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Center for Chinese Agricultural Policy, Chinese Academy of Sciences

N O T E

Yellow River Basin: Living with Water Scarcity
APRIL 2010

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Water and Poverty in China's Yellow River Basin

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INTRODUCTION

Rapid economic growth in the Yellow River Basin (YRB) of China has put intense demands on Yellow River waters. By far the largest user of water resources is the agricultural sector, accounting for 80 percent of total withdrawals—with industrial, urban, and rural domestic sectors sharing the remaining 20 percent. Demands for irrigation have surpassed available resources for decades. Given that water is critical for agricultural production, access to water is a key determinant of welfare of the rural poor in the YRB region for whom agriculture is the main source of livelihood.

This brief is based on a water-related poverty analysis for the YRB region conducted in 2009 by IFPRI in collaboration with the Center for Chinese Agricultural Policy. Most of the data for the analysis come from the 2001 Household Income and Expenditure Survey conducted by the National Bureau of Statistics of China. The purpose of the analysis is to determine to what extent agricultural water management explains poverty in relation to other factors such as safe drinking water, education, and agricultural and off-farm incomes. This assessment is important for understanding which agricultural water interventions result in the highest impact on poverty reduction.

POVERTY AND INEQUALITY IN THE YRB

Based on per capita income levels and the international poverty line of US$1.25 a day by purchasing power parity, 30.5 percent of the population in the rural YRB region were living in poverty in 2001. In the YRB region, which encompasses parts of nine provinces of China, the poverty rate was highest in the mountainous region and lowest in the plains region. The incidence of poverty (headcount poverty ratio) varied widely in different parts of the rural YRB, ranging from a low of only 3.1 percent in the YRB part of Shandong province in the east to as high as 52.2 percent in Gansu province in western China. This pattern of poverty incidence in the YRB corresponds to patterns at the national level, in that poverty in China is mainly concentrated in the western part of the country.

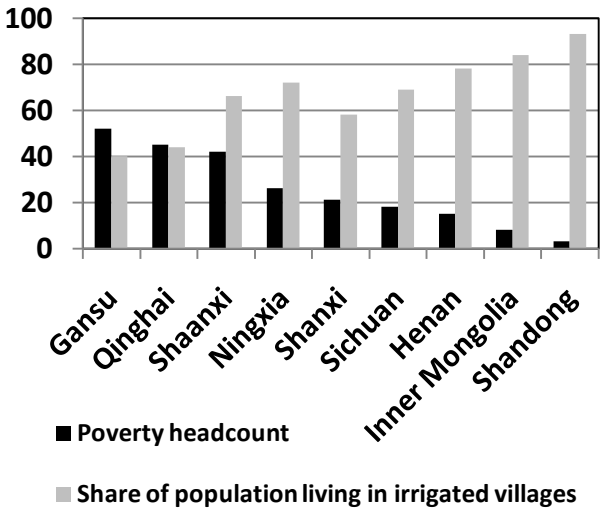
Income distribution within the YRB is rather skewed—only 7.1 percent of all income is earned by the poorest 20 percent of households and 27.5 percent by the richest 10 percent. The estimated Gini index was 40.5 percent for income distribution in rural YRB in 2001. At the national level, the Gini coefficient was 38 percent for rural China in 2002.

A PROFILE OF WATER-RELATED POVERTY IN THE YRB

The headcount poverty ratio is significantly lower in irrigated areas than in nonirrigated areas of the YRB region. For instance, while 19.4 percent of all households living in irrigated villages are poor, the rate is more than double (41.4 percent) in nonirrigated villages. According to Figure 1, the highest concentration of nonpoor are in irrigated villages such as Shandong, Inner Mongolia, and Henan. By contrast, provinces with the lowest share of the population living in irrigated villages, such as Gansu and Qinghai, have the highest levels of poverty among the nine YRB provinces.

