases on foreign companies. Meanwhile, the growing scarcity of water in certain farming regions of Brazil and the United States will likely lead to higher water prices to both encourage greater efficiency and pay for much needed upgrades to water-related infrastructure. Similarly, water scarcity in many of the world’s mining regions will force an increase in water-related costs.

Food prices

Higher water prices will add to the inflationary pressures already impacting the food sector, which include the rising cost of transportation, labour, energy, and fertilizers. (Brazil, for example, relies on imports for 80% of its fertilizer requirements.23)

The impact of rising food prices will be felt particularly in the developing world. Food accounts for 30% of household spending in India compared with only 10% in the United States.24

World: Food prices have surged
UN World Food and Agriculture Price Index (as of November 16, 2021)

23 “For Brazil, a Bad Year Could Get Worse,” Geopolitical Futures, October 20, 2021
24 “Food prices are soaring and could deliver the next disaster to the developing world,” The Globe & Mail, May 14, 2021
General

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