



Title of paper: Impacts of Seasonal Flooding on the Lives of Battambang Urban Poor, Cambodia

Author(s): LIM Dara

Master Student

Department of Development Studies

Royal University of Phnom Penh

I. Introduction:

The impact of climate change is broad. It drags down the economic growth as the change of temperature and other climate varieties negatively affects many economic sectors such as agriculture, forestry, fisheries, construction, tourism, and environment (Strzepek, 1996; Pielke, 2004; Brischke & Rapp, 2010; Convey et al., 2012; Yagbasan, 2016; Hein, Viergutz, Wyrwa, Kirchesch & Schöl, 2016; Navy, Minh & Pomeroy, 2016). Additionally, climate change can affect human health directly through extreme weathers (eg. heat wave, lightning, air pollution, too low temperature during winter, and etc.), climate hazards such as flood, drought, storm, and indirectly through food and water scarcity and widespread of vector-borne diseases (Kovats & Haines, 1995; Burton, Bambrick & Friel, 2014).

Moreover, urban areas are more vulnerable to climate change. Poor residents in a city are more susceptible to climate change than other types of urban residents (Balk et al., 2009). Because of rapid urban population growth due to influx of rural-urban migrants, urban poverty, and lack of support, the urban poor have no choice, but live in bad settlement conditions which are prone to climate hazards (Hope, 2009). Likewise, dense population in urban poor areas where there are not enough infrastructures such as healthcare centers, roads, water and electricity supplies, also contribute to more climate change vulnerability for urban people (Dodman, 2009).

Furthermore, climate change is a global phenomenon. No country can avoid the impact of climate change, but some are badly affected while some encounter less due to differences of the geography, economic status, governance, and people's knowledge and capability. Among Southeast Asian countries, Cambodia is one of the most vulnerable countries to climate change because of poverty, poor infrastructure, poor governance, low knowledge about climate change and adaptive capacity (Yusuf & Francisco, 2009).

Climate hazards in Cambodia are mainly floods, droughts, windstorms, sea intrusion (Ministry of Environment, 2006), forest fires, and landslides (Garcia, 2002). According to Garcia (2002), over the last ten year, 1990s to 2000s, 11.45% of Cambodian people suffered the climate hazards. Moreover, during devastated flood in 2000 alone, 347 Cambodian people lost their lives and

750,618 families (3,448,629 individuals) were affected (ibid). Regarding vulnerability to flood, amongst all provinces in Cambodia, Prey Veng, Takeo, and Battambang are top three; while Prey Veng, Battambang, and Banteay Meanchey are top three provinces which are suffered by drought (Ministry of Environment, 2005).

II. Context:

Battambang province locates northwest of Cambodia, bordering Banteay Meanchey, Siem Reap, and Pursat provinces, and Pailin city. The province is also bordered with Thailand. With the population of 1,173,414 (CDB—Commune Database, 2014), the province consists of 13 districts—Banan, Thma Koul, Bavel, Ek Phnum, Mong Ruessei, Rotanak Mondol, Sangkae, Samlot, Sampov Lun, Phnom Proek, Kamrieng, Koas Krala, Rukhak Kiri—and one municipal town—(Krong) Battambang city.

Battambang city is the second largest city of Cambodia after Phnom Penh. As an economic hub of northwest region of Cambodia connecting to Phnom Penh and Thailand, urbanization in the provincial town has been increased rapidly. Aside from the plausible economic opportunity, the urban expansion is still facing challenges where infrastructure such as educational institutions, healthcare facilities, road, and utilities, and so on, are less advanced.

The municipal town of Battambang province has population of 153,727 with 27,767 households (CDB—Commune Database, 2014). The provincial town situates Sangke River. The river flows across Rattanak and Preah Preah Sdach communes of the city. At the downstream, the river connects to Steung Mongkol Borey and Steung Sreng rivers before flowing into Tanle Sap Great Lake. The upper stream is the combination of two rivers, Sangke River itself and Steung Chamlang Kuoy River.

Sangke River is the main water reservoir for piped water supply of the whole city. However, through the river, Battambang city can be affected by seasonal flooding. For example, in 2013, there was a worst seasonal flood that affected almost half of the city (Ngin, Heng, Thuon & Kim, 2015).

The city residents are still prone to climate change impacts. Frequently, the city suffers both seasonal and flash floods. For example, there were seasonal floodings in 2010, 2011, and especially the worst one in 2013 when the flooding level rose to the highest one in 70 years (Ngin, Heng, Thuon & Kim, 2015). Moreover, the poverty rate of the city remained between 16% to 17% from 2012 to 2015 (Ministry of Interior, 2016). The rate is still high which means there are many people in the city who are still vulnerable to the impacts of climate change.

III. Literature Review:

Climate change is one of the topics that interests environmental researchers and scholars around the world. Specific subthemes of climate change were adapted to answer the research questions and fit the objectives of each study. For example, a study conducted in Zimbabwe to measure people's level of understanding about climate change, water stress caused by climate change,

climate change adaptation strategies, and rainfall data between 1920s and 2006 (Kanyepi & Tanyanyiwa, 2014). The study found that access to farming extension services and information, vulnerability context, and farmers' knowledge, had significant impacts on farmer's adaptation strategies (ibid).

Besides, another study was also conducted about climate change, but its objective was to identify risks caused by climate change on urban poor in Port Harcourt city of Nigeria. The main risks caused by climate change were housing issue, food security, basic sanitation, waste management and slum development issues (Tari, Brown & Chikagbum, 2015).

There are also many studies regarding climate change issues in Cambodia. Climate change vulnerability assessment is common in those studies. Assessing climate change impact vulnerability, three elements are used: exposure, sensitivity, and adaptive capacity. Referring to a study conducted in Kampong Speu of Cambodia, Laguna of the Philippines, and Thua Thien Hue of Vietnam, approximately two third of the villages studied were highly vulnerable to climate change impacts, among whom, women were more vulnerable (Mendoza, Naret, Ballaran & Arias, 2014).

