IMPACTS OF CLIMATE CHANGE ON HUMAN SECURITY IN THAILAND

ULLA-MARIA LIISA VESTERI

STUDENT ID: 5717812001

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Author: Ulla-Maria Liisa Vesteri

Student ID: 5717812001

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Committee Chairperson .....

Associate Professor Dr. Jomphong Mongkhonvanit

Advisor .....

Associate Professor Dr. Tatree Nontasak

Committee Member .....

Assistant Professor Dr. Chaiyanant Panyasiri

Committee Member .....

Dr. Emmanuel Okafor

.....

Associate Professor Dr. Tatree Nontasak

Director of Masters of Arts in Peace Studies and Diplomacy

Date 22/Dec/2017

Abstract

Title: Impacts of Climate Change on Human Security in Thailand

By: Ulla-Maria Liisa Vesteri

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As climate change impacts such as sea-level rise, droughts and floods can pose a threat to human security in Thailand, this research asks what kinds of challenges does climate change pose to Thailand and how will those challenges affect human security. Climate change is a well-researched topic but previous work has failed to address it through the lens of human security. This research aims to underline that climate change is not only an environmental problem, but can affect societies in larger scale. The methodology used in this research involved documentary research supplemented by three expert interviews. The findings of this research confirm that climate change impacts can affect human security of the Thai population by destroying the crops, real estate and infrastructure. It is recommended for Thailand to spread awareness of environmental issues, continue regional co-operation with ASEAN, and invest in research in order to enhance mitigation and adaptation measures. Thailand should also prepare for climate related migration in the future.

Keywords: climate change, human security, Thailand

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CHAPTER 1

Introduction

1.1 Background

Climate change is a global challenge and is already affecting the everyday lives of people around the world. Whereas the most prominent challenge in the Arctic region is melting ice and Africa and the Middle East suffer from desertification, the greatest issue for Asia is sea-level rise. This means that due to a range of factors, there will be less and less living space for both humans and animals. The reduction in space for farming, harsher conditions for both farming and living, together with the ever-growing global population creates a problem which will need a solution sooner rather than later. "Climate change will play an increasing role in causing – and exacerbating – humanitarian disasters, especially along coastlines" (Doig and Ware, 2016, p. 14). Table 1 (page 10) describes the regional challenges relating to climate change in more detail.

The impacts of climate change may vary from region to region, or similar challenges might occur in more than one part of the world.

> Future climate change is expected to severely affect people's livelihoods worldwide through the intensification of natural disasters; increased warming and drought affecting agricultural production and access to clean water; rising sea levels making coastal areas uninhabitable and increasing the number of sinking island states; and increased competition over natural resources that may lead to conflict. (Faist and Schade, 2013, p. 30).

The most prominent impacts of climate change in Southeast Asia, according to Lutvey et al. (2015), are typhoons, flash floods, landslides, droughts, rising sea levels, unpredictable water access, crop loss and large scale displacement of people. All of these events could pose a threat to human security. “Climate change is expected to have severe consequences on the lives and livelihoods of millions of people around the world, but its effects will not be evenly distributed” (Busby et al., 2014, p. 51).

The Southeast Asian region is especially vulnerable to the impacts of climate change for several reasons. Firstly, Southeast Asian economies rely heavily on agriculture and it is common that this sector may employ over fifty percent of the national workforce. In other words, climate change impacts such as droughts, floods and sea-level rise, threaten the livelihoods of almost half of the population of many Southeast Asian countries. Even though the livelihoods of half of the population might be at risk due to climate change impacts, the percentage of people who could be affected by impacts on food security may be much higher. Everyone needs access to food, and if the impacts of climate change cause challenges to food production, the whole population of some countries in Southeast Asia could be affected (World Bank, 2010).

Sea-level rise is one of the consequences of climate change which will affect Southeast Asia. Rising sea levels will have three main effects. Firstly the loss of arable land due to permanent floods. Secondly rising sea water will also salinize (increase the salt content of) the soil and, finally, the sea water may leak into freshwater sources contaminating supplies of drinking and irrigation water (Forster et al., 2011). Along with the economy, food security might be in jeopardy if Southeast Asian countries cannot meet the required level of crop production due to weather anomalies, caused by

climate change. As rice is an important export product of many Southeast Asian countries, a decline in production would also mean less income for the country's economy, not only at the individual level but also at the macro level. Another crucial factor when it comes to climate change is availability of water. As mentioned earlier, sea-level rise might contaminate fresh water sources, as could floods. Droughts can also affect the availability of drinkable water as well as changes in rain patterns, especially in the parts of the country where communities rely on rain water (Lutvey et al., 2015).

Regional Risks of Climate Change	
Sub-Saharan Africa	Low institutional capacity and high dependency on subsistence agriculture makes this one of the most vulnerable regions. Rain fed agriculture contributes nearly one-quarter of GDP and employs about 70 percent of the population.
East Asia and the Pacific	Large concentrations of populations on coastlines and a large number of small islands leave this region one of the most exposed to water-related climate shocks.
Eastern Europe and Central Asia	Poorly-designed infrastructure leaves this region ill-equipped to handle increasing flood risks, desertification, and changes in the flow of major rivers.

Latin America and the Caribbean	Warming will dramatically affect ecosystems in the LAC region, especially the Amazon rainforest, threatening the livelihoods of those who depend on ecosystem services.
Middle East and North Africa	Already the world's driest region, MENA will experience lower water availability and higher temperatures. The dependence on water intensive modes of employment such as irrigated agriculture are a concern in the context of further drying and increasing water demands.
South Asia	The large contribution of irrigated agriculture to food production and rural economies leaves this region highly vulnerable to predicted changes in the runoff of major rivers.

Table 1. Regional Risks of Climate Change (World Bank, 2010)

The United Nations have acknowledged that climate change must be taken seriously and hence the 21st Conference of the Parties (COP21) agreement was made in late 2015. Nearly two hundred countries were represented by their governments, intergovernmental organizations, civil society, non-governmental organizations or UN agencies. One of the most important elements agreed by COP 21 was to limit temperature increase to 1.5°C above current levels. Also, greenhouse gas emission

restrictions were set as well as promises of developed countries to help developing countries to meet environmental responsibilities. It was also agreed that every five years each country would be assessed according to these settlements. What is said to be special about this climate agreement is that each country can make a climate plan according to their own resources and capabilities. Therefore, it is said to be feasible as all the parties decide themselves how much they can contribute to the fight against global warming (UNFCCC, 2016).

Along with the United Nations, leading politicians have expressed their concerns about the climate change. U.S Secretary of State, John Kerry states that "climate change is as dangerous as terrorism" (Lee, 2016, p. 1). Kerry continued that climate change unfortunately does not get as much attention as terrorism, even though the two issues are interconnected. Another public character who agrees with Kerry on the relationship between climate change and terrorism is Bernie Sanders. The iconic U.S Democratic Party member also spoke about the link between terrorism and climate change but has faced a lot of criticism in the United States.

Many people and various institutions have expressed their concerns about climate change, and to back up their theories they need science. Two of the most well-known indicators of climate change are the changes of global temperature and sea level. These two indicators also have very comprehensive data collected by various organizations. The latest report made by Intergovernmental Panel on Climate Change (IPCC) predicts an increase in temperatures as high as 4.8°C, and a 0.82 metre rise in sea levels within the next century (Lutvey et al., 2015). Figures 1 and 2 on the following page show the trend of global temperature and sea-level during the last six decades.

These kinds of changes will have a radical impact on the lives of people in many different ways. Firstly, some areas might become uninhabitable due to sea-level rises or because of tremendous increases in the air temperature. These kinds of changes can cause a mass movement of people, which has been already seen in Bangladesh. Also, global food supply systems will be subject to some impacts of sea-level rises and the increase in atmospheric temperature (World Bank, 2010). When it comes to sea-level rises, certain areas, especially in Asia, will lose arable land. This will decrease food security due to the involuntary reduction of space for food production. In the case of Asia, rice production is particularly vulnerable to climate change impacts. Furthermore, as the "rice bowl" of the world, climate change impacts in Asia can affect food security and overall human security not only locally, but also regionally and even globally.

