Background Paper

Thailand

SRI-LMB Project

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Ministry of Agriculture and Cooperatives
Royal Government of Thailand

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SUMMARY

Agriculture sector despite its decreasing contribution to the national GDP is an important part and parcel of Thai economy, social and spiritual life. Rice, which occupies over 50% of the area, is by far a most important crops in the Kingdom not only to meet the domestic consumption needs but also for export to number of countries in the world. Thai Rice fetches a premium price in the word market and known for its quality and high standard. Majority of rice are grown in Central and NE part along with Northern part of the country. The geographical, hydrological as well as social and economic base in North and NE Thailand requires special attention in the wake of serious challenges on account of several important drivers but not limited to climate change, resource degradation, globalization and above all re-orientation towards the 'Sufficiency Economy" and Sustainable Agriculture Production policies of the HM the King, which is implemented by the Ministry of Agriculture and Cooperatives (MoAC).

To improve farmer livelihoods, natural resources and infrastructure must be considered and developed. Soil is an important factor in agricultural production. The poor soil health is a major problem in Thailand, with an area of about 27.988 million hectares, salt affected area is about 2.302 million hectares. Farm holding areas are about 24.31 million hectares or 47.31% of the total area of Thailand in 2010. More than a half of farmer's lack land ownerships that contribute to the problem of access to resources in the production of food security. Water management is a main problem lead to water shortage where irrigation areas cover just a 22.5% of the total agricultural land use areas. The agricultural sector is likely to have communities with a high proportion of the elderly population due to low birth rate and low attraction to new generation in term of income. Agricultural policy in 2012 fiscal year was mainly focused on urgent issues to embark and the reconstruction of agricultural economy. Crop insurance was introduced in relation to policy on food security.

To address some of the above-mention challenges under the broad umbrella of available policies of MoAC, principles of SRI, which has been applied and tested on a pilot basis by farmers group in Central and NE Thailand, provides a robust opportunity to undertake systematic action research as envisaged in the AIT-EU SRI Project. Asian Institute of Technology (AIT) in collaboration with Thai Education Foundation and DoAE has undertaken multi-year projects utilizing the principles of SRI, which provide evidence of not only factor productivity increase but also the increase in knowledge and capacity of the farmers to apply sustainable agriculture practices in their own farm.

A. SALIENT FEATURES AND ROLE OF AGRICULTURE AND ITS CONTRIBUTION TO NATIONAL ECONOMY

Thailand is fundamentally an agrarian society and Agriculture, value added (% of GDP) contributed 12.37% in 2011 (World Bank, 2012). Agriculture plays a crucial role as a source of food, raw materials, employment, export earning, ecology, culture, wisdom and social solidarity. Rice alone occupies over 50% of total cropped area (see Table 1, Table 2 and Table 3). The agriculture sector always faced the crisis and other changes arising from globalization. His Majesty the King realized that there are many risks that occur after the crisis, especially in small-scale farmers in agricultural sector. Farmers or the small-scale farmers face the risks not only in economic crisis such as the price of agricultural product and debts, but also natural disasters like droughts, water supply, plant diseases and pests. Therefore, His majesty the King has given the practical way in agricultural sector under "Sufficiency Economy" Philosophy. It was namely as **"New theory"** concept which simply implies the new approach of development in the agricultural sector. This concept is the guiding force in reducing dependence and at the same time envisage to increase the capability of farmers to manage the production independently with a minimum of risk to the smallholder farmers.

The Ministry of Agriculture and Cooperatives (MoAC) is responsible for implementing the sustainable agricultural development framework to achieve the goals set out by the His Majesty the King. Sustainable agriculture development framework provides the best guideline for small-scale farmer which can reflect the balance among three aspects, *i.e.,* economical, socio-cultural and environment and it aims to improve farmer's quality of life, food security and self-sufficiency in household and at community level.

The Royal initiative is to help farmers who usually suffer from the impact of other changes, crisis, natural disasters and external factors. The implementation process of agricultural development comprises of three phases:

(1) The first phase is to adapt production process to enable farmers to understand and apply it into their own farmland. By doing so, a farmers not only produces for the family consumption but also able to sell surplus to the market to generate additional income. Making informed decision on resources use for production could lead to reduce cost of production and enhanced income for families to reduce dependency.

(2) In second phase of this framework, farmers are encouraged to set up groups or cooperatives to carry out activity work in the areas of production, marketing, living conditions, welfare, education and other societal goals, and

(3) The third phase envisages that the farmer should be able to connect better to banks or private sector to obtain funds to assist in investment or developing their quality of life. In this phase, farmers can get more benefits, improve the quality of their life and strengthen their capacity building into the network both in community and national level.

Table 1 Agricultural land use in Thailand

Agricultural land use	Area (hectares)	Percent (%)
Household	594,654.56	2.72
Paddy field	11,464,468.8	49.74
Field crop	5,615,360.16	21.37
Orchard	5,539,374.88	21.35
Vegetable and flower plants	243,646.08	0.84
Pasture	159,974.24	0.74
Unclassified	252,390.56	1.38
Other	437,797.76	1.86
Total	24,307,667.04	100.00

B. RAINFED AGRICULTURE AREA AND ITS SALIENT FEATURES

1. Rainfed areas

The rainfed areas in Thailand primarily concentrated in northeastern and northern part of the country. In NE Thailand only 8% area is irrigated and remaining 92% is either rainfed or partially irrigated with the water harvested from higher slopes. Besides, in most part of the northeastern region the underground water is mostly saline because of the underlying rock salt geological formations (Senanarong et al., 2013). The following table (Table 2) provides the details of the main crop, planted area and other details. Similarly majority of households are engaged in either full-time or part-time farming for their livelihood needs.

