THA2019

Evaluation of Economic Damages on Rice Production under Extreme Climate and Agricultural Insurance for Adaptation Measures in Northeast Thailand

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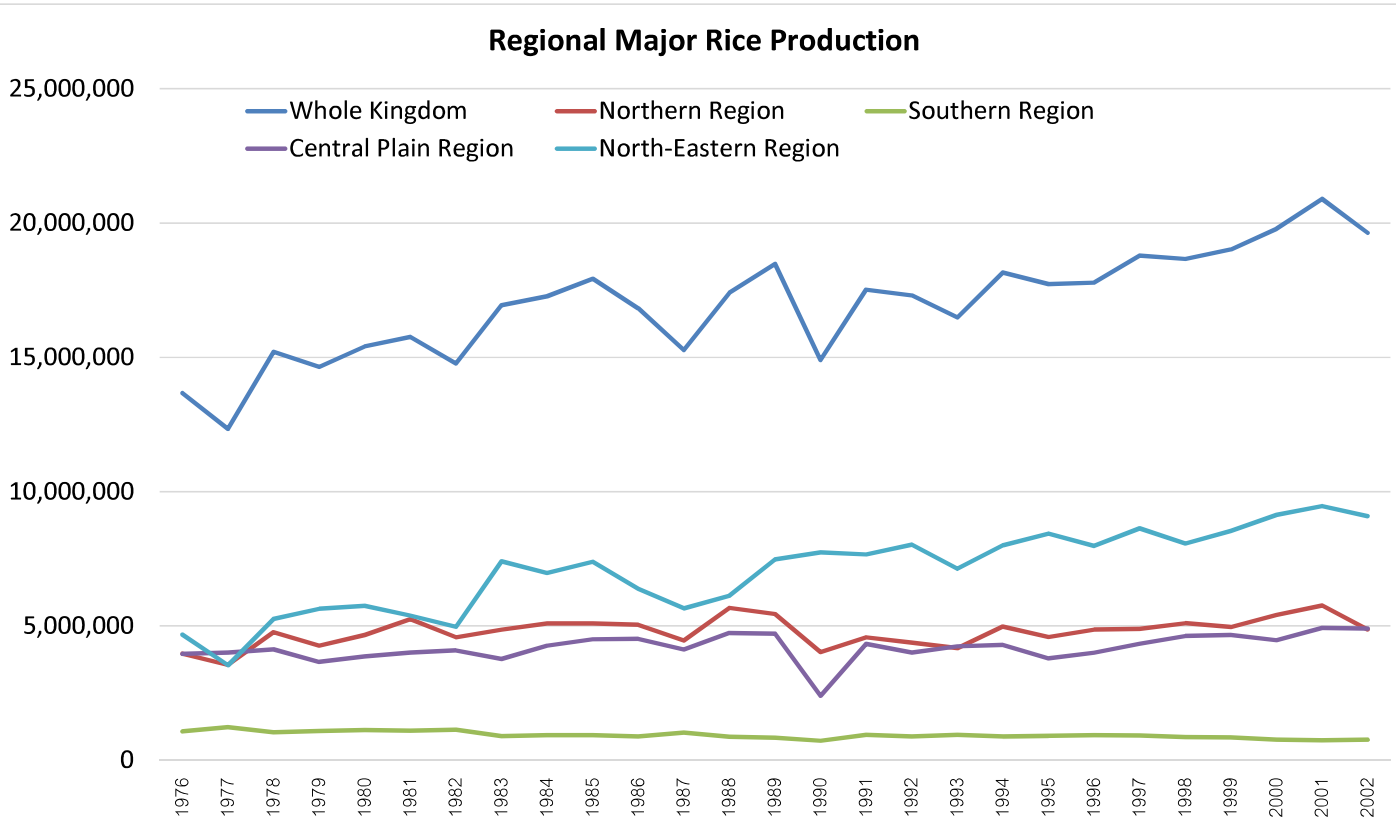
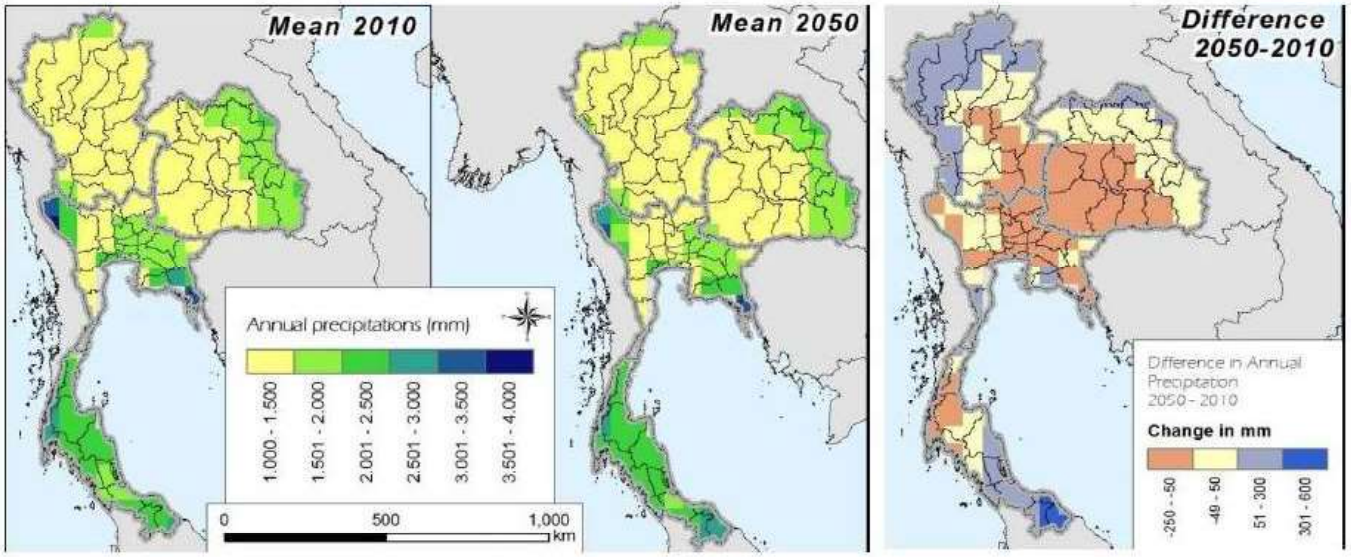
Northeast Thailand producing 50% of rice