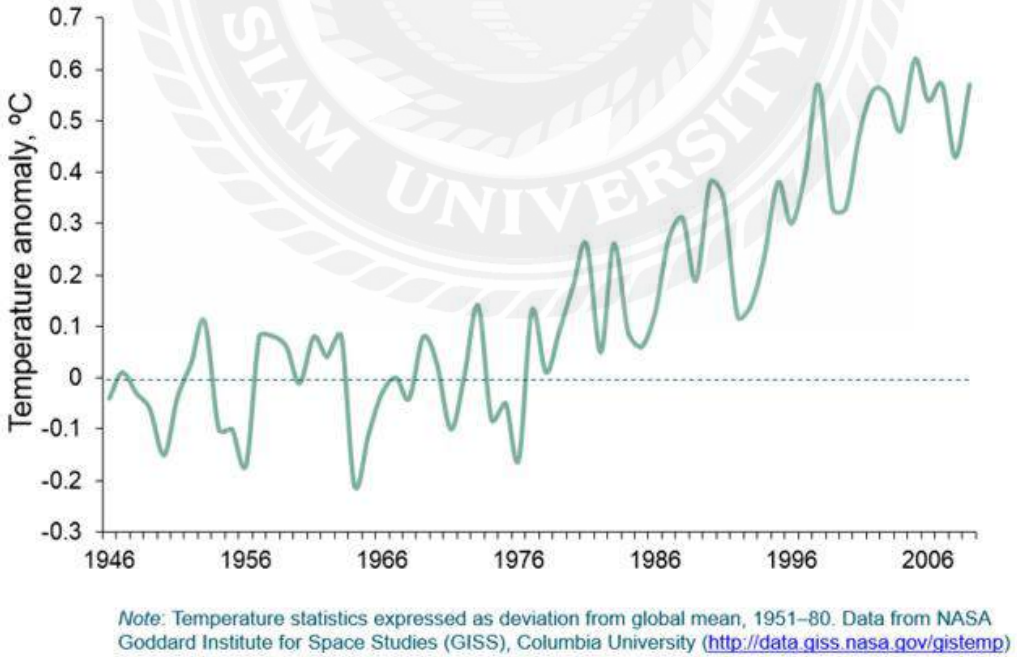

Figure 1. The Global Temperature Trend During the Last Six Decades

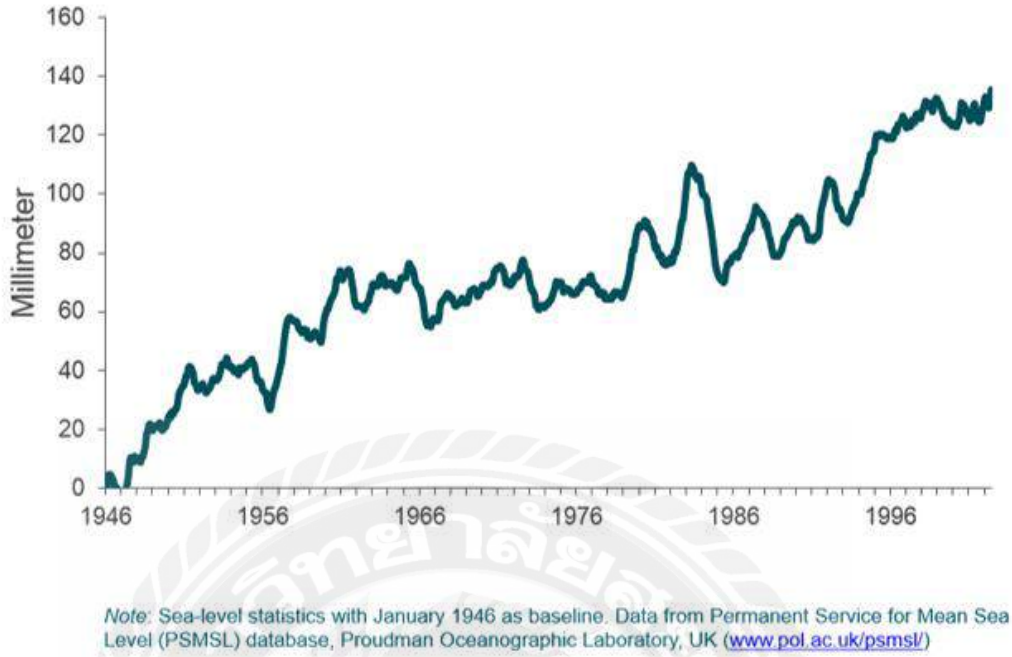

Figure 2. The Trend of Sea-Level Rise During the Last Five Decades

Climate change is not only going to affect the global food supply, but also through sea-level rises, droughts and so forth, some parts of the world might become uninhabitable and this will force people to relocate. The International Organization for Migration (IOM) suggests that climate change will cause large scale forced migration. IOM estimate that the number of migrants moving due to climate change will range anywhere between 25 million and 1 billion people by the year 2050. Lutvey et al. (2015) claim that low income populations lack the resources for planned migration and are thus increasingly vulnerable to become the victims of human trafficking and modern day slavery. The Office of the High Commissioner for Human Rights (OHCHR) has stated that climate change will increase the number of human rights violations and the people who will suffer the most are those who are already in vulnerable positions either

because of their geographical location, meaning mostly those from developing countries, or because of age or gender.

1.2 Rationale

Climate change is a global challenge, but the reason why this research decided to concentrate on Thailand lies in the statistics. The New Climate Change Vulnerability Index (CCVI) is a new ranking system which calculates the vulnerability of 170 countries to the impacts of climate change. According to this index released by global risks advisory company Maplecroft, five out of ten ASEAN countries are within the top sixteen countries which will be most affected by climate change impacts. The index rates 16 countries as 'extreme risk', including Philippines (#6), Myanmar (#10), Cambodia (#12), Vietnam (#13), and Thailand (#14). This data suggests that ASEAN countries are facing, and will face, significant challenges relating to climate change (Maplecroft, 2015). The fact that Thailand ranks #14 in the climate change vulnerability index is one of the motivations for this research to concentrate on collecting and analysing data from Thailand. Research by Standard & Poor's (2014) measures the potential vulnerability to climate change of many countries (see figure 3 on the following page). This research indicates that all of the Southeast Asian countries assessed are vulnerable to climate change impacts. Furthermore, several factors such as dependency on agriculture and fisheries as well as long coastal lines make the impacts of climate change very serious in Thailand. Therefore, this research will limit the study to Thailand, rather than other South East Asian countries.

Another index relevant to this research is the *Human Security Index* (2016), introduced by the United Nations Development Program. Components of the Human Security Index are as follows:

1. **Economic Fabric Index:**

- GDP per capita, adjusted for pricing (the term is "at purchasing power parity")
- Equality of income distribution
- Financial-Economic Governance (risk of hardship through unsustainable trade or debt, or from catastrophic health care governance disaster).

2. **Environmental Fabric Index:**

- Environmental vulnerability
- Environmental protection (clean water, etc.), policies & deliveries
- Environmental sustainability

3. **Social Fabric Index**

- Health
- Education and info empowerment
- Protection of, and benefits from, diversity
- Peacefulness
- Governance, including protection from official or illegal corrupt practices
- Food security

(Human Security Index, 2016)

According to the Human Security Index (HSI), Thailand is among the countries with a medium level of human security. "In terms of human security, Thailand ranks at number 103 out of 232 countries" (Thai Health, 2013, p. 1)

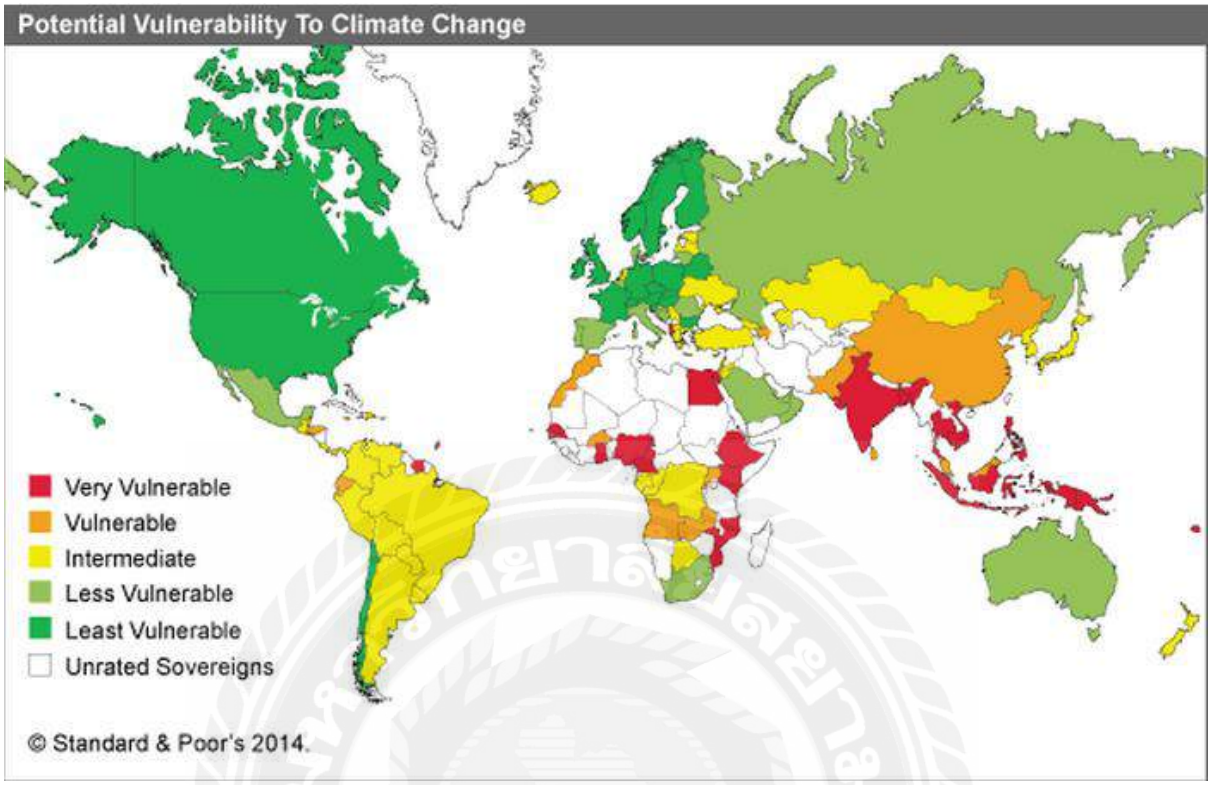

Figure 3. Potential Vulnerability to Climate Change (Standard & Poor's, 2014)