Moreover, climate change in rural areas and agriculture were also conducted by some researchers. For example, Murphy, Irvine & Sampson (2013) conducted literature reviews on potential negative impacts of climate change on water resource using for agriculture and also reviewed possible adaptive and mitigation strategies regarding crop management in Cambodia. Chhinh, & Millington (2015) studied about drought monitoring and rice production in Kampong Speu province of Cambodia. The study found that effective drought monitoring system was necessary for improving farmers' livelihood as well as enhancing rice production in Cambodia.

Additionally, still in Kampong Speu, a study found that agriculture dependent households in the province were vulnerable to drought (Chhinh & Poch, 2012). In order to improve climate change adaptive capacity of the farmers, the authors suggested that building irrigation system, providing other non-agriculture sources of income, and improving education, should be done. Likewise, Navin (2015) conducted a study among rice farmers in Ba Phnom district of Prey Veng province, Cambodia, to identify the impacts of climate change, assess climate change adaptive capacity. Similarly, another research on how farmers in Kampong Thom and Kampong Speu provinces coped with climate change was also done. Income from farming alone would not allow the studied farmers to survive during climate hazards, especially drought, so they needed other sources of income which were outside of agriculture (Martin, & Touch, 2013).

Besides, researches on link between climate change and other areas have been broadened wider and wider. For example, a topic about climate change adaptive capacity of health and water sectors in Cambodia was conducted by Dany, Bowen & Miller (2015). The research found that lack of financial support and cooperation between stakeholders were the main obstacles in capacity building of health and water sector in the country to adapt to climate change (ibid). There

should be more scientific researches on this area to proof and put pressure on the policy makers to take action on this problem. However, based on Dany, Bajracharya, Lebel, Regan & Taplin (2016) there were three main challenges in bringing climate change researches to policy makers for consideration, namely lack of implementation of government plans, lack of relevant information, and social and cultural barriers. However, the research has not got insightful understanding of policy making contexts yet for example what the process of policy making is, the structure of the institution, stakeholders and their roles, their capacity and how to improve it.

Additionally, a research examined the link between climate change and energy consumption reducing was also conducted. The study conducted in coastal area of Cambodia. It found that the more people were aware about the impacts of climate change, the more they tried to reduce energy (Ung, Luginaah, Chuenpagdee & Campbell, 2017).

Sustainable Livelihoods approach have been used as an analytical framework for research studies, especially about rural development issues, for instance, a study about rural institutions and Sustainable Livelihoods (Johnson, 1997; Hussein & Nelson, 1998), agriculture and Sustainable Livelihoods (livelihood strategies) (Carswell, 1997), migration and Sustainable Livelihoods (influences of institutions on both) (McDowell & De Haan, 1997).

Furthermore, Nicol (2000) used Sustainable Livelihoods approach to study on water and health sectors in order to do policy recommendations. The research tried to study the demand of clean water in household level and identified what were the barriers of accessing it. The author linked from household level to community and national levels. For example, lack of clean water accessed led to health issues which threatened sustainable livelihoods of the households, and the commune government could not achieve its sustainable development goal, which meant the national government's decentralization reform was not properly implemented. In order to maintain water security in the studied area, improving social assets was the key (ibid).

In addition, Sustainable Livelihoods approach was also used in a study to understand roles of prawn fishing in coastal area of Bangladesh. Prawn fishing folks faced many livelihood challenges such as decline of wild prawn catch and lack of alternative source of income during prawn fishing ban period (Ahmed, Troell, Allison & Muir, 2010). The paper suggested that more variable livelihood strategies should be sought out in order to maintain or improve the livelihood of the fishermen.

Rather than using for rural development context, Sustainable Livelihoods approach can be used for assessing roles of Information and Communication Technologies (ICT) in a country's development. Parkinson & Ramirez (2007) used Sustainable Livelihoods approach to understand the risks and vulnerable contexts of Colombian people, link between ICT and their livelihood strategies, and to identify key factors determined their livelihoods.

More and more, Sustainable Livelihoods approach can be used with wider sectors and topics. The approach has been widely used in climate change researches too. For example, there was a study conducted to assess livelihood adaptation to climate variability and change in the drought-prone areas of Bangladesh (Selvaraju, Subbiah, Baas & Juergens, 2006). The study looked at the livelihood systems, identified vulnerable groups, assessed past and current climate impacts, tried to understand local perceptions of climate impacts, local coping capacities and existing adaptation strategies. The study found that more vulnerable group was the poorer in the rural area, and it suggested that improving institution capacity, having effective action plans, targeting the right groups, and developing practical early warning system were what needed to improve the adaptation capacity of the people studied (ibid).

What is more, ecotourism, climate change adaptation, and Sustainable Livelihoods approach were studied about in Ghana. The research found that the respondents had some climate change adaptive capacity in order to maintain ecotourism in the area, but it was still limited (Agyeman, 2014). The report stated that more supports from the government and stakeholders were important for the community's adaptive capacity development.

Similarly, in order to cope with climate variability and other stressors, farmers in Morogoro of Tanzania adapted their livelihood strategies to low-input cultivation, adding more labors in agricultural production, diversifying sources of incomes, and doing migration (Paavola, 2008). However, based on the study, this caused deforestation which led to their future frustrations. Moreover, still in agriculture sector and impacts of climate change, Osbahr, Twyman, Adger & Thomas (2008) captured the importance of government institutions. The report illustrated that through institution reform, credit accessibility, and agricultural improvement, livelihood strategies could be better.

Dany, Regan, Taplin & Bajracharya (2013) studied roles of social capital and local institutions in dealing with climate change in rural Takeo province. The study found that the studied area had poor social capital and local institutions which led to ineffective climate change adaption. Another research was conducted in four zones of Cambodia, the Tonle Sap plain, Mekong plain, mountains/plateau and coast, to assess climate change adaptive capacity and Sustainable Livelihoods. Adaptive capacity to climate change of people in studied areas were low as they depended on climate-sensitive resources and they had limitation in accessing the assets (Nang, Sam, Lonn & Ouch, 2014).