Table 2 Main crops of Northeastern and Northern in Thailand 2011/2012 (Source: Department Agricultural Extension, http://www.agriinfo.doae.go.th/)

Sl.	Main crops		Growing season	Area (hectare)	Contribution to total national production (kg)
Nakhon Ratchasima	Wet season rice	186,615	May - October 54	641,148.16	1,898,760,405
	Cassava factory	71,976	March 54 - February 55	283,628.16	5,933,504,614
Roi Et	Wet season rice	188,519	May - October 54	570,592.00	1,404,776,825
	dry season rice	26,480	November - April 55	56,845.92	302,508,092
Kalasin	Wet season rice	130,701	May - October 54	271,582.24	709,174,404
	Sugar cane	31,640	August54 - January	79,893.12	3,747,951,254
Maha Sarakham	Wet season rice	127,199	May - October 54	376,702.40	1,118,392,876
	dry season rice	20,087	November - April 55	37,413.44	203,047,524
Sakon Nakhon	Wet season rice	139,313	May - October 54	358,273.76	992,637,368
	Rubber	19,352		39,138.72	28,486,458
Khon Kaen	Wet season rice	169,332	May - September 54	465,557.76	1,106,974,801
	Sugar cane	43,760	September 54 - July 55	129,923.36	7,041,088,981
Ubon Ratchathani	Wet season rice	248,720	May - October 54	696,212.64	1,654,229,298
	Cassava factory	50,040	March 54 - February 55	73,687.04	1,111,413,737
Buri Ram	Wet season rice	187,826	May - September 54	568,965.92	1,459,777,638
	Sugar cane	9,874	November 54 - September 55	40,548.32	5,957,655,162
Nong Khai	Wet season rice	31,804	May - October 54	108,307.52	201,385,805
	Rubber	12,117		36,649.28	33,996,919
Chaiyaphum	Wet season rice	103,709	May - October 54	309,926.08	820,017,945

Sl.	Main crops		Growing season	Area (hectare)	Contribution to total national production (kg)
	Cassava factory	36,887	March 54 - February 55	131,371.52	2,303,368,829
Si Sa Ket	Wet season rice	204,709	May - October 54	512,888.96	1,460,678,194
	Rubber	19,767		32,487.20	46,039,559
Nakhon Phanom	Wet season rice	87,341	May - October 54	253,974.72	491,614,844
	Rubber	18,217		41,849.76	11,747,170
Udon Thani	Wet season rice	171,062	May - September 54	381,766.72	989,636,176
	Sugar cane	26,010	January 54 - December 55	96,243.68	5,452,452,549
Surin	Wet season rice	200,058	May - October 54	567,558.08	1,350,629,481
	Rubber	11,087		26,074.24	8,306,965
Yasothon	Wet season rice	70,402	May - October 54	244,000.00	624,695,487
	Cassava factory	12,634	March 54 - February 55	20,996.32	352,677,638
Mukdahan	Wet season rice	45,012	May - October 54	84,027.36	213,808,778
	Rubber	15,423		24,729.44	11,170,857
Loei	Maize	45,395	May - December 54	159,550.40	738,844,850
	Rubber	35,826		127,934.72	24,281,428
Nong Bua Lam Phu	Wet season rice	52,897	May-September 54	153,573.60	392,171,636
	Sugar cane	19,569	November 54 - July 55	59,591.84	2,792,247,770
Amnat Charoen	Wet season rice	56,968	May - October 54	179,679.36	386,026,952
	Cassava factory	8,217	March 54-January 55	13,134.40	205,016,650
Buengkan	Wet season rice	34,336	May-October 54	107,384.80	158,417,361
	Rubber	32,643		102,821.44	319,223,499
Kamphaeng Phet	Wet season rice	29,609	May - October 54	270,946.56	1,047,399,638
	Dry season rice	21,078	November - April 55	209,400.80	899,293,507
Chiang Mai	Wet season rice	57,114	May - October 54	81,463.52	288,125,720
	Shiitake	19	March - July	78,880.00	41,005,000
Phichit	Wet season rice	34,236	May - October 54	305,424.96	890,963,077
	Dry season rice	161,470	November - April 55	253652.96	891401999
Nakhon Sawan	Wet season rice	50,736	May - October 54	500,762.24	1,389,426,637
	Dry season rice	27,586	November - April 55	300,014.08	1,056,128,541
Phitsanulok	Wet season rice	53,464	May - October 54	282,990.56	840,593,354

Sl.	Main crops		Growing season	Area (hectare)	Contribution to total national production (kg)
	Dry season rice	33,018	November - April 55	238,908.48	885,893,000
Chiang Rai	Wet season rice	79,781	May - October 54	225,606.08	654,481,071
	Maize	60,743	March - January	125,226.88	425,724,750
Lampang	Wet season rice	57,763	June - October 54	76,252.80	251,525,552
	Maize	13,714	May - March	27,480.00	155,355,383
Phrae	Maize	27,335	May - March	59,818.08	269,386,111
	Wet season rice	31,281	May - October 54	50,695.84	177,148,699
Uttaradit	Wet season rice	37,827	May - October 54	108,964.48	471,761,196
	dry season rice	17,989	November - April 55	62,363.36	263,043,209
Uthai Thani	Wet season rice	14,365	May - September 54	116,827.68	548,703,364
	Sugar cane	9,223	January-November	56,290.72	3,064,542,530
Phayao	Wet season rice	45,649	May - September 54	131,354.40	394,172,672
	Maize	22,980	May - February	65,551.52	312,671,056
Lamphun	Lounganoi	45,171		43,455.84	253,272,891
	Wet season rice	18,665	May - October 54	22,016.32	80,413,444
Nan	Maize	40,254	March-February	133,858.24	459,267,848
	Wet season rice	31,889	May-September	35,574.56	113,538,774
Sukhothai	Wet season rice	56,501	May - October 54	222,172.16	727,701,000
	dry season rice	42,239	November - April 55	165,612.00	622,663,112
Tak	Maize	29,750	May - January	114,721.92	555,576,438
	Wet season rice	17,421	May - September	46,078.24	142,335,520
Phetchabun	Wet season rice	50,577	May-September 54	208,002.08	806,493,249
	Maize	43,585	May-October	163,971.36	872,058,602
Mae Hong Son	Upland rice	20,010	May - September	16,385.44	34,156,577
	Wet season rice	15,588	June - October	15,018.56	41,668,124

Table 3: Paddy: Planted Area, Harvested Area, Production, and Yield - Thailand

Year	Planted Area	Harvested Area	Production	Yield
	(1000 ha)	(1000 ha)	(1000 metric tons)	(kg/ha)
1983	9,984.666	9,830.875	17,251.817	1,755
1984	9,950.420	9,597.610	19,606.114	2,043
1985	10,220.243	9,905.908	20,017.566	2,021
1986	9,935.829	9,276.221	20,073.831	2,164
1987	9,295.088	9,028.594	18,667.025	2,068
1988	10,170.237	9,727.559	18,811.181	1,934