Regional organizations are co-operating on many different issues, global warming being one of them. Climate change is a serious concern to ASEAN. On its website (ASEAN, 2016) some of the reasons why the Southeast Asian region is especially vulnerable to the impacts of climate change are summed up. The fact that the economic activities as well as the large proportion of the population being concentrated on the coast line means that sea-level rise might have an extensive impact on this region in particular. As mentioned earlier, the livelihoods of Southeast Asian people rely heavily on agriculture and the region is dependent on forestry and natural resources. This means that more frequent and severe droughts, heat waves, floods and tropical cyclones might have devastating consequences in the ASEAN countries. Therefore, the

regional organization is trying to tackle the issue of climate change by co-operating and creating common policies (ASEAN, 2016). As the world is a closed system, when one country pollutes with carbon dioxide, it will also affect other countries. Moreover, no country can create the solution to climate change independently, but regional and international co-operation is crucial in order to adapt and mitigate climate change impacts.

Not only have regional organisations such as the European Union and ASEAN expressed their concern about climate change but also, for the first time, the current leader of Catholic Church has addressed this issue. According to an article in *The Guardian*, Pope Francis will call for "an ethical and economic revolution to prevent catastrophic climate change and growing inequality" (Vidal, 2015, p. 1). This is very significant that the Vatican leader is stating that "humanity's exploitation of the planet's resources has crossed the Earth's natural boundaries, and that the world faces ruin without a revolution in hearts and minds" (Vidal, 2015, p. 1). These kinds of statements might cause controversy at least among the most conservative camps but the Pope is willing to take this stand and support the movement to mitigate climate change. Whether the statements of the current leader of the Catholic Church will have an impact on the opinions and views of the public remains to be seen, but the fact that the Pope is calling for actions to change the current consumer oriented way of life is remarkable. Furthermore, the Pope is connecting climate change impacts with inequality, which is also something that Mary Robinson, former president of Ireland and former High Commissioner for Human Rights in the United Nations has been advocating through her foundation. Mary Robinson Foundation is advocating for climate justice, and this is also what the Pope meant by mentioning climate change and growing inequality.

It seems that people and leaders all over the world are starting to recognize the challenges of climate change on a larger scale. When it comes to mitigation, history was made at the end of 2015. At the Paris climate conference, Conference of the Parties gathered for the 21st time (COP21) to discuss ways to combat climate change impacts. One hundred and ninety-five countries came up with the first universal, legally binding global climate deal as a conclusion of the United Nation's Framework Convention on Climate Change (UNFCCC). One of the main points of the Paris Agreement is the goal of keeping the increase of global average temperature below pre-industrial levels or in other words below 2°C. Another goal which was agreed is to reduce carbon emissions, while recognizing the fact that this will take longer when it comes to developing countries. Therefore, developed countries will support developing countries in these endeavours. Also, practices relating to climate change adaptation and transparency were agreed (European Commission, 2016). The new climate deal also gives countries a chance to determine their own goals according to the resources of each state. Intended Nationally Determined Contributions (INDC) might make the Paris Agreement more feasible. Each country will publicly outline the level of actions they are willing to take to combat the impacts of climate change. This factor makes the deal not only more feasible but also fairer, because some countries might have more possibilities to use more resources on mitigation than others and INDC allows this (Paris Agreement, 2015).

The Paris Agreement is a very significant step towards narrowing the gap of inequality. According to Pollanen (2006), the impacts of climate change would widen the gap between rich and poor countries as well as rich and poor people within countries. Most vulnerable to the impacts of climate change are the people who make a

living from nature. For example, keeping cattle is getting more difficult due to droughts which destroy the water resources and also floods which destroy the infrastructure such as roads and so forth. Developing countries usually already have hotter weather and when global warming is rising the temperatures, it is the developing world which faces the greatest challenges. Furthermore, the ability to adapt to the impacts of climate change in developing countries is more limited than in the Global North (Pollanen, 2006).

Nachmany et al. (2015) discuss several studies on the effects of climate change in Thailand specifically. According to the Grantham Research Institute on Climate Change and the Environment, Thailand has suffered from natural disasters and extreme weather phenomena during recent years. The 2004 tsunami and the heavy floods during 2011 – 2012 have helped to raise awareness about climate change. The National Economic and Social Development Plan (NESDP) has set targets and plans how to mitigate the impacts of climate change. In order to increase energy efficiency as well as to cut greenhouse gas emissions, NESDP has also developed a policy framework. Thailand has also created a National Committee on Climate Change (NCCC). Chaired by the Prime Minister, this legislative body was established in 2007. Even though climate change adaption is a key part of the Climate Change Master Plan 2014 - 2050, any concrete adaptation legislation has not been passed in Thailand yet.

This research aims to find the impacts of climate change on Thailand and how those impacts affect human security. Table 2 shows possible impacts of climate change in Thailand, their effects and the consequences. As Thanasupsin (2012) suggests, the

effect of sea-level rise is regional and consequence is inundation of the land with sea water. The same study also argues that rising sea temperature is also regional problem and it leads to acidification of sea water. Table 2 also suggests that variable climatic patterns will increase droughts as well as precipitation. This means farmers will not make good harvests due, for example, to flooding. The last line of Table 3 claims that when ecosystem changes rise, it will lead to disappearance of species and thus decrease biodiversity.

Impact	**Effect**	**Consequences**
Sea-level rise	Regional	Inundation
Sea temperature rise	Regional	Acidification
Variable climatic patterns	Rainfall pattern change e.g. Increase in precipitation More droughts	Flooding Bad harvest
Rise in ecosystem changes	Regional	Disappearance of species e.g. Decrease in biodiversity

Table 2. Possible Impacts of Climate Change in Thailand (Thanasupsin, 2012)

When it comes to the impacts of climate change on Thailand, it is said in many studies that the most prominent challenges will relate to more severe and extreme weather patterns, which will lead to floods or droughts as well as land-slides, and so

forth. As Table 2 describes, being a coastal country, Thailand will also be affected by sea-level rise, as stated earlier in this introduction. This research examines what kind of challenges the impacts of climate change pose to human security. Sea-level rise can lead to loss of arable land. Droughts and floods as well as more severe tropical storms can ruin crops and leave farmers without income and furthermore, communities without adequate nutrition. As a large rice exporter, climate change impacts might affect even the macro economy of Thailand, if the target production quotas cannot be met. All in all, climate change impacts might have more complex effects on human security than meets the eye. This research studies the challenges through documentary research as well as primary research interviews with experts.

1.3 Objectives of the Research

In general, this research examines the relationship between climate change and human security. The specific objectives of this research are to find out what the challenges caused by the impacts of climate change are, and how those impacts will affect the level of human security in Thailand.

1.4 Research Questions

This research asks the following questions:

1. What kinds of challenges does climate change pose to Thailand?
2. How will those challenges affect human security?

1.5 Scope of the Research

This research concentrates only on studying the impacts of climate change on human security in Thailand. Thailand was selected because the country has a long coastline and is heavily dependent on agriculture. Studies suggest that Southeast Asia is one of the regions which will suffer the most from the impacts of climate change (Lutvey et al., 2015). These are some of the factors which will make Thailand particularly vulnerable to climate change impacts. Furthermore, Thailand was selected also because there seems to be more research already conducted concerning South Asian countries such as India, Bangladesh and Sri Lanka than Southeast Asian countries such as Thailand.

1.6 Definitions of Terms

Climate Change

A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Human Security

Human security is an emerging paradigm for understanding global vulnerabilities whose proponents challenge the traditional notion of national security by arguing that the proper referent for security should be the individual rather than the state. In short, Human security is an approach to national and international security that gives primacy to human beings and their complex social and economic interactions (Gregoratti, C, 2017). Human security consists of:

1. Food Security
2. Health Security
3. Personal Security
4. Political Security
5. Economic Security
6. Environmental Security
7. Community Security

Sea-Level Rise

Sea-level rise as it relates to climate change is caused by two major factors. First, more water is released into the ocean as glaciers and land ice melt. Second, the ocean expands as ocean temperatures increase. Both of these consequences of climate change are accelerating sea-level rise around the world, putting millions of people who live in coastal communities at risk.

