

# Residents' responses regarding the flood in Chiang Mai (Thailand) and needs of education for disaster reduction

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## 1. Introduction

### 1.1 Background and Aim of study

Heavy rainfall from May to October 2011 caused the Chao Phraya River to overflow, resulting in citizens suffering from inundation at home and workplace in Bangkok. Nakamura and Oki (2012) conducted a research on people's responses and consciousness regarding the flood damage in Bangkok. Chiang Mai City also experienced the Ping River overflowing many times including 2011 and 2005. However, there is not enough research on residents' responses in Chiang Mai. The purpose of this study is to make clear the citizen's behavior towards flood and needs of education for disaster reduction in Chiang Mai City.

### 1.2 Methods

Interview surveys were conducted in August 2016. Questionnaires were prepared in Japanese and Thai language. Questionnaires were mainly related to flood response, flood recognition and opinions towards flood experiences.

Twenty-two cases were obtained. Respondents' age was between 23 to 77 years and 80% were women. About type of residence, 12 persons live in detached houses and 8 persons live in row houses. About 86% of resident's home village was Chiang Mai (Fig.1, Table 1).

### 1.3 Floods in Chiang Mai

All the recent floods of the Ping River flowing in Chiang Mai show that the most common reason for floods was heavy rainfall, especially in 2011, 2005, 1995 and 1994. In 2005, the flood occurred 4 times from July to October, and some areas were more damaged than in 2011. Tropical depression, typhoon and tropical storms were causes of floods in 2005. In 2011 flood occurred only one time (Table 2).

All 22 respondents experienced both floods in

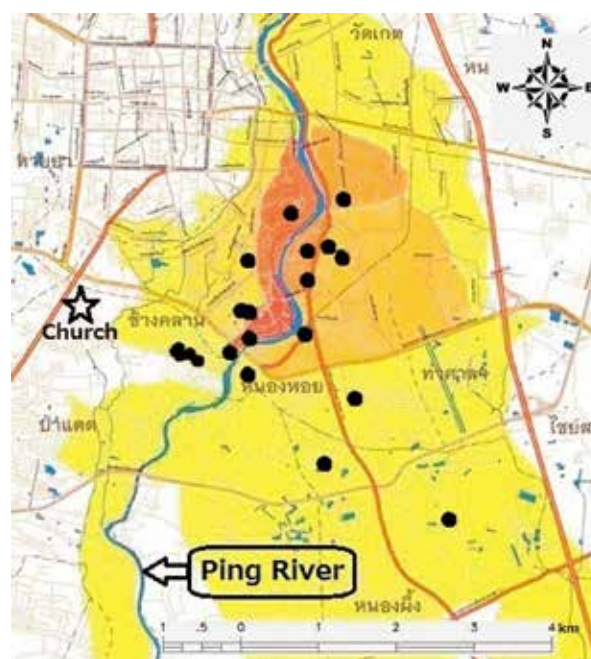


Fig.1 Ping River basin and surveyed houses ※The colors from dark to light represent the course of the flood spread. (Created based on hazard map made by Civil Engineering Natural Disasters Research Unit Chiang Mai University)

2005 and 2011. Thirteen out of 22 persons also experienced flood in 1995. The highest level of flood indoors was 1.3 m in 2005 and also in 2011.

## 2. Resident's responses in Chiang Mai City

### 2.1 Emergency evacuations

When the flood occurred in the year of 2005, 12 out of 20 persons whose indoor was flooded, left the house and evacuated (Table 3). The place most commonly used as an emergency evacuation was "Friends' house" (6 persons). On the other hand, 8 persons stayed at their house and did not evacuate. Even though the house was flooded, they decided to

wait out the flooding, as it usually only lasts for 2 to 3 days.

In 2011, 13 out of 17 persons whose indoor was flooded, left the house and evacuated. The place most commonly used as an emergency evacuation was also "Friends' house" (5 persons) and "Relatives' or family's house" (5 persons). On the other hand, 4 persons stayed at their house and did not evacuate. There were nobody went to the evacuation center during the floods in 2005 and 2011. They used their friends' or family's house as an evacuation place.