1989	10,272.953	9,944.899	18,629.893	1,873
1990	10,155.691	8,942.783	19,082.447	2,134
1991	9,518.909	9,028.328	19,240.098	2,131
1992	9,706.334	9,193.761	21,451.638	2,333
1993	9,611.074	8,648.250	17,707.114	2,047
1994	9,645.958	8,777.150	21,005.863	2,393
1995	9,633.943	8,847.830	21,050.208	2,379
1996	9,978.011	9,197.470	22,102.853	2,403
1997	10,004.641	9,794.750	22,772.761	2,325
1998	10,157.640	9,625.680	23,907.757	2,484
1999	10,365.344	9,774.090	23,581.636	2,413
2000	10,078.570	9,745.090	24,947.540	2,560
2001	10,833.345	10,193.901	28,487.408	2,795
2002	10,388.170	9,514.140	27,051.947	2,843
2003	10,479.256	9,513.302	29,336.704	3,084
2004	10,900.248	9,865.321	29,299.043	2,970
2005	10,623.307	9,997.229	29,387.010	2,940
2006	10,621.338	9,970.422	29,792.050	2,988
2007	10,818.556	10,165.160	29,641.871	2,916
2008	9,285.248	8,861.551	32,119.347	3,625
2009	10,321.315	9,933.601	31,909.794	3,212
2010	10,523.538	10,083.128	30,971.004	3,072

2. Food insecure provinces

The Thai government, supported by the FAO's Asia FIVIMS project, developed the National Food Insecurity and Vulnerability Mapping System (FIVIMS) as part of its commitment to the World Food Summit in 1996. The system was launched in 1997. It was later integrated in the regular national budget program in 2003, under the coordination of the Office of Agricultural Economics. The map (see Map 1) identifies vulnerable population in different parts of the country. The Thai FIVIMS classifies 76 provinces into 3 clusters based on food security and nutrition. Each cluster is divided into sub-groups (class) of provinces.

The first cluster, classified as the most vulnerable, is located in the *Northeastern* and the *Northern* regions. Population are characterized by high rate of low birth weight, underweight in children under 5 years old, and prevalence of iodine deficiency, in addition to other vulnerability factors such as low per capita income, high rate of inactive members and land ownership problems. This cluster is illustrated in red and pink colors.

Provinces in the second cluster are in the Central, the East, the West and the South of the country. These provinces have more favorable environments for food security and nutrition with higher per capita income. But there are some vulnerability factors. This cluster is illustrated in yellow and ample green. The last cluster is the least vulnerable group, consisting of the remaining provinces in the Central, the East, the West and the South of the country. Under this cluster, the populations have higher-than-national average income. There are also some negative factors in terms of food security. The cluster is illustrated in dark and light green. (Prachason, 2009)

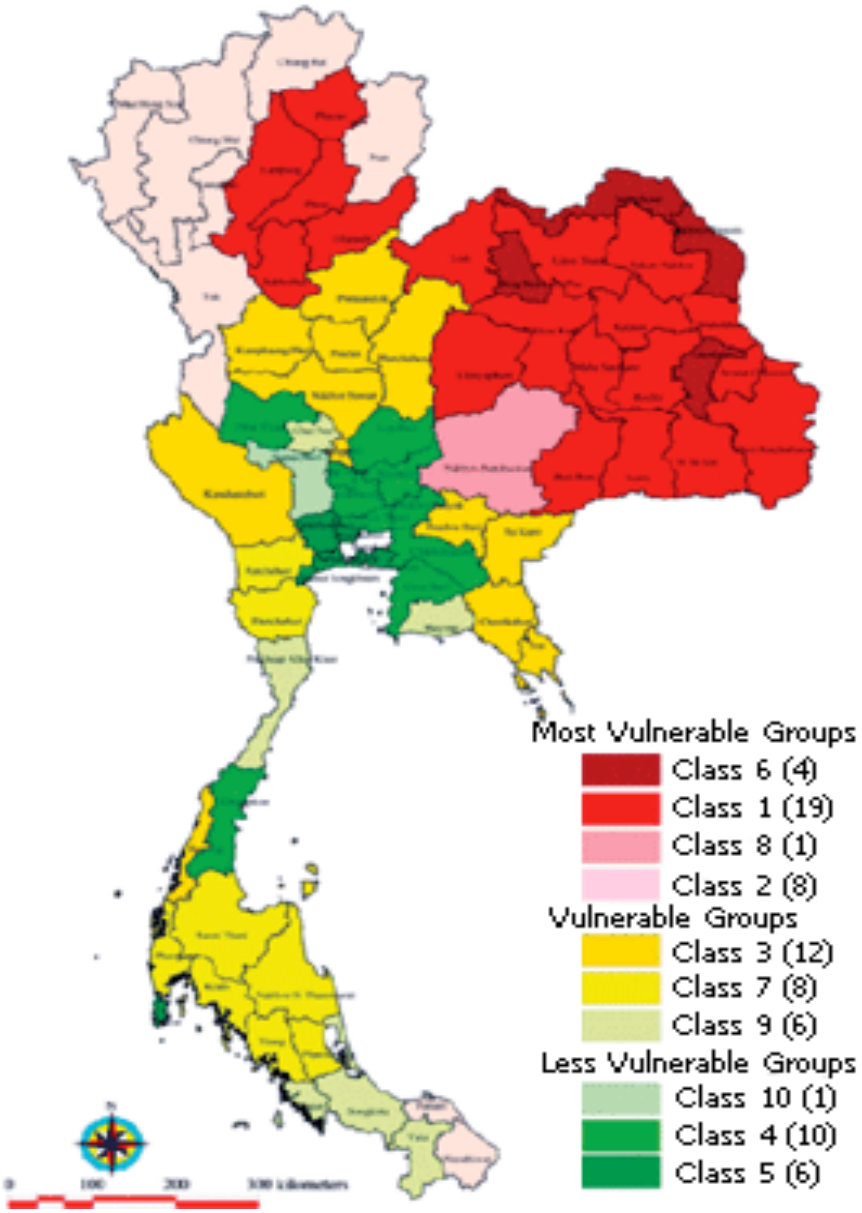

Figure 1 Thailand's Development of Food Insecurity and Vulnerability Mapping Systems (FIVIMS)*

