China's South-to-North Water Transfer Project

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Abstract

China's ongoing South-to-North Water Transfer Project (SNWTP) is the largest water pipeline project that has ever been undertaken anywhere in the world. At its completion sometime around 2050, it will connect the southern Yangtze River and northern Yellow River with 2,700 miles of tunnels and canals via three distinct routes through western, central and eastern China. This project is ecologically irresponsible and economically inefficient, but government officials staunchly defend it by highlighting its connection with historical Chinese water-use practices and its promise of sustaining economic growth. While water scarcity is a serious and growing problem in China, this project will have far-reaching, devastating, and unforeseeable consequences and will therefore exacerbate existing problems while introducing new ones. The Chinese government should instead pursue self-sufficient, environmentally friendly alternatives in lieu of this grandiose and wasteful water transfer scheme. Such alternatives can be realized, but only if Beijing can learn to adapt to the country's environmental realities and successfully promote water conservation practices.

Overview of the Project

China has been so focused on economic growth and agricultural self-sufficiency in recent decades that it has consistently failed to acknowledge the environmental impacts of its destructive and unsustainable practices, such as building dams and canals and over-utilizing groundwater. Past industrial and agricultural abuse of water resources in the North China Plain have created a situation in which the North is so desperate for water that a multibillion-

dollar water transfer project appears to be a viable solution. Indeed, scientists estimate that the aquifers beneath the North China Plain will dry up within the next 30 years. Since 60% of the water used in this region by its 200 million inhabitants is groundwater, this prediction is an immediate concern.[1] Beyond the extensive impact of water scarcity on individuals, the lack of water also limits economic productivity since Chinese industries, such as coal mining, tend to be highly water-intensive.

The direct and indirect impacts of the South-to-North Water Transfer Project are disastrous enough to condemn the entire endeavor. The project exacerbates water pollution in multiple locations, especially the Yangtze River. Since, the Yangtze receives 40% of China's wastewater, diversion of some of its waters to the North will result in increased concentrations of pollutants downstream, hurting the region's agriculture, industries and ecosystems.[2] The canals also have the potential to transmit waterborne diseases north despite water treatment plants.[3] Additionally, approximately 345,000 people have been resettled, and many of these former farmers and peasants were very inadequately compensated.[4] The overwhelming financial and environmental costs of the project mean that the majority of its benefits support residents and industrialists in Beijing (who directly receive the majority of the diverted water), while everyone else affected registers some form of net loss.

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[1] Susanne Wong, "China Bets on Massive Water Transfers to Solve Crisis," *International Rivers*, December 15, 2007, http://www.internationalrivers.org/resources/china-bets-on-massive-water-transfers-to-solve-crisis-1899 (accessed October 30, 2014).
[2] Lily Kuo, "China Has Launched the Largest Water-Pipeline Project in History," *The Atlantic*, March 7, 2014, http://www.theatlantic.com/international/archive/2014/03/china-has-launched-the-largest-water-pipeline-project-in-history/284300/ (accessed October 30, 2014).
[3] Ibid.
[4] Lily Kuo, "China's Desperate Need for Water is Forcing the Relocation of Hundreds of Thousands of People," *Quartz*, March 7, 2014, http://qz.com/165223/chinas-desperate-need-for-water-is-forcing-the-relocation-of-hundreds-of-thousands-of-people/ (accessed November 2, 2014).

In this paper I will argue that instead of massive water diversion projects, China must focus on conservation and improving water management practices. Measures should be taken to encourage increased water efficiency in agriculture, through measures such as increased water tariffs. Increased rainwater harvesting is another novel solution, especially for urban areas. The key advantage of these alternatives, and others, is that they neither jeopardize the environment nor displace large swaths of the population. People can and should adapt to their environments, rather than foolhardily impose and rely upon unsustainable practices.