### 2.2 Flood responses

In the cases of the 2005 and 2011 floods, the most

Table 1 Resident's profile

No.	1	2	3	4	5	6	7	8	9	10	11
Respondent's age	55	24	54	44	33	25	54	47	59	24	55
Occupation	Soldier	Architect	Company owner	Labor	Association staff	Illustrator	Self employed	Business	Cleaner	Student	Housewife
No. of residents	1	3	3	3	5	4	4	3	2	3	6
Home village	Lamphun	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai
No. of story	2F	2F	2F	2F	1F	1F	3.5F	1F	1F	2.5F	2F
Start of living (year)	Unclear	1993	1984	1984	1983	2007	1991	1986	1995	1992	Unclear
House structure	Deatched House	Deatched House	Row House	Row House	Deatched House	Deatched House	Shop House	Deatched House	Duplex House	Deatched House	Deatched House
Indor heigest flood level (cm)	130	15	20	0	80	100	30	25	60	2	60
No.	12	13	14	15	16	17	18	19	20	21	22
Respondent's age	49	55	74	62	78	44	48	55	23	77	23
Occupation	Nurse	Laundry	Housewife	Housewife	Housewife	Merchant	Community accountant	Tailor	Student	Housewife	Unemployed
No. of residents	5	3	4	3	5	3	2	2	3	2	3
Home village	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Chiang Mai	Petchabun	Chiang Mai	Khon Kean	Chiang Mai	Chiang Mai
No. of story	2F	1F	1F	1F	1F	2F	1F	2F	2F	1F	2F
Start of living (year)	2004	2001	1996	1986	1996	1987	1994	1976	2005	2005	1993
House structure	Deatched House	Row House	Row House	Row House	Row House	Row House	Row House	Deatched House	Deatched House	Deatched House	Deatched House
Indor heigest flood level (cm)	100	80	100	100	100	unclear	unclear	90	0	15	10

Table 2 2005 and 2011 floods

	2005				2011
Number of flood	1 <sup>st</sup> time	2 <sup>nd</sup> time	3 <sup>rd</sup> time	4 <sup>th</sup> time	Once
The highest water level*1	4.90m	3.79m	4.71m	4.93m	4.94m
The highest level of flood indoors*2	1.3 m	1m	1m	1m	1.3m

\*1 Based on government alarm. It will be flood when the water level rises 3.70m.

\*2 Based on interview survey

Table 3 Flood and people's evacuation

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
2005	Stayed at home	○		○	●	○		○					○							○	●	○	○
	Friend's house									○		○		○		○	○		○				
	Relatives houses		○				○		○		○							○					
	Other														Hotel								
2011	Stayed at home	○		●	●	○		●					○							○	●		
	Friend's house						○			○						○	○		○				
	Relatives houses		○						○		●	○							○				
	Other														Church	Hotel							Apartment

● The house was not flooded, ○ The house was flooded

Table 4 Flood responses

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
2005	1st time	●	●	●	-	●○	●	-	●	●○	●○	●	●	●○	N	N	N	○	N	○	-	●	●○
	2nd time	●	●○	●	-	●	●	●○	●	●○	●○	●	●○	●	●○	●○	●○	●○	●	●	-	●	●○
	3rd time	●	●○	●	-	●	●	●	●	●○	●○	●	●	●	●	●	●	●	●	●	-	●	●○
	4th time	-	●○	●	-	●	●	●	●	●○	●○	●	●	●	●	●	●	●	●	●	-	●	●○
2011	●	●○	●	-	●	●	-	●	●○	●○	●	●	●	●	●	●	●	●	●	●	-	○	●

● Lift up luggage and furniture, ○ Stacking sandbags, N Didn't do anything, - The house was not flooded

common response was "Lift up luggage and furniture" (Table 4). "Lift up luggage and furniture" was done by all 20 persons who's house was flooded. The next is "Stacking sandbags" in 2005 (13 persons). However, 9 cases stopped stacking sandbags at the second flood for reasons such as "It cannot prevent water comes in even if sandbags are stacked" or "After flood, it is difficult to clean it up" (Table 4). It is necessary to verify whether the respondents knew the right way of stacking sandbags or not. Two persons used the "Pump" to drain water, from the house (No.2, No.7).