Sok and Yu (2015) studied on livelihood adaptation and resilience, and Sustainable Livelihoods in three communes surrounded the Mekong basin in Cambodia. The research found that villagers of the studied area had limited access to the five assets of Sustainable Livelihoods Framework, and their adaptive capacity to floods, droughts, and high prices of food, and their resilience to natural resource depletion were low. Referring to the finding, climate hazards including flooding had bad impact on rural poor people in the studied area due to their low income, unreliable sources of income, and increasing of food price. By the way, the research just addressed adaptive capacity and resilience of the

rural area to climate hazards. It did not get insightful understand on clean water access in urban area yet.

IV. Data Analysis:

According to the Sangkat Preak Preah Sdach chief, in 2017, the commune has total permanent population of 13,521 people (7,187 are female) with number of households of 2,601 (personal communication, October 18, 2017).

One or two respondents from each village of Sangkat Preak Preah Sdach (commune) were selected for interviews. They had various educational background, from no education to year two level in university (but had already dropped). Five male and seven female respondents were interviewed. They are either household heads, main decision-makers in their families, and/ or bread-winners. The lowest household income is around 45 dollars of America and the highest household income is about 250 dollars of America per month.

Respondent ID	Education	Gender	Age	Monthly Household Income	Village
IDI-001	Grade 7	Male	70	130 USD	Baek Chan Thmey
IDI-002	Grade 8	Male	71	150 USD	Preak Ta Tan
IDI-003	Grade 5	Female	31	250 USD	Preak Preah Sdach
IDI-004	No education	Female	38	75 USD	Num Krieb
IDI-005	Bachelor, year II	Female	27	200 USD	13 Makara
IDI-006	Grade 12	Male	29	250 USD	Chamkar Russey
IDI-007	Grade 12	Female	30	200 USD	Ou Kcheay
IDI-008	No education	Female	69	45 USD	13 Makara
IDI-009	Grade 9	Male	28	100 USD	Ou Kcheay
IDI-0010	Grade 11	Female	32	160 USD	La Edth
IDI-0011	Grade 2	Male	54	125 USD	Chamkar Russey
IDI-0012	Grade 2	Female	48	150 USD	La Edth

Figure 4: IDI respondent profile

Besides household interviews, three Key Informant Interviews were conducted. The respondents are Chief of Administration and Human Resources of Battambang Water Supply Authority, Secretariat of Battambang Disaster Management Committee, and Sangkat Preak Preah Sdach (commune) Chief.

Respondent ID	Gender	Age	Position	Institution
KII-0013	Male	36	Chief of Administration and Human Resources	Battambang Water Supply Authority
KII-0014	Male	30	Secretariat	Battambang Disaster Management Committee
KII-0015	Male	59	Sangkat Preak Preah Sdach Chief	Sangkat Preak Preah Sdach Office

The data was analyzed with Qualitative thematic analysis method with some help from computer applications like Microsoft Word and Excel.

V. Findings

1. Situations before the Flood

a. Road Conditions before the Flood

Although Sangkat Preak Preah Sdach commune is a part of the provincial town, roads in this area were underdeveloped during time of the seasonal flooding in 2013. Based on the interviews, 92% of the respondents described the roads in their residential areas as in poor conditions. During the time of the flooding, there were few types of roads and they were in similar status such as rocky and shabby roads, small and old gravel roads, muddy gravel roads, and small dirt paths.

Because the road conditions were already bad, the damage by the flood made them worse. According to a respondent, the gravel road in front of her house—which already had many holes, was muddy and sticky—was damaged badly by the flood. No car could access the road anymore during the flood and immediately after the flood before it was repaired by the government.

b. Housing Conditions before the Flood

Normally, in rural areas of Cambodia, especially, in the areas nearby water sources, where are prone to seasonal flooding, people build their houses off the ground (stilt houses)—no matter how small or large the houses are—to avoid damage caused by flood on the ground floor. However, housing structures and preferences of the respondents who live in the city were different from the rural residents’.

Although they live near Sangke River which causes flooding often, around 67% of respondents mentioned that their houses were on-ground (not stilt houses) and 71% of them had only dirt floor with beds directly on the dirt. Additionally, the materials of the houses were not strong and durable. At the time of the flooding in 2013, the majority of the respondents’ houses built with wood mixed with tin walls, and tin roofs.

The housing conditions of the respondents put them into a situation where they were in high potential of property lose and living in lot of difficulties caused by the flood. A respondent described her shelter and the situation her family faced during the flood due to the house condition as quite terrible. Her house in that time was not the current house her family was living in. It was just a hut with tin roof, and the wall was made from bamboo structure covered by shabby plastic tarpaulin sheets. There was only a bed inside the hut. During the flood, her family moved every belonging to her mother’s house and stayed there instead. The hut became shelter for her pigs and chickens.

c. Clean Water Access before the Flood

The definition of clean water is still vague as there is no means for evaluating how safe the water is in the case of this study. During flooding, for example, ground water, well water and under-stand water in the affected area can be contaminated. However, with bare eyes, people will consider water as clean whenever the water body is clear and not smelly. As there is no tool to verify the water people used is clean or not, clean water can be referring to any type of water people think reliable to use for drinking, cooking, washing, and bathing.

Although they live in the same city or commune, their situations are not the same. They might live in different parts of the city or commune with different public service availability, physical infrastructure, and natural resource. Moreover, even though they live in the same village or even they are neighbors living next door, their living conditions are still different. The ways of living are diverse from household to household. Their ways of accessing to resources and ways of using them can be various from one another. Likewise, people can use the same or different types of water for their daily consumptions based on their needs, availability and accessibility of the resource.

From the interviews, the respondents used the same types of water for bathing and washing. However, there were various sources the respondents accessed to the water for the usages. 25% of the respondents depended on the state piped water supplied by Battambang Water Authority as their main water source for bathing, washing, and cleaning. They had already connected to the water supply since before the 2013 flood. Besides, 16% of the respondents bought water from vendors for bathing and washing. The vendors delivered the water in water tank with their motor carts. One tank cost around 1,000 riels (0.25 USD).

