



**Survey of Climate Change Impacts on Community Livelihoods,
The Yom-Nan Irrigation Project**

Survey of Climate Change Impacts on Community Livelihoods, the Yom-Nan Irrigation Project

Executive Summary

A questionnaire survey of 401 samplings in the Yom-Nan Irrigation Project is conducted with the purpose to collect information of economic and perception of climate change. The details are following;

1. Respondents' Socio-demographic Characteristics

1.1 Location (in - outside the municipality)	85 % in the municipality
1.2 Location (irrigated areas)	82 % irrigated areas.
1.3 HH members	4 people (average 3.81).
1.4 Age	average of 51 years old
1.5 Gender	50% of male and 50% of female
1.6 Education	48 % primary school
1.7 Primary / Secondary source of income	93% is from farm income
1.8 Revenue / year	60% earn more than 100,000 baht per year
1.9 Expense/ year	48% cost of 100,000 baht per year
1.10 Crop Revenue(on Average)	THB 174,345 per year.
1.11 fishing Revenue	THB 31,652 per year.
1.12 livestock revenues	THB 2,895 per year.

2. Perception and adapting to climate changes during the past 10-20 years

2.1 Period of doing farming	28 years (min. 1, max. 72)
2.2 In the past, farmers weather	67 % predict the climate
2.3 Year of forecasts	back within two years (min. 0, max. 20 year).
2.4 Perception of farmers on climate change	

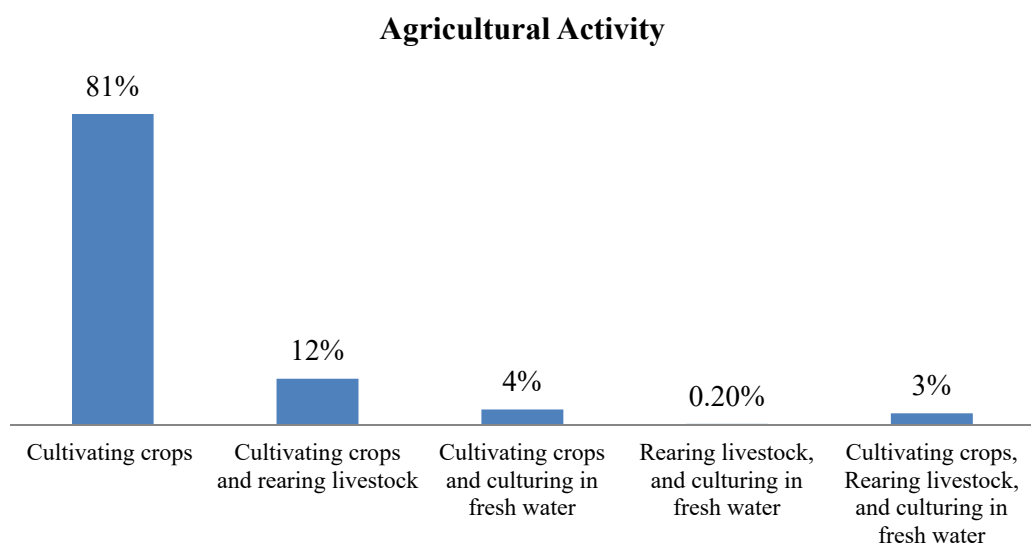
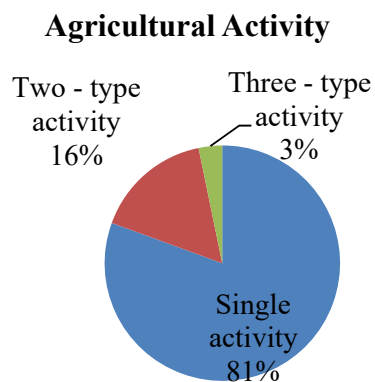
List	Feel change	Character of change	Top three ways of coping
Temperatures	93%	88% hotter	<u>Farming</u> 46% postpone the total crop 45% postpone some part of crop 45% use groundwater <u>Livestock</u> Build a water storage Change types of animals
Rain	91%	81% less rain	<u>Farming</u>

		71% less frequency 53% less intense	37% Postpone the total crop 36% Postpone some part of crop 20% Use groundwater <u>Livestock</u> Change types of animals Invest in new breeding
Droughts	88%	90% more frequency of droughts 85% more dry 86% longer drought	<u>Farming</u> 52% Postpone the total crop 47% Postpone some part of crop 40% Use groundwater <u>Livestock</u> Change types of animals Invest in new breeding
Floods	84%	62% less 45% less severe 45% shorter duration	<u>Farming</u> 52% Postpone the total crop 48% Postpone some part of crop 21% Stop cultivating and do other career <u>Livestock</u> 2% Change types of animals 9% Invest in new breeding
Disease and insect infestation	73%	86% occur more often 68% worse than before 63% take longer time than before	<u>Farming</u> 21% Postpone some part of crop 19% Postpone the total crop 13% change of plant varieties resistant to the disease <u>Livestock</u> 2% Change types of animals 2% Build a water storage

Note

- the heat and drought, disease and insect infestation apparently and according to the forecast. The models
- Rain water less, but the details are seen rarely consistent.
- Not a priority or affected by the flooding rains.

3. Agricultural Activity



1. Introduction

This field survey has been designed to collect general information about the living and perception of farmers in Yom-Nan irrigated areas towards climate condition. The study has been carried out in four districts of two provinces; Phitsanulok, and Sukhothai, during November 25 to December 1, 2016

2. Objectives

- 2.1 To gather data concerning the economic issues
- 2.2 To gather information on the impacts of climate changes on agriculture
- 2.3 To gather perception and adaptation of farmers on climate changes

3. Scope of the Survey

The farmers living in Yom-Nan irrigated areas in Phitsanulok and Sukhothai provinces are the target of the study.