China's Water Problem

Water is a necessity of life, essential to social, economic, political and environmental wellbeing and growth. One of the biggest issues China is trying to grapple with in the twenty-first century is water scarcity. China's population of about 1.3 billion people consumes more than 600 billion cubic meters of water every year; which is equal to about three-quarters of the nation's exploitable water resources.[5] The country faces a wide-reaching water crisis since its freshwater resources equal around 2,000 cubic meters per capita, which is only about one third of the global average.[6] Impacts of climate change, such as declining rainfall and prolonged drought, combined with urbanization, rapid population growth and industrial expansion, have led to the current precarious situation. Groundwater supplies are rapidly drying up, along with lakes and rivers across China. The North China Plain (NCP), where a quarter of China's population resides, is especially dry, and water tables in the region are falling by several meters each year.[7] This gradual, yet highly significant decrease threatens agriculture and food

[5] Yang Jian, "China's River Pollution 'A Threat to People's Lives'," *Shanghai Daily*, February 17, 2012, http://english.peopledaily.com.cn/90882/7732438.html (accessed November 2, 2014).
[6] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."

[7] Wong, "China Bets on Massive Water Transfers to Solve Crisis."

security. Even more disturbing, the aquifers beneath the NCP are projected to dry up completely within the next three decades if the current rate of water usage persists.[8] Some analysts predict the aquifers will dry up within a mere 15 years.[9]

Exacerbating the situation on the NCP, contamination of surface water by industrial activity and agricultural runoff has increased dependence upon groundwater in recent decades. Looking at the country as a whole, exactly half of China's 22 provinces are considered "water-stressed," meaning that their water resources equate to less than 1,000 cubic meters of water per person per year. The capital city of Beijing's water resources contribute only about 120 cubic meters per person per year, which is a small fraction of the 500 cubic meters the United Nations considers to constitute a situation of "absolute water scarcity".[10] The city has been supplementing its insufficient supply of water by transferring water from the neighboring province of Hebei and by undertaking some relatively insignificant efforts to lower water usage in the city.[11] The World Bank has estimated the current annual cost of China's water problems, especially in regard to water scarcity and water pollution, as 2.3 percent of GDP, but adds that in actuality the cost is probably much higher.[12] Meanwhile, about 45% of China's GDP is generated in water-scarce provinces, predominantly located in the north.[13] Water scarcity poses a direct and unavoidable threat to economic growth largely due to the overlap of regions suffering water shortages and regions with a high density of industrial activity. This threat is

[8] Ibid.
[9] Wang Kunzuo, "Drying Up the Han," *China Dialogue*, January 2, 2011, https://www.chinadialogue.net/article/4085-Drying-up-the-Han (accessed October 31, 2014).
[10] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[11] Ibid.
[12] Jian Xie, *Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues* (Washington, D.C.: The World Bank, 2009), xxi.
[13] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."

not brand-new, however, except in scale; China has a history of dealing with water scarcity issues.

History of Water Use in China

China has a historical precedent of addressing water shortages with physical water transfers, dating back to the Han Dynasty, which began in 206 B.C. Most other ancient civilizations have similar histories, such as the 500-year reign of the Roman Empire and its famous aqueducts. The Chinese would move water from lower to higher elevations using chain pumps in order to irrigate their fields and provide water to cities.[14] Mao Zedong, the founding father of the People's Republic of China, continued his nation's traditional methods of water use by encouraging the digging of tube wells in the 1950s. This allowed grain farmers in northern China to tap into aquifers and boost production, although this practice has since proven to be unsustainable.[15] Recognizing his young state's dire water predicament, in 1952 Mao posed the question "The South has plenty of water and the North lacks it, so if possible why not borrow some?"[16]His choice of words, however, paints an inaccurate picture. "Borrowing" implicitly means the item taken will be returned in the future. Yet the proposed transfer of water is a one-way trip that would benefit the dry, industrial North at the expense of the wetter and more rural South. Exactly 50 years after this proposal was made by Chairman Mao, work on the South-to-North Water Transfer Project officially began.

Current Predominant Water Use

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[14] Carla Freeman, "Quenching the Dragon's Thirst: The South-North Water Transfer Project – Old Plumbing for New China?," *Woodrow Wilson International Center for Scholars*, http://www.wilsoncenter.org/publication/quenching-the-dragons-thirst-the-south-north-water-transfer-project8212old-plumbing-for (accessed October 24, 2014)

[15] Julian Doczi, Roger Calow and Vanessa d'Alancon, "Growing More with Less: China's Progress in Agricultural Water Management and Reallocation," *Overseas Development Institute*, Case Study Report (September 2014): 22.

[16] Kunzuo, "Drying Up the Han."

