Farmers' Adaptation to Water Management under the Effect of Climate Change in Chiang Dao District, Chiang Mai Province

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This research aimed to study demographic data of farmers, their farming conditions and water management in farming in Chiang Dao District, Chiang Mai Province: and to study the farmers' perception toward climate change. Of which, 384 farmers out of 9,781 households were chosen for this research by using simple random techniques.The instrument was constructed by the researcher, and structural interviewed which consisting of close-ended and open-ended questions. Collected data were analysed using Descriptive Statistics. The research findings revealed that the majority of the sample group were men with the average age of 50, married, Buddhist, and had primary-level education. Most of them are Thai and the rest are from other ethnic groups. The average individual income was 83,947 Baht per year and the annual household income was163,968 Baht. Farming areas were 15.8 Rai per household and most of the farmers's samples have ownership over the land. Major cash crops include rice, maize, longan and garlic. Labor used in farming was domestic. Most of the farming areas are non-irrigated and depend on natural water sources, particularly rain water. 10% of farming areas have been flooded and 25% face inadequate water supply and no action has been taken. The only way was to let the nature solve itself. With regard to farmer's perception of global warming, 74% of the farmers' samples percieved of the issue. Most of them explained that global warming was the increase of temperatures which affected the changes of seasons and resulted in production loss due to the increase of various diseases and insect plant pests. The increasing use of pesticides and fertilizers were also lead to higher cost of production and lower income. 68% of the farmers described climate changeas the fluctuation of temperatures which could slow down the growth of plants, contribute to the spread of diseases and insects. This would result in the higher cost of maintenance and decrease of income. Supports from the government sector which farmers needed were the provision of reserved water supply in case of drought.

Keywords: Adaptation, Water Management, Effect of Climate Change

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Introduction

Public Policy Studies Institute 2009 (reported that in 2007, IPCC 4th Assessment Report) concluded that temperature rising was resulted from human activities which apparently affected global physical and biological systems, as well as natural systems in every continent. In Thailand, a study was conducted in order to predict climate change, based on the hypothesis that human's development activities were continually increasing and living behaviors continued without the decrease or control of greenhouse gases. Due to the above mentioned future situation on environmental change, it is obvious that the Thailand's natural resources, especially water, sea and seashores, forest, ecosystem and biodiversity will be affected. Since Thailand's economy is based on its natural resources and a vast number of its people are in agricultural sector or production & service sectors which require agricultural raw materials and/or natural resources (e.g. food processing and tourism industries), the country tends to be seriously affected by environmental change. Thailand, thus, urgently needs to get ready to adapt and cope with such change.

Thailand has three seasons including summer (March, April and May); rainy season (June, July, August, September and October); and winter (November, December, January and February). Farmers have adequate amount of water for farming only in the rainy season. The water shortage usually happens in dry seasons and production can be less than it should be. Jaroenmuang (2008) pointed that Chiang Mai Province covers a vast area of forests and mountains. Its forests vary by altitudes: 100-800 meters over sea level are dry evergreen forests; 50-1000 meters over sea level are dry dipterocarp forests; and 1200-1500 meters over sea level are cloud forests. Cloud forests take in water and humidity from floating clouds and they are at great risks from the future environmental change. Chiang Mai also covers valley basins which makes it ideal for rice farming.

In the past, Chiang Mai Province was so fertile and productive that its agricultural productions were enough for local consumption with additional surplus for exporting to other provinces and countries. Nevertheless, in the last 2 decades, its agricultural areas have been invaded by the real estate sector and fertile areas with well-invested irrigation have been decreasing. Also, they are apparently affected by the environmental change. The studied areas have continuously faced similar impacts of environmental change i.e. natural disasters which damage agricultural produces. One example is the year 2005 (B.E.2548) when heavy rain from Chiang Dao Mountains caused 4 unexpected big floods in Chiang Mai. There had not been any floods for a long while

especially after the construction of Mae Tang Dam. People, therefore, were not prepared and a great damage was caused. (Jaroenmuang, 2008: 228)

Chiang Dao District is the origin of the Ping River. The area is significant for farming in the upper part of the Ping River Basin particularly for its biodiversity and plant varieties. The considerable decrease of forests in this area is a major concern and it is interesting to see how local people, particularly farmers who are the biggest population of Chiang Dao District, are affected by climate change. This research will try to understand and present some facts.

This research, therefore, aimed to study farmers' adaptation to effects of climate change, especially adaptation on water management and farming in Chiang Dao District, Chiang Mai Province. This research will also seek alternatives for water management in order to improve farmers' wellbeing. Climate change obviously affects farming and plant growth. Agricultural produces may decrease due to water shortage which is a major problem faced by many farmers. The purpose of this research was to consider farmer's perception and adaptation to climate change and its effects, especially water shortage and water management, as well as their solution in the future.