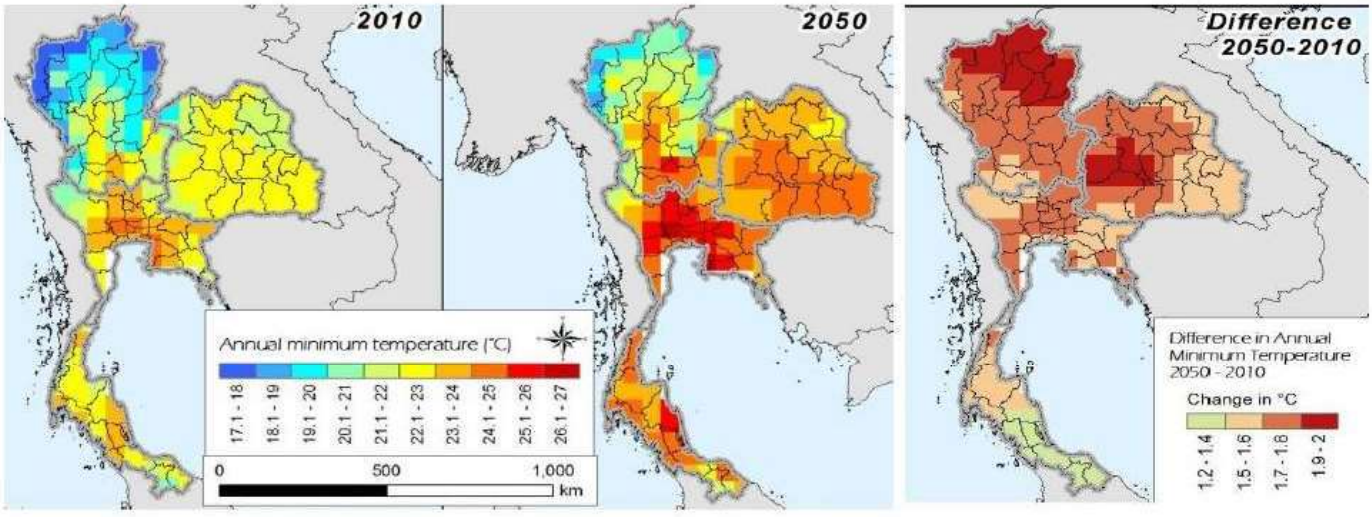
Annual Rainfall Projection



Source: LDD

Average rainfall is 1200 mm/year in Northeast Thailand.
Annual rainfall tend to decrease in the future.

Minimum Temperature Projection



Minimum temperature will increase every region range between 1.2 – 2 Celsius. Temperature rise the most in Northern and central part of Northeastern.

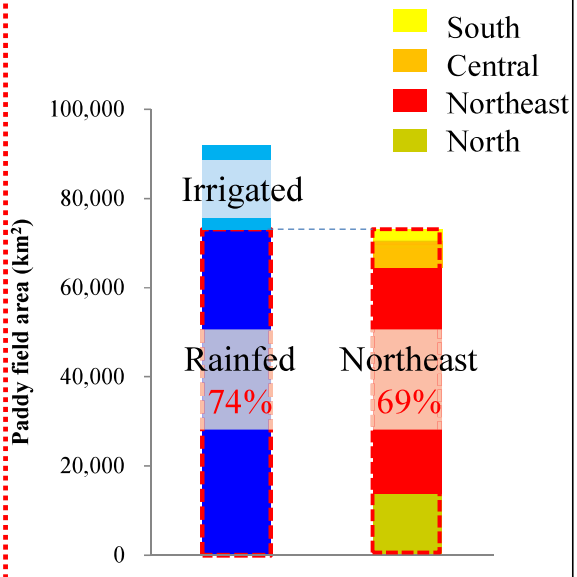
Rural Sector~Agricultural Production~

Extreme weather impacts on agricultural communities, especially where infrastructure investments are insufficient.

The ratio of irrigated agricultural land was only 7.6% (in 2012) and others were rain-fed in NE Thailand so that climate change makes agricultural production more unstable.

⇒ Flood : 2000, 2011,2017,

Drought : 1993, 2004,2015



Source : Planted area , OAE(2007-2009)

Irrigation rate 26% in Total, 69% of rain-fed paddy were located in Northeast thailand

Countermeasure : Weather Index Insurance for Agriculture(WIIA)

EXAMPLE

The Sompo Japan Insurance company and the Bank of Agriculture and Agricultural Cooperatives (BAAC) Thailand are selling the WIIA in NE Thailand from 2010.
it is beneficial for rain-fed rice farmers to restore or mitigate the economic loss caused by extreme weather by WIIA.

Farmer pay the fee : 10% of their loan budget included in their loan
(Ex. loan 20,000-40,000 Baht/season)

Under extreme condition;

(1) Early drought: Sompo pay 10 % of loan to farmers
when rainfall in July less than 100 mm/month (Index1)

(2) Drought: Sompo pay 15 % of loan to farmers
when rainfall in Aug-Sep less than 320 mm/month (Index2)

(3) Sever drought: Sompo pay 40 % of loan to farmers
when rainfall in Aug-Sep less than 220 mm/month (Index3)

Over 6,000 farmers bought WIIA in 2011, but the number was dropped after 2011.

WHY? (only 1-2% buy)

Objective

Evaluate the effectiveness of insurance and agricultural damage on farmers income, then propose more suitable insurance design.