4. Methodology

A questionnaire survey is used to collect information on the economic and perception of climate change..

4.1 Population and Samplings

The study area covers 4 districts; Bang Rakam, Phrom Phiram, Mueang Phitsanulok, and Kong Krailat and the number of population is shown in the following table.

Table 1 Population in the study area

Province	District	Population year 2014
Phitsanulok	Bang Rakam	94,980
	Phrom Phiram	87,864
	Mueang Phitsanulok	280,595
Sukhothai	Kong Krailat	64,805
Total		528,244

Source: Ministry of Interior

To determine the sample size, the Yamane Formula with 95% confidence interval was used.

$$n = N / 1 + (N) (e)^2$$

$$n = \frac{528,244}{1+528,244 (0.05)^2}$$

$$N \sim 400$$

where,

n is the sample size

N states the number of population in project area

e shows the 95% confidence interval (0.05)

Therefore, the survey conduct a sample of 400 farmers living in the area of the Yom-Nan irrigated project.

5. Results

Table 2 Samplings in the study area

Provinces	Districts	Sub-Districts	Sampling
Phitsanulok	1. Bang Rakam	Chum Saeng Songkhram	46
		Tha Nang Ngam	39
		Bang Rakam	26
	Total		111
	2. Phrom Phiram	Taluk Thiam	11
		Tha Chang	20
		Si Phirom	11
		Nong Khaem	20
		Wang Won	9
	Total		71
	3. Mueang Phitsanulok	Ban Krang	28
	Total		28
Total			210
Provinces	Districts	Sub-Districts	Sampling
Sukhothai	1.Kong Krailat	Kok Raet	31
		Krai Klang	33
		Krai Nok	30
		Krai Nai	27

		Dong Dueai	33
		Ban Mai Suk Kasem	37
Total			191
Total			401

5.1 Profiles of Respondents

Phitsanulok residents accounted for 52% of all the respondents. The respondents, who live out the municipality area accounted for 84 % of the total. The respondents, who live in irrigated area, accounted for 82 % of the total. The average age is 51 years old. The female and male respondents are equal in number. Pratom 1-3 accounted for 48 % of all the respondents. The member of household is approximately 4. The primary source of 93% of their income is farming. The percentage of respondents, who have the income levels more than 100,000 bahts per year is 60. The percentage of respondents, who spend levels more than 100,000 bahts annually, is 48. The averages revenue per year from crop, livestock, and fisheries are THB 174,345, THB 31,652 , and THB 2,895 respectively.

Table 2 Respondents' Socio-demographic Characteristics

Characteristics	Number of households interviewed	Percent
(Sampling = 401)		
1. Location		
Phitsanulok- Bang Rakam	111	28
Phitsanulok - Phrom Phiram	71	18
Phitsanulok - Mueang Phitsanulok	28	7
Sukhothai - Kong Krailat	191	48
2. Location		
Municipal area	62	15
Non - municipal area	339	84
3. Irrigated Area		
In Irrigated Area	331	82
Out Irrigated Area	70	17
4.Average Age (year)		
	51	

min. (year)	19	
max. (year)	76	
5. Gender		
Female	199	50
male	202	50
6. Education		
Uneducated	28	7
Pratom 1-3	192	48
Pratom 4-6	93	23
Junior High School	42	10
Senior High School/Vocational Certificate	29	7
High Vocational Certificate	9	2
Bachelor degree	6	1
Master degree	2	0.5
7. Average Member (person)		
min. (person)	1	
max. (person)	10	
8. Primary source of income		
Rice Farming	384	95.8
8. Primary source of income		
Rice Farming	384	95.8
orchard	4	1.0
farming	2	.5
Livestock	3	.7
Employment	4	1.0
Government officer	1	.2
Trading	1	.2
Others	2	.5
9. Crop Revenue(on Average) per year	THB174,345	
10. livestock revenues	THB 31,652	
11. fishing Revenue	THB 2,895	

5.2 Agricultural Activity

Type of Agricultural Activity in the study is separated into 3 types; (1) Cultivating crops, (2) Rearing livestock and (3) culturing in fresh water. It was found that most of agricultural holdings 323 people (81%) are cultivating crops only. The two - typed activity of agricultural holdings was found 16 percent, while the holdings of three - typed was found only 3 percent.

Table 3 Number of holdings by type of agricultural activity

Activity	Frequency	Percent
Single activity	323	81
Two - type activity	65	16
Three - type activity	13	3
Total	401	100

Table 4 Number of holdings by type of agricultural activity

Activity	No.	Percent
Cultivating crops	323	81
Cultivating crops and rearing livestock	47	12
Cultivating crops and culturing in fresh water	17	4
Rearing livestock, and culturing in fresh water	1	0.2
Cultivating crops, Rearing livestock, and culturing in fresh water	13	3
Total	401	100

5.2.1 Cultivating crops

1. Cultivating crops

It is found that 99 % of agricultural holdings (400 samplings) are cultivating crops.

2. Location of Planted area

It is found that 66 % of agricultural holdings (347 samplings) grow crops in the same place of living.

3. Crop growing season

The majority of agricultural holdings in the study area (87%) had two times of cultivating crops. There are 11 percent and 2 percent for the agricultural holdings having a time per year, and three times, respectively.

4. Number of plots use for cropland

It is found that 68 % of agricultural holdings (273 sampling) has 2 plots and above.

