

Impacts and Outcome

The first year of the work of this project has included the production of a large number of papers, which have extended the literature of our understanding of farmer responses to climate change. Some key results and their policy implications are the following.

Key results area	Policy application or implication	Source paper (See below for more information)
Property rights : <ul style="list-style-type: none"> Farmers with contracted land are more likely to implement adaptation measures than those who have rented their land from the collective and from other farmers. 	<ul style="list-style-type: none"> Improvements to the existing status of land rights OR establish properly defined rights 	Paper No 10
Social capital <ul style="list-style-type: none"> Social capital significantly increases households' adaptive capacity. 	<ul style="list-style-type: none"> More emphasis on farming communities Government/state/county level policies to raise farmers' social capital by encouraging increased interactions among farmers in the community (i.e., registrations in farm organizations). 	Paper No 03
Policy support <ul style="list-style-type: none"> Access to government policy support, such as early warning information, post-disaster services, technical assistance, financial services, and in-kind assistance, improves farmers' ability to adapt in response to a drought disaster. 	<ul style="list-style-type: none"> Provision of policy support or further improvements to the existing disaster-related government support services 	Paper No 3 Paper No 6
Community assets/Infrastructure <ul style="list-style-type: none"> Household and community assets significantly and positively affect farmer adaptation, and thereby increase crop yields. 	<ul style="list-style-type: none"> Investments in village irrigation infrastructure and provision of technical services and information. 	Paper No 9
Crop diversification <ul style="list-style-type: none"> Farmers respond to extreme weather events by 	<ul style="list-style-type: none"> Provision of early warning information to assist farmers to make 	Paper No 5

<p>increasing crop diversification. This decision varies with age, gender, education and farm size, and depends primarily on their experience of extreme weather events in the previous year.</p>	<p>their decisions and adaptation plans in advance.</p> <ul style="list-style-type: none"> • Capacity building programmers to enhance adaptation 	
<p>Determinants of perception</p> <ul style="list-style-type: none"> • The higher the social capital and more operating the lands, the greater the farmers' ability to perceive temperature changes correctly 	<ul style="list-style-type: none"> • Provision of better information services to improve farmers' climate related knowledge • Improvements to social capital 	<p>Paper No 4</p>
<p>Yield and/or irrigation (water management)</p> <ul style="list-style-type: none"> • The negative impact of climate change on availability of water in northern China is severe. The impact on crop production would be moderate if water is reallocated among crops. • Adaptation of farm management measures significantly increases rice yield and reduces the downside risk of rice yield. • Growth in urban population has caused a decline in use of water in agriculture. Total irrigated area has fallen and total rain-fed area has grown. This has a negative impact on average yield and total production. • Net crop revenue declines with increases in temperature, particularly in North China. Nevertheless, changes in precipitation are positively associated with crop revenue of farmers, particularly in South China. Irrigation is a key 	<ul style="list-style-type: none"> • Reallocation of water among crops and land adjustments between irrigated and rain-fed crops in each river basin. • Scaling up cost-effective farm management adaptation, and provision of disaster-related public services • Incentives for farmers to adopt water saving technologies • Implementation of appropriate institutional and policy innovations (i.e., water use association, water pricing and water use rights) • Investments in community irrigation infrastructure • Provision of irrigation-related incentives/technical assistance 	<p>Paper No 8</p> <p>Paper No 1</p> <p>Paper No 7</p> <p>Paper No 2</p>

adaptation measure dealing with these changes.		
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Source Papers

- (1) Title: Farmers' Adaptation to Extreme Weather Events through Farm management and Its Impacts on the Mean and Risk of Rice Yield in China.