Some people in the village still used pump wells and ring wells. 16% of the interviewees bought pump well water from their neighbor. Pipes were already connected. When the users need water, they just informed the owner. The owner would draw water from the well with their pump machine. The users need to store the water in their own water storage. They used large cement jar for storing the water. One jar of water cost them 2,000 riel (0.50 USD). At the meantime, another 16% of the respondents used their own ring wells.

Moreover, for bathing and washing, other respondents also used other sources. A household used water from their pond. The pond is in front of the house. It was a small pond around 5 meters length and width. The pond is open. There's no concrete pond wall. It's just a simple pond with dirt wall. Apart from using for bathing and washing, the water from the pond was used for cleaning the pigs and the pig cage too.

Another household used water from their mother's house's ring well. The house was just around 10 meters from each other. They connected with pipes directly to their house. The water was stored in cement jars. Besides this, sometimes, they bought piped water from her neighbor too. One jar of water cost 2,500 riels (0.625 USD) which could be used for around a week.

The other respondent used water in their workplace for bathing and washing. Her job is washing sauce battles. Her workplace used state piped water. She and her grandson took bath and wash their clothes at the workplace. The owner allowed them to use it.

Source of water for washing and bathing	# Respondents
Pipe water	25%
Cart water	16%
Bought pump well	16%
Own ring well	16%
Pond	8%
Mother's ring well	8%
Workplace	8%

Table 1: Sources of water for washing and bathing

For cooking, the majority of the respondents still used the same sources as for bathing and washing. However, 33% of respondents switched to other sources of water. The majority of those who changed the sources for cooking opted from pond, ring well and pump well to rain water. They stored rain water in their cement jars for the usage. Additionally, the respondent who used water at their workplace for bathing and washing used water from her neighbor's pump well. She used it sparingly as she need to carry it with her water bucket. One bucket for one cooking time. She used it for cooking, cleaning and washing cooking utensils and ingredients. The water was also used for bathing her mother who is old, fragile and has mental disorder.

For drinking, 42% of respondents consumed boiled rain water. 8% of respondents drank rain water without boiling. If no rain water available, they drank the water bought from the vendor without boiling or other treatments too. 16% used gallon water (big bottled water) for drinking. One gallon can be used for around 10 days by two adults and two children. It cost 2,500 riels (0.625 USD) per gallon buying from nearby mom & pop store, or cost 2,000 riels (0.50 USD) buying from a vendor who delivered by cart. With slightly less volume of water and poorer quality water and bottle, a gallon of water cost around 1,000 riel (0.25 USD). Those who connected to state piped water consumed boiled piped water. The rest used boiled well water and cart water bought from the vendors.

Source of water for drinking	# Respondents
Rain water (boiled)	42%
Gallon water	16%
Piped water (boiled)	16%
Rain water (not boiled)	8%
Well water (boiled)	8%
Cart water (boiled)	8%

Table 2: Source of water for drinking

2. Situations during the Flood

a. General Situations

Flood causes damages and/or loses of the infrastructure, property, health, and even lives. More than these, during the flood, people faced many difficulties in their daily lives. According to the interviews, 100% of the respondents said that they and other family members could not work or go to work. All income-earning activities were hold due to the flood. Most of them were manual workers with daily wages. Either working for others or self-employed activities, all the operations were stopped during the flood. People worried that they would not have enough food to eat and would not have enough money for other expenses either if the flood lasted longer. A respondent said that her husband, who was a barber, could not go to his place. His place, which was just a small shop at a nearby market, was flooded deeply. His haircutting job was the only main source of income for the whole family. His daily income was cut off because of the flood. During the flood, everything was just only expense. They tried to spend as little as possible.

Besides, all the respondents mentioned travelling difficulties. It was also the reason that some respondents could not go to work. However, travelling difficulties brought many more issues than this. During the flood, many roads were damaged. Due to the flood and bad roads, none of the water vendors delivered their water to the customers' houses as before. If any household needed water, they had to push their own carts with water tank to buy water at the vendors' houses. As a single son in a family of old parents, the son of the respondent need to push their cart alone to buy water for their daily usages from the vendor's house at the main road. The road from his house to the vendor's house was an old gravel road. It was flooded, but still walkable. The road was muddy and sticky. The vendor's house is around 1 kilometer from his house. He said he really pity on his son, but they had no choice. If the son did not go to buy the water, they would not have water to use.

Furthermore, some respondents said their family members got sick and they need to buy medicine for them or took them to see a doctor. Because of the flood and difficulties in travelling, some did not go to buy medicine or visit doctors at all if the illnesses were not considered serious like fever, cold, cough, headache, and diarrhea. They just tried their own ways to reduce the sickness. However, some still need medicine or doctor as the illnesses were serious or the patients could not bear with the pain. Travelling at that was dangerous, difficult, and time consuming. A respondent recalled her travelling difficulties when she went to buy medicine for her brother. During the flood, her brother had a boil on his cheek. It was very painful. Her brother got fever because of the boil. She need to go to a doctor's house, around 2 kilometers from her house, to buy medicine for him. Before the flood, she could spend only a few minutes to arrive the doctor's house with her motorbike. However, during the flood, she spent around 2 hours forth and back. She said the flood was high and it flowed fast. She could traveled by bicycle only. On the part of the road that was flooded deeply, she walked her bike. On the shallow part, she rode it. She said she was scared and exhausted. It was a very bad experience for her.

Furthermore, female respondents complained about their difficulties in travelling to markets. As they were the ones who prepared food for their families, they need to go to the market to buy cooking ingredients like vegetables, meat, and more. During that time, most of them walked to the market although it is far, around one kilometer from home. Their feet were in flood water most of the time. Small traditional markets are open spaces, no actual building and stalls. If no flood, some vendors displayed their products on plastic mats on ground, but during the flood, they displayed their products on shelves. However, they still stood in the flood. Both buyers and sellers spent many hours in the flood in the morning. It was not comfortable, and they got the painful foot infection easily.

