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Integrated water resources management and water users' associations in the arid region of northwest China: A case study of farmers' perceptions

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ABSTRACT

Water scarcity is a critical policy issue in the arid regions of northwest China. The local government has widely adopted integrated water resources management (IWRM), but lacks support from farmers and farm communities. We undertook a case study in the Minqin oasis of northwest China to examine farmers' responses to IWRM and understand why farmer water users' associations (WUAs) are not functioning effectively at the community level. Results of quantitative and qualitative surveys of 392 farmers in 27 administrative villages showed that over 70% of farmers disapprove of the IWRM market-based reforms. In particular, the failure of farmer WUAs can be attributed to overlapping organizational structures between the WUAs and the villagers' committees; mismatches between the organizational scale of the WUAs and practical irrigation management by the farmers themselves; marginalization of rural women in water decision-making processes; and the inflexibility of IWRM implementation. An important policy implication from this study is that rebuilding farmer WUAs is key to overcoming the difficulties of IWRM. The current water governance structure, which is dominated by administrative systems, must be thoroughly reviewed to break the vicious cycle of tension and distrust between farmers and the government.

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1. Introduction

Drought and desertification threaten the sustainable livelihoods of more than one billion people (UNCCD, 1994), most of whom are agricultural producers in developing countries. In particular, the projected intensification of water scarcity as a result of global climate change will cause greater stresses in arid areas (MEA, 2005; UNDP, 2006; Bates et al., 2008). With an increasing understanding of the coupled social-ecological systems (Holling, 2001; Walker et al., 2004; Folke et al., 2005; Reynolds et al., 2007; Liu et al., 2007; Kotchen and Young, 2007), a significant paradigm shift in the management of water resources is being manifested by trends towards both participatory management and adaptive governance (Gleick, 2003; Pahl-Wostl, 2007; Huitema et al., 2009).

The arid region of northwest China, situated in the hinterland of the Eurasian continent, occupies about 30% of China's total land area (Zhao, 1985). Low precipitation and high evaporation make this one of the world's most arid regions (Shi and Zhang, 1995). In recent decades, this region has experienced serious water shortages, drought, and desertification due to population growth, intensive agricultural activities, and poor water resources management (Zha and Gao, 1997; Feng and Cheng, 1998; Wang and Cheng, 1999; Fan and Zhou, 2001; Yang et al., 2005; Zhou and Yang, 2006; Bao and Fang, 2007; Wang et al., 2008). Most residents earn their livelihood through irrigated agriculture that relies on meltwater from snow and glaciers. The projected increase in the surface air temperature of northwest China is expected to result in a 27.2% decline in glacial area and severe drinking and irrigation water shortages by 2050 (Qin, 2002; MOST et al., 2007).

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Facing an unprecedented water crisis, northwest China has been designated as a pilot area for the development of water-saving practices by the central government (NDRC et al., 2006). Because over 80% of the local water resources are used for agricultural production, a cost-effective option to mitigate water shortages is to improve irrigation water management (Deng et al., 2006; Jiang, 2009). Integrated water resources management (IWRM) is currently being implemented as the core of water-saving strategies. As a management practice, IWRM emphasizes decentralizing water management to the local level by increasing community participation in the decision making process (Savenije and Van der Zaag, 2008). To promote participatory irrigation management and the full involvement of small-scale farmers, farmer water users' associations (WUAs) have become increasingly common in the arid region of northwest China (Wang et al., 2010; Qiao et al., 2009). WUAs were used as the organizational foundation for water allocation and were expected to play a critical role in promoting the IWRM reform at the community level.

In this paper, we present empirical results of a survey of small-scale farmers regarding IWRM. This survey was part of a case study in Minqin oasis, Shiyang River basin, northwest China. The objectives of this study were: (1) to measure the farmers' attitudes toward IWRM and their perception of WUAs; (2) to identify the adaptation measures used to cope with IWRM; (3) to explore the reasons why WUAs are not functioning effectively at the community level. On the basis of our findings, we offer policy recommendations to promote the development of farmer WUAs.