In order to understand the general trends of water usage in China and their broader impacts, it is pertinent to recognize the main uses of water throughout the country. One factor that has played an especially key role in increasing water scarcity is the rapid urbanization of the past six decades. Half of the Chinese population now lives in urban areas, compared to less than 15% in 1953.[17] Since urban dwellers use more water on average than rural people, water scarcity can be expected to become an ever-greater issue.[18] However, most of China's water resources go toward agriculture. Agriculture utilizes 60% of the country's water, and only half of this water is used effectively. This rate of efficiency is 20% less than that of other advanced, industrialized countries.[19]

Other water-intensive industries in China include textile, paper and steel production, which combined account for 60% of the total industrial water consumption.[20] Chinese industries like these use four to ten times more water on average for production compared to other industrialized countries' industries.[21] The coal industry, in particular, accounts for one-sixth of China's overall water usage; the industry includes mining, preparation, power generation, coke production and coal-to-chemical factories.[22] Coal is indispensable to the country's growth because it currently supplies three-quarters of China's energy. It is predicted that between now and 2040, China's total energy demand will double and become twice that of the United States.[23] Assuming China remains reliant on coal for the foreseeable future, water scarcity

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[17] "Basic Statistics on National Population Census in 1953, 1964, 1982, 1990, 2000 and 2010," *Government Statistics*, http://www.stats.gov.cn/tjsj/Ndsj/2011/html/D0305e.htm (accessed November 2, 2014).
[18] Ben Taylor, "Water: More for Some…or Some for More? Monitoring Equity in Water and Sanitation," *Tanzania Water and Sanitation Network*, WaterAid Tanzania (September 2008): 7.
[19] Yang Jiang, "China's Water Scarcity," *Journal of Environmental Management* 90, (2009): 3191.
[20] "China's Urban Water Security Situation and Countermeasures," *H2O-China*, February 19, 2014, http://news.h2o-china.com/html/2014/02/125350_1.shtml (accessed October 28, 2014).
[21] Zmarak Shalizi, "Water and Urbanization," *China Urbanizes: Consequences, Strategies, and Policies*, World Bank (2008): 166.
[22] Coco Liu, "Coal: As China's Demand for Coal Soars, So Does its Water Scarcity," *E&E Publishing, LLC*, July 1, 2013, http://www.eenews.net/stories/1059983712 (accessed November 15, 2014).
[23] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."

presents a major dilemma. This is especially true because the majority of coal resources is located in the North and remains underutilized in large part because of the shortage of water necessary to exploit them.[24] In summary, water scarcity is harming China's economic productivity in many ways and on a large scale.

The Problem of Water Pollution

Water pollution in China is a pervasive and expanding problem with no easily enforced solutions. Industrialization, urbanization and agricultural modernization are the most blameworthy actors on the stage. Largely thanks to industrial and agricultural runoff, as well as urban sewage, about 20% of rivers in China are now so polluted that they are unsafe to touch, much less drink.[25] About 300 million people living in China, or around 25% of the country's population, drink contaminated water every day.[26] Hu Siyi, the Vice Minister of China's Ministry of Water has stated, "The deterioration of water quality has threatened the safety and health of people, while the water quality problem has limited economic and social development."[27] The current level of contamination of available water resources poses a serious issue right alongside the problem of water scarcity.

The South-to-North Water Transfer Project

The South-to-North Water Transfer Project (SNWTP) is the Chinese central government's partial remedy to the country's water scarcity woes. Upon completion, it will connect the southern Yangtze River to the northern Yellow River with 2,700 miles of tunnels and canals via three distinct routes through western, central and eastern China. This distance is

[24] Freeman, "Quenching the Dragon's Thirst."
[25] Yang Jian, "China's River Pollution 'A Threat to People's Lives'."
[26] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[27] Yang Jian, "China's River Pollution 'A Threat to People's Lives'."

comparable to crossing the U.S. from the Pacific coast to the Atlantic. China is constructing some of the longest canals in the world, as well as pipelines that crisscross beneath riverbeds, a gigantic aqueduct and powerful pumping stations.[28] The SNWTP is the world's largest transfer project and its scale is unprecedented.