Authors: Jikun Haung, Yanggjie Wang and Jinxia Wang

Publication status: Published in American Journal of Agricultural Economics in 2015

Abstract

We explore how rice farmers adjust their farm management practices in response to extreme weather events and determine whether their adjustments affect the mean, risk, and downside risk of rice yield. Based on a survey of 1,653 rice farmers in China, our econometric analyses show that the severity of drought and flood in the study areas significantly increases the risk and downside risk of rice yield. The applied farm management measures respond to severe drought and flood and can be considered as adaptation to climate change, an issue often ignored in previous studies. We model adaptation and its impact on rice yield for adapters and non-adapters. Utilizing a moment-based approach, we show that adaptation through farm management measures significantly increases rice yield and reduces the risk and downside risk of rice yield. Several policies, including scaling up the cost-effective farm management adaptation and providing public services related to natural disasters, are recommended to improve adaptive capacity of farmers, particular the poor, in response to extreme events.

- (2) Title : Impacts of climate change on net crop revenue in North and South China

Authors: Jinxia Wang, Jikun Huang, Lijuan Zhang and Yumin Li

Publication status: Published in China Agricultural Economic Review in 2014

Abstract

Purpose – The purpose of this paper is to explore the impacts of climate change on crop net revenue by region. Particularly, the authors focus on the impact differences between north and south regions.

Design/methodology/approach – The authors applied the Ricardian approach which assumes that each farmer wishes to maximize revenue subject to the exogenous conditions of their farm. The climate data are based on actual measurements in 753 national meteorological stations and the socio-economic data covers 8,405 farms across 28 provinces in China.

Findings – On average, the rise of annual temperature will hurt farms both in the north or south. The impacts of climate change on both precipitation and temperatures have different seasonal impacts on producers in the north and the south of China. As a consequence, the impact on net farm revenues varies with farms in the north and the south being adversely affected (to different degrees) by a rise in the temperature, but both benefiting from an anticipated increase in rainfall. The results also reveal that irrigation is one key adaption measure to dealing with climate change. Whether in the north or south of China, increasing temperature is beneficial to irrigated farms,

while for rainfed farms, higher temperature will result in a reduction in net revenues. The results also reveal that farms in the north are more vulnerable to temperature and precipitation variation than that in the south. Irrigated farms in the south are more vulnerable to precipitation variation than that in the north; but rainfed farms in the north are more vulnerable to precipitation variation than that in the south.

Originality/value – Applying empirical analysis to identify the differences of climate change impacts between north and south regions will help policy makers to design reasonable adaptation policies for various regions.

- (3) Title : Policy Support, Social Capital, and Farmers' Adaptation to Drought in China
Authors: Huang Chen, Jinxia Wang, Jikun Huang
Publication status: Published in Global Environmental Change in 2014

Abstract

Increasingly severe drought has not only threatened food security but also resulted in massive socioeconomic losses. In the face of increasingly serious drought conditions, the question of how to mitigate its impacts through appropriate measures has received great attention. The overall goal of this study is to examine the influence of policies and social capital on farmers' decisions to adopt adaptation measures against drought. The study is based on a large-scale household and village survey conducted in six provinces nationwide. The survey results show that 86% of rural households have taken adaptive measures to protect crop production against drought, most of which are non-engineering measures. In the case of non-engineering measures, changing agricultural production inputs and adjusting seeding or harvesting dates are two popular options. A multivariate regression analysis reveals that government policy support against drought such as releasing early warning information and post-disaster services, technical assistance, financial and physical supports have significantly improved farmers' ability to adapt to drought. However, since only 5% of villages benefited from such supports, the government in China still has significant room to implement these assistances. Moreover, having a higher level of social capital in a farm household significantly increases their adaptation capacity against drought. Therefore, the government should pay particular attention to the farming communities, and farmers within a community who have a low level of social capital. Finally, farmers' ability to adapt to drought is also associated with the characteristics of their households and local communities. The results of this study also have implications for national adaptation plans for agriculture under climate change in other developing countries.

