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Southern Water for North China: Is Water Conveyance Infrastructure a Long-Term Solution to Water Stress?

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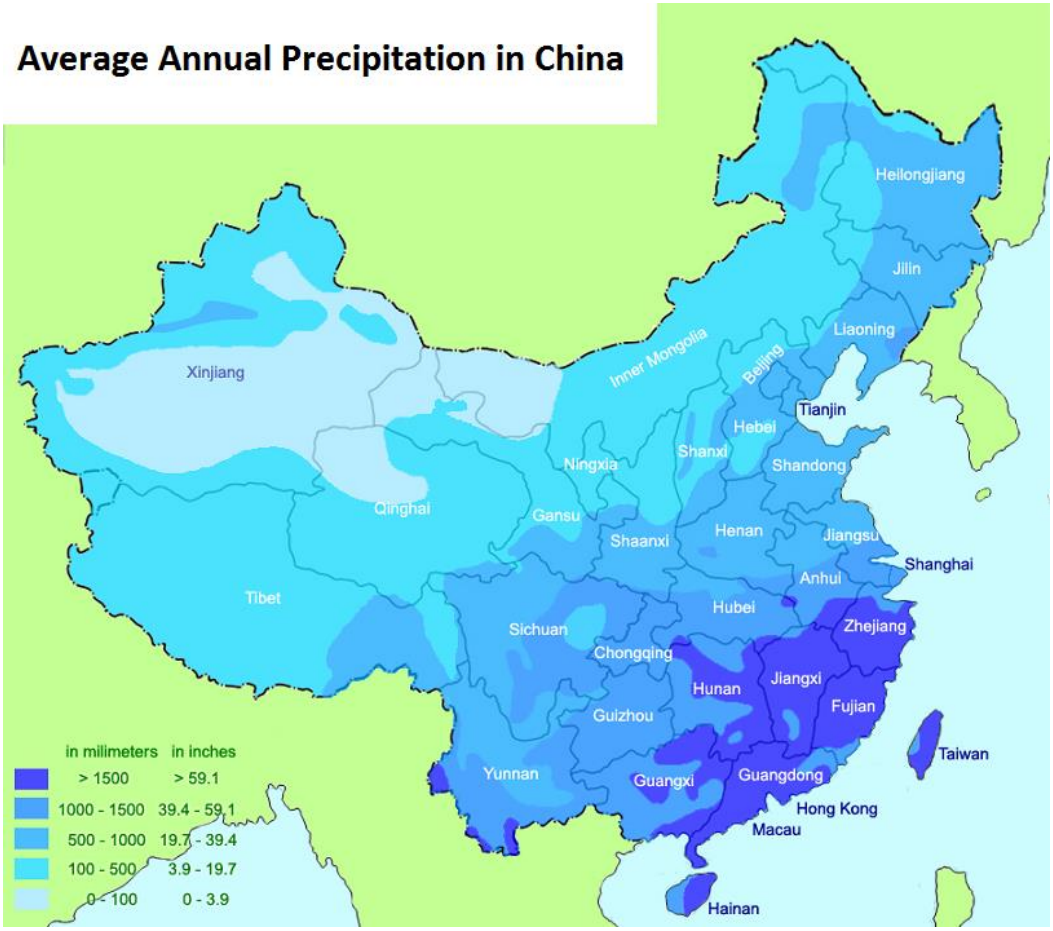
Key Points

- The planning, construction and operation of grand infrastructure projects is a key component of the Chinese Communist Party's legitimacy.
- Canals that shift water from the south of the country to the drier north, are the most recent examples of those grand infrastructure projects.
- While the transfer of water from the south to the north has relieved some of the pressure on ground and surface water sources, it is not a long-term solution to water stress in China.
- A greater focus on demand-side reform, including the introduction of water-conserving measures in agriculture and industry, will result in a larger reduction in the level of water stress.

Summary

The north of China has considerably less water than the south. That is a problem, as the majority of the Chinese population resides in the north and most of its productive farmland is also located in that region. A solution to the imbalance was proposed in the 1950s. It involved the construction of a series of three canals that would transfer water from the Yangtze River in the south, to the Yellow River in the north. Two of the canals are operational and, while they have reduced the north's dependence on ground and surface water sources, they will not be a long-term solution to water scarcity.