The US$1.25 a day poverty headcount ratio shows stark differences across upstream, midstream, and downstream areas of the YRB. The poverty rate in the upstream area (47.5 percent) is nearly five times higher than in the downstream area (only 9.9 percent), while the rate in the midstream area (29.6 percent) is three times higher. The combination of higher rainfall and the extensive use of tubewell irrigation contribute to higher crop productivity, and hence, increased income of the households living in the downstream area. The downstream region receives 48 percent and 38 percent more rainfall than the upstream and midstream areas, respectively. The percentage of households using electric tubewells for irrigation increases considerably from upstream to midstream areas, and increases dramatically from midstream to downstream areas. Village-level coverage of surface irrigation reveals a rather different pattern, however, with the largest share of cultivated land irrigated in the midstream area. The patterns of surface water irrigation coverage and tubewell usage for irrigation suggest that households living in the downstream area rely mostly on groundwater for irrigating

Figure 1—Headcount poverty and share of population living in irrigated villages



their crops, probably due to a lack of timely surface water availability. Further, school enrollment rates are higher in irrigated villages than in nonirrigated villages, and rates are lower for children from poor households than from nonpoor households; however, the gap in school enrollment rates between the poor and the nonpoor is smaller in irrigated villages than in nonirrigated villages. These results indicate that the availability of irrigation at the community level is not only associated with increased school enrollment in the community, but also seems to benefit the poor more than the nonpoor.

Irrigated villages also have better access to safe drinking water in the YRB—78 percent of households in irrigated villages have access to safe water compared to only 47 percent in nonirrigated communities. The results also show that nonpoor households have greater access to safe water compared to poor households, but the poor–nonpoor gap in access is much smaller in irrigated villages. While the difference in access to safe water between poor and nonpoor is 16 percentage points in nonirrigated villages, it is only 3 percentage points in irrigated villages. These findings have important policy implications, as access to safe water is critical for improved health and nutrition, particularly for children. As such, there is a need for further research in China and elsewhere on the links among irrigation, poverty, and access to safe water.

There also is a direct and obvious relationship between crop yields and irrigation coverage. Higher irrigation coverage of cultivated land at the village level is associated with greater crop productivity, and yields of various crops grown in the YRB are substantially higher in irrigated villages than in nonirrigated villages, particularly for rice—where yields in irrigated villages reach 7.2 tons per hectare (ha) of land compared to 3.3 tons per ha in nonirrigated villages.

Furthermore, the shares of land under high-yielding varieties (HYVs) of wheat and maize—the two main crops grown in the YRB—increase considerably with greater coverage of irrigated land. Cultivation of HYVs of crops is more capital-intensive than traditional varieties. Irrigation reduces the risks associated with crop production as the dependence on rainfall is lessened, encouraging farmers to invest more in seed-fertilizer technology.

DETERMINANTS OF POVERTY IN THE YRB

While the poverty profile provides important clues to the underlying determinants of poverty, a more rigorous analysis of the determinants of poverty in the rural YRB was also conducted to isolate the effects of particular factors.

Surface water irrigation coverage is a statistically significant determinant of per capita household income. Results suggest that a 10 percent increase in the village-level coverage of surface irrigation increases the per capita income of households living in that village by 1.7 percent, on average. Further results show that increasing irrigation coverage by 10 percent reduces the incidence of poverty by 5.1 percent. Irrigation yields a higher return in relatively low-rainfall communities. The marginal return to irrigation is lower in relatively high-rainfall communities of the YRB above a certain level (to be precise, communities with annual average rainfall greater than 492 millimeters).

While the impact of irrigation expansion on poverty reduction is significant, the analysis shows that fairly large and positive effects are also caused by the expansion of off-farm income opportunities in the rural YRB. The headcount poverty ratio is expected to decline by 4.5 percent if the share of non-farm income in total per capita household income increases by 10 percent.

POLICY CONCLUSIONS

Expanding irrigation in the YRB will help boost crop yields, which in turn will increase incomes of the poor and help reduce poverty. Labor productivity, however, is known to be lower in the agricultural sector than in other sectors. Therefore, accelerating a shift of the rural labor force out of agriculture by creating off-farm employment opportunities in higher productivity sectors in rural areas is arguably just as or even more important for the poor.

Nevertheless, rapid agricultural growth is an essential component for poverty reduction that must be pursued. The World Bank's World Development Report 2008 shows that growth in agriculture is two to four times more poverty alleviating than growth in other sectors. Therefore, faster agricultural growth, aided by expanded irrigation and accompanied by a speedy shift of the rural labor force out of agriculture, are critical for poverty reduction in the YRB.

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