- (4) Title : Social Networks, Farm Assets, and Farmers' Perceptions of Climate Change in China
Authors: Lingling Hou, Jikun Huang and Jinxia Wang
Publication status: Forthcoming publication in Climate Research

Abstract

Farmers' perceptions of the local climate reflect their awareness of climate change and may affect their adaptation behaviors toward climate change. However, the literature suffers a knowledge gap on understanding farmers' perceptions of climate change. This study

examines farmers' perceptions of annual mean temperature, the consistency of these perceptions with meteorological record data, and what influences the consistency. The study found over 70% of farmers in China perceived an increased annual mean temperature in the past 10 years. However, only 18% of farmers have perceptions consistent with the meteorological record data. Econometric analysis shows that social networks can improve farmer's ability to correctly perceive temperature changes. Additionally, farmers with more operating land have better capacity to consistently perceive temperature. This paper concludes with several policy and research implications.

- (5) Title : Crop Diversification in Coping with Extreme Weather Events in China
Authors: Jikun Huang, Jing Jiang, Jinxia Wang and Lingling Hou
Publication status: Published in Journal of Integrative Agriculture in 2014

Abstract

Apart from the long-term effects of climate change, the frequency and severity of extreme weather events have been increasing. Given the risks posed by climate change, particularly the changes in extreme weather events, the question of how to adapt to these changes and mitigate their negative impacts has received great attention from policy makers. The overall goals of this study are to examine whether farmers adapt to extreme weather events through crop diversification and which factors influence farmers' decisions on crop diversification against extreme weather events in China. To limit the scope of this study, we focus on drought and flood events only. Based on a unique large-scale household survey in nine provinces, this study finds that farmers respond to extreme weather events by increasing crop diversification. Their decision to diversify crops is significantly influenced by their experiences of extreme weather events in the previous year. Such results are understandable because farmers' behaviors are normally based on their expectations. Moreover, household characteristics also affect farmers' decisions on crop diversification strategy, and their effects differ by farmers' age and gender. This paper concludes with several policy implications.

- (6) Title : Information Provision, Policy Support, and Farmers Adaptive Responses Against Drought: An Empirical Study in the North China Plain
Authors: Jinxia Wang, Yu Yang, Jikun Huang and Kevin Chen
Publication status: Forthcoming Publication in Ecological Modelling in 2015

Abstract

As an important agricultural production region in China, the North China Plain (NCP) is an ecologically vulnerable region that frequently is hit by drought. Faced with drought and other extreme climate events, policy makers have given top priority to the formulation and implementation of adaptation policies. This paper assessed the effectiveness of adaptation policies, including the provision of early warning information and policy supports, on farmers' adaptive decisions regarding the planting of the wheat crop in the NCP. Based on a unique dataset from a large-scale village and farm survey in five provinces in the NCP, an econometric model of farmers' adaptation practices is estimated. Results show that when faced with a more severe drought, farmers change their management practices to

mitigate its effects by adjusting seeding or harvesting dates and enhancing irrigation intensity. The provisions of early warning and prevention information and policy supports against drought facilitate farmers to make farm management adaptations. However, the effectiveness of early warning and prevention information or policy supports differs by their provision channels or types. The findings of this study have policy implications in coping with the rising frequency and seriousness of extreme weather events in China as a whole and in ecologically more vulnerable NCP in particular.

- (7) Title : Urbanization, Agricultural Water Use, and Regional and National Crop Production in China
Authors: Tingting Yan, Jinxia Wang and Jikun Huang
Publication status: Forthcoming publication in Ecological Modelling in 2015