### 2.3 Cleaning methods

In 2005 and 2011, the most common cleaning method was "Cleaning before mud dries, sweeping with a hard broom and sprinkling tap water" (9 persons) (Fig. 2). Because of previous experiences, 9 persons learned that they should start sweeping when the water level drops, otherwise, it is difficult to scrape it from the floor, walls and luggage. Many respondents haven't changed their cleaning methods as well (Table 5).

Table 5 Cleaning methods

	2005				2011			
	1st time	2nd time	3rd time	4th time				
1	● ○ ▲	● ○ ▲	● ○ ▲	—	○ ▲	▲	■	
2	◇	◇	◇		◇			
3	○ ▲	○ ▲	○ ▲	○ ▲	—			
4	—	—	—	—	—			
5	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲			
6	▲	▲	▲	▲	▲			
7	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	—			
8	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲			
9	▲	▲	▲	▲	▲			
10	○ ▲	○ ▲	○ ▲	○ ▲	○ ▲			
11	□	□	□	□	□			
12	● ▲ ◇	● ▲ ◇	● ▲ ◇	● ▲ ◇	● ▲ ◇	● ▲ ◇	● ▲ ◇	● ▲ ◇
13	○ ▲	○ ▲	○ ▲	○ ▲	○ ▲			
14	● ▲ □	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	■	
15	□	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	■	
16	□	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	■	
17	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲		
18	● ○	● ○	● ○	● ○	—			
19	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲	● ○ ▲			
20	—	—	—	—	—			
21	▲	▲	▲	▲	▲			
22	▲	▲	▲	▲	▲	■		



Fig. 2 Hard broom (right) (No.5)

- Cleaning before mud dries,
- Sweeping with a hard broom
- ▲ Sprinkling tap water
- ◇ Scraping Mud
- Getting some help from government
- Cleaning by the private company
- ◆ Using EM (Effective Microorganisms)
- The house was not flooded

2.4 Residential renovation

After the flood, 10 persons renovated their houses. 8 persons changed the flooring materials. (Table 6). Seven out of the 8 persons changed to tiles for reasons such as "The floor was flooded and broken", "Tiles were easy to clean". One person changed to cement floor. The next common renovation method was moving the sockets to higher positions. No.5, No.11 and No.17 changed flooring materials and also moved the socket to higher place. There was one person who made a traditional Thai-style raised-floor type of house, and another person who built the house 90 cm higher floor level from the ground.

It is seen 2 cases to construct defensive wall by using cement and concrete blocks (No.3, 9) (Fig.3).

Table 6 Residential renovation

		Total
Renovation after flood	Change of flooring materials	8
	Change of water pipe	1
	Move the sockets to higher place	3
	Raised floor	1
Devices before flood	Traditional stilt house	1
	Floor elevated above ground level	1

Two persons made and used devices to make it easy to move luggages (No.11, 21) (Fig. 4, 5).

3. Experience about education for disaster reduction

3.1 Participation of disaster prevention activities

There were only 6 out of 22 persons who have

participated in disaster prevention activities (Table 7). Three out of 6 participated in during high school. They are 23-25 years old and relatively young. The evacuation drills at school are executed by the Public Disaster Prevention and Mitigation Act, B.E. 2550 in 2007. The others were working as a soldier, a nurse and a community accountant respectively, so they got experience through their offices and their role of community. There are still few opportunities for residents to participate in disaster prevention activities.