IPCC

IPCC is the acronym for the Intergovernmental Panel on Climate Change. First set up in 1988 under two UN organizations, the IPCC surveys the research on climate change conducted around the world and reports to the public about the current state of our scientific knowledge.

COP and UNFCCC

These two abbreviations are best defined together as they work hand-in-hand. The United Nations Framework Convention on Climate Change (UNFCCC) is an environmental treaty that nations joined in 1992, with the goal of stabilizing greenhouse

gas concentrations in the atmosphere at a level that would prevent dangerous human interference with the climate system.

The Conference of the Parties (COP) to the UNFCCC is a yearly international climate conference where nations assess progress and determine the next steps for action through the UNFCCC treaty. 2015 marked the 21st Conference of the Parties (COP 21), which was held in Paris beginning Nov. 30. Here, a historic global agreement to reduce greenhouse gas emissions was passed, and marked a landmark achievement in the fight against climate change (Definitions of Terms sources: Climate Reality Project, 2015 and definitions.net).

CHAPTER 2

Literature Review

In this chapter, various articles, pieces of research, studies and books related to climate change and human security are reviewed. This chapter includes the reviews of climate change literature in general and also takes a look at the more specific articles about climate change impacts on human security. The literature reviewed discusses the climate change challenges globally as well as specifically, concentrating on Asia and Thailand. This chapter ends with a conceptual framework of this specific study.

1.1 Climate Change Literature

The term climate change refers to a "noticeable change in the Earth's regional or global climate system over a longer period of time" (Chandrappa et al., 2011, p. 1). The time scale can vary from decades to millions of years. Policy makers use the term climate change usually when referring to a timeline from the recent past to the present. The term also suggests that human activities are the cause. According to Chandrappa et al., "Intergovernmental Panel for Climate Change (IPCC) was given Nobel Prize for highlighting man made activities over the past few decades as the cause of climate change" (2011, p. 1). There is ongoing debate concerning whether climate change is caused by human activities. Data suggests, that the Industrial Revolution, with the increasing use of coal in particular, affected the speed of climate change due to carbon emissions. After the Industrial Revolution, urbanisation also affected the speed of climate change. When more and more people abandoned the traditional peasant life and migrated to the cities, it also led to increased consumption and production, hence higher carbon emissions. As for Asia, there are some special characteristics which enhance the

challenges climate change is causing, one of them is population density (Chandrappa et al., 2011).

South Asia is one of the most vulnerable regions in the world, when it comes to floods. One of the reasons why floods occur so often within this region is the monsoons. These floods do not occur without severe consequences. Flooding river basins cause enormous damage to infrastructure, property and crops. When floods ruin rice crops, food security is at stake and the poorest women and children are especially at risk of malnutrition. Due to the geographical location of Bangladesh, Pakistan and India, it is inevitable that the floods will continue within this region. The floods have also caused human casualties and displacement of people. For example, in 2008 the Koshi River engulfed hundreds of villages displacing over three million people. One might claim that monsoons have always existed in the region and that South Asia has been able to deal with them in the past. Scientific data show however, that climate change is making monsoons rougher and the rainfalls heavier. In the future, not only will rivers flood but also sea levels will rise, causing severe loss of land in Asia. Given the population density in the region, millions of people will be forced to relocate (Mirza, 2010).

Thailand is also not immune to floods. Due to the geographical characteristics of the region, floods occur regularly. In 2011, the country suffered from the largest floods ever recorded. The volume of this major flood was 15 billion m^3. The damages the floods left behind were tremendous, including 813 casualties. Also, the economic damage was extensive. All together 804 companies were affected by the inundation. According to the estimate from the World Bank (2011) "660 billion baht in damage to

property such as real estate, and 700 billion baht in opportunity loses, for a total loss of 1.36 trillion baht due to this flood" (Komori et al, 2012:41). The floods in 2011 also temporarily slowed down the economic growth from 3.7% to 0.1%. According to Haraguchi (2015) the damages of the 2011 floods spread outside the state borders. The global supply chain in the automotive and electronics industries was also impacted due the locations of facilities.

Because the impacts of climate change differ from region to region, the adaptation and mitigation strategies must also differ. If a region is suffering from droughts, then they should be concentrating on preventing or dealing with that particular issue, but that is not enough. Climate change effects can be global, regional or local. Meaning that some of the problems caused by climate change appear only at the local level, some in regional level and some of them can affect everyone on earth. Therefore, it is important that governments cooperate regionally and also globally instead of only trying to slow down climate change effects at the national level. In order to make effective policies it is important to recognize what kind of challenges climate change is posing (Dincer et al., 2013).

Climate change is well researched nowadays, and there are a number of studies conducted trying to predict what will be the impacts of global warming. In its 2007 Fourth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) addresses “serious risks associated with climate change that could undermine the living conditions of people all over the world” (Scheffran & Battaglini, 2010, p. 1). According to the article, these risks include those to agriculture, forestry, water resources as well

as human health, energy systems, human settlements and the economy. As Scheffran and Battaglini referenced Gilman et al. climate change “poses unique challenges to U.S. national security and interests” (2007, p. 15). This research suggests that climate change could cause large-scale migration, increased border tensions, spread of diseases, as well as conflicts over food and water. This is quite significant, if the United States have recognised that climate change could be threat to their national security through intermediate impacts.

Not all countries are equal when it comes to adaptation or mitigation of climate change impacts. An example from South Asia, "At present, Bangladesh is too poor to be able to adapt to such a rise in sea level. The costs of protection would be substantial” (Agrawala et al., 2003:19). Huq et al. (1995) estimate that 4,800 km of existing coastal defences would need upgrading and an additional 4,000 km of new defences would be needed. These protection measures would cost up to US$ 1 billion (Huq et al., 1995). The most vulnerable part of Bangladesh, the Khulna region, lies along the country’s south-western coast. With the exception of the hilly Chittagong area and the north-western part of the country, most of the country is less than 10 m above sea level. In the long run, sea-level rise could displace tens of millions of people. To resettle 13 million people, Debove (2003) estimates it would cost US$ 13 billion. However, since this is a gradual, long-term problem, it is less urgent than other risks that may become acute over the coming decades rather than toward the end of the century (Ota et al., 2003). People in Bangladesh are really paying the price of climate change even if they are not the ones who are causing it.

Hollo et al. (2013) discuss mitigation of greenhouse gases as well as energy policies which are becoming in major focus in the field of environmental protection. Also, the negative impacts of climate change are calling for various adaptation measures concerning water resource management, health policies as well as agriculture. Hollo et al. (2013) also claim that climate change is a global challenge and hence requires not only local or regional co-operation, but strong international co-operation in order to face the negative impacts. The Paris Agreement could be one of these collective solutions Hollo et al. (2013) are calling for, depending on how it will be enforced and the scale of the impacts of the agreement in the long run. One interesting factor which will impact climate change legislation, according to Hollo et al. (2013) is that climate change can lead to spill-over effects due to its cross-cutting nature. In other words, there may be some overlap with future climate change legislation and some other global matters such as biodiversity conservation and international trade, just to mention a few. Hollo et al. (2013) are also calling for flexible instruments to work with the negative impacts of climate change, Intended Nationally Determined Contributions (INDCs) included in the Paris Agreement could be seen as one of those flexible tools.

Whereas Hollo et Al. (2013) talk about the importance of mitigation, Pelling (2011) suggests that merely learning to live with climate change impacts, in other words adaptation, will be the priority for human development. Pelling (2011) claims that climate change adaptation is a defensive task and furthermore, climate change risks can be seen as drivers of social systems. Interestingly, Pelling (2011) also argues that deep political, cultural and social changes will be needed in order to reduce human vulnerability to the risks associated with climate change. Furthermore, according to Pelling (2011), climate change will bring humanity to the point where choices are made.

Pelling (2011) claims that societies will either continue via resistance, meaning that no changes will be made in the political or cultural structures, another choice would be transition which would involve minimal social changes or new rights claims, and finally transformation, where the situation would bring significant new rights claims and changes in the political regimes. Pelling (2011) offers a very interesting analysis about the social dimensions of climate change adaptation which includes urban governance and national policies.

Another study which considers policies as a part of climate change adaptation is one conducted by Salamanca and Nguyen (2016). They talk about the climate change adaptation readiness of ASEAN countries. According to this research, Southeast Asia is highly vulnerable to the impacts of climate change due to the fact that most of these countries rely heavily on agriculture and furthermore, the level of agriculture in Gross National Product (GNP) is approximately 10%. Salamanca and Nguyen (2016) further state that poverty, low level of education and the carelessness of policy makers will also amplify the impacts of climate change in this region. The researchers make some recommendations based on the data they collected. In order to increase climate change adaptation readiness Salamanca and Nguyen (2016) stress the importance of developing a regional agenda for farmers' adaptation as well as including farmers in the planning and decision-making process. The study also recommends "supporting sub-national networks and processes to advance adaptation, build public support for adaptation, facilitate sharing insights and experiences as well as strengthen funding for adaptation planning and action" (Salamanca and Nguyen, 2016, p. 1).