Source: Ministry of Agriculture and Cooperatives, 2005, "The Results of the Thailand Analysis", <http://www.asiafivims.net/thailand/fivims/analysis.htm, 10 October 2008>

3. Climate change

Several studies pertaining to the impact of climate changed pointed that in the year 2100 there will be 1.4 to 5.8 degrees Celsius increase in temperature, which will cause sea rise of about 0.9 m. This would result into alternation of weather patterns, which in turn will cause flood and drought in some areas of the world including in some part of Thailand as well. There is a prediction that there would be wide ranging impacts on growth and development of the important crops, and general impact on overall biodiversity

could not be ruled out The sea rise will cause corrosion of coastal fisheries and also worsen the plant diseases and would increase herbivory by a number of insect-pest either prevalent ones. Apart from climate change there are other factors, which are adversely affecting the agricultural production base. For instance, one cannot rule out emergence and spread of new insects and vectors from other parts of the world not because of climate change but due to increasing transport and movement of peoples and goods. Thus, in general a negative impact of climate change and other factors are predicted that would pose serious challenge to maintain the crop growth and overall productivity.

3.1 Impacts of climate change

Thailand GHG Emission (as estimated by Ministry of Energy)

In 2000:

- 454.3 ton CO_2 equivalent/ US$ one mill. GDP
- 0.75% of the world GHG emission
- Ranked as the 31stor 109thin term of per capita GHG emission
- In 2003, 344.2 ton CO_2equivalent/ US$ one mill. GDP

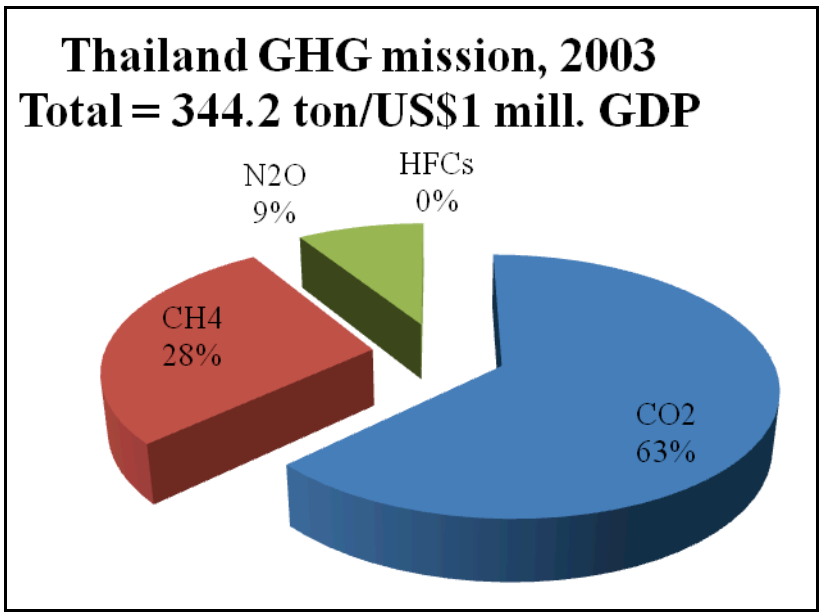

Figure 2: Thailand GHG Emission (Source: Ministry of Energy, Thailand, 2005)

The impact of climate change will make the region hotter with long hot summer with increased evaporation of water, reduced water retention capacity and increased water scarcity. In Thailand, a study of the issue of climate change has to be pointed out that with temperature rise of 1-2 degrees Celsius rainfall tended to decrease. The rainfall during the rainy season tends to be lower in the dry season of the following year. Thus causing a shortage of water for agriculture as a whole. The Table 4 shows the rainfall and number of rainy days during the period of 2001-2010.

Table 4: Rainfall and number of rainy days in 2001-2010.

Year	Rainfall (millimeter/year)	Number rain days (day/year)
2001	1,682	139
2002	1,586	132
2003	1,499	122
2004	1,408	118
2005	1,590	129
2006	1,655	133
2007	1,601	129
2008	1,751	142
2009	1,610	130
2010	1,647	131
Average	1,603	130
Growth rate (2001-2010) (%)	0.68	0.25

Source: Department of Meteorology

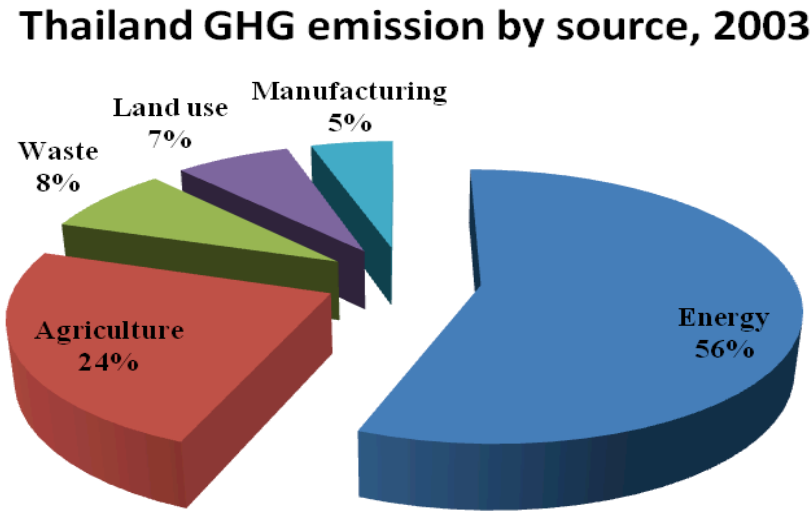

Figure 3 Thailand GHG Emission by source, 2003 (*Source: Ministry of Energy, Thailand, 2005)*

3.2 Emission in agriculture (GHG emission from agriculture)

- Agriculture: 58% is CH_4 or 12.7% of total emission
- Livestock 25%
- N_2O: soil 15%,
- Burning 2%

(Source: Office of Agricultural Economics, 2000)

Table 5: Climate and Optimal Climate by region

2010	Northern	Northeastern	Central	Southern
Temperature (Celsius)				
Minimum	6.7	7	15.2	18.5
Average	26.6	26.7	27.8	27.3
Maximum	42.3	40.6	38.8	36.8
Rainfalls (Millimeter)	1,112	1,504	1,393	2,264