Based on their house conditions and the types of their houses, moving their stuffs out of water was another task that the affected people need to do. 92% of the respondents mentioned that they need to move things that could be damaged by water to somewhere or put on top of something off water. They raised their rice sacks on beds, moved to upstairs, kept in someone's house which is higher if their houses did not have an upstairs. Some laid bricks higher than water and put their stuffs there. Some kept their stuffs on tables and cupboards. Some cooked on tablets or even beds. A respondent said that she kept her firewood and the stove on a table. When cooking, she stood in the flood water in her house, prepared, and cooked on the table. She also boiled water for drinking on the table too. As it is difficult and she need to save some firewood, she tried not to cook often. She prepared some extra food for other meal time. She tried to avoid boiling water for drinking too. She boiled water only when she ran out of gallon water.

While flooding, animals, insects, and other on-land creatures moved to high and dry area. Many types of harmful creatures fled to people's houses. 92% of the respondents said they were scared of venomous creatures such as cobras, centipedes, scorpions, and ants. Those creatures did not just scare people with their appearances, but some of them could kill, poison, bite and cause severe pain to people and their animals. They kept kaffir limes and leaves in the areas in their house where snakes could possibly hide to prevent them from entering the places. They used mosquito spray to spray on the flood water in their house or burned mosquito coil to chase those insects away. A respondent described her scary experience during the flood. She kept her chickens in her house. One day, she saw a cobra was swallowing her small chicken. She was shocked and scared. She said her family was lucky that no one was bitten by the cobra. Besides, she saw other venomous creatures like scorpions and centipedes floating and swimming in the flood water in her house. Her family could only just be cautious and check clothes, bed, blankets, pillow and mosquito net carefully before using them. She used mosquito spray, burning mosquito coil, and kaffir lime to chase the harmful insects and creatures away. She did not know for sure whether those methods were useful or not. She followed her parents and the other villagers who experienced with such flooding.

25% of respondents mentioned that either they themselves or their family members were bitten by centipedes. It was very painful. The victims got swollen on the areas that were bitten. A child victim got fever and the pain lasted for many days. Because of the pain, they could not eat well. However, when asked whether they visited a doctor or use any prescribed medicine, none of them did. This was because private clinic and public hospital are far from their houses, treatment could be expensive in their perspective, and difficult in travelling. Some did not even know that modern medicine could cure it. They could use their own methods or use medicine without prescription to ease the pain like warming the bitten area with hot water or light fire, went to nearby traditional healer, and/or taking Paracetamol pill. A respondent said that a centipede bit her while she was collecting clothes for washing. The pain was too much. She said she was hungry, but because of the pain she could only eat a little bit. She did not know that the modern medicine could cure it. She went to traditional healer, but the pain did not go away. It took her few days to get better.

Moreover, there were many more concerns and difficulties the respondents and their families faced during flooding such as muddy house grounds, muddy roads, road damage, dirty floodwater, foot tinea pedis infection, damage of property, and so on. A respondent said that everyone in his family got foot tinea pedis infection during the flood as everyone contacted the water most of the time and the water was so bad. It was painful, but they did not know how to deal with it. They could only use Mercurochrome to apply to the infected area and tried as much as they could to keep their foot dry. He said the infected foot was cured by themselves when the flood receded.

Difficulties	# Respondents
Couldn't work	100%
Difficult to travel	100%
Venomous creatures such as ants, scorpions, centipedes, cobras	92%
Raised stuffs	92%
Muddy in house ground	83%
Road damaged	83%
Road muddy	83%
Dirty floodwater	83%
Tinea pedis (the respondents)	42%
Damage of property--table, cupboard, loud speaker...	42%

Table 3: Difficulties faced during seasonal flooding

b. Water Access during the Flood

The flood did not cause much change on how people access to drinking water. 92% of the respondents still used the same sources of water for drinking. Like before the flood, they drank boiled piped water, rain water, gallon water, and cart water, and only a household drank untreated rain water. However, one of the interviewed households changed from using the water they bought from their neighbor's piped water by boiling for drinking to consuming gallon water instead. The house was flooded deeply and it was hard for her to boil the water.

However, accessing other sources of water was very hard for people during the flood, and some sources of water were not safe.

The household who bathed in Sangke River still bathed in the river as what he did before the flood, but they need to go to bath earlier when it was still bright. The parents in the household were in their 70s already. It was not simple for such old people to do that. They were also scared of venomous creatures such as snakes, scorpions, ants, and centipedes, and walking in the flood was not easy too. Additionally, during the flood, no water seller came to the village, so the member of the household need to pull their own cart to buy water from the water seller at their houses. The road was muddy and pulling cart in water by carrying a water tank was somehow a hard work. The water bought from the vendor's house used for washing utensils, meat, vegetables, and other stuffs for cooking.

During the flood, one of the respondent's house was flooded for around 30 days, and it took around 2 months to dry up. At that time, they used rain water for cooking because it rained often during that time and they had several cement jars for storing the rain water. However, they bathed, washed clothes and cleaned stuffs in the flood water. When asking about how they felt about the quality of the flood water they used, the respondent said that after bathing, everyone felt itchy. They used body powder (Bhesaj) to ease the itchiness. The respondent said that she knew the water was not good enough, but they had no choice.

The other respondent's house was flooded 0.5 meter, and it lasted around 7 days. During the flood, the family mainly depended on rain water too. They stored rain water in two big cement jars and two other smaller jars. The stored rain water was enough for using during the flood. The rain water was used for washing, cleaning, and cooking. They drank gallon water. Although, for bathing, the family need to go to respondent's mother's house which is around 300 meters from his house. His mother's house connected to the state piped water, and the flood did not affect it. They could use the water there.

The area around the respondent's house was low. The flood took around 10 days to completely receded, and it took around another 15 days until the road dry enough for use. It was very muddy and it was hard for them to go out to the main road as, at that time, there was only very small dirt path with around 1 meter width accessing to the main road which was around 300 meters from the house. During the flood, the household bought water from their neighbor. It was state pipe water, but it was not always clear, according to what the respondent said. Sometimes, it looked red, black, or cloudy, but it still smelled the chloride. In that case, the respondent kept the water to settle before using. She had no choice, but still used the water. She said the flood water was very dirty. It mixed with sewage water. Her daughter was irritated by the water, so they tried to avoid contacting the water as much as possible. They could not use the flood water for anything. Hence, the water bought from the neighbor was used for many things included bathing, washing, cleaning, and cooking.