1.2 Human Security Literature

According to the Commission on Human Security (CHS) "Whereas state security concentrates on threats directed against the state, mainly in the form of military attacks, human security draws attention to a wide scope of threats faced by individuals and communities" (United Nations, 2009, p. 12).

The Commission on Human Security also lists two main reasons why the concept of Human Security was necessary to introduce:

> First, human security is needed in response to the complexity and the interrelatedness of both old and new security threats – from chronic and persistent poverty to ethnic violence, human trafficking, climate change, health pandemics, international terrorism, and sudden economic and financial downturns. Such threats tend to acquire transnational dimensions and move beyond traditional notions of security that focus on external military aggressions alone. Second, human security is required as a comprehensive approach that utilizes the wide range of new opportunities to tackle such threats in an integrated manner. Human security threats cannot be tackled through conventional mechanisms alone. Instead, they require a new consensus that acknowledges. (United Nations, 2009, p. 5)

In his article *Human Rights, Human Security and Peace* (2015), Professor Dr. Likhit Dhiravegin, Fellow of the Royal Society, discusses human security. This concept has been outlined by the United Nations Development Program (UNDP). Human security is divided into seven following sub categories:

1) Food security

2) Health security

3) Personal security

4) Political security

5) Economic security

6) Environmental security

7) Community security

When it comes to the impacts of climate change, one might think that only environmental security would be at stake, but actually all of these seven sub categories mentioned above are interrelated and thus all of them might be threatened by climate change.

Table 3 demonstrates the possible types of threats to human security. For instance, the United Nations Development Program (1994) lists environmental degradation, resource depletion, natural disasters as well as pollution as examples of threats to environmental security. Whereas Table 3 lists the examples of main threats to human security, Table 4 illustrates the examples of strategies and capacities needed for addressing human insecurities.

Type of Security	Examples of Main Threats
Economic security	Persistent poverty, unemployment
Food security	Hunger, famine
Health security	Deadly infectious diseases, unsafe food, malnutrition, lack of access to basic health care
Environmental security	Environmental degradation, resource depletion, natural disasters, pollution
Personal security	Physical violence, crime, terrorism, domestic violence, child labor
Community security	Inter-ethnic, religious and other identity based tensions
Political security	Political repression, human rights abuses

Table 3. Possible Types of Human Security Threats (UNDP Human Development Report, 1994)

Human Security Components	Strategies to Enhance Protection and Empowerment	Capacities Needed
Economic Security	Assured access to basic income Public and private sector employment, wage employment, self-employment When necessary, government financed social safety nets Diversify agriculture and economy	Economic capital Human capital Public finance Financial reserves Diversified agriculture and economy
Food Security	Entitlement to food, by growing it themselves, having the ability to purchase it or through a public food distribution system	Diversified agriculture and economy Local and national distribution systems

Health Security	Access to basic health care and health services Risk-sharing arrangements that pool membership funds and promote community-based insurance schemes Interconnected surveillance systems to identify disease outbreaks at all levels	Universal basic education and knowledge on health related matters Indigenous/traditional health practices Access to information and community-based knowledge creation
Environmental Security	Sustainable practices that take into account natural resource and environmental degradation (deforestation, desertification) Early warning and response mechanisms for natural hazards and/or man-made disasters at all levels	Natural resource capital Natural barriers to storm action (e.g. coral reefs) Natural environmental recovery processes (e.g. forests recovering from fires) Biodiversity Indigenous/traditional practices that respect the environment
Personal Security	Rule of law Explicit and enforced protection of human rights and civil liberties	Coping mechanisms Adaptive strategies Memory of past disasters
Community Security	Explicit and enforced protection of ethnic groups and community identity Protection from oppressive traditional practices, harsh treatment towards women, or	Social capital Coping mechanisms Adaptive strategies Memory of past disasters Local non-governmental organizations or traditional organisms

	discrimination again ethnic/indigenous/refugee groups	
Political **Security**	Protection of human rights Protection from military dictatorships and abuse Protection from political or state repression, torture, ill treatment, unlawful detention and imprisonment	Good governance Ethical standards Local leadership Accountability mechanisms

Table 4. Examples of Strategies and Capacities Needed for Addressing Human Insecurities (United Nations, 2009, p. 15)

Gemenne et al. (2014) claim that climate change, conflicts, famines, epidemics and migration are all covered by research as independent disciplines. However, if these incidences lead to human suffering then they, including climate change, should be researched through the lens of human security. The article also suggests that it might be challenging to prove the correlation between climate change and human security. Furthermore, even if there are already discussions about how weather-related events affect migration dynamics, "highlighting of the issues of human insecurity has not been matched by a sufficient engagement of the social sciences that have plausible and testable theories of how climate change can affect the security of populations" (Gemenne et al., 2014, p. 1).

As stated by Voicu, "Human security is new only by its terminology, but is eternal by its very substance. It belongs at the roots of any civilized society" (2009, p.

1). In May 1999, the Human Security Network held its ministerial meeting in Lysrsen, Norway and they came up with the term human security. They claimed that the foundation for building human security is enabled by committing to human rights and humanitarian law.

McMichael et al. (2006) claim that much of the research about climate change in the framework of human health has concentrated on extreme weather events, thermal stress as well as infectious diseases. Therefore, a broader approach, including social, economic and demographic factors, would be welcomed. When talking about the impacts of climate change, some authors claim that even violent conflicts might occur from the aftermath of global warming. For example, Raleigh and Urdal (2007) argue that scarce water resources and arable land might lead to conflicts.

Faist and Schade (2013) referenced the report published by the Intergovernmental Panel on Climate Change (IPCC) about climate extremes, backed up by the most recent scientific knowledge. The IPCC report confirms "a high degree of likeliness for many phenomena" (Faist & Schade, 2013, p. 3). These phenomena include droughts, more severe tropical storms, floods and erosion of permafrost, among others. "Such observations and projections raise the question of how people living in the affected areas are going to deal with the climatic repercussions of global warming" (Faist & Schade, 2013, p. 4). Faist and Schade (2013) later argue that climate change could cause a major migration when some parts of the world will become more challenging to live in. According to the IPCC report mentioned earlier, the migration

issue has become an important concern and what they call the “climate push” factor has been born.

In its annual report *ASEAN security outlook 2015* the member countries acknowledge that in addition to traditional security concerns, the regional organization is also aware of the non-traditional security issues. According to the report, non-traditional security concerns include terrorism, transnational crime, sea piracy, but also natural disasters and climate change. To address these issues, ASEAN plans to cooperate not only within the association itself, but also seek external partners in order to ensure peace and stability in the region (ASEAN, 2015).

Another piece of research, conducted in Bangladesh, Akter (2009) suggests that the increased frequency as well as the ever growing intensity of natural disasters in Bangladesh are causing large scale displacements. “Bangladesh is already experiencing recurrent floods, severe cyclones, water logging, salinity intrusions, droughts and river bank erosion which induce mass population displacement” (Akter, 2009, p. 3). Some of the estimations, made based on Akter’s (2009) research imply that approximately 78 million people could end up being displaced before the year 2020. In the case of Bangladesh, climate change causes different types of displacement. Whereas cyclones and floods might cause temporary displacement, enabling people to possibly return to their homes after the incident is over. Sea-level rise on the other hand results in permanent displacement. When sea water swallows the homes and lands of people forcing them to move to higher lands, they may lose everything they own, not only homes but also livelihoods. Another factor which will make the impacts of climate

change in Bangladesh more severe is the rapid population growth. As Akter (2009) later references Falguni (2009), the population in Bangladesh will almost double from 35 million to 58 million before the year 2050. Population density in Bangladesh is already one of the highest in the world and together with the loss of land due to sea-level rise, climate change impacts will be difficult to combat in the country.

In his speech *Globalization: a blessing or a curse* (2011) Dr. Likhit Dhiravegin talks about the five world trends which are prominent in the era of globalization. First of all the promotion of democracy as well as respect for human rights and on the other hand, free trade and protection of intellectual property have become dominating world trends of western powers, led by United States. Most relevant to this study however is the fifth world trend: protection of the environment. The most significant and recent effort to protect the environment is of course the signing of the Paris Agreement. Climate change and environmental protection are interrelated. All the various impacts of climate change; sea-level rise, droughts, floods and so forth, have an enormous impact on the environment. These kinds of serious changes to the environment will also impact the lives and livelihoods of people. The trend of protecting the environment is now also seen at the highest level of states' representatives. Various country leaders as well as the current Pope, as was mentioned earlier, are now talking about the importance of environmental protection as well as the reduction of carbon emissions to combat the impacts of climate change.