Method

① Correlation analysis between rice production and seasonal rainfall → Suitable period for insurance index

① Probability analysis of extreme drought → Suitable amount for insurance index

② Interview to farmers about their revenue structure → Insurance effectiveness for farmers household income

Evaluation of Weather Index Insurance

7 7

① Regression between rice production and seasonal rainfall

Process

- Correct rainfall data from 41 station in North-east Thailand
- Evaluate how affect the rainfall amount and patterns on rice production in wet season through regression analysis

Period

Major rice : 1985～2004（20 years）

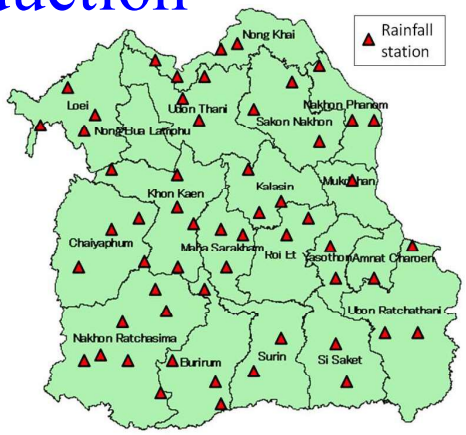


Fig. Rainfall station and Province map

Table Regression coefficient of wet season rice

(Province) (Month)	May-Jul	Jun-Aug	Jul-Sep	Aug-Oct	Sep-Nov	Oct-Dec
Buriram	0.30	0.32	0.30	0.13	-0.11	-0.13
Chaiyaphum	0.28	0.26	0.13	0.04	-0.14	-0.11
Kalasin	0.42	0.49	0.37	0.13	-0.05	-0.05
Khon Kaen	0.38	0.53	0.53	0.54	0.45	0.35
Loei	0.39	0.45	-0.30	0.08	-0.04	0.48
Maha Sarakham	0.15	0.45	0.54	0.42	0.32	0.25
Mook Zehnder Hahn	0.05	0.33	0.34	0.22	0.06	-0.25
Nakhon Phanom	0.00	-0.12	-0.19	-0.13	-0.07	0.04
Nakhon Ratchasima	0.27	0.35	0.33	0.05	-0.15	-0.32
Nong Khai	0.02	-0.12	-0.11	-0.24	0.02	-0.15
RoiEt	0.36	0.49	0.31	0.09	-0.18	0.07
Sakon Nakhon	-0.01	0.02	0.17	0.44	0.35	0.17
Sisaket	0.05	0.13	0.02	-0.04	-0.29	-0.32
Surin	0.38	0.47	0.34	-0.01	-0.49	-0.48
Ubonratchathani	0.27	0.24	0.14	0.08	0.12	0.21
Udon Thani	-0.12	0.26	0.48	0.26	0.17	-0.20
Yasothon	0.26	0.06	-0.12	-0.18	-0.21	0.07

:Positive

:Negative

Positive relation with 3 month accumulated rainfall in 10 province.
⇔Negative relation in Nakhon Ratchasima, Si Saket and Surin.

⇒Index(period) is suitable

8

② Probability analysis of extreme drought

To check the insurance design

Probability Functions

- Normal distribution
- Gumbel distribution
- Lognormal distribution

Periond

- Khon Kaen Province
- July, August+Sepember
- Monthly Rain（1985-2004）

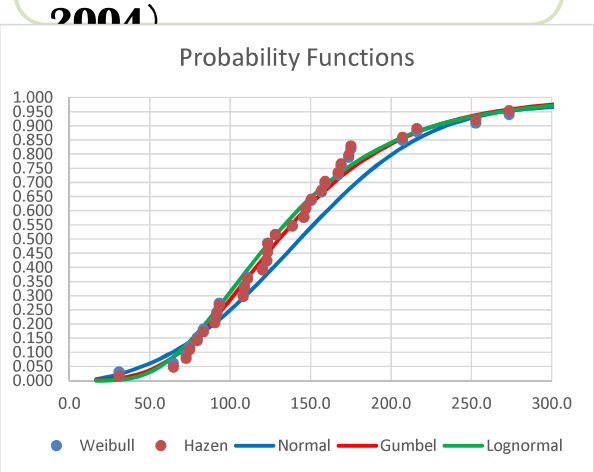


Table. Return period of extreme drought

Year	July (mm)	Aug+Sep(mm)
50	41	208
30	48	224
20	55	239
16	59	248
12	65	260
10	67	269
8	74	281
5	87	311
4	95	328
3	107	354
2	130	407

Farmer's expected benefits are below;
(1) Early drought: 10%/4yr = 2.5%/yr
(2) Drought: 15%/5yr = 2.2%/yr
(3) Sever drought:40%/30yr = 1.1%/yr
Total is 5.8%/yr (while company get 4.2 %)