5. Planted area

Plot1

- Season 1, Planted area (annual): mean = 23.8 rai, smallest: 1, largest: 119
- Season 2, Planted area (annual): mean = 23.8 rai, smallest: 1, largest: 119
- Season 3, Planted area (annual): mean = 25.5 rai, smallest: 12, largest: 37

Plot2

- Season 1, Planted area (annual): mean = 21.7 rai, smallest: 1, largest: 135
- Season 2, Planted area (annual): mean = 21.5 rai, smallest: 1, largest: 135
- Season 3, Planted area (annual): mean = 18.7 rai, smallest: 4, largest: 64

Table 5 Details of plots by seasons

Items	Plot 1			Plot 2		
	Season 1	Season 2	Season3	Season1	Season2	Season3
Agricultural holdings	386	354	6	251	244	8
Planted area (rai)	23.9	23.8	25.5	21.7	21.5	18.7
Smallest area (rai)	1	1	12	1	1	4
Largest area (rai)	119	119	37	135	135	64

6. Tenure Type

As regards the land tenure, it was found that the majority of holdings operated under own land (61 %), and rented (36 %)

Table 6 Type of Land Tenure

Land Tenure	Plot 1	Percent	Plot 2	Percent
Own land	246	61	136	53
Rent	151	38	119	46
SPK (Sor Por Kor)	2	0.5	1	0.4
Free of charge Public Land	1	0.2	1	0.4
Other: PBT	1	0.2	0	-
Total	401	100	257	100

7. Rent

For rent, the average rent cost about 1300 -1400 baht per rai per year. The lowest and the highest rents are around 200-300 baht per rai per year, and 3,600- 3,650 baht per rai per year, respectively.

Table 7 Rent by plots

รายการ	Plot 1	Plot 2
No. of farmer	158	115
Rent (THB/rai/year)	1,372	1,343
Minimum (THB/rai/year)	278	225
Maximum (THB/rai/year)	3,642	3,600

8. Cost of cultivation

Cost of cultivation is separated into Land preparation, Sowing, cost of transplanting rice seed, harvesting, Fertilize/ Herbicide / Insecticide, and others.

Table 8 Cost of cultivation separated by plots, and seasons

Items	Season 1		Season 2		Season 3	
	Plot 1	Plot 2	Plot 1	Plot 2	Plot 1	Plot 2
Area (rai)	24	21	25	22	2	21
Land preparation (THB/rai/season)	361	364	370	376	307	307
Sowing (THB/rai/season)	85	56	57	56	53	53
Cost of transplanting rice seed(THB/rai/season)	727	313	1,200	1,200	-	-
Harvesting (THB/rai/season)	446	450	446	448	416	416
Fertilise/ Herbicide / Insecticide (THB/rai/season)	120	144	165	149	163	163
Others (THB/rai/season)	349	294	331	300	-	-
Total	986	930	996	967	647	610

2.5 Type of crops cultivated

Table 9 Type of crops cultivated in 2014

Type of crops	Frequency	Percent
Rice	382	96
Vegetable crop	5	1
Rice and vegetable crop	5	1
Rice and permanent crop	4	1
Rice, permanent crop and vegetable crop	4	1
Total	401	100

Note - vegetable crop: yard long bean, chilli, better gould
 - permanent crop: mango, lime, guava, and banana

2.5 Rice Varieties

Table 10 Types of Rice Varieties

Items	Frequency	Percent
1. Non-glutinous	390	54.7
Group of RD (RD 41, RD 43, RD47)	213	24.8
Group of Phitsanulok	97	17.1
Group of Suphan Buri	67	2.6
Khao Dawk Mali 105 KDML105	10	0.5
khao Hom Rajini	2	0.3
Pathum Thani	1	100
2. Glutinous: Sanpatong	2	
Total	392	

2.6 Crop Calendar

Table 11 Crop Calendar

	Period
First crop	May - August
Second crop	November – February
Third crop	February -April

2.7 Crop product

Table 12 Crop product in season 1, separated by plot

Items	Plot 1		Plot 2	
	Crop 1	Crop 2	Crop 1	Crop 2
No. of farmers (persons)	389	4	256	-
Planted/Cultivated Area (rai)	24	18	22	-
No. of days for planting (day)	110	112	111	-
Plot area planted in crop (%)	99.8	100.0	99.8	-
Product (kg./rai)	787	605	772	-
Quantity consumed by household (kg./rai)	-	-	6	-
Quantity consumed by livestock (kg./rai)	-	-	1	-
Harvest lost due to disease and pests (kg./rai)	-	-	13	-
Quantity for seeding (kg./rai)	22	15	22	-
Quantity sold (kg./rai)	750	760	730	-
Price per unit (THB/kg.)	6	7	6	-
Income (THB/rai)	4,587	4,101	4,625	-

Table 13 Crop product in season 2, separated by plot

รายการ	Plot 1		Plot 2	
	Crop 1	Crop 2	Crop 1	Crop 2
No. of farmers (persons)	366	4	247	-
Planted/Cultivated Area (rai)	25	20		-
No. of days for planting (day)	109	101		-
Plot area planted in crop (%)	99.7			-

Product (kg./rai)	804	632	781	-
Quantity consumed by household (kg./rai)	13	-	6	-
Quantity consumed by livestock (kg./rai)	2	-	1	-
Harvest lost due to disease and pests (kg./rai)	15	-	12	-
Quantity for seeding (kg./rai)	24	15	19	-
Quantity sold (kg./rai)	751	617	744	-
Price per unit (THB/kg.)	6.4	7.5		-
Income (THB/rai)	4,584	4,218	4,697	-