Furthermore, the family who used neighbor's well water before the flood still used it during the flood. Noticeably, the well owner had stored the well water in a basin before the flood reached the well. The respondent used the water for cooking and bathing her mother. Besides, as the respondent and her other family member used water in their workplace, it was very challenging for them to access to the water during the flood. Their workplace was closed. Luckily, the owner visited the place regular and would open the door for them to use the water if they were there. She and her grandson need to watch out for the owner. When the owner came, they need to go the workplace immediately to bath and wash clothes. They need to do it as quickly as possible as, normally, the owner visited the place for a short time only. They didn't want to bother the owner much.

3. Situations during the Time of Fieldwork

Since the severe flood in 2013, Battambang city has not suffered any serious seasonal flooding yet. Currently, there were some improvements in term of road and housing conditions, and state piped water access.

Few years after the flood, some roads have been improved. Based on the observation and interviews, 33% of the respondents experienced road improvement in the areas of their living. Roads which were gravel at the time of the flooding has been changed to paved roads; while the previous small dirt paths have been innovated to concrete roads. On the other hand, there is still a shortage in the development. 67% of respondents raised that after the flood the roads in their residential areas were repaired, but, currently, they were not in good conditions and not much different from the conditions before the flood.

People got a bitter lesson from the flood that year about their housing conditions. As the result, 50% of all respondents had their houses improved after the flood. Immediately after the flood, a respondent said that water still trapped in the house ground because the ground was lower than the surrounding land. It looked like a lake at that time. If they did not do anything, it would take half year until in dry season to dry the flood water. They could not live like that. Eventually, the family borrowed money from others to buy land to fill in the ground to raise the ground higher, so they could have dry house ground.

Besides, other respondents tried to improve mainly on their house floors as they were just plain dirt at the time of flooding. 25% of the respondents upgraded from dirt to concrete floor. By the way, at the meantime, a household got completely a new house. During the flood, the family lived in a shabby hut with one bed. After the flood, an NGO built a house on the family's land for them. The house has the size of 4 meters width and 5 meters length. It is a stilt wooden house (around 1 meter off ground) with bamboo floor, tin wall and roof.

Remarkably, 25% of respondents had connected to state piped water already before the flood. They did not have any problem with water access during the flooding at all. After the flood, other 25% of the respondents also have connected to the state piped water too. However, there are still 50% of the respondents do use piped water yet nowadays. When asked, cost is one of the main reasons. A

respondent said his current source of water does not require him to spend on the connection. Another respondent said that her family cannot afford the connection fee and consumption cost, and her family can access other sources that are free: pond and rain.

Although cost is a main issue, it is not the only obstacle preventing people from connecting to state piped water. There are few other causes. According to a respondent, apart from the cost of connection and consumption, land issue with the government is also another reason that the family does not want to connect to piped water. The water authority would provide water connection for them although the land they live in still has the issue, but the problem is that the family is not sure whether they might move out or get the land title. They do not want to risk their money on it. Besides, another respondent mentioned that she could not afford the cost and her family is live on an illegal land (on sewage canal) too. She was not sure whether the authority would allow her family to get state piped water connection or not if she could afford it. The other respondent said that her family has their own open well already. They spent only on electricity to draw water from the well with their pumping machine. If they connected to the state piped water, she was afraid that they would consume lot of water, so they could not cover the cost.

4. Roles of Local Government and NGOs

Early warning could let people prepared for the flood better. However, none of the respondents mentioned they received any early warning by any way about the flooding from the local authority. Those who were more cautious relied totally on their own ways. They watched or listened to weather forecast. Some went to look at the river by themselves; while some just heard from mouth to mouth. For those who did not stay alert about the flood knew nothing about the status of the flood until the water reached their houses.

Moreover, there was no activity to raise awareness about sanitation, water safety and risk of vector-borne diseases at all according to what the respondents said. During flooding, people could face health issues. As mentioned by the respondents, during the flood, they and/or their family members had diarrhea, cold, fever, cough, and foot tinea pedis infection. Those health problems could prevent by maintaining sanitation, using clean water, and less contacting with the flood water. Although few respondents were aware the causes, but they did not know how to cope with them. The local authority and NGOs should provide needed material and train the flood affected people how to treat water with simple methods such as boiling, using alum or chlorine tablet, water sterilization with Sunlight, use simple water purifier, and so on. There were no such support mentioned by the respondents at all.

During the interviews, none of the respondents mentioned they received any direct support from the local government and any NGO, including clean water, at the time of the flooding. It is always easier for people to see direct support. However, when they were asked about their perspectives on future seasonal flooding, many of them either believed that there would be no more seasonal flooding or no more serious seasonal flooding. Their reasons were because of

multifunctional hydro-dam in Banan district, higher roads and better sewage system in the city and household land fill. According to the perspectives, the national and local governments have more or less implemented projects that could prevent or lessen seasonal flooding impacts.

Those who have piped water connection did not face clean water access difficulty at the time of the flooding. State piped water connection could ease people's lives in term of water access even in a hazard event. According to the interview with Sangkat Preak Sdach commune chief, the commune authority has been trying to ease poor households to get state water connection. The commune office has helped poor people to issue Poor-ID cards and poverty certificate for them, so they can use it to get some discount from Battambang Water Supply Authority when they request for piped water connection.

Moreover, there are assistances from international and local NGOs in supporting poor people to access to clean water and other public services. Based the Chief of Administration and Human Resources of Battambang Water Supply Authority, they can provide discount to the poor people because JICA has supported in material. The NGO has also built another new water factory, and provided technical persons. The NGO also sponsored water meters to the authority, so the authority can connect the water for people with low cost. Besides this, recently, Habitat funded around 40 poor households to build their houses, connect to electricity and piped water.

VI. Conclusions

The seasonal flooding put Battambang poor people, specifically people in Sangkat Preak Preah Sdach, under more stresses and difficulties, from clean water access to incoming earning. Road and housing conditions, state piped water supply, local authority and NGOs, household capacity (knowledge, experience, wealth, and adaptive capacity), and social bond (good neighborhood, relatives, and friends), were factors determined whether not people were more prone to the negative impacts of the seasonal flooding.