Table 6: Climate and Optimal Climate for Major Crops

Crop	Growing period	Temperature			Rainfalls		
		Min	Optimal	Max	Min	Optimal	Max
Rice	120-150	8	25-35	43	600	800 - 1,200	2,000
Rubber		10	24-27	45	1,350	2,000 - 4,000	6,000
Sugar cane	300-450	15	30-35	40	600	1,500 - 2,000	3,000
Cassava	240-365	10	25-37	45	500	1,000 - 1,500	2,500
Maize	100-120	10	25-35	40	600	1,000 - 1,200	1,800
Oil palm		12	22-32	38	1,400	1,800-2,500	2,800

3.3 Trend of Climate change in Thailand

3.3.1 Temperature

- Increased by 1degree during the last 45 years
- Less rain volume and number of raining days in summer but longer in winter monsoon
- Increasing high temperature days in summer and less lower temperature days in winter
- 4 degree increase in temperature can lead to change in direction and degree of typhoon by 10 – 20%

The impact of higher temperature

- Increased water evaporation, more frequent but concentrated rain in specific areas, leading to flood in the south but drought in the north and northeast.
- Changes in water flow thus affecting the ecosystem and biodiversity.
- Loss of some marine species, coral bleaching.

3.3.2 Sea water level

- Increased by 3 mm/yr. during 1940-1960, followed by 20 mm/yr. afterward
- In 2020, the increase in the Gulf of Thailand was estimated to be 17 –49 mm/yr.
- Impact on lower Chao Phraya River

The impact from higher sea level

- Bangkok will be only 1 m. above sea level, in risk of flood and damages on public utilities
- 40 km intrusion of sea water into fresh water –increasing salinity, impact on agriculture in the lower central plain
- Less shorelines along the coasts in the south
- Loss of mangroves and agricultural and shrimp farm areas in the south (Ruangrai Tokrisna, 2008)

3.3.3 Volume of rain

- Estimated to decrease from 960 –1,290 mm/yr. to 800-900 mm/yr. with greater variation – impact on agriculture

Impact of lower rainfall

- Lack of water in major river basins.
- More frequent and severe flood in lower plain.
- Greater drought in the north, and northeast and more flood in the south
- Water sources: Reduce by 5 –10%, main impact on paddy production but lessen by the irrigation system and less aquatic abundance. (Tokrisna, 2008)

3.3.4 Drought hazard and desertification

- Total risk area = 2.2% of country area
- Share of risk area by region (% of total risk area)–North 56.21–Northeastern 23.27–East 7.69–Central 6.62–West 6.21

3.4 Rain-fed farmer vulnerability and adaption to climate change impact

- Rain-fed rice farmers in Kula field, northeastern Thailand
- 45.5% loss in rice yield due to climate change
- High risk 10%, medium 56.2%, low 33.8%
- 76.8% vulnerable
- 43.4% adaptation

(Source: Wichien Kerdsuket et al., 2005)

3.4.1. Private and public responses

Farmer response

- Appropriate production technology, breed resistant varieties, adjustment in planting schedule
- Improve Water management and soil management
- Concentrate on livestock and integrated farming
- Increase avenue for Off-farm employment
- Develop Farm/farmer group on local water management
- For saving group
- Establish rice bank

Government support

- Payment on loss, grace period on credit payment, credit on farm inputs, reduction on interest rate (Ruangrai Tokrisna, 2008)

3.5 Climate Change Policy (chronology in Thailand)

- 1994: UNFCCC ; 2005: Kyoto Protocol
- 2007: Office of the Prime Minister Regulation on Climate Change Management (2007) National Climate Change Policy Committee, chaired by PM set up Thailand Greenhouse Gas Management Organization (TGO)
- 2008: National Strategy for Climate Change Management (2008-2012) Building adaptive capacity & reducing vulnerabilities to climate change impacts
- Promoting GHG mitigation activity in harmony with sustainable development
- Promoting climate change R&D
- Raising awareness & encouraging public participation
- Building capacity of relevant personnel & institution
- Supporting international cooperation on climate change mitigation & sustainable development
- 2007: Climate Change Alleviation Plan for Agriculture (2007-2011) Knowledge management; Prevention & correction; Public relation

3.5.1 Adaptation actions

- Climate Change Knowledge Information Center
    - Conduct research on risk and vulnerability of coastal areas
    - Organize policy dialogues
    - Process & disseminate climate change knowledge
    - Encourage society & coastal community
- Water Resource Management in Agricultural Sector
    - Royal projects on water resource development
    - Irrigation systems for low land areas
    - Top soil conservation using Vetiver grass
    - R&D on local plants & animals
    - Natural Disaster Management
    - Disaster Prevention & Mitigation Act 2007
    - National Disaster Prevention & Mitigation Committee

3.5.2 Specific adaptation actions implemented

- Early warning system: Utilize climate model for projection, assess impact and vulnerability of climate change on agriculture
- Water harvesting in rainfed area: Excavate a 1,260 cubic meter well per household (co-fund by government)
- Insurance for Natural disaster: started pilot project in 2006 in Northeastern region, later expanded to many crops
- R&D in rice varieties: New varieties being developed are more focused on varieties resistant to drought, saline soil, short-live harvest crop in certain area, and of course high yield varieties.

3.5.3 Adaptation strategies at different levels

- Farm level: cropping patterns, delay growing seasons
- Institution level: raise awareness, build adaptive capacity, provide reliable climate and crop information, infrastructure development (irrigation system)
- Technology level: R&D in climate change, soil improvement, drought & flood resistant varieties (Anupit Supnithadnaporn et al.)

3.5.4 Future policy options

- Network on CC R&D
- R&D on effective CC model
- Climate change projection and warning system
- R&D on varieties in tolerance on CC
- Records on CC for effective forecasting and precautionary approach
- For the farmers: bio-fuel, animal work, reducing plough, reducing deforestation and increasing replanting, increasing use of organic fertilizer, better water management, adapting cropping system

3.5.6. Existing government policy and on-going development programme

In response to the various challenges mentioned in the above section, the following set of policies to restructure the agricultural economy by Ministry of Agriculture and Cooperatives (MoAC) are underway in the Kingdom:

- Production Development for Sustainable Agriculture
- Food Security: By promoting the reasonable production of food crops and energy. Allocating production for sufficient consumption and renewable of energy which emphasizes on the importance of the food.
- Organic: Promotion of organic farming to farmers to comply with environmental friendly production.
- Regeneration / Conservation land: Promoting the planting Vetiver grass at highland to prevent soil erosion and planting green manure as soil conditioner
- Promote integrated water management
- Promote the development of agriculture and farming
- Crop of insurance
- Reduce production costs
- GAP (Good Agricultural Practices)
- Rice Bank
- Promote rice productivity (Demonstration field , training , supporting inputs)

4. Food security maps

Discussed in Section 2.0 above.