Table 14 Crop product in season 3, separated by plots

Items	Plot 1		Plot 2	
	Crop 1	Crop 2	Crop 1	Crop 2
No. of farmers (persons)	8	-	8	-
Planted/Cultivated Area (rai)	24	-	19	-
No. of days for planting (day)	94	-	94	-
Plot area planted in crop (%)	99.4	-	99.4	-
Product (kg./rai)	861	-	849	-
Quantity consumed by household (kg./rai)	3	-	1	-
Quantity consumed by livestock (kg./rai)	15	-	-	-
Harvest lost due to disease and pests (kg./rai)	11	-	33	-
Quantity for seeding (kg./rai)	45	-	14	-
Quantity sold (kg./rai)	787	-	801	-
Price per unit (THB/kg.)	6	-	6	-
Income (THB/rai)	4,944	-	5,024	-

2.8 Fertilizer, Pesticide, and Crop seed

Table 15 Fertilizer, Pesticide, Seed in Season 1, separated by plots

Items	Plot 1		Plot 2	
	Crop 1	Crop 2	Crop 1	Crop 2
Inorganic fertilizer applied (kg./rai)	49	-	47	-
Inorganic fertilizer cost (THB/kg.)	12	-	12	-
Organic fertilizer applied (kg./rai)	18	-	26	-
Organic fertilizer cost (THB/kg.)	21	-	12	-
Pesticide applied (powder) (kg./rai)	0.6	-	0.8	-
Pesticide cost (powder) (THB/kg.)	318	-	355	-
Pesticide applied (liquid) (litre)	1	-	1	-
Pesticide cost (liquid) (THB/litre)	497	-	415	-
Seed quantity bought (kg./rai)	29	-	44	-
Seed cost (THB/kg.)	17	-	20	-

Table 16 Fertilizer, Pesticide, Seed in Season 2, separated by plots

Items	Plot 1		Plot 2	
	Crop 1	Crop 2		Crop 1
Inorganic fertilizer applied (kg./rai)	45	50	46	21
Inorganic fertilizer cost (THB/kg.)	12	13	12	-
Organic fertilizer applied (kg./rai)	27	-	26	-
Organic fertilizer cost (THB/kg.)	12	-	11	-
Pesticide applied (powder) (kg./rai)	0.8	-	0.8	-
Pesticide cost (powder) (THB/kg.)	402	800	410	-
Pesticide applied (liquid) (litre)	2	-	2	-
Pesticide cost (liquid) (THB/litre)	498	300	410	-
Seed quantity bought (kg./rai)	111	-	93	-
Seed cost (THB/kg.)	26	-	22	-

Table 17 Fertilizer, Pesticide, Seed in Season 3, separated by plots

Items	Plot 1		Plot 2	
	Crop 1	Crop 2	Crop 1	Crop 2
Inorganic fertilizer applied (kg./rai)	41.00	-	43.75	-
Inorganic fertilizer cost (THB/kg.)	9.00	-	11.25	-
Organic fertilizer applied (kg./rai)	37.50	-	31.67	-
Organic fertilizer cost (THB/kg.)	8.00	-	10.33	-
Pesticide applied (powder) (kg./rai)	2.75	-	-	-
Pesticide cost (powder) (THB/kg.)	487.50	-	-	-
Pesticide applied (liquid) (litre)	18.00	-	48.33	-
Pesticide cost (liquid) (THB/litre)		-	242.4	-
Seed quantity bought (kg./rai)	333.00	-	396.20	-
Seed cost (THB/kg.)	20.33	-	11.75	-

5.2.2 Livestock

Table 18 Livestock in 2014

Types	No. of Holdings (person)	Percent	Purpose of raising	No. of Holdings (heads)	Buying price (THB per head, kg.)	Selling product (head,kg.)	Selling price (THB per head,kg.)	Income per year(THB)
1. Cattle	9	6.3	sell	7	28,444	heads	30,777	59,444
2. Buffalos	1	2.1	sell	5	38,000	heads	38,000	80,000
3. Pigs	21	27.1	sell	48	1,206	Kg.	60	5,494
4. Chickens	33	52.1	sell /consume	57	181	Kg.	60	11,330
5. Ducks	3		sell /consume	12	97	heads	200	2,000
6. Others	6							
Total	63							

Note: others; Cockfighting, Cricket, Thai bangkaew dog

5.2.3 Fisheries

Fisheries in the study area consist of two types; Capture, and Culture

Table 19 Fresh Water Culture in 2014

Types	No. of Holdings (person)	Having Product (kg.)	Buying Price per kg./unit	Selling Price per kg.	Income per year	Place	periods
1.Nile Tilapia	10	740	15	52	26,833	Pond cultur	6 month, 1 year
2. Walking Catfish (Pla Duk)	12	1,277	13	45	12,142	Pond cultur	4, and 6 month,
3. Striped Catfish (Pla Sawai)	3	20,100	9	37	26,666	Paddy -field	1 year
4. others	7						
Total	32						

Note: others Common Silver Barb, Common Climbing Perch, iant Gourami

5.3 Irrigation System

Table 20 Surface Water and Ground Water Quantity Applied

Items	Season 1	
	Plot 1	Plot 2
1 st Rank	Irrigated canal	Irrigated canal
2 nd Rank	Artesian well	Artesian well
3 rd Rank	Rain	Rain
Surface water-Cost of power for irrigation pumping (THB/rai/year)	556	609
Surface water-Cost of electricity for irrigation pumping (THB/rai/year)	364	571
Surface water- Maintenance and	383	599

repairing cost (THB/rai/year)		
Ground water-Cost of power for irrigation (THB/rai/year)	602	679
Ground water-Cost of electricity for irrigation pumping (THB/rai/year)	319	350
Ground water-Maintenance and repairing cost (THB/rai/year)	386	564

5.4 Farmers' Perceptions and Adaptation towards climate changes

5.4.1 Temperature

Table 21 Farmers' Perceptions of Temperature

Items	Yes	%	No	%
Noticing long-term shifts in temperature on farm in the period of 10- 20 years	373	93	28	7
Temperature become cooler	45	12		
Temperature become warmer	331	88		