This research aims to analyse the impacts of climate change within the framework of human security, therefore it is important to also review some literature

concerning human security. Gasper (2008) discusses the concept of human security and claims that human beings are seen as possible victims and further "Human security is discussed at different scales and with reference to threats of varying scope" (Gasper, 2008, p. 2). Gasper explains in more detail that human security can be seen either as security of the human species or in the narrower view, as the security of human individuals. As Gasper further quotes O'Brian "The Global Environmental Change and Human Security project (GECHS) treats human security as the capacity of individuals and communities to respond to threats to social, human and environmental rights".

"While security studies and international relations scholars remain sceptical about the idea of human security, arguing that it is too woolly and broad a concept to be useful either analytically or practically, decision-makers increasingly recognize the importance of human security as a policy framework" (Bajpai, 2000, p. 2). In his article Bajpai (2002) further states that policy-makers might favour human security because of a lack of auditing tools. In other words, human security is vaguer and not enforced through international law, unlike for example human rights. Moreover, human development is audited yearly through the *Human Development Report* of the United Nations Development Program but human security does not yet have such procedures.

When it comes to explaining the very existence of a human security concept, the following quote from the Commission of Human Security does a very good job:

> The international community urgently needs a new paradigm of security. Why? Because the security debate has changed dramatically since the inception of state security advocated in the 17th century. According to that traditional idea, the state would monopolize the rights and means to protect its citizens. State power and state security would be established

> and expanded to sustain order and peace. But in the 21st century, both the challenges to security and its protectors have become more complex. The state remains the fundamental purveyor of security. Yet it often fails to fulfil its security obligations—and at times has even become a source of threat to its own people. That is why attention must now shift from the security of the state to the security of the people— to human security. (Commission on Human Security, 2003, p. 2)

As the publication later states, human security enhances human rights and contributes to human development while complementing state security (Commission on Human Security, 2003). Furthermore "Security between states remains a necessary condition for the security of people, but national security is not sufficient to guarantee peoples' security". (Commission on Human Security, 2003, p. 3) In order to protect their citizens, the state's responsibilities consist of various factors. "But individuals also require protection from the arbitrary power of the state, through the rule of law and emphasis on civil and political rights as well as socio-economic rights" (Commission on Human Security, 2003, p. 3). All in all, a decent level of human security requires regional or continental co-operation. Moreover, according to former UN Secretary General Kofi Annan "Freedom from want, freedom from fear and the freedom of future generations to inherit a healthy natural environment—these are the interrelated building blocks of human, and therefore national, security" (Commission on Human Security, 2003, p. 4). "Human security also includes protection of citizens from environmental pollution, transnational terrorism, massive population movements, such infectious diseases as HIV/AIDS and long-term conditions of oppression and deprivation" (Commission on Human Security, 2003, p. 4).

A survey conducted by the World Economic Forum in fall 2015 indicates the global fears, threats and risks for the next decade. This research had a sample of over

700 experts and stakeholders representing a vast variety of fields such as banking, government and academia. Interestingly, those regions which are most vulnerable to climate change impacts, such as Asia, Latin America and Africa, see climate change as the greatest threat whereas North America, Europe and Russia see other factors such as ISIS or economic instability as the greatest threats. Few countries see super powers such as Russia or China as their biggest threats. Figure 4 shows that almost half of the world in fact sees climate change as bigger threat than for example radical terrorism or economic instability.

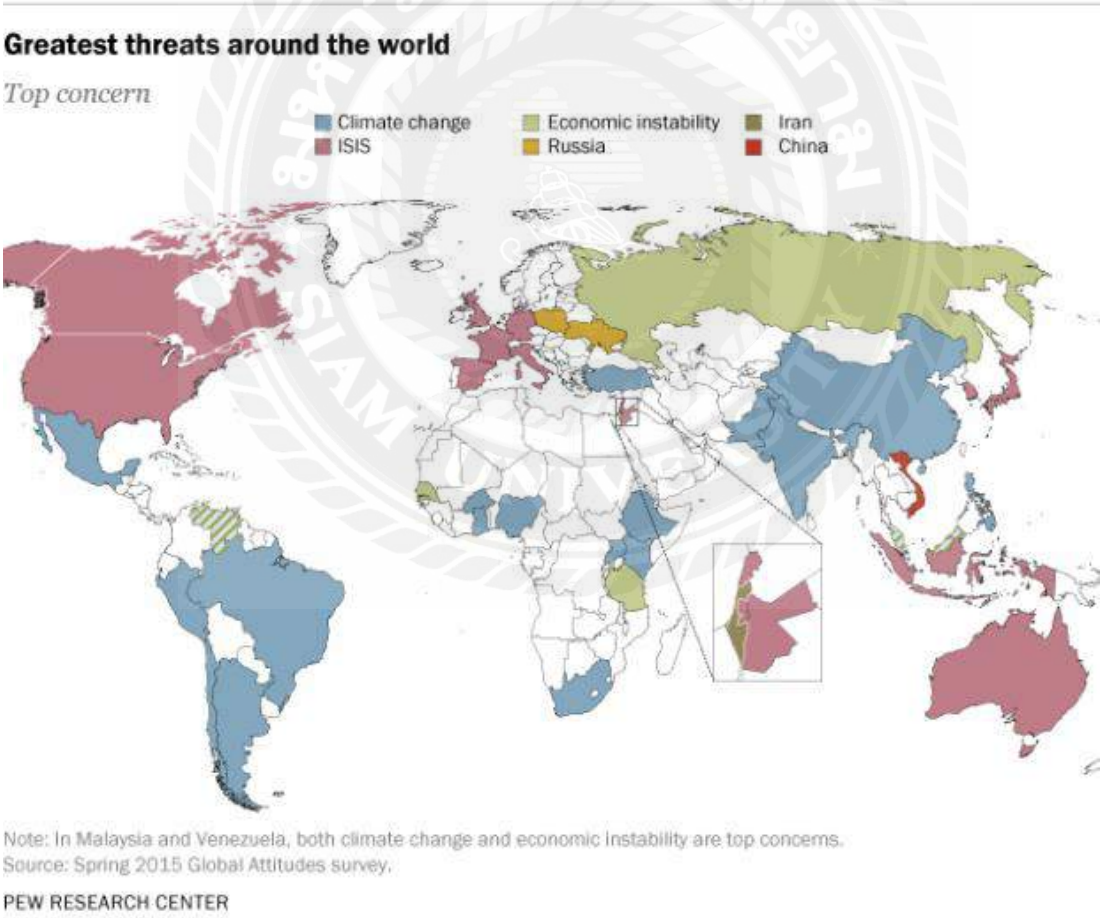

Figure 4. Greatest Threats Around the World (PEW Research Center)

The research data of the PEW Research Center (Figure 5) indicates that the top global risks have shifted from the economy to other issues since the year 2007. 2016 was the first year when the top global risk – impact was "Failure of climate change mitigation and adaptation".

Top global risks have shifted from the economy to other issues since 2007

Risk category: Economic Environmental Geopolitical Societal Technological

Year	Top global risk - LIKELIHOOD	Top global risk - IMPACT
2016	Large-scale involuntary migration	Failure of climate-change mitigation and adaptation
2015	Interstate conflict with regional consequences	Water crises
2014	Income disparity	Fiscal crises
2013	Severe income disparity	Major systemic financial failure
2012	Severe income disparity	Major systemic financial failure
2011	Storms and cyclones	Fiscal crises
2010	Asset price collapse	Asset price collapse
2009	Asset price collapse	Asset price collapse
2008	Asset price collapse	Asset price collapse
2007	Breakdown of critical information infrastructure	Asset price collapse

Note: The Global Risks Perception Survey is an elite survey of 742 stakeholders in business, government, academia and non-government organizations, about half of which are located in North America and Europe, conducted from September to October, 2015. The 2016 report is based on the methodology used in previous years and results are largely comparable. Global risks may not be strictly comparable across years, as definitions and the set of global risks have evolved with new issues emerging on the 10-year horizon.
Source: The Global Risks Report 2016, 11th Edition, World Economic Forum.

PEW RESEARCH CENTER

Figure 5. Top Global Risks 2007 – 2016

Whereas the previous paragraph talked about the global risks and global attitudes, a study conducted by European scholar Worm (2006) predicts a very dark future for salt water fish. Worm (2006) claims that within the next few decades, the oceans will suffer a massive disappearance of marine species. The research states that the causes of these extinctions are not only over fishing, habitat loss and pollution, but

also climate change. Climate change will affect ocean temperatures and not all of the species will be able to adapt to these kinds of changes. Worm (2006) underlines that this kind of scenario does not only mean that people cannot enjoy seafood anymore, but ocean species also have a job of filtering toxins from the water. According to the research, when ocean species are lacking from the environment, it also affects the people living next to the coastline. The findings of this research can be interpreted that human insecurity could rise. The study analysed data from various experiments (Worm, 2006).