Some roads, especially those in the areas far from the city center like Sangkat Preak Preah Sdach commune, were under developed at the time of the flooding. During the flood, difficulty in travelling was one of the major challenges people faced. People chose to bear with their illnesses, which were not very serious, by themselves with their own ways of treatment. Apart from high flood level, poor road condition such as holes, rockiness, bumpiness, and muddiness, made it harder for people to travel to markets to buy their daily food, and to somewhere else outside of their houses.

Although there were some road improvements after the flood, many respondents mentioned that the roads in their area were still poor. The roads in their residential areas were still the same as what they were in the time of the seasonal flooding in 2013. They are still old shabby rocky, old gravel, muddy and dirt paths. If there is another flood again, people will still face similar difficulties.

During the flood, the majority of the respondents' houses were not strong. Their houses' walls made from wood mixed with tin, the roofs made from tin, and many of the houses were on ground with only dirt floor. Lives of people living in such houses were even more difficulties during the flood. Only their beds and tables were off water. They need to move all the stuffs that could be damaged by water up on their tables or beds, or they need to leave those things in someone else's house which was larger and higher. Some could not even stay in their houses as the water was too high. They slept and cooked in relatives' or neighbors' houses.

Currently, half of the respondents said that their houses have been improved partly, mainly from dirt to concrete floor. However, the majority of them are living in only one on-ground floor. Although the floor is cement, the house grounds are still low and prone to be flooded. Raising the grounds with land fill is very costly, which is not affordable for them.

During the flood some people got diarrhea, cold, flue, fever, foot infection, and were bitten by centipede. Some were reported seen cobra. Some issues were minor, but some could be fatal. Household condition, poverty, difficulty in travelling, clean water accessibility, poor hygienic practices, and being far from hospital, clinic or doctor's house, could made the issue worse. Moreover, preparing the medicine for such health issues and making it accessible to everyone needed could be done by the local authority and or the NGOs. However, none of the respondents mentioned receiving such an assistance from them.

Moreover, the respondents also complained about being unable to generate or earn their income during the flood and the time immediately after the flood. During that time they could spend money only. The flood and road conditions could not allow them to go to work. Many businesses closed due to the flood. They worried that, if the flood lasted longer, they would suffer more as they could not have enough money to buy food.

The families that have access to state piped water did not face any difficulty in water access. Apart from using for bathing, washing, cleaning, and cooking, they can boil the piped water for drinking. However, the households that did not have state piped water access faced lot of difficulties in accessing to clean water during the flooding. Unfortunately, 50% of the interviewed households still have not accessed to state piped water yet until now.

From the interviews with the households, in their perspectives, there were absent direct supports either from the local authority or from the local NGOs. The respondents claimed that they totally depended on themselves to deal with the flood. However, indirect assistances from the local government, national government, and NGOs, are undeniable. As state piped water secured clean water access during the flood, supporting state piped water access is very important. Hence, the local authority has been assisting poor households in issuing ID-Poor cards or certificates, so they can get 25% discount from the water authority for the connection. However, without the assistances from JICA and the approval

from Battambang Water Authority, the deduction of the connection cost for the poor would not be possible.

On the other hand, although some activities have been done by the authority and the NGOs to improve the situation, roles of the local authority and the NGOs in supporting the poor people regarding seasonal flooding issue is still significantly seen as lack behind the needs and the circumstances. The national and local governments should do more either alone by themselves or cooperating with NGOs to improve the adaptive capacity and resilience of the poor people to the seasonal flooding.

VII. Recommendations

Early Warning System

It is noticeable that none of the respondents had received any early warning from the authority about the flood. There were weather forecast and news about water level in television during flooding season. However, the forecast and warning were too general. It covered the whole province, not any specific area. As the result, the respondents could not predict the level of flooding water. Some were more cautious, so they could know the status of the flooding well, but some could not do that. It was until the water reach their houses that they could realize that the flood was serious.

Early warning system could prevent heavy loses, especially property, and let the people prepare themselves well to deal with the impacts of the flood. A respondents said that her whole family was not at home when the flood reached her house. No one in the family would expect that the flood could rise that high. When they arrived home, they found that a sack of their milled rice was spoiled by the flood. Some utensils like dishes, pots, and buckets, went with the water. She continued that it was lucky for her family that the loss was not much as they did not keep many things on the ground.

According to the personal conversation with the secretariat of Battambang Disaster Risk Management Committee, there actually are warning systems when there is any disaster such as flooding, storm, drought, and lightning strike. For Battambang province, people can report the disasters happening in their areas by dial 1294. Warning voice mail could be sent to the people listed, around 4,000 in Battambang province, in the systems. These warning systems could inform some people in the affected areas to stay alert and prevent themselves from any harms. However, these types of warnings are not early warning. They are used when the disasters are already happened.

Battambang Disaster Risk Management Committee could use these types of warning to inform people about predicted serious seasonal flooding too. However, the committee need to cooperate with the Ministry of Water Resource and Meteorology to get clear information on a specific area, so their early warning will be more reliable and respectful. However, the current number of contacts in the system is still too small. People in the narrow network can share information from mouth to mouth, but there will be many people miss the information. The Committee should update and expend the list of contact

number in their system so that many people will not be left behind, and they can avoid great loss during such a flood.

Adaptive Capacity Building and Basic Needs Support

Basic human needs, especially food and clean water, are needed during the flood. The respondents said foods such as dried salt fish, smoked fish, soy sauce, fish sauce, and instant noodle were their regular food during the flood. However, they said their stocks of the foods were limited. If the flood lasted longer, they would suffer food shortage. Besides, during the flood, those who could not access bottled water boiled piped water, water from the vendors, or rain water, for drinking. Nevertheless, boiling water was not easy and efficient in such condition as the firewood was wet, limited amount of charcoal, and conserving gas for cooking food. In such cases, aids from the local authority and NGOs could be done inclusively. Packed and dried foods should be given to the affected households, especially the poor, with drinking water.