Analysis



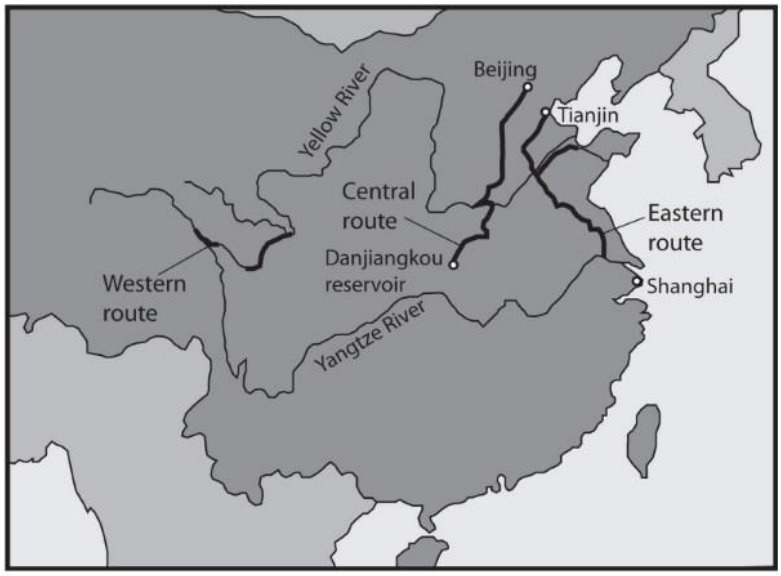
On a country-wide scale, China has an adequate supply of water. Those water resources are not uniformly distributed throughout the country, however, with four-fifths of the supply located in the south. This imbalance of water resources leaves some parts of the country with high levels of water stress. It also limits agricultural expansion, as the most productive farmland is predominantly located in the north. Most of the country's water is located in the Yangtze River basin, which is generally too mountainous for the kind of large-scale agriculture that is required to feed the Chinese population.

Urbanisation, population growth and widespread pollution in the north-east, have further heightened the disparity between the north and the south. Another two million people are expected to be added to the population of Beijing before the government caps the population at 23 million in 2020. The heavy-handed expulsion of tens of thousands of migrant workers from Beijing is possibly partly explained by the desire to reduce the strain on water reserves. To relieve some of the population pressure on the city, President Xi Jinping announced plans to build a new city about 100 kilometres to the south-west, but, as the new city is likely to draw water from the same source, it is questionable whether it will reduce water stress in Beijing itself.

The South-North Water Diversion Project

Some of the oldest national myths in China relate to the manipulation and control of water. Throughout Chinese history, the mastery of water resources has been linked to political power. As Philip Ball explains in his book *The Water Kingdom*, early political dynasties believed that a ruler who failed to manage water supplies, risked social decay and possibly the accusation that they had lost the heavenly mandate to rule. In the modern era, Communist Party leaders, including Mao Zedong, Hu Jintao and now Xi Jinping, have staked part of their legitimacy to rule on the manipulation of water resources.

Since the 1980s, projects that involve the transfer of water over long distances to dry northern cities have become increasingly common. The South-North Water Diversion (SNWD) project is the latest in a litany of grand infrastructure schemes intended to demonstrate the power of the Chinese state over nature.



The three routes of the South-North Water Diversion project

The initial idea for the project was introduced by Mao Zedong in 1952. Mao observed that 'the south has plenty of water and the north lacks it, so, if possible, why not borrow some?' Once completed, the three canal routes will divert 45 cubic kilometres of water annually from the Yangtze to the Yellow River.

Beijing sources 70 per cent of its water from the SNWD project. Prior to the construction of the canal, it obtained the majority of its water from aquifers below the city. After years of increased pumping, however, the aquifers were close to depletion and the ground under the city began to subside. After the SNWD came into operation, per capita water availability rose from 100 to 150 cubic metres per year. The city's water availability is still well below the Chinese and world averages of 2,000 and 5,000 cubic metres per annum, respectively. Xiongan, a new city that Xi proposes to build to the south of Beijing, could relieve some of the water stress that the city experiences, particularly if the claims that immense water storage areas will be built under it are true. It is more likely that Xiongan will

source at least some of its water from the SNWD and prolong the high level of water stress conditions that Beijing endures.