Abstract

The overall goal of this paper is to analyze the impacts of the urbanization on regional and national agricultural production through its impact on water use in agriculture in China. Given the historical trend of water use in agriculture and its correlation with urbanization, the change in agricultural water use due to urbanization is estimated. Then the impacts of this change on regional crop production are simulated based on the China Water Simulation Model (CWSM). Within CWSM, a positive mathematical programming (PMP) optimizes water allocation among crops and between irrigated and rain fed areas within a crop in each of ten river basins in China. The results show that water use in China has an obvious increasing trend, particularly in the industrial and domestic sectors, while the share of water use in agricultural sector has been dropping. A 1-percentage-point increase in urbanization can result in a 0.47 percentage-point decline in share of water use. Based on the model simulation, this will lead to the further decrease of irrigated areas and the increase of rain fed areas at both the national and river basin levels, particularly for water intensive crops (such as rice and wheat). Accordingly, average yields and total production will also decrease. A river basin with large production of either rice or wheat (or both) decreases more in irrigated area as urban area expands. Adaptation measures are recommended for both authorities and farmers to ensure food security, such as providing incentive for farmers to adopt water saving technology, implementing appropriate institutional and policy innovations (e.g., water use association, water pricing and water use rights).

- (8) Title : Impacts of Climate Change on Water and Agricultural Production in Ten Large river Basins in China
Authors: Jinxia Wang, Jikun Huang and Tingting Yan
Publication status: Published in Journal of Integrative Agriculture in 2013

Abstract

The overall goal of this paper is to examine impacts of climate change on water supply and demand balance and their consequences on agricultural production in ten river basins in China. To realize this goal, China Water Simulation Model (CWSM) is used to analyze three alternative climate scenarios (A1B, A2 and B2). The results show that the impacts of climate change on water supply and demand balance differ largely among alternative scenarios. While significant impacts of climate change on water balance will occur under the A1B scenario, the impacts of climate change under the A2 and B2 scenarios will be marginal. Under the A1B scenario, the water

shortage in the river basins located in the northern China will become more serious, particularly in Liaohe and Haihe river basins, but the other river basins in the southern China will improve their water balance situations. Despite larger impacts of climate change on water balance in the northern China, its impacts on total crops' production will be moderate if farmers would be able to reallocate water among crops and adjust irrigated and rainfed land. The paper concludes with some policy implications.

(9) Title : Household and Community Assets and Farmers' adaptation to Extreme Weather Event: The Case of Drought in China

Authors: Yangjie Wang, Jikun Huang and Jinxia Wang

Publication status: published in Journal of Integrative Agriculture in 2014

Abstract

Under climate change, rising frequency and serious extreme weather events have challenged agricultural production. Designing appropriate adaptation measures to the extreme weather events require rigorous and empirical analysis. The overall goals of this study are to understand physical adaptation measures taken by farmers and the impacts of household and community assets on farmers' adaptation when they face drought. The analyses are based on a unique data set collected from a household survey in three provinces in China. The survey results show that though not common on annual basis, some farmers did use physical adaptation measures to fight drought. Regression analysis reveals that both household and community assets significantly affect farmers' adaptation behaviors. Improving households' social capital and wealth, communities' network and access to government's anti-drought service can facilitate farmers' adaptation to drought. Results indicate that community's irrigation infrastructure and physical adaptation taken by farmers can substitute each other. Further analysis shows that the households taking adaptation measures have higher crop yields than those without taking these measures. The paper concludes with several policy implications.

(10) Title: Adaptation to Climate Change in Guangdong Province in China: do Property Rights Matter?

Authors: Jayanthi Thennakoon, Christopher Findlay, Jikun Huang and Jinxia Wang

Publication status: a working paper

Abstract

Adaptation is necessary to mitigate the staggering impacts of climate change on the agricultural sector in China. The condition of land tenure in China is often cited as an institutional factor constraining farmers' decisions to adopt new technologies. This study investigates the association between the characteristics of land tenure and farmer adaptation behaviour in Guangdong Province. It employs a statistical analysis and probit regression model based on a farm household survey. Results indicate that farmers with contracted land are more likely to implement adaptation measures than those who have rented their land from the collective and from other farmers. Farm households tend to adopt measures in anticipation of rather than in response to an extreme weather event. Results highlight the importance of properly defined land rights for agricultural sector investments in the context of climate change.