Barnet et al. (2010) talk about how throughout the history of mankind, the environment has posed a threat to human life through floods, frost and several other types of uncontrollable events. Even with today's modern technology people are still vulnerable to environmental changes and Barnet et al. (2010) claim that environmental change is posing risks to human security. Among various other factors, climate change and sea-level rise play a significant role in this scenario. Barnet et al. also argue that "global environmental change poses new and in some cases unprecedented threats to human security" (2010, p. 4). Good examples of unexpected threats could be the part climate change is playing in spreading viruses such as the Zika virus, or the latest news from Siberia where due the melting of permafrost, anthrax was reintroduced to the area and has already caused human and animal fatalities.

Research conducted by Patz et al. (2005) claims that climate change is not solely an environmental problem, but it has crucial impacts on human health too. The study reveals that there is a correlation between some human diseases and climate change.

Patz et al. (2005) argue that respiratory illnesses due to heat waves, cardiovascular mortality, as well as infectious diseases can all be linked to climate change, in certain circumstances. Another way climate change is affecting human health, according to the study is when extreme weather patterns such as floods or droughts cause a crop fail and this can lead to malnutrition due to a lack of sufficient food. Patz et al. (2005) reference The World Health Organization's (WHO) estimate, which says that warming due to climate change over the past 30 years has already been fatal to over 150,000 people every year.

In their report *High and Dry: Climate Change, Water, and the Economy*, The World Bank Group (2010) estimate that one of the most serious challenges in the year 2050 will be feeding the earth's population, 9 billion people, in a sustainable way. The report also states that "the impacts of climate change will be channelled primarily through the water cycle, with consequences that could be large and uneven across the globe" (WB, 2010, p. vi). The climate challenges linked with water will also affect the world food system. The World Bank Group also suggests that water scarcity due to climate change is going to be one of the most prominent threats and further, it will only get worse in the regions which are already struggling with the problem and it will also affect new regions, which have had enough water in the past. "As an example, in rural Vietnam, most families engage in rain-fed crop production- mainly irrigated rice production. Income is therefore heavily dependent on favourable rainfall conditions, and rainfall shocks often lead to significant income reductions for families" (WB, 2010, p. 18).

Doig and Ware (2016) claim that more than 1 billion people around the globe are living in coastal cities which are very vulnerable to climate change impacts. Many coastal cities are already suffering from recurrent floods, as well as extreme weather and aggressive storms. The report suggests that these climate change impacts will get even stronger and more severe due to the increasing population of the coastal cities. The study predicts that within several decades, the coastal population which will be affected by climate change impacts could rise by more than 50 percent. Table 5 demonstrates that by 2060 Thailand's coastal population will be the 9th highest in the world. The coastal population in Thailand, which were exposed to climate change impacts in the year 2000 was 16.4 million and is anticipated to rise up to 36.8 million by the year 2060. Table 6 on the other hand, shows the statistics at the city level. Whereas Thailand as a country ranked 9th highest in the world for numbers of people living in coastal locations, Bangkok as a city ranks 7th, meaning that in 2010 907,000 people were exposed to coastal flooding, the anticipated number exposed in 2070 will be more than 5 million.

Whereas Tables 5 and 6 concentrate on the affected population, Table 7 focuses on the exposed assets. Thailand ranks as the 10th highest country by assets exposed to the effects of climate change. Meaning that in 2010 Thailand's exposed assets were US$ 38.72 billion, the Doig and Ware (2016) report anticipates that by 2070 Thailand's assets exposed to the effects of climate change will be as high as US$ 1,117.54 billion. The report also underlines that the most vulnerable people to the impacts of climate change in the cities will be poor and already otherwise marginalised. At the continental level, the study suggests that Asia will be the most vulnerable to the impacts of climate change as it contains 15 of the 20 most vulnerable cities in the world. The report states

that climate change is real and is already affecting the lives of millions of people. Not only threatening the lives but also the livelihoods of a number of people. The report *Act Now or Pay Later: Protecting a billion people in climate-threatened coastal cities* anticipates humanitarian disasters, caused by climate change impacts, especially in the coastal areas (Doig and Ware, 2016).

In his article *Climate Change and Thailand: Impact and Respons*e, Marks (2011) talks about how climate related events such as floods, droughts and sea-level rise as well as health related issues are already severe in Thailand and will get more serious in the future. The article talks about how climate change will cause various challenges such as increasing the number of refugees and migrants. Furthermore, climate change impacts could hinder the tourism industry and according to Marks, and cause class related tensions. The article is also mentions the aspect of food security, "Major climate-induced changes could have severe negative impacts on Thai food production, particularly rice" (Marks, 2011, p. 230). Marks also anticipates that climate change related issues such as water management, refugee settlement as well as energy policies might cause friction between Thailand and its neighbours and therefore have an effect on the political stability in the region. When it comes to sea-level rise, Marks suggests that "saline intrusion from the sea has already contaminated some underground water sources" (2011, p. 233). This will have a severe impact on the soil productivity in the future. The article also discusses that sea-level rise can damage properties.

Country rankings in 2060	Coastal population exposed by 2000 (in millions)	Coastal population exposed by 2030 (in millions)	Coastal population exposed by 2060 (in millions)
China	144.0	204.1	244.8
India	63.9	120.8	216.4
Bangladesh	63.1	85.1	109.5
Indonesia	39.3	61.9	93.7
Vietnam	43.1	58.7	80.4
Egypt	25.5	45.0	63.5
Nigeria	7.4	19.8	57.7
US	23.4	34.0	43.9
Thailand	16.4	24.7	36.8
Philippines	13.0	23.8	34.9

Table 5. Countries Anticipated to Have the Highest Numbers of People Living in Low-Lying Coastal Zones by 2030/2060 (Doig & Ware, 2016)

Cities in order of ranking in 2070	Population exposed 2010	Population exposed 2070
1. India, Kolkata (Calcutta)	1,929,000	14,014,000
2. India, Mumbai (Bombay)	2,787,000	11,418,000
3. Bangladesh, Dhaka	844,000	11,135,000
4. China, Guangzhou	2,718,000	10,333,000
5. Vietnam, Ho Chi Minh City	1,931,000	9,216,000
6. China, Shanghai	2,353,000	5,451,000
7. Thailand, Bangkok	907,000	5,138,000
8. Myanmar, Yangon (Rangoon)	510,000	4,965,000
9.US, Miami	2,003	4,795,000
10. Vietnam, Haiphong	794,000	4,711,000

Table 6. Top 10 Cities Ranked in Terms of Population Exposed to Coastal Flooding Showing Numbers for 2010 and Those Anticipated for 2070s (Including the Effects of Both Climate Change and Socio-Economic Change) (Doig & Ware, 2016)

Cities order in ranking 2070	Assets exposed 2010 ($ billions)	Assets exposed 2070 ($ billions)
1. US, Miami	416.29	3,513.04
2. China, Guangzhou	84.17	3,357.72
US, New York City/ Newark	320.20	2,147.35
4. India, Kolkata (Calcutta)	31.99	1,961.44
5. China, Shanghai	72.86	1,771.17
6. India, Mumbai	46.20	1,598.05
7. China, Tianjin	29.62	1,231.48
8. Japan, Tokyo	174.29	1,207.07
9.China, Hong Kong	35.94	1,163.89
10. Thailand, Bangkok	38.72	1,117.54

Table 7. Top 10 Cities Ranked in Terms of Assets Exposed to Coastal Flooding in the 2070s (Including the Effects of Both Climate Change and Socio-Economic Change) and Showing Present-Day Exposure (Doig & Ware, 2016)

Lobell and Burke (2010) explore how climate change can impact food security. Furthermore, the authors claim that even if economic growth, which is reached through industries which cause carbon emissions, has made living standards better for many people around the world, not everyone has benefited from this growth. Still, today a vast majority of low income families live in the countryside and continue to rely on

agriculture. “Given that agriculture everywhere remains dependent on weather, changes in climate have the potential to disproportionally affect these poor populations” (Lobell & Burke, 2010, p. 3). The book also uses the definition of food security provided by Food and Agriculture Organization of the United Nations (FAO) (2001):

> Food security is a situation that exists when all people at all times have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. (FAO, 2001, p. 1)

Figure 6 demonstrates the regional trends in undernourishment or, in other words, food insecurity. The statistics suggest that South Asia as a region is the most insecure when it comes to the number of undernourished people. On the other hand, the Sub Saharan Africa region leads when measuring the percentage of the population who are undernourished, meaning that in that region, more than one third of the population does not get sufficient nourishment.