Main Goals of the Project

This project realizes Mao Zedong's vision in 1952 of a large-scale water diversion project from the wet South to the dry North. It was officially launched in December of 2002, and upon its expected completion around 2050, it will transfer a total of 44.8 billion cubic meters of water from the Yangtze to the Yellow River annually.[29] To compare, this is more water than there is in the River Thames. The project's head engineer, Shen Fengsheng, has acknowledged that the project does not solve China's water problem. He stated, "For now, the transfer project is just compensating an amount. It can't completely fix the problem".[30] Still, despite not being the ideal fix-all solution, the project will provide economic benefits by relieving water shortages in the north. The project is projected to increase China's GDP by 0.12% to 0.3% annually, and create 600,000 jobs, according to a state research center.[31] The government generally does not focus on the project's adverse impacts.

Justification for the Project

The North China Plain is rapidly drying up. Almost two-thirds of the water used in this region by its 200 million inhabitants is groundwater. At current usage rates, within 30 years

[28] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[29] "South-North Water Transfer Project," *International Rivers*, http://www.internationalrivers.org/campaigns/south-north-water-transfer-project (accessed October 20, 2014).
[30] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[31] Ibid.

this resource will no longer exist.[32] This is an astoundingly threatening prediction. Lack of water also strictly limits economic productivity since Chinese industries tend to be very water-intensive. Less than 500 cubic meters of renewable water per person per year are available in the NCP. While some Middle Eastern countries and small island states have even lower levels of per capita renewable water, no location on Earth can compare in terms of immense population size relying on the NCP's limited resources.[33] Suffice it to say, the NCP is facing an unprecedented, serious renewable water shortage. Additionally, the Yellow River, northern China's most important river and a major source of water, has been shrinking for the past 30 years. More recently, the river has been drying up before it even reaches the sea almost every year.[34] Similarly, lakes have been drying up in the Hebei province neighboring Beijing, leaving some farmers with no alternative but to resort to watering their crops with sewage water.[35]

Conversely, China's government depicts the South as a land of plenty, with more water than it could possibly need. Indeed, southern China has four-fifths of the country's water resources, and most of that water is located in and around the Yangtze River Basin. Government officials persistently claim that the Yangtze River has more than enough water, with 96% of its water currently flowing unutilized into the Pacific Ocean.[36] Transferring some of this water north, they argue, could go a long way toward alleviating the North's water scarcity issue. The Yangtze River will only lose about 5% of the water which normally ends up flowing into the ocean, according to Shen Fengsheng, the project's head engineer, who adds

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[32] Wong, "China Bets on Massive Water Transfers to Solve Crisis."
[33] Jeremy Berkoff, "China: The South-North Water Transfer Project – Is it Justified?," *Water Policy 5* (2003): 2.
[34] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[35] Ibid.
[36] Gong Jing and Cui Zheng, "China – Water Diversion Blues – South to North Water Diversion Project," *Save the Water*, January 4, 2012, http://savethewater.org/water-crisis-china-water-diversion-blues-south-to-north-water-diversion-project/ (accessed October 28, 2014).

that "the negative impacts [of the project] are so small they almost don't exist".[37] However, this loss of water flow is no small matter, as will be discussed later on.

Why has China decided to invest in such a huge project to combat this issue of water scarcity in the North, rather than implement smaller policy measures that could make a more positive difference in the long-term? One answer could be the Communist Party's penchant for massive projects, implementing them as a display of the party's power. "It's an approach that comes from both a Maoist impulse to subjugate nature in the pursuit of economic development, as well as what you'd expect from a government made up of engineers," says Peter Martin, an analyst of Chinese politics at APCO Worldwide.[38] However, this project can also be interpreted as a sign of weakness because it demonstrates the failure of the central government to effectively coordinate national efforts to promote water conservation. For instance, government pollution regulations are often willfully overlooked by companies, which do not fear fines since they are insignificant and infrequently enforced. Also, local officials often refuse to raise water prices despite government pressure for fear of local backlash.[39] For the central government, it is easier to pay to build massive canals and move water physically than to convince local authorities and businesses to comply with its demands.