Table 22 Farmers' Adaptations to Temperature Shifts

Crops	Yes	%	No	%
Changed planting dates-partial	167	45	205	55
Changed planting dates-total	173	46	202	54
Change crop varieties that consume less water	105	29	260	71
Change crop varieties that resist to flood	34	10	317	90
Change crop type that consume less water	43	12	305	88
Change crop types that resist to flood	21	6	325	94
Using ground water	159	45	191	55
Using water from pond/ well	54	16	288	84
Saving water	27	7	314	93
Stop planting for a while to other career	57	17	273	83
Livestock/fisheries				

Change Livestock/fisheries type	8	3	229	97
Invest in new breeds	7	3	229	97
Made investment for water (such as digging well)	8	3	227	97

5.4.2 Precipitation

Table 23 Farmers' Perceptions of Perceptions

Items	Yes	%	No	%
Noticing long-term shifts in Amount of rain on farm in the period of 10-20 years	364	91	36	9
Amount of rain is changed in the period of 10-20 years				
1. Less rain	301	81		
2. More rain	71	19		
Frequency of rain				
1. more	59	16		
2. unchanged	47	13		
3. less	26	71		
Intense of rain				
1. more	107	29		
2. unchanged	68	18		
3. less	197	49		
Duration of rain per time				
1. more	69	18		
2. unchanged	62	17		
3. less	241	65		

Table 24 Farmers' Adaptations to Precipitation

Crops	Yes	%	No	%
Changed planting dates-partial	133	36	238	64
Changed planting dates-total	136	37	234	58
Change crop varieties that consume less water	54	15	299	85

Change crop varieties that resist to flood.	17	5	343	95
Change crop type that consume less water	27	8	314	92
Change crop types that resist to flood	17	5	324	95
Using ground water	67	20	273	80
Using water from pond/ well	35	10	299	90
Saving water	10	3	314	97
Stop planting for a while to other career	55	14	274	83
Livestock/fisheries				
Change Livestock/fisheries type	4	2	222	98
Invest in new breeds	4	2	221	98
Made investment for water (such as digging well)	3	2	222	98

5.4.3 Drought

Table 25 Farmers' Perceptions of Drought Impact

Items	Yes	%	No	%
Noticing long-term shifts in Drought occurring on farm in the period of 10-20 years	350	88	49	12
Frequency of drought 1.322 (90%) 2 34 (10%)				
1. more	322	90		
2. less	34	10		
Intense of drought				
1. more	303	85		
2. unchanged	34	34		
3. less	18	5		
Duration of drought per time				
1. more	306	86		
2. unchanged	33	33		
3. less	16	5		

Table 26 Farmers' Adaptations to Drought

Crops	Yes	%	No	%
Changed planting dates-partial	166	47	188	53
Changed planting dates-total	184	52	169	48
Change crop varieties that consume less water	83	24	267	76
Change crop varieties that resist to flood	30	9	298	91
Change crop type that consume less water	45	14	282	86
Change crop types that resist to flood	11	3	317	97
Using ground water	132	40	201	60
Using water from pond/ well	48	15	273	85
Saving water	7	2	280	98
Stop planting for a while to other career	70	22	251	78
Livestock/fisheries				
Change Livestock/fisheries type	7	3	214	97
Invest in new breeds	7	3	214	97
Made investment for water (such as, digging well)	8	4	213	96

5.4.4 Flood

Table 27 Farmers' Perceptions of Flood

Items	Yes	%	No	%
Noticing long-term shifts in flood t occurring on farm in the period of 10-20 years	337	84	63	16
Frequency of flood				
1. more	129	38		
2. less	213	62		
Intense of flood				
1. more	113	33		
2. unchanged	74	21		
3. less	157	46		
Duration of flood per time				
1. more	111	32		
2. unchanged	76	22		

3. less	157	46		
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Table 28 Farmers' Adaptations to Flood

Crops	Yes	%	No	%
Changed planting dates-partial	163	48	175	52
Changed planting dates-total	176	52	162	48
Change crop varieties that consume less water, i.e.	41	13	281	87
Change crop varieties that resist to flood, i.e.	18	6	292	94
Change crop type that consume less water, i.e.	20	6	288	94
Change crop types that resist to flood, i.e.	16	5	292	95
Using ground water	30	10	275	90
Using water from pond/ well	25	8	282	92
Saving water	3	1	275	99
Stop planting for a while to other career	65	22	238	78
Livestock/fisheries				
Change Livestock/fisheries type	19	9	188	91
Invest in new breeds	5	2	201	98
Made investment for water (such as, digging well)	4	2	202	98

5.4.5 Pest and Disease Incidence

Table 29 Farmers' Perceptions of Pest and Disease Incidence

Items	Yes	%	No	%
Noticing long-term shifts in pest and disease incidence occurring in the period of 10-20 years	110	27	290	73
Frequency of pest and disease incidence				
1. more	264	86		
2. less	42	14		
Intense of pest and disease incidence				
1. more	209	68		
2. unchanged	66	22		
3. less	31	10		
Duration of pest and disease incidence				

1. more	193	63		
2. unchanged	77	25		
3. less	36	12		

Table 30 Farmers' Adaptations to Pest and Disease Incidence

Crops	Yes	%	No	%
Changed planting dates-partial	64	21	241	79
Changed planting dates-total	59	19	247	81
Change crop varieties that consume less water	38	19	263	87
Change crop types that resist to Pest and Disease Incidence	21	7	262	93
Stop planting for a while to other career	19	7	262	93
Livestock/fisheries				
Change Livestock/fisheries type	4	2	199	98
Invest in new breeds	4	2	199	98
Made investment for water (such as, digging well)	5	3	197	97