Index(amount) also looks like suitable

③Estimation of Economic Loss (Major rice)

Method

By using statistic data of rice production and rice price,

※EL ＝ RP×DN
DN=（X－$\bar{x}$）

EL:Economic loss, RP: rice price, DN: difference from normal year production,
X：rice production/year,$\bar{x}$：normal（5year average）

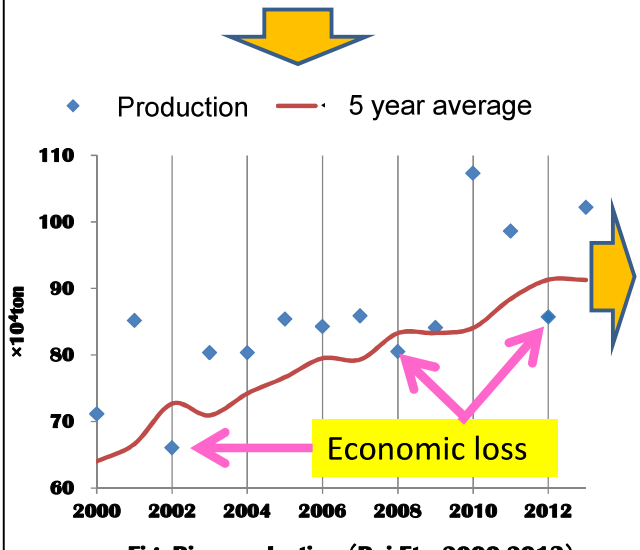


Fig. Rice production（Roi Et, 2000-2013）

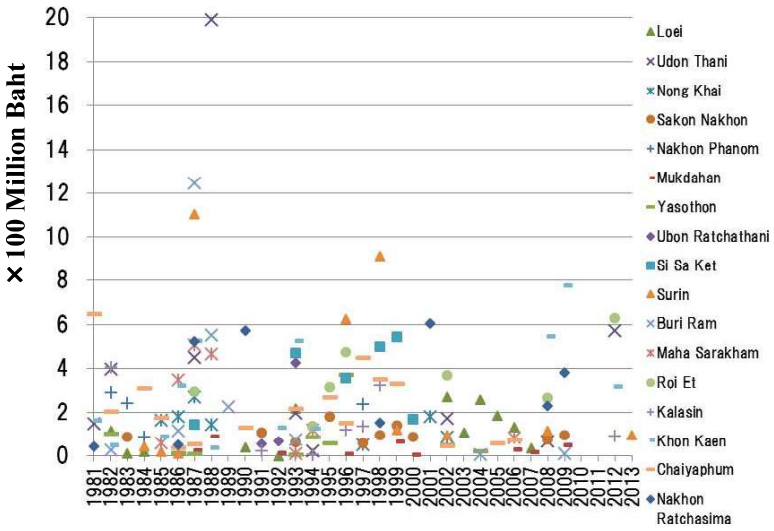


Fig. Economic loss in Northeast Thailand

⇒still large economic loss for government

④ Impact on famers household income

Interview to farmers

〈Khon Kaen province〉
Total 62 households
〈Date〉
2015/9/15-20,
2016/4/6-8, 2016/9/8

〈Questionnaires〉
- Labor power
- Income from agri- and non-agriculture
- Cropping schedule
- Knowledge of insurance system
- Adaptation under extreme drought ・・
etc.