The Three Routes

The project consists of three canal routes travelling separately through eastern, central and western China. The Eastern Route Project is predominantly an upgrade to the preexisting Grand Canal. The amount of water diverted through this canal is planned to increase incrementally as the project progresses. This route provides water directly to northeastern

[37] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[38] Ibid.
[39] Ibid.

provinces and is about 176 miles long. There are 23 pumping stations running along this route to counteract topography and raise the water as it travels north.[40] This route's construction was completed in 2013. The Central Route is built on the North China Plain and is constructed so that water can flow all the way from Danjiangkou Reservoir in the South to Beijing by gravity. Therefore, this route does not require pumping stations. Construction began in 2004, and completion was delayed from 2010 to around 2014 to allow for more environmental protections to be built.[41] The canal system was completed on December 25, 2013, and has since begun to operate.[42] Last but not least, the Western Route, called the Big Western Line, is still in the planning stage. Theoretically, it aims to divert water from the Yangtze River's headwaters to the Yellow River's headwaters. Such a feat requires the construction of huge dams and long tunnels in order to navigate the water through the Qinghai-Tibetan Plateau and the Western Yunnan Plateaus. The feasibility of this route is still under consideration. Besides the route's expected financial cost, the route presents many unforeseeable and incalculable risks. For instance, environmentalists are concerned about the route's potential to increase the risk of flooding in the region and downstream.[43]

Overall Costs and Pitfalls of the Project

The SNWTP was originally estimated to cost $62 billion, which is more than twice the cost of the Three Gorges Dam. Already, more than $79 billion has been spent on constructing

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[40] "South-to-North Water Diversion Project, China," *Water Technology*, http://www.water-technology.net/projects/south_north/ (accessed October 31, 2014).
[41] Ibid.
[42] Dr. Britt Crow-Miller, "Diverted Opportunity: Inequality and What the South-North Water Transfer Project Really Means for China," *Global Water Forum*, March 4, 2014, http://www.globalwaterforum.org/2014/03/04/diverted-opportunity-inequality-and-what-the-south-north-water-transfer-project-really-means-for-china/ (accessed October 28, 2014).
[43] Craig Simons, "In China, a Water Plan Smacks of Mao," *Cox News Service*, September 10, 2006, http://web.archive.org/web/20070911233235/http://www.coxwashington.com/hp/content/reporters/stories/2006/09/10/BC_CHINA_WATER10_COX.html (accessed October 30, 2014).

the eastern and central routes alone, making this one of the most expensive engineering projects in the world. And it is far from certain that the benefits will ultimately outweigh the costs. The project has appropriately been called a "high-cost gamble".[44] In fact, as a result of its unanticipated, skyrocketing costs, there is a significant risk that the project could become too burdensome to continue.[45] There is also the potential for a government-wide financial catastrophe if the project fails to pay back its own costs.

The project's huge cost will make the water it redirects to the North potentially prohibitively expensive for its consumer base. Residents, industries and some cities may be unwilling to pay the high price for the water it offers. Many of the project's unexpected costs come from wastewater management systems and extra engineering projects in southern provinces. Local officials in southern provinces are worried about suffering water shortages in their towns because of the SNWTP, and are building supplementary dams and water-transfer systems to protect their water stability. This has consequently generated a sort of circular flow of water from one river to another that is inefficient, harmful, and, increasingly costly.

Current Adverse Impacts of the Project

Many negative impacts of the project are already being perceived by locals, especially in the southern provinces along the Yangtze River. When aggregated, these underreported and sometimes unintended consequences of the project point to a deep, multifaceted disparity between the northern and southern regions of China, which is being reinforced by the state's implementation of the SNWTP.

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[44] James E. Nickum, "The Status of the South to North Water Transfer Plans in China," *United Nations Development Programme*, Human Development Reports (2006): 1.
[45] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."

The project exacerbates water pollution in the Yangtze River. The Yangtze receives 40% of China's wastewater, making it very polluted. As some of the river's waters are diverted north, the river's pollution will become less diluted.[46] The higher concentration of pollution will hurt the region's agricultural production, industries and ecosystems. Due to the positioning of water treatment facilities along the canals carrying water northward, this pollution issue is not likely to affect northern communities as much as those living alongside the Yangtze River in the South.[47]

The project also carries the risk of spreading waterborne diseases. Such diseases could be transmitted north despite water treatment plants via polluted and infectious Yangtze River water. These diseases include schistosomiasis, commonly known as bilharzia, which can cause damage to internal organs and impair children's brain development.[48] The increased risk of the spread of disease should not be overlooked.

The resettlement required by the project inspires a great deal of criticism. Almost 500,000 people will have been relocated by the time the project is completed.[49] Approximately 345,000 people have already been resettled, making this the largest resettlement for an infrastructure project since 1.4 million people were resettled for the construction of the Three Gorges Dam in 1994.[50] Many of those resettled for the SNWTP were farmers and peasants living in the Hubei and Henan provinces near the construction of the central route. These people were moved away from the canal and the Danjiangkou Reservoir, since the dam is being elevated in order to raise the water level to permit the canals to flow via gravity. Of the

[46] Ibid.
[47] Crow-Miller, "Diverted Opportunity."
[48] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[49] Ibid.
[50] Kuo, "China's Desperate Need for Water."