### 3.2 Sharing flood experiences

To the question "Do you want to tell your children about the floods?" 20 persons answered that they want to tell their children about their experiences. They want to tell their children or the next generation about their experiences, when it comes to floods. The most common opinion was "We want children to know what to do when there is a flood" (14 persons). Two persons want to tell their children how to read the water level (No.11, No.16), 2 persons want to tell about the dangers of their living place (No.17, No.20), and so on. Those who answered no, think that their children already know about floods. In other words, everyone wanted their

children to know about the floods. They wanted to tell them about their experiences and teach them useful things (Table 8).

### Conclusions

1. Among the 22 respondents, the highest level of flood indoor was 1.3 m. As an evacuation place, friends' or family's houses were mostly used both in 2005 and 2011. Nobody went to the evacuation center. 80% of respondents did not know about the emergency evacuation center.
2. Twenty respondents, whose house was flooded, first decided to move their furniture. The next common method was stacking sandbags. This method was used in 2005, however, it did not prevent the water in some cases and 9 of the respondents decided not to use sandbags in the next flood time. It is necessary to verify whether the respondents knew the right way of stacking sandbags or not.
3. The most common cleaning method after the flood was "Cleaning before mud dries, sweeping with a hard broom and sprinkling tap water". Many respondents haven't changed this cleaning method both in 2005 and 2011. Following previous experiences, respondents learned it should be cleaned before mud dries. Some of the respondents learned from their flood experiences, 8 respondents changed floor materials from parquet flooring to tiles for easy cleaning and moved electric sockets to higher positions.
4. There are very few opportunities for residents to participate in disaster prevention activities.

Table 7 Participated disaster prevention activities

No.	Participation of disaster prevention activities
1	Military disaster prevention and mitigation
2	Evacuation drills during high school
6	Evacuation drills during high school
12	Hospital evacuation drills
18	Lecture on disaster prevention
22	Evacuation drills during high school



Fig. 3 A 70 cm cement wall was made at the entrance of apartment to prevent flooding (No.9).



Fig. 4 A cupboards that can be taken out and move to higher place (No.11).



Fig. 5 One meter high pipe shelf that can be used to keep things away (No.11).

Table 8 Residents' opinion to share flood experiences

No.	Do you want to tell your children about floods ?	
		Reason
1	<input type="radio"/>	Know what to do when there is a flood
2	<input type="radio"/>	Know what to do when there is a flood
3	<input type="radio"/>	Know what to do when there is a flood
4	<input checked="" type="radio"/>	Children experienced flooding, and already know about floods
5	<input type="radio"/>	Know what to do when there is a flood, especially the dangers and safety
6	<input type="radio"/>	Know what to do when there is a flood
7	<input type="radio"/>	Know how to stock some food when there is a flood
8	<input checked="" type="radio"/>	Children experienced flooding, and already know about floods
9	<input type="radio"/>	Know what to do when there is a flood
10	<input type="radio"/>	It will not flood anymore, but I want children to know.
11	<input type="radio"/>	Want to teach how to read the water level and listen to warnings
12	<input type="radio"/>	Want to teach about "no matter what kind of method, you can not prevent flooding."
13	<input type="radio"/>	Know what to do when there is a flood
14	<input type="radio"/>	Want children to be careful and react well and fast in order to prevent floods
15	<input type="radio"/>	Know what to do when there is a flood
16	<input type="radio"/>	Know about how to check the water level and move the baggage by yourself
17	<input type="radio"/>	Want children to know that the area where we live has flooded
18	<input type="radio"/>	Want to share the experience of the flood
19	<input type="radio"/>	Want to tell children to make a traditional Thai-style high floor residence
20	<input type="radio"/>	Do not want children to live in areas where flooding may occur
21	<input type="radio"/>	Want to share the experience of the flood
22	<input type="radio"/>	Know what to do when there is a flood

Yes,  No

Furthermore everyone wanted their children to know about the flood. They want to tell them about their experiences and want to children how to prepare for it. There is need for education for disaster prevention. It is effective that adults who encountered flood will talk about their experiences to children and share the experiences with all.

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