Construction of the SNWD initially focused on widening and deepening the existing Grand Canal, which was built 1,400 years ago to transport grain to the imperial capital. Under the SNWD, the Grand Canal was expanded to carry 14.8 billion cubic metres of water a year to Jiangsu, Anhui, Shandong and Hebei provinces, as well as the port city of Tianjin. Construction of the eastern route, which transports water from the lower Yangtze River to Tianjin, was completed in 2013. The central route, opened in 2014, carries water from the Danjiangkou reservoir on the Han River, a tributary of the Yangtze, to parts of Hubei, Henan and Hebei provinces, as well as to Beijing and Tianjin. A western canal, to connect the headwaters of the Yangtze and Yellow Rivers on the Qinghai-Tibetan Plateau, could be built in the future. If it is built, the route will transport water through the Bayan Har Mountain range, which involves traversing elevations of 3,000-5,000 metres above sea level. Due to the difficulties of the Tibetan terrain, there is some doubt as to whether the western route will ever be constructed, but official plans maintain that it will be operational by 2050.

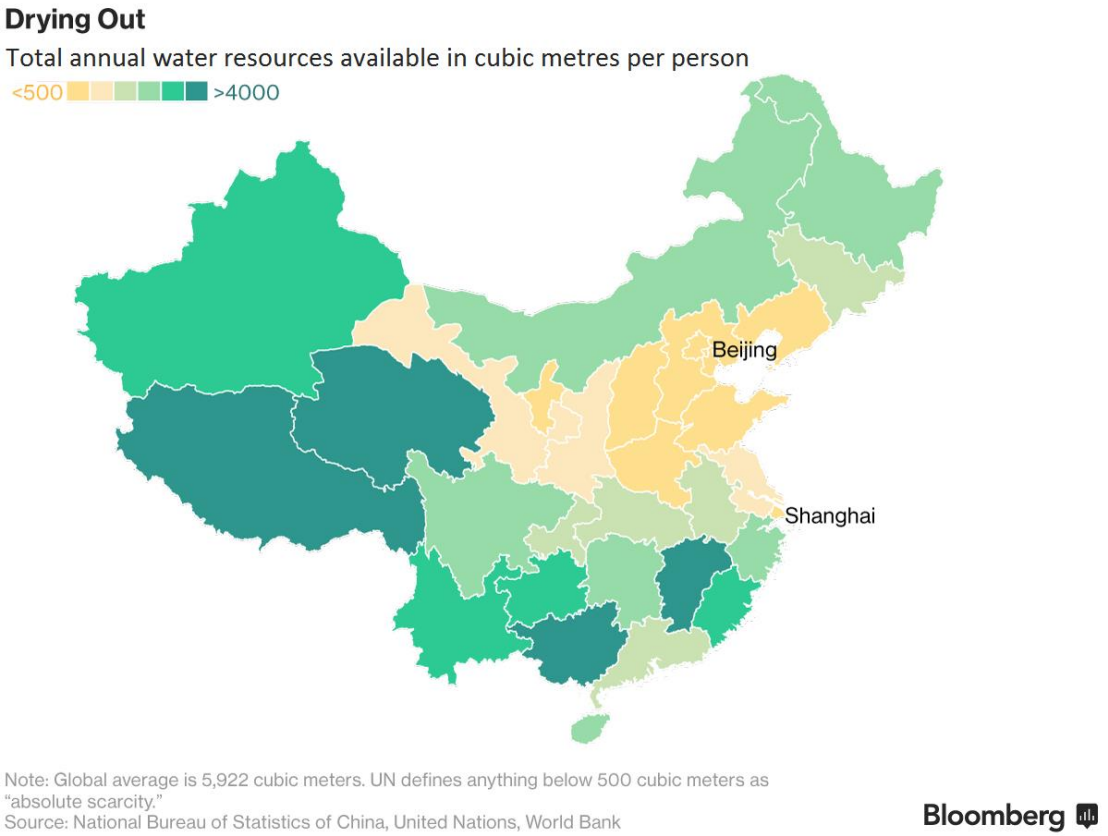
As the Yellow River flows through the Loess Plateau, it carries with it a large amount of sediment that is blown into the region from the Gobi Desert. Sediment accounts for up to 30 per cent of the river, making it one of the most sediment-rich rivers in the world. High concentrations of sediment are both a blessing and a curse for the downstream agricultural industry. Soils on the North China Plain are fertilised by the seasonal deposition of loess-rich water, which helps to increase the yields of the wheat, sorghum, millet and maize crops that are grown in the region.

Half of the wheat and a third of the maize and cotton grown in China come from the North China Plain. It is also one of the most densely populated regions of the country, with a quarter of the population residing there. Any disruption to the deposition of sediment caused by the operation of the SNWD could have deleterious effects on the agricultural productivity of northern China. Due to the high concentration of sediment, however, the river bed rises over time, making any flood event more destructive than it would otherwise have been.