4.1. General government policies, food insecured provinces, and priorities

The policies and guidelines of the Ministry of Agriculture and Cooperatives are in accordance with government administration plan in related to the implementation of the basic policies of the State under the Constitution. The government policy statements to Parliament on 23 - 25 August 2012 consisted of two main policies.

4.1.1. Policy on urgency to embark for the first fiscal year consists of:

a) Promote integrated water management in order to deal with flood and drought and the increase of water-use-efficiency through adjusting cropping systems accordingly and expanding the land and the accelerating expansion of the irrigated area in all its forms is performed;
b) Promote the development of agriculture and farming in the Southern provinces;
c) Development of cooperation with neighboring countries in order to create a trade cooperation among the various partners. The data link standards for certification of agricultural products and with National Single Window will be established;
d) Moratorium of household and low income farmers: To set up the revitalization plan and occupational development for farmers after moratorium;
e) Upgrade agricultural prices: Promoting the development of agricultural insurance risk appropriately by set up price hedging and crop of insurance crop as a result of natural disasters.

4.1.2. Policy to restructure the agricultural economy

The policy framework and operational guidelines are as follows:

4.1.2.1. Development of the farmers

a) Creating a new generation of farmers through knowledge production and production management;
b) The establishment and development of agriculture and village volunteers to gain knowledge in order to support the implementation of the Ministry of Agriculture and Cooperatives;
c) Preparation of farm household registration book electronically for further development of the subject and farmer's household registration which can be linked to farmers' credit card information as well as to a pledge system by government policy for obtaining a clear and accurate.
d) To ensure security (social as well as financial) to farmers who are building career in agriculture and also to old age farmers (welfare scheme). This is capped by the Ministry of Agriculture and Cooperatives and has already initiated several schemes. Such as the Commonwealth Fund for farmer.
e) Development of the farm business through training, knowledge management organization and access to funding sources thoroughly and fairly.
f) Vocational Rehabilitation farmer moratorium regarding the government policy on the moratorium for farmers, the Ministry of Agriculture and Cooperatives is required to prepare a revitalization plan for the occupation farmer.
g) National Farmers Federation Farmers National Council Act 2553 was announced in Gazette on 19 November 2553 and effective. According to the transitional provisions, the Minister of Agriculture and Cooperatives is acting under this law for a period of two years.
h) Televisions for agriculture: By equipping television program for agriculture. This is a channel for the dissemination of agricultural knowledge. In particular, it has been communicated to the farmers via various information and knowledge.

4.1.2.2 Production Development (Focused on producing environmentally friendly products)

a) Reduce production costs: Focus on promoting the use of appropriate technology or the supply of various inputs of fertilizers breeds and agricultural machinery.

b) Commodity Standards: By supporting farmers and entrepreneurs develop production and quality international standards. The product is safe to consume the crops, livestock and fisheries.
c) Production efficiency: Enhance the production of agricultural crops, livestock and fisheries by the transfer of knowledge from research to farmers on appropriate breeding technology and the production system to suit local conditions.
d) Food Security: By promoting the reasonable production of food crops and energy. Allocating production for sufficient consumption and renewable of energy which emphasizes on the importance of the food.
e) Organic: Promotion of organic farming to farmers to comply with environmental friendly production.
f) Research and development of plant species, livestock and fisheries production: Research results led by the government and institutions will be adapted to accommodate the change and adaptation of the production process in accordance with the changing weather as remedies to reduce global warming from agriculture.
g) Developing agricultural industries: To increase their ability to compete on the world market by processing of various products and value-added product development including the promotion of new products to be effective.

4.1.2.3. Development of the infrastructure and factors support.

a) Integrated water management in preventing floods and drought and increase water use efficiency by adjusting cropping systems accordingly and expand land consolidation.
b) Expansion of irrigation: Rapid expansion of all forms of irrigation as well as ponds to the farm community and throughout the country.
c) Organize arable land to the landless farmers: By land reform and land rights in a fair and sustainable to poverty alleviation and livelihood security.
d) Warning system in agriculture for floods, drought, pests and plant outbreaks.
e) Protection of agricultural land: By precipitation and push for legislation to protect the potential and appropriate agricultural areas, especially areas that infrastructure are already been developed.
f) Regeneration/Conservation land: Promoting the planting Vetiver grass at highland to prevent soil erosion and planting green manure as soil conditioner.

Accordance with the policies and guidelines of the Ministry of Agriculture and Cooperatives, the third is to focus on the development of products such as rice, maize, cassava, palm oil, rubber, soybean / green beans, fruit, livestock and fishing (fresh water/sea).

4.3 Government policies and measures related to food security

4.3.1 Crop insurance

Agricultural insurance is one way to build food security in Thailand. The project was initiated by the Department of Insurance Cotton. Committee, and corn, sorghum and soybean insurance are unified by a private company. Later in the Development Plan No. 7 of the Cabinet, it has approved the Bank for Agriculture crop insurance in a mutual fund relief in all the protected areas, especially rice, maize, and hurricane flood protection only drought, but not implemented due to lack of funding in the 9th Development Plan Committee scrutinize the Council of Ministers. A resolution of the Ministry of Agriculture and the agricultural insurance to the Bank for a pilot project using an index crop insurance, weather (Weather Index Insurance) and the World Bank to assist the crop insurance programs. The weather index insurance use to study patterns of droughts and floods.

Council of Ministers had a resolution (dated 9 November 2010) to approve the creation of a system of crop insurance to farmers by the Ministry of Finance. Ministry of Agriculture and Cooperatives, Ministry of Natural Resources and Environment, Ministry of Commerce established a common set of guidelines for proper operation which has appointed a working group to prepare a national strategy for

the development of crop insurance. Ministry of Agriculture and Cooperatives is to response for seven major strategic as detailed:

- Project of development of information database and the district mapping and flood risk for economic crops.
- Project to disseminate information to the insurance company as a researcher and executives.
- Pilot project for the production of natural wet season insurance.
- The study of the plant monitoring: land cover change by using an index of plant growth.
- The further development of a comprehensive weather index crop insurance suits
- The prototypes programs in each region of the country.
- Project the possibility of wet season insurance in the production area.
- The project preparation of a list of areas suitable for economic crops of insurance.