The objectives of reserch findings were to study demographic data of farmers, their farming conditions and water management in farming in Chiang Dao District, Chiang Mai Province and to evaluate farmers' perception toward climate change.

Materials and methods

Population Selection & Sampling Techniques

Among 9,781 farmer households who registered with Chiang Dao District Agricultural Extension Office, farmers were chosen using Sampling Techniques. The sample size is calculated by using the formula of Yamane (Yamane, 1967), and the number of farmer households were 384. Data were collected as follows:- primary data included demographic data of farmers, e.g. gender, age, religion, race, ethnic group, marital status, education attainment, member in family, income from farming, farming area, plant varieties, and data of farming including water management. Data were gathered using individual interviews on perception of climate change, water usage in farming and farmers' adaptation toward climate change which affects farming and planning for better water management in the future. Secondary data included the basic information gathered by reading materials concerning climate change, related studies and basic agricultural data from Chiang Dao District Agricultural Extension Office, Chiang Mai Province.

The instrument used in this research was structural interviewed by the researchers. This interview consisted of close- ended questions and open-ended questions. Constructing this structural interview, the researcher decided variables and data according to the research objectives. The researcher was designed structural interview, checked quality of the instrument and made an interview table. The interview topics are as follows: Part 1 Demographic data of farmers in Chiang Dao Sub district was done. The interview questions are both closed and open-ended. Part 2 Farmer perception of climate change in Chiang Dao Sub district was evaulated. The interview questions are both closed and open-ended.

After the interviews with farmers in Chiang Dao Sub district, the researcher checked the completion of data, coded and analyzed data using computer programs. Description statistic was used to achieve the first research objective in terms of farmers' demographic data, their farming conditions and water management in Chiang Dao Sub district. Data were analyzed using descriptive statistics which include percentage, mean, maximum score, minimum score and standard deviation. Data from acquire answers for the second research objective in terms of farmers' perception of climate change and its effects on farming were analyzed using descriptive statistics which include percentage, mean, maximum score, minimum score and standard deviation. The area of research findings located in Chiang Dao District, Chiang Mai Province. The period of study was from April to September 2015.

Results

To achieve the 1st research objective, 384 farmers in Chiang Dao District were interviewed. Farmer's general information obtained is as described hereinafter. The studied population consists of 78% male and 22% female. Among them, the oldest is 83 years old and the youngest is 20. The average age is 50. For marital status, 80% of them are married; 12% are single and 4% are divorced and 4% widows/widowers. Concerning their education, most of the farmers (48%) finished primary level (Prathom 4-6); 17% had lower level than Prathom 4; 13% had no formal education; 9% finished lower secondary level (Mattayom 3) and 9% finished upper secondary level (Mattayom 6); a few of them had higher education as 3% held bachelor degree and 1% had diploma degree. Ethnic groups are divided into those of Thai origin (75%) and hill-tribe ethnic groups (25%) which include 57% Karen, 20% Tai Yai, 14% Lisu, 6% Lahu and 2% Aka and 1% Burmese. With regard to religion, 99% of the surveyed population are Buddhist and 1% are Christian. The largest number of household members is 8 while the smallest is 1 and the average number is 3.

Concerning individual income, the highest is 700,000 Baht and the lowest is none. The yearly average income per person is 83,947 Baht. For household income, the highest is 1,520,000 Baht and the lowest is as low as 10,000. The average income per household is 163,968 Baht. Major source of income is farming. The largest size of farm holding is 45 Rai and the smallest is 2 Ngan (200 square metres). The average size of farm holding per household is 15.8 Rai. 73% of farmers own the land while 20% rent theirs. 5% of them are allowed to use the land free of charge. 2% of the farmers in this study lease out their land.

Agricultural produces grown in this area include lowland and upland rice, longans, tangerines, mangoes, avocados, dates, shallots, garlics, maize, sweet corns, groundnuts, string beans, soy beans, red beans, chillis, cucumbers, coconuts, bananas, pumpkins, eggplants, papayas, bitter gourds, Chinese mustards, and palms. Some areas are for husbandry. Main cash crops contributing to major sources of income are rice, maize, longans and garlics. Most farming is done by domestic labor together with occasional paid and/or exchanged labor. 95% of farming areas are non-irrigated and depend on natural water resources such as rain water, river streams and brooks. The irrigated areas (5%) are in Muang Ngai Sub District and are mainly used for rice farming. 10% of the farming areas have been flooded, which result in loss of agricultural produces. As there is no proper flood management, farmers wait until water levels lower naturally, though some of them dredge up local dams to fasten water flow. 25% of farming areas, mainly in Mae Na Sub District, have inadequate water supply. Some farmers deal with such problem by digging up ponds, using water pumps and water tanks but most of them take no action at all.