The Yangtze carries far less sediment than the Yellow River, but it still carries enough to extend the coastline by more than a kilometre each century as the load is deposited in the delta. Prior to the completion of the eastern and central routes, there were concerns that the SNWD project would save the Yellow River at the Yangtze's expense. If the flow of the Yangtze is reduced, there is an increased possibility of salt water intrusion into the delta, but it would also slow the extension of the coastline and reduce the need for dredging.

Heilongjiang, Jilin and Liaoning – three provinces located to the north-east of Beijing – have historically been at the centre of Chinese heavy industry. Prior to Deng Xiaoping's economic reforms, their economies boomed and furthered the industrialisation of the country. In the decades that followed, however, the regional economy stagnated. Plans to revitalise the north-east industrial economy were introduced in 2003, but they have achieved limited results. While Heilongjiang faces only limited water insecurity, the other two provinces are

experiencing water stress. The SNWD project does not stretch as far as these provinces and, if water security is to be improved in the region, more efficient industrial processes will need to be introduced.



The western route of the SNWD project is the most controversial, due to the possible effect it could have on international river systems. If the western route is constructed as planned, water will be diverted from the Shuomatan Point or "Great Bend" of the Yalong Tsangpo River. The Yalong Tsangpo is shared with India and Bangladesh, where it becomes the Brahmaputra River. Both of those downstream countries are concerned about the effect Chinese water diversions could have on their share of the river's water.

The Tibetan Plateau, where the headwaters of the Yellow River are located, is already fragile. Up to three-quarters of the lakes on the Tibetan Plateau have disappeared. If the western portion of the diversion project fails, reduced water availability in the downstream section of the Yangtze will lead to poorer agricultural production, a decline in hydropower generation and a reduction in industrial activity. Independent Chinese scientists have raised concerns that the government has unrealistic expectations about the volume of water that can safely be withdrawn from the upper reaches of the Yangtze. They also believe that large infrastructure projects in the region could induce seismic instability and pollute the river.

At times in the past, the lower reaches of the Yellow River have failed to reach the sea. During 1997, for instance, it stopped 650 kilometres short of the Bohai Sea for 226 days, as a large portion of its flow was diverted for agricultural and industrial use. The diversion of

water from the headwaters of the Yellow River could result in those dry conditions becoming a more common occurrence.

Ensuring Long-Term Water Security

While the SNWD has reduced pressure on ground and surface water sources in the north, diverting water from the south to the north is unlikely to relieve the pressure from increasing water demand over the long-term. The Hebei Water Resources Department, estimates that water demand in the province will rise to 24 billion cubic metres by 2030. It claims that even if the Yellow River is fully utilised, it will only be able to supply the province with up to 23 billion cubic metres per year, leaving the region with a supply gap. Already thousands of farms close to the SNWD project are denied access to the water in the central route, as it is reserved for use in the capital.

To address water stress in the long-term, measures to better manage demand-side pressures will need to be implemented. Water costs remain disproportionately low across China, providing little incentive to conserve water. Water utilities are economically unprofitable and dependent on government subsidies, as water prices remain below full-cost recovery.

Water efficiency measures will also assist in reducing water stress. As agriculture is the main water consumer in China, focusing efforts on that industry is likely to yield the greatest results. China tries to maintain a food self-sufficiency policy that aims to ensure that 95 per cent of rice, wheat, coarse grains, soybeans and potatoes are domestically produced. China is likely to continue to view self-sufficiency as the best way to maintain its food security. Given the constraints on land and water, however, it is likely to increase its dependence on food imports. The Australian Bureau of Agricultural and Resource Economics and Sciences estimates that China will account for almost half of the global increase in food demand by 2050 and, while a large portion of that demand will be met by increased domestic efficiencies, it presents significant opportunities for Australian agriculture.

A 2009 World Bank report stated that China was using ten times more water per unit of production than the average high-income country. The average middle-income country uses 25 per cent less water per unit of production than China. While it has improved its water efficiency since then, there is still room for improvement. The industrial revitalisation of the north-eastern provinces could increase the competition for water, unless water efficiency measures are made a central component of that renewal. If current inefficient processes are not improved, China is likely to become increasingly reliant on food imports as competition for scarce water resources increases.

There are limits to how much water can safely be transferred from areas of abundance to areas of scarcity; a message that is relevant globally. How China rectifies, or fails to address, its water challenges, could hold lessons for many nations. It is likely to become clear that a singular focus on supply-side water management is not sustainable over the long term; a water management policy that combines both supply- and demand-side management, is a better path to water security.

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