A national strategic crop of insurance for year 2010-2012 was presented by the Department of Agriculture to the Chairman of the Permanent Secretary, Ministry of Finance, for the Fund. The Department of Agriculture acts as the Secretary of the Committee.

4.4 Major Constraints and needs

In general followings are categorized as major constraints that would need more focused attention to be solved:

- Technological know-how
- Water management: Technology pertaining to less water by measuring the water level inside the soil and around the roots
- Land management: enhanced soil fertility management
- Rice varieties: Varieties suited to local conditions. Resistant insects. Market requirements.
- Loan and credit facilities to the farmers
- Farmers knowledge and practical understanding on sustainable agricultural development aspect to enable them to apply these principles in their own farmland
- The farmers can produce the agricultural product for the family's daily consumption
- The surplus will be sold in community to get more income in household
- This aspect is to help farmers to cut down in living expenses and allow the farmers to be self – reliant
- The farmers unite in the form of groups or cooperatives to carry out activity work in the areas of production, marketing, living conditions, welfare, education and society.
- The farmer's connection, the farmers should move into this phase by making contacts with banks or private sector to obtain funds to assist in investment or developing their quality of life.
- In this phase, farmers can get more benefits, improve the quality of their life and strengthen their capacity building into the network both in community and national level.

C. EXPERIENCES OF SRI ADAPTATION AND ADOPTION BY FAMERS WITH EMPHASIS ON RAINFED AREAS

5. Experiences with SRI in Thailand *(Extracted from SRI website maintained by Cornell University, USA)*

Although initial 2001 trials of SRI methods by the Multiple Cropping Center (MCC) at Chiang Mai University were not successful, continued evaluations by MCC, the McKean Rehabilitation Center (see MRC trials) and others led to a national SRI network, which was formalized at a national SRI workshop held in Chiang Mai in May 2003. A February 15, 2005, meeting of the SRI Network in Thailand held at MCC reviewed progress of network members (4 government groups and 9 NGOs and projects). With Thailand Alternative Agriculture Network (AAN) coordination, the SRI Network organized a workshop in June 2005 co-hosted by the Surin Farmers' Support Project (SFS) in the southern section of northeast Thailand.

During 2005-2006, Abha Mishra, at the time a PhD student at the Asian Institute of Technology (AIT), wrote successful proposals to the Asia Rice Foundation USA (see resulting journal article) and the CGIAR Challenge Program on Water and Food to support participatory action research with farmer field school groups to evaluate SRI.The CPWF project, undertaken by an AIT team headed by Prof. V. M. Salokhe (Professor at AIT), introduced SRI through action-research with villages in northeast Thailand (see report at Cornell website).

The 2008 AIT project proposal on Community preparedness for climate change and increased water use efficiency for rice cultivation using principles of System of Rice Intensification (SRI) in central Thailand was selected for the Asia-Pacific Forum for Environment and Development (APFED) Showcase 2008 Programme. The project, which used FFS extension, took place in Ratchaburi Province between 2009 and 2011 (see summary report).

A Southeast Asia regional workshop on SRI involving Mekong River Basin (MRB) countries (Cambodia, Laos, Vietnam and Thailand) was organized at Asian Institute of Technology (AIT), Bangkok, Thailand, June 22-23, 2009, in collaboration with the World Bank Institute. During 2011, AIT began a EU-financed regional project, Sustaining and Enhancing the Momentum for Innovation and Learning around the SRI in the Lower Mekong River Basin, which is focused rainfed SRI in Cambodia, Laos, Thailand and Vietnam. During 2012, a thesis and several academic papers were published on SRI (see 2012 updates for summaries). One of these, Rice root growth and physiological responses to SRI water management and implications for crop productivity, won the SAWADA Prize for best paper published in the journal Paddy and Water Environment Engineering for the year 2012. Also during 2012, AIT recieved an EU grant for working on SRI in the Lower Mekong Delta River Basin in Cambodia, Laos, Thailand and Vietnam.

The details could be seen at the SRI homepage hosted at Cornell University Website (http://sri.ciifad.cornell.edu/countries/thailand/index.html).

5.1. Challenge Program for Water and Food

A competitive grant was won by AIT from Challenge Program on Water and Food (CPWF), Consultative Group of International Agriculture Research (CGIAR) to undertake a series of action research in Roi-et, NE Thailand in collaboration with the Thai Education Foundation (TEF) and Local office of the Department of Non Formal Education (2006-2008). With funding support from FAO-IPM to the NGO partner, TEF, an additional third season experiments were carried out.

The followings provides short summary of the project (http://sri.ciifad.cornell.edu/countries/thailand/index.html):

- An innovative Participatory Action Research (PAR) program was initiated in Ban Chaeng, Roi-Et province, NE Thailand during wet season of 2006 to meet the project objectives of increasing water productivity of rice by using some elements form the SRI principle in-combination of inter-cropping of local bean species for the first 40 days of rice growth and development. During first season PAR (June-Dec. 2006) 3 experiments were set-up; testing of two different seedling age (12 days and 30 days (farmers practice) under two different water regime; and, testing of performance of three local bean species (Mung bean; cow pea and jack bean);

- Younger seedlings performed better under either of the water management practices and a total yield of 477 kg./Rai and 597 Kg./rai with 30 days and 14 days old seedlings were achieved respectively ($F = 12.33$; $df = 1, 5$; $P < 0.0248$), (Tukey's test [SAS Institute 1999]). Whereas, under flooded condition (15 cm or more ponded water), yields of 456 kg/rai and 531 kg/rai with 30 days and 14 days old seedlings were achieved respectively (($F = 18.33$, $df = 1, 5$, $P < 0.0123$), (Tukey's test [SAS Institute 1999]). Similarly when a hybrid variety was tested in following dry season similar trends of yield increase were obtained;

- A much higher yield under SRI and Bean at 1200 Kg./rai at 14% moisture were obtained. In all cases, the productivity of supplementary irrigation increased up to 4kg/m3 of water. In contrast, water productivity at farmer's level are in range of 0.5 to 0.6 kg rice/m3 of water in the region. Net return from the level of 100 baht/rai was increased up to 3000 Baht/rai. Experiences showed that farmers and trainers proved excellent partners in this action research initiative which allowed them to better understand SRI principles and which helped them, in turn, to generate location-specific and knowledge-intensive sets of agronomic practices for better rice yields with lesser inputs.

