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Climate change and Chinese farmers: Perceptions and determinants of adaptive strategies



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Abstract

Farmers' perceptions, beliefs, adaptive strategies, and barriers regarding climate change are critical to promoting sustainable ecosystems and societal stability. This paper is based on an extensive survey of 1 500 farmers and their households in Henan Province in China during 2013–2014. Henan is the largest agricultural province in China with over 51 million farmers. The survey results showed that approximately 57% of the respondents perceived the direct impact of climate change during the past 10 years, with 70.3% believing that climate change posed a risk to their livelihood. Not surprisingly, most farmers reported that they have adopted new measures to mitigate the negative impacts of climate change. The main barriers hindering farmers' adopting adaptation measures were lack of funds and timely information. A multinomial logit model revealed that land ownership, knowledge of crop variety and the causes of climate change, as well as the belief of climate change, were all positively related to the likelihood of employing adaptive strategies. Moreover, the percentage of households engaging in agriculture activity, and years of engaging in farming were both negatively correlated with farmer's likelihood of adopting adaptation strategies. More importantly, farmers with high incomes were less likely to adopt adaptive strategies and more willing to engage in other business activities. In conclusion, it is important to communicate climate change related information and government policies in rural areas, promote farmer associations and other educational outreach efforts to assist Chinese farmers to deal with climate change.

Keywords: climate change, Chinese farmers, adaptive strategies, Henan Province

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1. Introduction

Climate change has significantly impacted the pattern of precipitation and caused frequent extreme weather events in China, leading to natural disasters such as droughts and floods (IPCC 2007; Chen *et al.* 2014; PDO 2014). Agriculture is generally considered one of the most vulnerable sectors

directly affected by climate change (Chen *et al.* 2016). China's crop production and food security are beginning to be threatened by climate change (Tao and Zhang 2010; Tao *et al.* 2014, 2015). As home to the world's largest population and a generally self-sufficient food producer, any decline in Chinese agricultural production would have grave global consequences. The IPCC estimated China's yields of rice, wheat, and maize (corn) will drop about 20–36% over the next 20 to 80 years (IPCC 2007). While these estimates are based on future scenarios, declines in key cereal production in important areas of China have been observed. Due to changes in precipitation and solar radiation in the past three decades, there has been a 1.2–10.2% reduction in wheat yields in southern China (Tao *et al.* 2014).

Farmers must adapt in order to mitigate the impacts of climate change (Deressa *et al.* 2009). The Chinese government has paid considerable attention to the formulation and implementation of pro-adaptation policies. In 2007, the first National Comprehensive Plan was issued to encourage adaptation to climate change. This clearly stated that mitigation and adaptation were given equal weighting in policy formulation (NDRC 2007). In 2011, the National Strategic Plan for climate change presented the major tasks and plans for agricultural adaptation to climate change in China (SDTD *et al.* 2011). In 2013, the National Development and Reform Commission issued a revised National Strategic Plan for adaptation to climate change that emphasized the importance of adaptation in the agricultural sector (NDRC 2013).

To date, the published adaptation studies of China's agriculture with respect to climate change have focused on estimation of adaptation strategies based on models (Tao and Zhang 2010; Du *et al.* 2013; Wang *et al.* 2013, 2015; Tao *et al.* 2014, 2015) and the driving forces involved (Li *et al.* 2010; Gemmer *et al.* 2011; Chen *et al.* 2014, 2016; Yu *et al.* 2014; Jin *et al.* 2015). A large household survey of six provinces in China examined the impact of policies and social capital on farmers' adaptation decisions related to drought (Chen *et al.* 2014). The results indicated that early warnings facilitated the likelihood of successful adaptation. A challenge of adapting to droughts is that by the time costly strategies are adopted by farmers, droughts are often over, if not replaced by floods. In another study, the contributions of various adaptation options were explored based on a super-ensemble-based probabilistic projection system (Super EPPS) (Tao and Zhang 2010).

Farmers' attitudes and risk perceptions were found to be greatly influenced by public policy and measures to adapt to climate change (Leiserowitz 2005; Lorenzoni and Pidgeon 2006; Li *et al.* 2010; Chen *et al.* 2014; Peter *et al.* 2015). Agriculture was often the first sector to face

the consequences of climate change. Therefore, whether farmers are willing to adopt new measures or improve their ability to adapt is crucial to mitigate the negative impacts of climate change. For the Chinese government to gain a better understanding of farmers' perception of climate change, farmers' ongoing adoption of adaptation measures, the existence of barriers to adaptation, and related social factors is essential. Therefore, the Chinese government can develop and implement policies to guide farmers to successfully adapt to climate change. Very few studies of the agricultural sector's adaptation to climate change in China have been conducted. Consequently, this paper focuses on farmers' perceptions, beliefs, and adaptation decisions in relation to climate change.

Agricultural planting seasons and methods, farming systems, soils, environmental and climatic conditions vary across China's 34 provincial administrative regions. Agricultural adaptation to climate change is a dynamic process with a large variation in the region, physical and socioeconomic contexts. Hence, the formulation of a uniform adaptation policy that guides farmers in the whole of China to adapt to climate change is difficult.

Henan Province is in the middle and lower reaches of the Yellow River. It is the largest agricultural province and is a major grain-producing province in a nation largely self-sufficient in cereal production. Wheat, corn, and rice dominate the agricultural sector in Henan Province, with the total grain output from the province accounting for 10% of China's output. Henan Province's agricultural sector plays a pivotal role in the national grain production in China. In recent years, the agricultural sector in Henan Province has been adversely affected by drought, floods, and insects. In 2014, 23.1 million acres in Henan Province were affected by a severe drought, causing a direct economic loss of about 142 million USD to farmers (PhoenixNet 2014).

Henan Province is used in this paper as a case study to address the following research questions: (1) What are farmers' perceptions and beliefs related to climate change? (2) What are the barriers to adaptation that farmers have experienced and what are the adaptation measures that farmers have taken? (3) What are the determinants affecting farmers' decisions to adopt adaptive measures?

This paper is organized as follows: Section 2 describes the study area, outlines data collection methods and provides explanations for the driving forces affecting the farmers' adaptation to climate change, Section 3 shows the farmers' perception, beliefs in climate change, adaptation strategies and the model results, Section 4 discusses the implications of the results and future research plan, whilst Section 5 presents the conclusion and policy implications.

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