345,000 people relocated, 230,000 have been moved out of the area completely.[51] Some of these former residents were forced to sign relocation agreements because they would not leave voluntarily.[52] These former farmers were inadequately compensated with poor-quality housing and an insufficient monetary stipend.[53][54] Left both landless and jobless, these people found themselves no longer able to make a living. This issue of resettlement has the potential to create a large number of impoverished migrant people who once had stable, stationary lives.

The project has a variety of direct ecological impacts that yield long-term damage to two of China's most important rivers and the communities that depend on them. The SNWTP is likely to permanently damage the Han River, upon which 30 million people rely, and the Yangtze River, which runs through 11 provinces and supports around 400 million people.[55] Both of these rivers are located in the South. The project causes habitat destruction of both wildlife and people, increases wetland erosion and the frequency of severe floods, and fails to account for the potentially devastating impact of earthquakes on the canals.[56][57] Basically, it is extremely difficult if not impossible to calculate the long-term impact of the project upon the environment. An example of the project's unintended ecological consequences was brought to light in the summer of 2013. Fish farmers on the Dongping Lake on the eastern route of the SNWTP reported that, as a direct consequence of the canal system, polluted Yangtze River water was entering their lake and killing the fish upon which their livelihoods depend.[58]

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[51] Kunzuo, "Drying Up the Han."
[52] Jing and Zheng, "China – Water Diversion Blues."
[53] Kuo, "China's Desperate Need for Water."
[54] Louisa Lim, "A Village Sacrificed for China's Greater Good," *NPR*, September 25, 2014, http://www.npr.org/templates/story/ (accessed October 16, 2014).
[55] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[56] Tadanobu Nakayama and David Shankman, "Impact of the Three-Gorges Dam and Water Transfer Project on Changjiang Floods", *Global and Planetary Change* 100 (January 2013): 40-45.
[57] Freeman, "Quenching the Dragon's Thirst."
[58] Xin Lin, "Chinese Water Diversion Project Kills Fish on Test Run," *Radio Free Asia*, July 8, 2013, http://www.rfa.org/english/news/china/project-07082013131802.html (accessed November 2, 2014).

Another problem is that, with a smaller volume, the Yangtze River will flow more slowly and thus become slower at depositing sediments along the riverbed. This process is crucial for the formation of wetlands, which in turn help to mitigate pollution and improve the health of the river's ecosystem.[59] Also, a lower water volume may make Yangtze more susceptible to inland encroachment by saline seawater, which would have a negative impact on the coastal environment, as well as the factories located in that area, which require large amounts of freshwater to operate.[60]

There are already almost 1,000 dams on the Han River and its tributaries as well as hundreds of dams and other hydro-projects on the Yangtze, making it the world's second-most engineered water basin.[61] Given China's goal of tripling hydropower generation, Ma Jun, the director of the Institute of Public and Environmental Affairs, predicts that many Chinese rivers will no longer be flowing in a decade.[62] Despite all the impressive and very costly projects, the issue of water scarcity may not be resolved, but in fact exacerbated.

Unequal Distribution of Costs and Benefits

The overwhelming financial and environmental costs of the project indicate that the vast majority of the project's benefits will go toward supporting residents and industrialists in Beijing. Everyone else affected by the project will register some form of a net loss. The North China Plain is home to more than 25% of China's population and accounts for more than a quarter of its GDP.[63] Doubtless the central government is heavily invested in maintaining the growing economic productivity of this region.

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[59] Freeman, "Quenching the Dragon's Thirst."
[60] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[61] "South-North Water Transfer Project," *International Rivers*.
[62] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[63] Berkoff, "China: The South-North Water Transfer Project – Is it Justified?," 1.