Normally, Cambodian people do not have a first aid box at home. Over-the-counter medicines such as pain killer, medicines for a cold, flu, fever, cough, foot infection, and venomous creature bite, are crucial for the flood affected households. Being poor is being limited. They did not keep those medicines at home because they did not have knowledge about such medicines. They did not know how to or dare not to use them without instructions or prescriptions. Additionally, they did not want to spend money to buy any medicine to cure the illness that they did not have yet. They would keep the money for something else. Unluckily, some members in their families got sick or were bitten by venomous creatures during the flood. It was not easy to travel, most of pharmacy closed, and doctors did not go to work. They have no choice, but bear the pain or illness until they receded by the nature or they tried to ease the pain or cure the illness by their own ways.

Consequently, the roles of the government and NGOs are necessary. They not only should provide the medicines to the affected people, but should educate people about sanitation and how to prevent any harm during the flooding. Besides this, the government and NGOs should also distribute water treatment material (purifier, alum, and chlorine tablet) and water storage (water tank, gallon and bucket), and train the flood affected people how to treat water with simple methods such as boiling, using alum or chlorine tablet, water sterilization with Sunlight, and using simple water purifier, to ensure that people could access to clean water and prevent them from catching water-borne diseases. Importantly, they should hold workshops, arrange training or propagating (leaflet, billboard, radio or TV advertisement) about water safety and how to be safe from vector-borne diseases.

Infrastructure Improvement

Road and Sewage System

In the meanwhile, activities that have long term effects should be implemented by the local authority to better people's adaptive capacity and resilience to seasonal flooding as well as improving people's wellbeing.

Regarding seasonal flooding issues, all the respondents suggested to improve infrastructure, especially road and sewage system, as well as state piped water connection.

Improvement areas	# Respondents
Build new/renovate roads	50%
Install sewage system	50%
Renovate the old canals	33%
Receive the land titles	17%
State piped water connection	17%
Raise road higher	8%
Cover the canal	8%
Raise sewage system higher	8%

Table 4: Improvement areas

Road is one of the Physical Capitals of Livelihoods Assets. People almost solely depend on the government in order to access to this type of asset. The local authority as well as the relevant NGOs in the area can have a great influence in advocating the national government to improve the roads in the local areas.

However, financial resource limitation at the local level can be one of the major obstacles for road improvement in the area. According to Commune/Sangkat Fund Allocation data, apart from administration and unplanned expenses, annual budget allowance from 2012 to 2015 for Sangkat Preah Preah Sdach for development purposes was around 20,000 USD. With this amount of budget, how much the local government can do? At the national level, with financial deficiency, careful budget plan, and so the allowance, must be implemented thoroughly. As the result, development or improvement in a certain area or field can be put aside or on hold.

With regard of the importance of financial resource, in the meanwhile, human resource also play an essential role in road development in the area too. With limited budget but with good human resource, the local government can find other solutions that are effective and possible. For example, they can prepare clear and effective plan and submit a request to the national level with convincing impact and benefit evaluation of the plan. They can conduct an evaluation study about pros and cons of bad and good roads related to key aspects—economy, social wellbeing, road safety, poverty deduction, school performance, climate change adaption and resilience, and government image—to give more solid foundation for the request. Besides, they can gain trust on their capability, and they can cooperate well with international NGOs and partners, so they can receive development assistance in term of financial and technical resources.

Just only about a small aspect, road improvement, a controversial idea about whether to do it or not may pop up in implementers' heads already. They would question the return(s) of spending for that. Weighing the benefits would be conducted first. A specific group of decision makers would consider from the economic growth, social wellbeing, poverty deduction, overall development, and

impact on social change (the overall living situation) to the personal gain (individual people in general), the society, and the nation as the whole; while, other group would consider political party gain (maintaining image, more popularity and trust), government image, good image of the person who initiate the road improvement. Whatever group, the decision to whether or not improve the road(s) will be made based on high benefits. People in small community who are seen as having small impact in the social change would be left behind or considered the last. For instance, a road innovation would be highly considered if it was in an area with hundred or thousand households or used by many travelers. In the contrary, if the road was in an area of a few households, the road would be never considered for innovation unless it was used by many travelers from other areas. Unequitable opportunity from development activities led to a difficult-to-answer question “for whom is the development?”

The national and local governments holds the gear. Faster and more efficient road improvement can be achieved whenever the national government supports actively on financial and human resources, and the local government implements their strategies and plan effectively and responsibly.

State Piped Water Connection

Those who hold Poor-ID cards could get some discount, around 25%, from the supplier for the connection. Providing discount for preliminary piped water connection could somehow encourage poor households to use the water. However, consumption cost is still another concern. Some respondents choose not to connect to the piped water although they hold Poor-ID cards. They said they could not afford the consumption fee too. A respondent, whose house does not connect to the state piped water, said that the water cost 2,000 riels (0.50 USD) per cube meter, but another respondent, whose house connected to the water, said that it cost 1,500 riels (0.37 USD) per cube meter. Either way, the cost is still higher than buying water from the vendors. It cost only around 1,000 riels (0.25 USD) per cube meter. And, people can also use rain water, well, and pond, as their free water sources too.

In addition, not every household could access to the state piped water even they can afford it. It is critical regarding the issue. Affordability of the connection fee and consumption cost is one of the barrier, but it is not always the major obstacles. Another key hurdle is those households whose houses are isolated from others'. They cannot connect to the water supply. The main pipe installation is very expensive. Spending a huge amount of money to install the main pipe and earn very little from the few houses is something business people cannot take risk with. The water authority cannot take the responsibility of the profit loss, but has no choice leaving those houses unconnected.

Remarkably, according to the interviews with the local government and water authority, there was no other support on poor people's clean water access rather than offering the discount on state water connection. Assisting people, especially the poor, to access to state piped water supply and to achieve the government goal of 100% state piped water access in urban areas by 2025, the government should lower connection and consumption costs and fund the expansion of the

main pipe connection to the isolated areas. According to the representative of Battambang Water Authority, once the main pipe is already installed, the connection to the households is easy and not costly.

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