Interviews regarding to farmer's perception of climate change as in the 2nd research objective produced the following findings: 74% of farmers know what global warming is. Most of them explained that global warming is the increase of temperatures which affect the changes of seasons and result in produce loss due to the increase of various diseases and insect plant pests. The increase use of pesticides and fertilizers also mean higher cost of production and lower income.

Regarding climate change, 68% of the farmers understand the issue while 32% do not know what environmental change is. Farmers described the terms as the fluctuation of temperatures which can slow down the growth of plants,

contribute to the spread of new diseases and insects. This will result in the higher cost of maintenance and decrease of income.

Interventions from the government sector required by farmers include the provision of reserved water supply, such as ponds and reservoirs, to fight with droughts. Campaigns on forestation and conservation of forests as major water sources should be done by government offices. Farmers believe that forests play important roles in maintaining land fertility, encouraging seasonal rain, absorbing and slowing down water flow which can turn into hazardous floods.

Table 1: Demographic data of farmers.
Study Results Collected from 384 farmers from 7 Sub Districts, in Chiang Dao District, Chiang Mai Province.

Farmer's general information						
Ethnic Groups	Ethnic Groups= 96 (25 %)					Northern /Thai =
	Karen	Hmong	Lisu	Lahu	Others	
	55 (57 %)	19 (20 %)	13 (14 %)	6 (6 %)	3 (3 %)	288 (75 %)
Age(years)	Oldest		Youngest		Average	
	83		20		50	
Gender	Male			Female		
	230 (78 %)			54 (22 %)		
Religion	Buddhism			Christianity		
	380 (99 %)			4 (1 %)		
Numbers of Household Members	Largest		Smallest		Average	
	8		1		3	
Marital Status	Married		Single		Divorced &widows/widowers	
	307 (80 %)		46 (12 %)		31 (8 %)	
Education	Lower Than Prathom 4	Prathom 4-6	Mathayom 3	Mathayom 6	Diploma	Bachelor Degree / None
	65 (17 %)	184 (48 %)	35 (9 %)	35 (9 %)	4 (1 %)	11 (3 %) / 50 (13 %)
Individual Income (Baht / Year)	Highest		Lowest		Average	
	700,000		None		83,947	
Household Income (Baht / Year)	Highest		Lowest		Average	
	1,520,000		10,000		163,968	
Production Systems/ farming areas						
Sizes of farming areas (Rai)	Largest		Smallest		Average per household	

	45	0.5	15.8
Ownership over farming areas	Owned	Rented	Non-expense lease
	280 (73 %)	78 (20 %)	19 (5 %)

Table 2: Show Farmer's perception of climate change

Farmer's perception of climate change	
Know Global Warming	Know Climate Change
284 (74 %)	261 (68 %)

Discussion

From the research findings, it is found that most of the interviewed sample group, who are heads of the household, are middle-aged men with the average age of 50. Their education is primary school level. They are Thai and Buddhist. The average individual income is 80,000 Baht per year, or 7,000 Baht per month which is moderate and enough to survive. Most of them own the farming land. Plants commonly grown include rice, maize, longans and garlics which are locally suitable. In terms of water management, some areas have been flooded and the farmers can deal with such problem. They also face inadequate water supply for farming but it is not considered major impediment for farming. The farmers have a fair amount of understanding on the issues of global warming and climate change. Hence, they are well prepared for future crisis. This includes digging water reservoirs to supply water in dry seasons.

Summary

The majority of the sample group is men with the average age of 50. Most of them are married and finished the primary school level. Thai constitutes the largest group of the population and the rest are from other ethnic groups. Most

of them are Buddhist. The average individual income is 83,947 Baht per year and the yearly household income is 163,968 Baht. Farming areas are 15.8 Rai per household and most of the interviewees have ownership over the land.

Major cash crops include rice, maize, longans and garlics. Labor used in farming is domestic. Most of the farming areas are non-irrigated and depend on natural water sources, particularly rain water. 10% of farming areas have been flooded and 25% face inadequate water supply and no action has been taken. The only way is to let the nature solve itself.

With regard to global warming, 74% of the sample group know of the issue. Most of them explained that global warming is the increase of temperatures which affect the changes of seasons and result in produce loss due to the increase of various diseases and insect plant pests. The increase use of pesticides and fertilizers also mean higher cost of production and lower income.

Farmers are 68% know about climate change. Farmers described the terms as the fluctuation of temperatures which can slow down the growth of plants, contribute to the spread of new diseases and insects. This will result in the higher cost of maintenance and decrease of income.

Supports from the government sector which farmers need are the provision of reserved water suppy in case of drought.

Acknowledgement

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