

The Impact of climate change on rice production In Thailand

Jainta Chomtoranin¹, Eric Strobl², Robert Elliott³, and Elodie Blanc⁴

^{1,3}University of Birmingham, Birmingham, UK

²University of Bern, Bern, Switzerland

⁴Massachusetts Institute of Technology, Cambridge, USA

1.Introduction

- According to the Disaster Prevention and Mitigation Department of Thailand (2014), rice fields are negatively affected by frequent and intense floods and droughts every year. However, floods have more impact on rice production
- Thailand has 2 rice growing cycles: Rain-fed rice (80%) and irrigated rice (20%)
- The average of lost rice production areas are 8,845.137 hectares for rain-fed rice and 181.422 hectares for irrigated rice (Office of Agriculture Economics, 2015)
- Nevertheless, rice production in both rice growing seasons has been growing between 2001 and 2014
- Therefore, increasing rice production suggests that factors other than weather is influencing rice production

2.Objectives

- To monitor rice field changes in response to weather fluctuation
- To detect the main rice ecosystems of the country
- To identify factors that might affect rice cultivation, including climate, production, and relevant government measures/policies on rice production
- To determine the current weather impacts and the future climate threats to rice farming



3.Methodology

3.1 Rice field detection

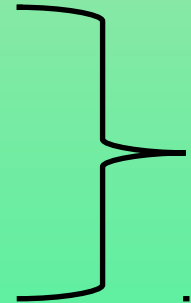
a. Rice ecosystems

★ Rain-fed lowland rice

★ Deep water/ Floating rice

Upland rice

★ Irrigated lowland rice



Rain-fed rice season



Irrigated rice season

b. Rice field detection algorithm

-We use a software called STATA in stead of remote sensing software

-The study employs satellite product called MOD09A1 from 2001-2014

-Basically, we follow the threshold developed by Xiao et al (2005; 2006). However, we need to modify the threshold to include major rice ecosystems of the country

3.2 Regression analysis

a. Model specification for rice yield

- We use panel data at province level
- We develop the model based on the study of Wei *et al.* (2014)

$$Y_{it} = \beta_1 \text{Climate}_{it} + \beta_2 \text{Land}_{it} + \beta_3 \text{Capital}_{it} + \beta_4 \text{Labor}_{it} + \beta_5 \text{Policy}_{it} + \Psi_i + \Phi_t + \varepsilon_{it}$$

b. Model Specification for rice production loss areas

- Also, we use panel data at province level to regress the model below:

$$L_{it} = \beta_1 \text{Climate}_{it} + \Psi_i + \Phi_t + \varepsilon_{it}$$

3.3 Climate change projection on rice production over the 21st century

- We employ six climate models -> rainfall and temperatures
- We also link the climate variables with the rice pixels
- Previous studies estimate irrigation water for rice production based on demand side
- In contrast, our study proposes a new formula for irrigation water projection derived from supply side as below:

$$\text{Projected irrigation water} = \text{Initial water stock} + \text{Surcharge water}$$

4.Results

1. Rice field detection

- Rain-fed rice -> Average accuracy is 83.49 %
- Irrigated rice -> Average accuracy is 85.13 %

2. Regression analysis

a. Rice yield

- At the mean of rainfall and irrigation water, irrigated rice tends to have double yield than that of rain-fed
- Rain-fed rice relies solely on rainfall. In addition, rice production area and fertilizer can help to increase rice yield
- Irrigated rice depends only on irrigation water. In addition, rice production area and rice quantity pledged under the pledging scheme can boost rice yields.

b. Rice production loss areas

- Rain-fed rice is likely to be damaged by flooding
- There is no significantly negative impact of climate change on irrigated rice. However, minimum temperature can benefit the yield

3. Climate change projection over the 21st century

- Rainfall and irrigation water are likely to rise for the two crop cycles
- Minimum temperature tends to decrease whilst maximum temperature is likely to increase for the two rice seasons
- Rain-fed rice yield tends to decrease whereas irrigated rice yield is likely to increase

5. Conclusions

5.1 Climate variables

- Rainfall -> [rain-fed rice](#)
- Irrigation water -> [irrigated rice](#)

5.2 Non-climate variables

- Area and fertiliser -> [rain-fed rice](#)
- Area and rice quantity pledged under the pledging scheme -> [irrigated rice](#)

5.3 Policy implications

- The government should prepare to cope with [frequent and intense floods](#) in the future
- [Deep water rice](#) should be introduced and grown in flood prone areas

Thank you

For further comments:

jxc465@bham.ac.uk; jainta66@yahoo.com