Meanwhile, the many consequences of the project are predominantly the burden of the South. For instance, the Yangtze River could suffer from water shortages, especially during the dry season. This would be detrimental to river transportation since even now local governments must dredge at least once a year to make sure ships can travel unimpeded.[64] Also, several southern provinces have been required to conserve water so that more will be available to transport north. For example, the government has directed some people to switch crops from rice to corn in order to conserve more water, an idea that has substantial problems of its own.[65] Some localities have been suffering their own water shortages in recent years, which have been primarily caused by the diversion project.[66] Local authorities have urged the central government to compensate communities whose water has been diverted north. This is because, in addition to the increased strain on water resources, the project has led to the shutdown of factories along the canals and consequently increased unemployment rates and reduced local tax revenues in the region. However, the government has not been very responsive.[67]

Heightening this injustice, the Han and Yangtze Rivers will end up with less water than the diversion plan allows because of the project's use of outdated information. For instance, the amount of water planned to be diverted via the central route is based on calculations of the Han River's water flow between the 1950s and the early 1990s. In more recent years the Han River has suffered from more frequent droughts and does not remain at consistent levels. However, the amount the project plans to divert from the river has not been adjusted to account for this.[68]

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[64] "The Geopolitics of the Yangtze River: Developing the Interior," *Stratfor*, April 1, 2013, http://www.stratfor.com/analysis/geopolitics-yangtze-river-developing-interior?utm_source=freelist-w&utm_medium=email&utm_campaign=20130702&utm_term=WelcomeFL&utm_content=copy10&elq=ca18c199001d45e7834b79157dc9ac4a#axzz3IQ4io6J9 (accessed November 2, 2014).
[65] Freeman, "Quenching the Dragon's Thirst."
[66] Ibid.
[67] Ibid.
[68] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."

The Yangtze River's water levels have also been falling due to a 15% decrease of glacier water flowing into the river over the past four decades.[69] Also striking, total freshwater reserves in the Yangtze River Basin had fallen 17% in just four years between 2005 and 2009.[70] Therefore, transferring 5% of the rivers' annual runoff, as the SNWTP plans to do, is not nearly as insignificant as the government claims it to be.

Alternatives

As Beijing's population grows over the coming decades, its water needs will expand faster than the SNWTP can provide, even with the canals flowing at full capacity. In fact, the project is insufficient for providing water to the northern region as a whole.[71] Research predicts that the total demand for water in northern China will reach 203 billion cubic meters by 2050, and that the SNWTP will only be able to supply slightly more than a quarter of that demand.[72] Since the project is both insufficient and is accompanied by a vast number of unpleasant consequences and costs, cheaper and more sustainable alternatives must be considered and implemented. The extraordinary amount of wealth and resources being used to construct the SNWTP could be allocated elsewhere to make a much more substantial difference. The government already plans to invest over $600 billion in water conservation projects over the next 10 years.[73] It could do so much more by redirecting its resources from the SNWTP to promote and implement varied conservation practices on both statewide and localized scales.

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[69] Jane Qiu, "Thawing Permafrost Reduces River Runoff," *Nature*, January 6, 2012, http://www.nature.com/news/thawing-permafrost-reduces-river-runoff-1.9749 (accessed October 30, 2014).
[70] Keith Schneider, "Choke Point China: Confronting Water Scarcity and Energy Demand in the World's Largest Country," *Circle of Blue*, February 15, 2011, http://www.circleofblue.org/waternews/2011/world/choke-point-chinaconfronting-water-scarcity-and-energy-demand-in-the-worlds-largest-country/ (accessed October 31, 2014).
[71] Kuo, "China Has Launched the Largest Water-Pipeline Project in History."
[72] Berkoff, "China: The South-North Water Transfer Project – Is it Justified?," 3.
[73] Yang Jian, "China's River Pollution 'A Threat to People's Lives'."

There are a variety of ways in which the central government can improve the state's water management practices. Every alternative is more cost-effective and efficient than the SNWTP. These include increasing water tariffs, issuing provincial water quotas, harvesting rainwater, promoting urban water conservation in households, investing in infrastructure to increase urban water recycling, resorting to saltwater desalination for some coastal cities, and leading other significant social campaigns to cut overall water usage.