5.4.6 Weather prediction

Table 31 Information of weather prediction

Items	Yes	%	No	%
1. Using past weather to predict next year's weather	269	67	132	33
2. Number of years for considering back	2.47 years			

Table 32 Sources of data for predicting weather in the next season

Sources	Yes	%	No	%
1. Expert opinions; i.e. official	320	80	78	20
2. Newspaper	235	59	164	41
3. Radio	315	79	84	21
4. TV	357	89	43	10
5. Others	6	2	393	98

Note: Others; Searching internet, Training, Monitoring current's weather condition, Neighbors

5.4.6 Impact of Climate Change on Agricultural activity, and Living place

Table 33 Impact of Climate Change on Agricultural activity

Items	Frequency	Percent
No. of farmers (person)		
- Affected	369	92
- Not affected	32	8
Impact		
- Flood	352	87
- Drought	255	63
- Pest and Disease Incidence	176	44
- Weed infestations	70	17
- Crops Disease outbreaks	111	26
- Animal disease outbreaks	23	6

Note : respondents can answer more than one type

5.4.6.1 Information on flooding

Table 34 Details of Flooding in the study area

Items	Frequency	Percent
No. of farmers (person)		
- Flooding	348	88
- No flooding	49	12
Frequency of Flooding		
- Every years	134	39
- Recurring, but not every year.	139	40
- one time in the past five years.	35	10
- two time in the past five years.	24	7
- others ; occurring in 2011	14	4
Period	August - October	
flood duration (day)	78 (min. 7 , max. 240)	
Plant - Resistance against flooding (day)	13 (min. 0 , max. 90)	
Livestock/fisheries - Resistance against flooding (day)	14 (min. 2 , max. 30)	

5.4.6.1.1 Damage and benefit of flooding in 2011

Table 35 Damage of Flooding in 2011

Items	Crops	Livestock	Fisheries
Damage			
-Area (rai)	30 (min. 1 , max. 170)		
-Heads		95 (min. 6 , max. 400)	5,000
-% of damage	86% (min. 2 , max. 100)	86 (min.50, max. 100)	100
Cost of Damage (THB/rai) (THB/head)	4,716 (min. 625, max. 18,750)	878 (min. 50, max. 3,333)	39,666 (min. 3,000, max. 150,000)
Cost of Damage (THB)	122,022 (min. 3,000, max. 672,000)	13,700(min. 625 , max. 18,750)	44,600(min. 625 , max. 18,750)
Details of Damage	Rice is flooded	Staple is flooded	Pond is flooded

Table 36 Benefit of Flooding in 2011

Items	Crops	Livestock	Fisheries
Benefit (Area, Heads)	-	-	-
% of benefit	-	-	-
Value of Benefit (THB/rai) (THB/head)	-	-	16,000(min. 2,000 , max. 30,000)
Details of Benefit	-	-	Catching fish

6.1.2 Information on drought

Table 37 Details of Drought in the Study Area

Items	Frequency	Percent
No. of farmers (person)		
- Drought	289	74
- No Drought	104	26
Frequency of Drought		
- Every years	84	28.93
- Recurring, but not every year.	126	43.96

- One time in the past five years.	24	8.79
- Two time in the past five years.	25	9.16
- others ; occurring in 2015	31	9.16
Period	April -May	
Drought duration (day)	90 (min. 12 , max. 270)	
Plant - Resistance against drought (day)	23 (min. 3 , max. 100)	
Livestock/fisheries - Resistance against drought (day)	22 (min. 2 , max. 100)	

6.1.2.1 Cost and Benefit of Drought in 2015

Table 38 Damage of drought in 2015

Items	Crops	Livestock	Fisheries
Damage			
-Area (rai)	31 (min. 2, max. 119)	61 (min. 6, max. 200)	
-Heads			
-% of damage	78 (min. 4, max. 100)		
Cost of Damage (THB/rai) (THB/head)	3,896 (min. 181, max. 15,000)	1,613 (min. 20, max. 3,333)	68,000 (min. 2,000, max. 150,000)
Details of Damage	- Harvested, but yield less. -do not cultivating	-lacking of water -water expenses increasing	-no water for fish - inadequate water

Table 39 Benefit of drought in 2015

Items	Crops	Livestock	Fisheries
Benefit (Area, Heads)	-	-	-
% of benefit	-	-	-
Value of Benefit (THB/rai) (THB/head)	-	-	-
Details of Benefit	-	-	-

6.1.3 Information on Insect infestations (Brown planthopper, Rice Leaffolder, Stem borers, rice gall midge) in 2014

Table 40 Details of Insect Infestations in the Study Area

Items	Frequency	Percent
No. of farmers (person)		
- Having Trouble	267	68
- No Trouble	127	32
Frequency of Insect infestations		
- Every years	179	67
- Recurring, but not every year.	73	27
- One time in the past five years.	9	3
- Two time in the past five years.	6	2
Period	ธ.ค.-ม.ค.	
Insect infestations duration (day)	69 (min. 7, max. 90)	
Plant - Resistance against Insect infestations (day)	16 (min. 1, max. 90)	
Livestock/fisheries - Resistance against Insect infestations (day)	2 (min. 2, max. 2)	

6.1.2.1 Cost and Benefit of Insect infestations in 2014

Table 41 Damage of Insect infestations in 2014

Items	Crops	Livestock	Fisheries
Damage			
-Area (rai)	23 (min. 1, max. 115)		
-Heads		-	-
-% of damage	62(min. 1, max. 100)	-	-
Cost of Damage (THB/rai) (THB/head)	3,222 (min. 200, max. 9,677)	-	-
Details of Damage	-Dried leaves - Less yields	-	-