2. The study area

The study was conducted in the Minqin oasis (total area 15,870 km^2), which is located in the lower reaches of the Shiyang River basin of northwest China (Fig. 1). This area is surrounded by the Badain Jaran and Tengger deserts, China's third and the fourth largest deserts, respectively. Minqin is a typical oasis, with a mean annual precipitation of 112 mm and mean annual potential evaporation of 2582 mm (over the period of 1953–2006). Since the Han Dynasty (circa 100 B.C.) (Xie et al., 2009), the Minqin oasis has been an irrigation-dependent farming area. Today, the local agricultural ecosystem provides livelihoods for over 300,000 people, 77% of whom are small-scale farmers. The only surface water source for irrigation is the Shiyang River, which originates in the Qilian mountains.

The Minqin oasis became an artificial oasis in 1958 when the Hongya mountain reservoir, Asia's largest desert reservoir, was constructed. Over the last 50 years, as water consumption increased in the middle reaches of the Shiyang River, the surface water discharged into the Minqin oasis gradually decreased, shrinking from 5.14×10^8 m^3 in 1956 to only 1.79×10^8 m^3 in 2006. Even as available surface water resources are becoming increasingly scarce, population growth has led to large-scale land reclamation (for agriculture) during the past 50 years, especially in the oasis-desert ecotone. Groundwater has become the main source for irrigation (Xiao et al., 2007); the number of active wells increased from 27 in 1965 to 9519 in 2006. More than 85% of the annual water consumed in the oasis is now supplied by groundwater extraction.

Over-exploitation of groundwater resources has led to severe environmental degradation (Ma et al., 2005; Sun et al., 2005, 2006; Zhang et al., 2005). Sandy desertification directly threatens the sustainable livelihoods of small-scale farmers, and events such as sandstorms are becoming more common, leading to socio-economic consequences such as increasing numbers of ecological refugees. Moreover, as the demand for water increases, the competition for water resources is becoming more intense, leading to more conflicts among stakeholders and a decline in agricultural benefits. The Minqin oasis faces a dilemma: how to promote the sustainable livelihoods of small-scale farmers, while maintaining the resilience and sustainability of the socio-ecological system.

2.1. IWRM and WUAs in Minqin

The government has launched a series of measures to cope with the challenge faced by Minqin. The Shiyang River Basin Restoration Plan, approved by the State Council of China in 2007, includes planned investments of RMB 4.75 billion (USD 695.6 million) from

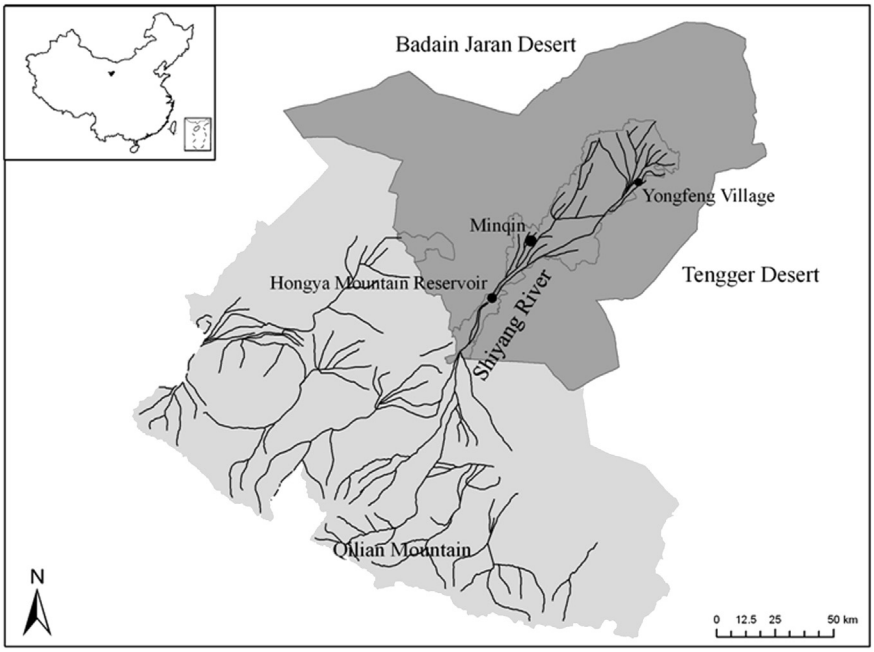

Fig. 1. Case study area.

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