Water-use conservation in both agriculture and residences can be encouraged by increasing water tariffs. The tariff programs currently in place are insufficient because they fail to account for total water consumption and the costs of related facilities. Farmers currently pay for water based on the area of the land they irrigate rather than the amount of water they use.[74] The application of non-crippling tariffs based on quantities of water used could decrease overall water consumption, especially since irrigation is the country's largest single use of water.[75] A similar increase of water tariffs in cities would also be beneficial, since current water prices in most cities do not reflect the costs of water distribution, maintenance of sewers and water treatment processes, despite a gradual increase in water prices over recent decades.[76] Reform of water prices, although unpopular, is a great tool to encourage water conservation. Its main caveat is that it would affect the poor more than the rich. To address this disparity and avoid mass protests, the central government has promised to give subsidies to the groups most affected by price increases and has required local governments to ensure that low-income families maintain a basic standard of living.[77] However, rising water prices are still very

[74] Nathanial Matthews, "China's Water Crisis Needs Better Farming, Not the South-North Water Transfer," *The Third Pole*, June 13, 2013, http://www.thethirdpole.net/chinas-water-crisis-needs-better-farming-not-the-south-north-water-transfer/ (accessed October 30, 2014).
[75] Berkoff, "China: The South-North Water Transfer Project – Is it Justified?," 3.
[76] Freeman, "Quenching the Dragon's Thirst."
[77] Ibid.

unpopular because they are accompanied by higher food and energy prices, making basic necessities less affordable. Still, raising prices and carefully adjusting markets are generally effective methods to promote a widespread practice of sustained water conservation.

Rainwater harvesting would especially help urban areas, since it is relatively easy and cheap to set up rainwater collection systems. These systems reduce pressure on the urban drainage system by alleviating the degree of urban waterlogging.[78] This alternative has multiple benefits because it helps abate urban flooding, groundwater depletion and rainwater runoff pollution, thereby improving the local environment. Beijing, for example, has an annual rainfall of about 600mm. If 20% of that was collected across an area of the city equivalent to 1,800 square kilometers, then about 220 million cubic meters of water could be harvested. That equates to 14% of Beijing's annual water usage.[79]

Saltwater desalination could help address severe water shortages in coastal areas, although wastewater recycling is generally a preferable alternative thanks to its lower cost and lack of geographical restrictions. Where desalination is applicable, it can feasibly replace 5% of the urban water supply.[80] China is already planning the construction of large-scale seawater desalination facilities, since this method has recently become economically viable due to the rising price of water and the falling price of desalination techniques thanks to technological advances. This alternative is expected to become a major source of water for cities including Tianjin and Beijing.[81]

[78] "China's Urban Water Security Situation and Countermeasures."
[79] Ibid.
[80] Ibid.
[81] Freeman, "Quenching the Dragon's Thirst."

The central government can also propagate smaller, yet nonetheless significant social campaigns urging reductions in meat consumption and food wastefulness. Meat requires a large amount of water to produce because feed, livestock, meat processing and retail each require substantial water inputs. Meat consumption has quadrupled in China in the last three decades and is continuing to rise.[82] The country could conserve a considerable amount of water by decreasing its demand for meat. Food wastefulness is also a notable concern, since large amounts of food are thrown away each year. It requires great quantities of water to grow and process food, including the manufacture of chemicals and the production of energy that go into agriculture.[83] Every piece of food that is thrown in the garbage represents a portion of the country's water resources. Therefore, if people stopped wasting so much food, they would conserve more water. These social measures, along with the other alternatives briefly described above, could make a big enough difference to counterbalance water scarcity in the North China Plain and elsewhere if they are implemented on a large-scale and enforced dependably.

Conclusion

The government's attempt to save the Yellow River at the Yangtze River's expense is blatantly unjust, supporting the wellbeing of northern urbanites over the livelihoods of southern urban and rural people. The project defends urban and economic development on the North China Plain rather than accepting the fact that growth in the region should naturally decrease in response to water stress, forcing investment and growth in other regions.[84] This project exemplifies the political nature of water management, as it makes the futile effort to

[82] Matthews, "China's Water Crisis Needs Better Farming."
[83] Ibid.
[84] Crow-Miller, "Diverted Opportunity."

ensure the longevity of politically significant places, like the capital, over those deemed more expendable.

Building a massive water-transfer project is more feasible socially and politically for the central government, unlike conservation projects, which local officials tend to ignore or counter. However, however, building ultimately falls far short of resolving the core problem; indeed, this so-called "solution" provokes myriad more problems than it solves. China needs to combine a variety of flexibly applied strategies, utilizing science, technology, economics, and public policy, in order to solve its problem of urban water security while restoring health to its aquatic ecosystems.[85]

[85] "China's Urban Water Security Situation and Countermeasures."

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