Table 4 2 Benefit of Insect infestations in 2014

Items	Crops	Livestock	Fisheries
Benefit (Area, Heads)	-	-	-
% of benefit	-	-	-

Value of Benefit (THB/rai) (THB/head)	-	-	-
Details of Benefit	-	-	-

6.1.4 Information about the weed infestations in 2014

Table 43 Details of Weed Infestations in the Study Area

Items	Frequency	Percent
No. of farmers (person)		
- Having Trouble	188	48
- No Trouble	205	52
Frequency of weed infestations		
- Every years	147	78
- Recurring, but not every year.	38	20
- One time in the past five years.	2	1
- Two time in the past five years.	1	0.5
- Other	1	0.5
Period	all year round	
weed infestations duration (day)	68 (min. 3, max. 365)	
Plant - Resistance against weed infestations (day)	24 (min. 3, max. 100)	
Livestock/fisheries - Resistance against weed infestations (day)	31 (min. 31, max. 31)	

6.1.2.1 Cost and Benefit of Weed Infestations in 2014

Table 44 Damage of Weed Infestations in 2014

Items	Crops	Livestock	Fisheries
Damage			
-Area (rai)	21(min. 1, max. 115)		
-Heads			
-% of damage	57 (min. 100, max. 10,000)	-	-
Cost of Damage	3,307 (min. 100, max.	-	-

(THB/rai) (THB/head)	10,000)		
Details of Damage	- Less yields		

Table 45 Benefit of Weed Infestations in 2014

Items	Crops	Livestock	Fisheries
Benefit (Area, Heads)	-	-	-
% of benefit	-	-	-
Value of Benefit (THB/rai) (THB/head)	-	-	-
Details of Benefit	-	-	-

6.1.5 Information on plant disease (ragged stunt disease, blast disease) in 2014

Table 46 Details of Plant Disease in the Study Area

Items	Frequency	Percent
No. of farmers (person)		
- Having Trouble	247	63
- No Trouble	147	37
Frequency of plant disease		
- Every years	151	61
- Recurring, but not every year.	71	29
- One time in the past five years.	5	2
- Two time in the past five years.	7	3
- Other	12	5
Period	ม.ค.-ธ.พ.	
Plant disease duration (day)	67 (min. 5, max. 180)	
Plant - Resistance against plant disease (day)	21(min. 3, max. 120)	
Livestock/fisheries - Resistance against plant disease (day)	33 (min. 7, max. 60)	

6.1.2.1 Cost and Benefit of Plant Disease in 2014

Table 47 Damage of Plant Disease in 2014

Items	Crops	Livestock	Fisheries
Damage -Area (rai) -Heads	22 (min.1, max. 80)		
-% of damage	62 (min. 2, max. 100)	-	-
Cost of Damage (THB/rai) (THB/head)	2,964 (min. 100, max. 8,333)	-	-
Details of Damage	-Less produce grains -Less yield		

Table 48 Benefit of Plant Disease in 2014

Items	Crops	Livestock	Fisheries
Benefit (Area, Heads)	-	-	-
% of benefit	-	-	-
Value of Benefit (THB/rai) (THB/head)	-	-	-
Details of Benefit	-	-	-

6.2 Impact of Climate Change on Living place

Table 49 Impact of Climate Change on Living place

Items	Frequency	Percent
Water Supply		
1 st rank - Village pipe		97
2 nd rank - Rain water, irrigated canal		34
3 rd rank- Rain water		47
Getting Impact of weather		
- yes	160	44
- No	205	56
Types of impact		
- Flooding	50	73
- Lacking water	16	23

- Other; flooded road, illness, stress	3	6
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Table 50 Details of Flooding in Living Place in the Study Area

Items	Frequency	Percent
No. of people		
- Having problem	176	45
- No problem	216	55
Frequency of flooding		
- Every years	61	36
- Recurring, but not every year.	84	49
- One time in the past five years.	7	4
- Two time in the past five years.	10	6
- Other	8	5
Period	August – November	
Flooding duration (day)	89 (min. 30, max. 240)	
Flooded Area	19,132 sqm.	
% of Flooding Area	92% (min. 22, max. 100)	
Details	landscape is flooded	

Table 51 Details of Drought in Living Place in the Study Area

Items	Frequency	Percent
No. of people		
- Having problem	117	30
- No problem	275	70
Frequency of drought		
- Every years	39	33
- Recurring, but not every year.	57	49
- One time in the past five years.	7	6
- Two time in the past five years.	1	1
- Other	7	6

Period	April – June.
Drought duration (day)	49 (min. 7, max. 90)
Drought Area	22,404 sqm.
% of Flooding Area	73% (min. 20, max. 100)
Details	Lacking of drinking water

6.2 Impact of Establishment of Project Yom, Nan

The impacts is separated in to the area of crops, livestock, and fisheried as followes.

