

# Will Water Scarcity Affect Agricultural Production in China?

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China has achieved impressive increases in grain production over the last 50 years due in large part to the expansion of irrigation, but many observers are beginning to question whether irrigated agriculture is sustainable in areas of China where water is relatively scarce. Despite competition from rapidly growing industry and increasingly wealthy consumers, farmers still receive over two-thirds of China's water, even in water-stressed regions.

Most observers agree that the increasingly acute water problems in China will affect agricultural production, particularly on the north China plain, where irrigation is extensive but water depletion is severe. Some scholars have argued that rapid depletion of water resources will reduce China's grain production capacity, leading to massive grain imports that will dominate world markets. Others argue that a shift to less water-intensive crops and other measures will help China solve many of its most pressing water problems, averting the crisis scenario predicted by others. The actual changes that take place will depend largely on the effectiveness of reform policies presently being discussed and implemented in China.

## *Does China Have a Water Crisis?*

While there is widespread concern that China faces a water crisis in the future, disruptions in water supplies to date have been isolated and water is still generally available at low prices. Industrial production continues to surge, even in China's northern coastal regions where water depletion is most rapid. Ever-wealthier urban consumers continue to use water with few restrictions (water rationing has been implemented in some northern cities during dry years). Farmers also have maintained access to water at prices well below its marginal value in agricultural production, which is much lower than its value in nonagricultural uses. China has expanded irrigated acreage in recent years and plans to continue expanding it. To date, there are no indications that water scarcity has significantly affected aggregate agricultural production or economic activity.

Disruptions in water supplies, however, have occurred in some areas of China and the rapid depletion of both surface and ground water resources in northern China has caused many observers to conclude that a far more serious crisis looms. The most notorious event associated with water overexploitation in China is the reduced flow of the Yellow River, which failed to reach the ocean for some period of every year between 1972 and 1999. In the river's driest year, 1995, it failed to reach the ocean for over 200 days. Similar reduced flows have occurred on the Huai and Hai Rivers, the two other major river basins on the north China plain. Tributaries of the Hai River often dry up before connecting to the main stream. Many downstream users cannot rely on surface water deliveries during the irrigation season because upstream users deplete water supplies. Poor maintenance of the existing surface water systems has resulted in large water withdrawals. Only about 30 percent of water withdrawals reach the crop root zone due to conveyance losses and inefficient irrigation practices (World Bank).

Unreliable and unavailable surface water deliveries have led to a heavy reliance on ground water. The combined effects of urban/industrial and agricultural water withdrawals are rapidly drawing down water tables on the north China plain. Heavy ground water withdrawals have caused wells to go dry in some villages. Private entrepreneurs have raised capital to sink deeper, more powerful wells, from which they sell water for a profit (fig. L-1). While this practice maintains irrigated acreage in the short run, it may further deplete ground water levels.

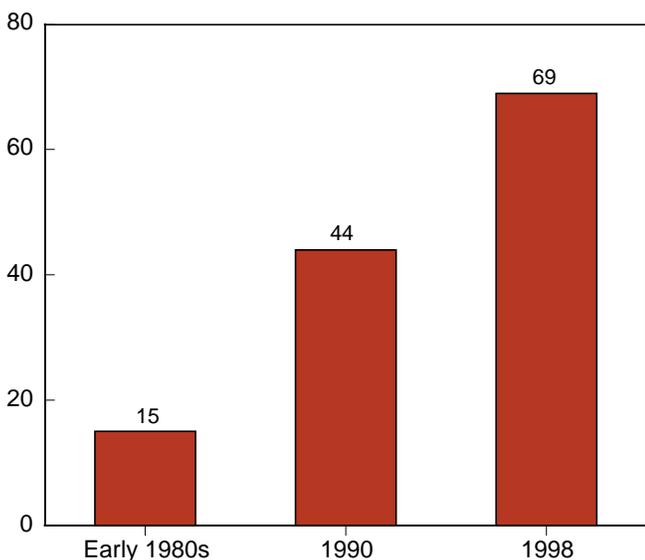
## *How Is China Responding?*

Water managers and users, from the national level to the village level, are developing water-saving strategies and plans to secure future water deliveries. China's national government has renewed its commitment to invest in water storage, delivery infrastructure, and maintenance. The government has also strengthened the enforcement of national laws meant to restrict

Figure L-1

**Percentage of private wells, sample villages in Hebei province, 1980s-1998**

% of private wells



Note: Primary survey data collected from a sample of villages.

Source: Lohmar et al.

withdrawals from major river basins. Urban and industrial centers are experimenting with reforms to better rationalize water management and treat more urban and industrial water runoff so that it can be used for agriculture. In rural areas, local water managers and farmers are experimenting with new management systems intended to improve the reliability of water deliveries, maintain irrigated acreage, and encourage water saving.

It is unclear whether policy initiatives and new institutional arrangements will help China avert a severe water crisis in the future. Because water is of fundamental importance to industry, agriculture, and the general population's well-being, government agencies and managers that oversee water use have substantial power and clout that they do not want to relinquish. This factor will make reform of the management infrastructure difficult and politically costly. These costs, however, are far lower than the costs of running out of water entirely.

From an economic perspective, pricing irrigation water on a volumetric basis would increase water-use efficiency in agriculture but would be difficult to implement. With nearly 200 million farm households cultivating an average of 1.5 acres of land spread across several small plots, the high cost of monitoring

***What We Need to Know***

How will increases in water price or water rationing affect cropping patterns in China?

Which policies to reduce water consumption are most effective?

How does industrial water policy affect water availability for agriculture?

How effective is the extension system for introducing water-saving irrigation technologies and practices?

What role does poor water quality play in China's overall water-scarcity situation?

water deliveries to each tiny plot would outweigh the benefits to be gained from volumetric water pricing.

***Effects on Agricultural Production***

Increasingly scarce, less reliable, and/or more expensive water is expected to significantly affect China's agriculture. Cropping patterns are already being affected by water scarcity, but only on the margins, and effects on aggregate agricultural production are not yet apparent. Of all crops, wheat produced in the north China plain is the crop most threatened by water scarcity. Large production increases over the last 40 years are almost entirely due to the introduction of irrigation systems into much of this region, which now suffers some of the most severe water depletion in China.<sup>1</sup> Many farmers who lack secure access to ground water are already giving up wheat production because surface water supplies are not reliable. Farmers also complain that the low wheat/water price ratio reduces wheat profitability.

It is difficult to predict how China's agriculture will change cropping patterns in response to water scarcity. Prices, of course, will help determine which crops become more profitable, but so will research into high-yielding and less water-sensitive seed varieties. Farmers may forgo irrigated wheat and adopt a full season of corn to achieve high corn yields. Others may switch from wheat to cotton because cotton yields are

<sup>1</sup> Over 70 percent of the rainfall in this region comes between July and September—after the wheat harvest, but during the corn-growing season. Thus, wheat relies on irrigation, while corn is generally rain fed.

less dependent on irrigation. In other areas where transport costs to urban areas are low and water-saving irrigation technologies and information is accessible, farmers may choose to grow high-valued vegetables.

***Further Reading***

Lohmar, B., J. Wang, S. Rozelle, J. Huang, and D. Dawe. *Investment, Conflicts and Incentives in China's*

*Water Crisis: The Role of Institutions and Policies in China's Agricultural Water Management on the North China Plain*, Agriculture Information Bulletin, U.S. Department of Agriculture, Economic Research Service, (forthcoming) 2002.

World Bank. "At China's Table: Food Security Options," China 2020 Series, World Bank, 1997.