



RESEARCH REPORT 71

Abstract

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Policies Drain the North China Plain: Agricultural Policy and Groundwater Depletion in Luancheng County, 1949-2000

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The North China Plain, 320,000 km² in extent, is China's most important center of agricultural production and home to more than 200 million people. Through extensive irrigation, the region produces more than 50 percent of the nation's wheat and 33 percent of its maize, making it critical to national food self-sufficiency. Yet, on the North China Plain, water is the most vital and limiting resource. Natural streamflow has almost completely ceased because of diversions to urban, industrial and agricultural uses. Groundwater levels are declining steadily; salt water is intruding into previously fresh-water aquifers and in some places the land surface is subsiding. Even the largest cities, which receive highest priority for water distribution, endure repeated "crises" set off by water shortages.

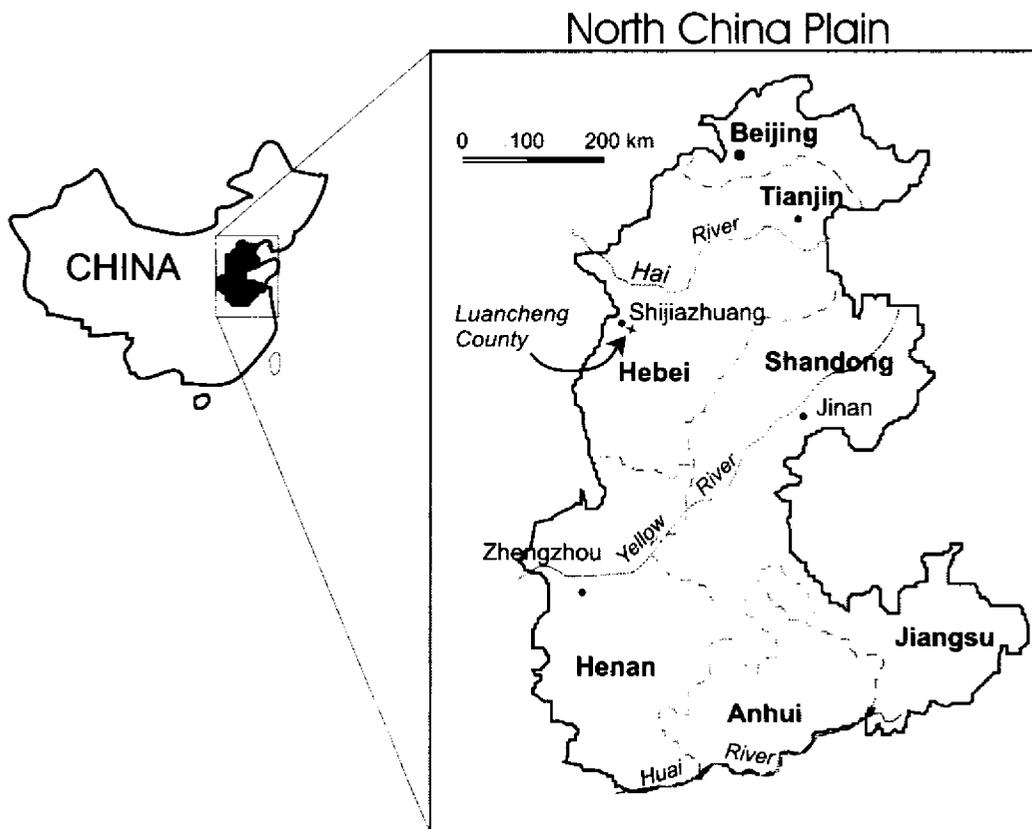
The report examines the relationships between agricultural policies in the North China Plain, the approaches to water management that evolved from them, the quantity of water that was actually used, and the consequent groundwater depletion beneath Luancheng County, Hebei Province, from 1949 to 2000 (figure 1). To systematically address these relationships, we use a comprehensive water-balance approach. Our results indicate that a single, longstanding policy—that of using groundwater to meet the crop-water requirements not supplied by precipitation—is responsible for the steady rate of groundwater decline.

Attempts to make water use sustainable have centered on improving irrigation efficiency to reduce groundwater pumping. Indeed, pumping rates for irrigation in Luancheng County have decreased more than 50 percent since the 1970s. However, water-table declines have continued unabated. This is because the only significant inflows and outflows to and from this hydrologic system are precipitation and crop evapotranspiration, respectively. As long as the irrigated area remains unchanged, crop evapotranspiration remains constant. In Luancheng County, irrigated areas overlie the shallow aquifer, so any excess irrigation water supplied by groundwater pumping passes through the soil profile and replenishes the water supply. Thus, decreased

pumping causes a corresponding decrease in groundwater recharge from excess irrigation, while precipitation and crop evapotranspiration remain unchanged. In this physical configuration, irrigation efficiency improvements save no water.

We explore various proposals to stabilize water levels, including crop changes, water-saving technology, and urbanization. Integrating these proposals, we present a quantitative framework for collaborative land-use planning and long-term, sustainable water management, again using a water-balance approach. The inevitable conclusion of this analysis is that withdrawing some land from irrigation is an essential requisite for achieving sustainable water use in the

Figure 1. Location of Luancheng County within the North China Plain.



North China Plain. This finding counters China's longstanding and successfully implemented policy goal of continually increasing the irrigated area in order to achieve the key societal objective of food self-

sufficiency. The report is based on data, maps, reports, and interviews obtained in Shijiazhuang City and Luancheng County, Hebei Province, People's Republic of China in 2001.