5.2. Civil Society Organization (CSO) - Consultative Group of International Agriculture Research (CGIAR) initiative

The AIT in association with International Water Management Institute (IWMI—a CGIAR* center) and Thai Education Foundation (TEF—a national NGO) with funding support from the World Bank through CSO-CGIAR Competitive Grant Programme set up a multidisciplinary and integrated mode of enquiry in Roi-Et and Surin province of Northeast Thailand. The purpose of the study was to address the major and common constraints to rice production in Northeast Thailand, that include poor fertility and physical conditions of the soil, frequent flood and drought, and limited farm management skill. The team investigated and assessed the results of a collaborative action research, and undertook season-long learning and training to address the above stated constraint. The overall objective of the project was to increase the productivity of Jasmine rice production systems through integration of various indigenous (termite mound soil) and exogenous soil rejuvenating techniques (bentonite) and/or innovative agronomic crop management practices (IACM), under the umbrella of SRI principles, using the farmer field school (FFS) approach that could lead to enhanced incomes and poverty alleviation in Northeast Thailand. The project envisaged that a forward linkage to markets and at the same time a backward linkage to research institutions of national and/or international would immensely benefit farmers and participating partners in the long-term.

The three season action research works involving farmers, researchers, traders and extension personnel demonstrated that the average yield of Jasmine rice, variety "HomeMali", increased up to 40-50% under the IACM practices compared to farmers' practices (FP) so called "conventional practices". Average net return under IACM was 2.5-3 times higher compared to FP. The higher net return under IACM/SRI was due to significant reduction in seed cost (almost 90%) and increased paddy yield. Water productivity in terms of grain yield per kg of water inflow to the field during land preparation and crop growth period was also higher under IACM compared to FP. The FFS approach provided an excellent platform to bring all stakeholders together at farmers' field for coherent and inclusive actions to address

such cross-cutting issues and opened the channel for information flow from local to international level (*see* Mishra et al, 2012)

5.3 APFED Showcase Project (2008-2010)

"Community preparedness for climate change and increased water-use efficiency for rice cultivation using principles of System of Rice Intensification (SRI) in Central Thailand" project has been funded by UNEP through its APFED project in 2008. The project with its partner, Department of Agriculture Extension (DoAE), RTG, rice farmers in Ratchaburi province, extension personnel, and scientists from AIT were able to successfully adapt several practices of SRI to achieve higher yields with less amount of land, water and other external inputs. Such practices are widely known to reduce the emission of greenhouse gases, thus, combining the best of science for climate-change adaption at community level.

Based on baseline survey and extensive discussions while formulating the various interventions (treatments), the existing Parachute method of rice transplanting was adapted using principles of SRI as one of planned innovative treatments in these participatory trials. Higher rice yields (over 8.0 tons/ha) coupled with higher water productivity and greater net returns in the planned interventions plots (SRI plots) (4 replications) resulted into development of locally-adapted technologies at plot scale, meeting the major aims of the project. A number of extension workers along with farmers were trained in these processes from the local government and are expected to carry forward this learning to newer places with new farmer groups. The farmers also shared their results with other visiting farmers from Southern Thailand during the Field Day, which aimed to showcase their hard work to other members of the local community and tencourage them to adopt climate-friendly rice production system. Average 82% attendances (at 18 weekly meetings), over 80% enhancement in knowledge along with sustainability of seedling raising method for parachute transplanting are some of the immediate impacts that were established during the project, indicating its success in meeting set objectives (*see* Mishra and Kumar, 2011).

5.4. Regional SRI Consultation

A two-day Southeast Asia regional learning event on SRI involving MRB countries (Cambodia, Laos, Vietnam and Thailand) was organized at AIT, Bangkok, Thailand, 22-23 June 2009, in collaboration with World Bank Institute, Washington DC, USA followed by a field-visit on 24 June 2009 in NE Thailand. The workshop was attended by about 50 persons representing government organizations and ministries, non-government organizations, development organizations, academicians, journalists from print and audio-visual media, farmers, students and a United Nations agency. The current situation of SRI adaptation and adoption in the region and challenges, especially in the context of climate change and water productivity, were presented and deliberated. Emerging issues were captured for in-depth discussions.

The deliberations resulted into a set of recommendations, and chief among them were regional collaboration for scientific benchmarking and adaptive measures, as well as development of quality extensions materials for SRI dissemination. In addition, local and regional-level institutionalization of SRI support capacities was proposed to further disseminate and sustain SRI. Finally, a session on SRI in relation to water productivity and climate change clearly enlivened the imagination of a majority of participants. This session resulted in acceptance of the potential role of SRI principles in reducing crops' vulnerability to climate change, expecting that scientific studies would produce reasons for adding SRI in local and regional plans and initiatives of governments and regional groupings (like ASEAN).

In summary, these initial initiates provided opportunity to scale up SRI efforts at national and regional level for addressing the productivity and food security concern of rain-fed smallholder farmers in Lower Mekong River Basin countries. The SRI-LMB project intervention can be seen as a first step towards this direction.

D. OPPORTUNITIES EXISTING TO INCREASE THE AGRICULTURAL PRODUCTIVITY AND QUALITY PRODUCE IN RAINFED AREAS, AND CONSTRAINT FACED

Above SRI examples along with various initiatives taken under "Sufficiency Economy" concept and existing policy provide ample opportunities to address the concern of farmers as mentioned below:

- Technological know-how and practical experiences so that farmers could produce high quality rice with reduced input use;
- Land soil management: Enhancing soil fertility and vitality to be able to raise more corps per year
- Possible testing of newer rice varieties to suit the local condition, especially for the insect resistance;
- Easy access to loan;
- Farmer can produce safe foods, decrease input use and, abandon/ terminate tuse of chemical inputs;
- Farmer can reduce cost especially for purchasing of material input and use agricultural waste for maximize benefits such as using dung and rice hush for organic fertilizer and biogas from dung etc;
- Farmer can apply the local wisdom to create agricultural innovation by using appropriated technology based on local resources.

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