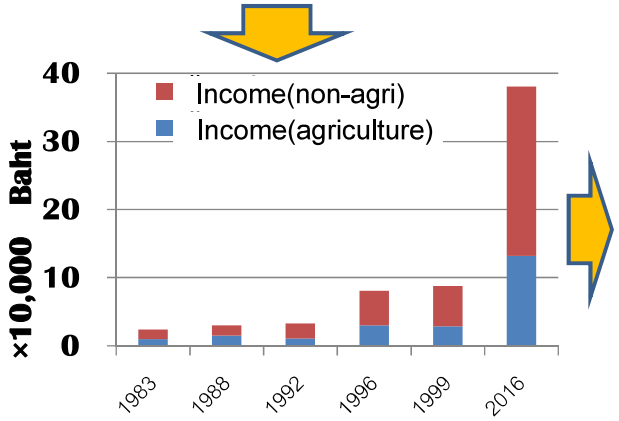


Fig. Farmers income change

⇒farmers become rich than before ⇒ Impact is not so large for them

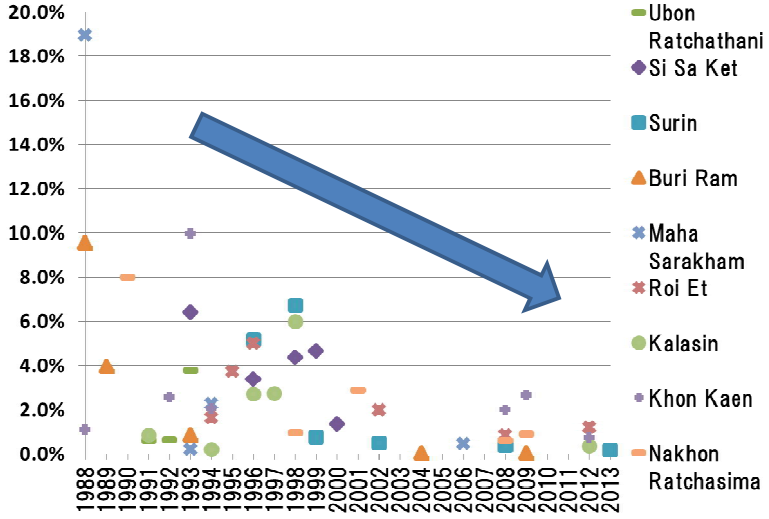


Fig. Impact of agricultural damage on farmers income

11

Conclusion

Correlation Analysis

- Wet season rice production had positive correlation with accumulated monthly rainfall during July to Sep.

  ⇒ index period is suitable

Probability Analysis

- Return period of insurance index was suitable.

  ⇒ Farmers can get benefit 5.8 % (while payment was 10%)

Economic loss in provincial, farmers level

- Still big impact in provincial level,
- However, small impact on farmers income,

  because 60% income from non-agricultural sector.

12

13

Current Problem

We need more information

- Recent agricultural statistic
  after 2013 for rice.
- Upland crop data
  before 1993, and after 2013.

14

Background

FLOOD

Historical records of climate
Flood : 2009, 2010, 2011

DROUGHT

Historical records of climate
Drought : 1993, 2005, 2014-2015

Impact to Human Life and likelihood

Mainly Agricultural Sector
◆ GDP12% ◆ Population 40%

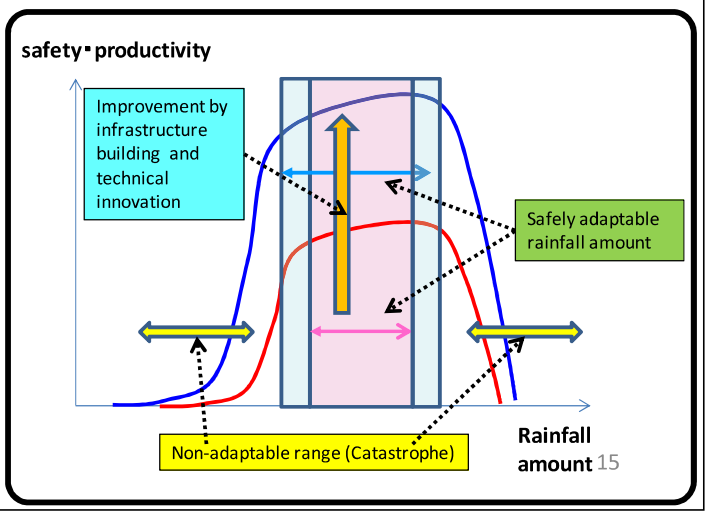
Food Production

Low productivity
Unstable production

- **Investment in agricultural sector enhance the productivity or stability of agricultural production**
- **However, there is a limitation of adaptation by infrastructure under the extreme climate condition.**
- **Question is how to enhance disaster resilient social system ?**

  Financial system for quick recovery from disaster damage

  → **Enhancing public welfare**



15