Table 52 Benefit on crop

	Benefit	Frequency	Percent
Quantity of water	More water for cultivation resulting in more productivity	219	
	Solving flood	15	
	More water during the drought season resulting in more productivity	14	
	Reducing cost of pumping water	11	
Water management	Managing water system	38	
	Having water on schedule	22	
	Having water storage	15	
	Receiving water from irrigation system to fill in canal	5	
Economic, social	Receiving knowledge about water	9	
	Receiving knowledge about agriculture .i.e. rice varieties	9	
		4	

In addition, some farmers' opinion are

- Not having enough water
- During the flood period, slow water drainage from farm area resulting in delayed planting

- Discontinuous planting due to digging canals

Benefit for livestock/ fisheries

- Water for animal raising
- Water for aquaculture
- More water for usage
- Knowledge on animal raising, fish species
- Water for fish raising
- Receiving fish species

Other benefits

- Saving cost: Saving oil costs in water pumping
- Increasing income: Raising livestock and catching fish as a supplement occupations
- Reducing risks: Notifying the date for rice growing yearly
- Knowledge and information: Acquiring more knowledge on water

6.8 Recommendation on the Yom-Nan Project

Base on the survey, the farmers' recommendations are categories into Structural measures and Non-Structural measures, as follows

Table 54 Farmers' recommendations, Structural measures

Structural measures	Frequency	Percent
Digging and dredging canals	84	
Constructing water gate	62	
Supporting the canal ridges	23	
Digging and dredging the old Yom River more deeper to restore more water	19	
Repairing water gates	17	
Constructing roads along the canals	13	
Constructing irrigation buildings/ repairing irrigation buildings	8	
Constructing dikes	6	
Digging detention areas	5	
Digging and dredging canals of the same depth	2	

Constructing artesian wells	2	
Installation of pumps	2	
Linking Wang Tong canal with Kri Klang canal	2	
Constructing roads to block flooding	2	
Installation of drainage pipe	1	
Digging more canals	1	

Table 55 Farmers' recommendations, Non-Structural measures

Non-Structural measures	Frequency	Percent
Technical areas		
Releasing water during farming regularly	52	
Needing water for farming	22	
Releasing water before the farming season	11	
Storing water in canals in their full capacity	5	
Getting rid of weeds around canals	3	
Draining water from the flooded areas	3	
Economical, social areas		
Authorities should take care of drainage door	4	
Managing the drainage doors well	2	
Setting trading group/ place for selling product	2	
Guidelines for livestock raising	1	
Giving information and knowledge on self-sufficient living	1	

5.6.7 Methods to Protection Flooding in 2011

Table 57 Methods to Protection Flooding in 2011, Structural measures

Structural measures	Frequency	Percent
Constructing dikes	6	
Digging the shallow canals to store water	2	
Digging water vent channels to release water faster	1	

Table 58 Methods to Protection Flooding in 2011, Non-Structural measures

Non-Structural measures	Frequency	Percent
Technical areas		
Pumping water out of the flooded area	4	
Using sandbags to block floods	3	
To close drainage doors at Yom river	2	
Economical, social areas		
Catching fish	56	
Letting it remain natural	20	
Looking for supplementary occupations; General employment	13	
Government and private sectors provide assistance	4	
Move stuff into high areas	3	
Changing planting dates	2	
Facilitating to harvesting of rice by using the harvest boats	2	
Growing plants on highlands to avoid floods	1	

5.6.7 Methods to solve drought in 2015

Table 60 Methods to solve drought in 2015, Structural measures

Structural measures	Frequency	Percent
Constructing artesian well	17	
Involving in the government project of canal dredging	3	
Digging wells	2	

Table 61 Methods to solve drought in 2015, Non-Structural measures

Non-Structural measures	Frequency	Percent
Technical areas		
Using groundwater	34	
Requesting for water from RID	1	
Economical, social areas		
Looking for employment	34	
Stop planting	11	
planting with less use of water	8	

Remaining in natural condition	6	
Growing crops, that can resist drought, by consuming less water	5	
Requesting for assistance from the government sectors	5	
Growing less plants/Lowering agricultural activities	4	
Changing planting dates	2	
Pig raising	1	
Catching fish	1	
Burning charcoal	1	

5.6.7 Recommendation on coping with flooding and drought

Table 63 Recommendation on coping with flooding and drought, Structural measures

Structural measures	Frequency	Percent
Digging canals for storage water	11	
Constructing detention areas	7	
Constructing aquifer wells	7	
Constructing reservoirs	2	
Constructing/repairing the drainage doors	2	
Building a soil ridge to prevent flooding	1	

Table 64 Recommendation on coping with flooding and drought, Non-Structural measures

Non-Structural measures	Frequency	Percent
Technical areas		
Releasing water to farms during cultivation period	14	
Monitoring current's weather condition	6	
Providing weather information for cultivation preparation	2	
Changing the dates of growing plants	1	
Economical, social areas		
Requesting for government cultivation financial support	5	
Improving drainage system, especially during the rainy period	4	
Providing supplementary works for farmers to get revenue in a short period of time.	2	
Monitoring the water system continuously.	2	
Providing agricultural knowledge; reducing the burning of rice	1	

straws and make organic fertilizer		
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5.6.7 Recommendation for authorize on coping with flooding and drought

Table 66 Recommendation for authorize, Structural measures

Structural measures	Frequency	Percent
Digging canals deeper for storing water the dry season.	12	
Constructing the drainage doors	4	
Opening - closing the drainage doors in October of each year.	3	
Constructing a road along the canal	3	
Constructing dikes for the drought season	2	
Constructing line barriers on the Yom River	2	
Constructing dikes along the river	1	
Constructing the irrigation system	1	
Digging canals	1	

Table 67 Recommendation for authorize, Non- Structural measures

Non-Structural measures	Frequency	Percent
Technical areas		
Releasing a lot of water thorough years	8	
Releasing water in April for preventing from flood	5	
Constructing drainage doors systematically	4	
Getting rid of weeds	2	
Getting enough water for cultivating of 3 rounds	2	
Economical, social areas		
Authorities should always take care of the areas	22	
Giving information and knowledge on water	7	
Giving information and knowledge on agriculture	4	
Supporting the higher price of product	2	
Performing duties efficiently and amicably	2	
Getting farmers' opinions before irrigating.	2	
Increasing the numbers of relevant officers	1	

Looking after everything important during flood and drought periods	1	
Providing supplementary job that suit ages and situations	1	
Providing flexible regulatory actions by authorities for actual conditions	1	