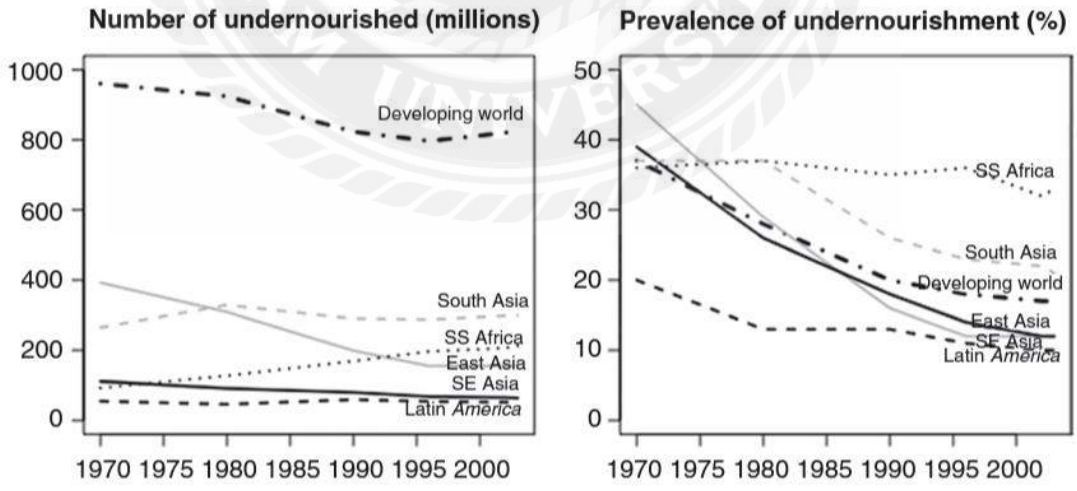

Figure 6. Regional Trends in Undernourishment, 1970–2004. Left Panel Indicates the Number of Undernourished in Millions. Right Panel Shows the Percentage of Undernourished in Population (FAO, 2009)

In their publication *Climate Change and its Effects on Water Resources Issues of National and Global Security* Baba et al. (2011) claim that food production, sanitation and access to drinkable water are the key elements for securing human life.

> Global warming, climate change and sea-level rise are expected to intensify the resource sustainability issue in many water-stressed regions of the world by reducing the annual supply of renewable fresh water and promoting the intrusion of saline water into aquifers along sea coasts where 50% of the global population reside. (Baba et al., 2011, p. v)

Therefore, Baba et al. (2011) call for *proactive resource management decisions*, meaning that "reliable predictions can be made to assess the impact of the changing global conditions" (Baba et al, 2011: v). However, this is not feasible before reliable predictions of the changing global climate are made. Furthermore, the publication continues "…global climate models predict that many regions would experience drier summers, higher annual rates of evapotranspiration and a significant increase in the frequency of extreme events such as droughts and floods" (Baba et al., 2011, p. v). The researchers are especially concerned about the coastal areas. These predictions of sea-level rise affect Thailand which has a long coastline and large population living along the coastline.

According to Lewis "Climate security is the study of the impact of climate and climate change on the security of affected communities." (2014, p. 11). Lewis talks about how the definition of security in this case should be expanded. In other words, a softer definition of security should be included and not considering that conflict is the only threat to security. As Lewis (2011) later references Soroos "the assurance people

have that they will continue to enjoy those things that are most important to their survival and well-being" (1997, p. 1). The article *Climate science in climate security scenarios* (Lewis, 2014) explains how the concept of climate security combines the comprehension of global weather systems and the dynamics of the socio-economic system in the particular region. Lewis also claims that "Nearly all the climate security scenarios identify the key threats of climate change as related to food security, water availability and weather related disasters" (2014, p. 18).

Gleick (1989) considers whether climate change could lead to conflict or at least resource constrains which can cause tensions when it comes to economic issues. Gleick also calls for re-examination as well as expansion of the so called traditional definition of *international security*. Gleick (1989) later references Ullman (1983) and claims that changes in the climate which limit access to resources or lead to deterioration in quality of the environment fit into both of the following categories:

> Threats to security can be defined to include actions that (1) threaten to drastically and quickly degrade the quality of life for the inhabitants of a state, or (2) threaten to significantly narrow the range of policy choices available to governments or non-governmental entities. (Ullman, 1983, p. 1)

Gleick claims that climate change will have "widespread societal impacts" (1989, p. 322). Later in the article Gleick lists the impacts as follows: "changes in the quality of, quantity of, or ease of access to freshwater and mineral and energy resources, and changes in the productivity of agriculture" (1989, p. 1). Furthermore, the article predicts that these impacts of climate change will alter the well-being of people as well

as quality of life, and also limit the options of policies which respective governments will have chance to implement.

Climate change is a serious issue in Asia Pacific claim Elliot & Caballero (2013) in their book *Human Security and Climate Change in Southeast Asia Managing risk and resilience*. According to the Intergovernmental Panel on Climate Change (IPCC), likely climate change impacts in this region include:

> A decline in crop yield, an increase in climate- induced disease, an increased risk of hunger and water scarcity, an increase in the number and severity of glacier melt- related floods, significant loss of coastal ecosystems, a high risk of flooding for many millions of people in coastal communities, and an increased risk of extinction for many species of fauna and flora. (Elliott & Caballero, 2013, p. 1)

Whereas the Intergovernmental Panel on Climate Change (IPCC) list the possible impacts of climate change, the Asian Development Bank states that the Asia Pacific region is "likely to suffer more from climate change than the rest of the world," and that "the potential economic cost of inaction is huge" (ADB, 2009, p. xxvi). Furthermore, "Climate change is presented as a non- traditional threat multiplier, overstretching societies' adaptive capacities and creating or exacerbating political instability and violence, possibly to the extent of inter- state conflict" (Elliott & Caballero, 2013, p. 1).

The following Figures 7 and 8 illustrate the rising trends of the number of both floods and storms in Southeast Asia from 1960 to 2008. For example, the Philippines, which seems to have the highest number of floods and storms throughout the time

period, has experienced an increased number of weather anomalies during the past fifty years. On the other hand, according to Figure 8, Vietnam seems to have had the most serious economic losses caused by the storms and floods due their inability to adapt.

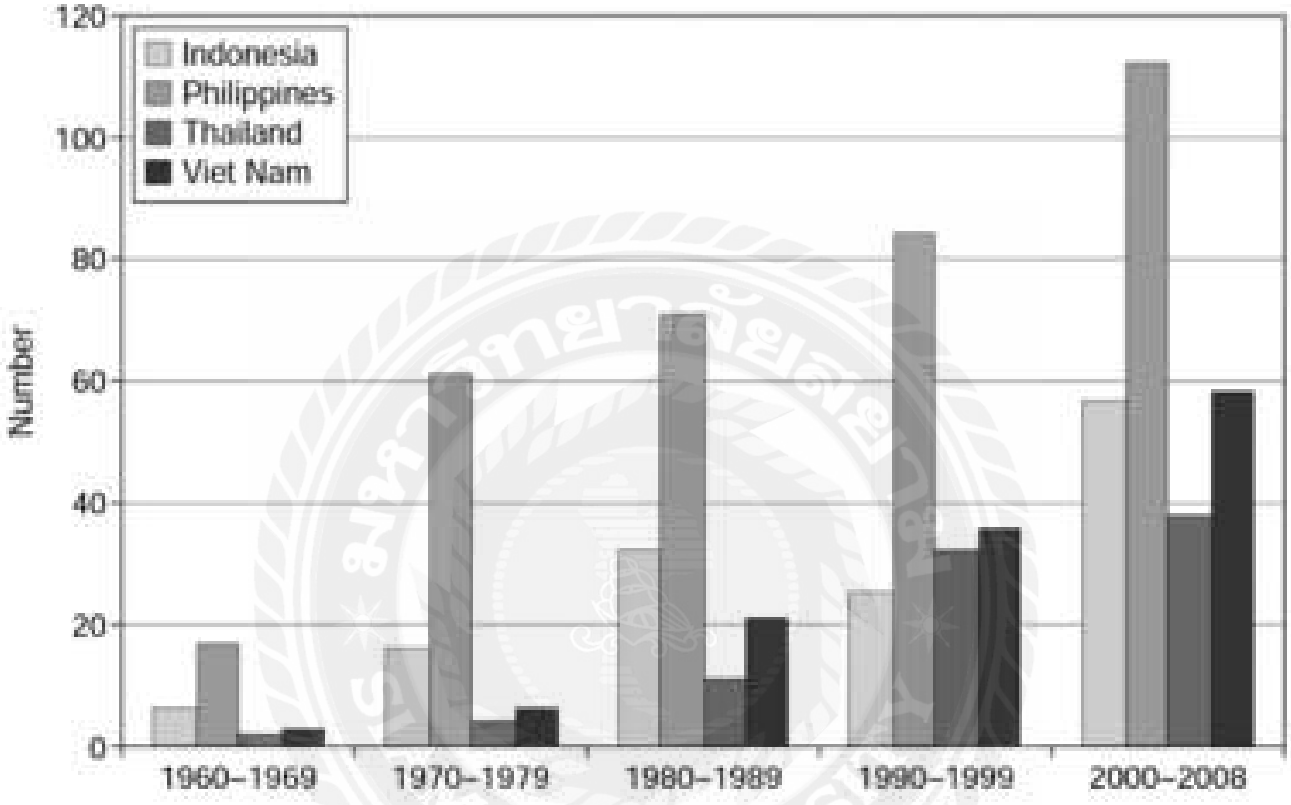

Figure 7. Number of Floods and Storms from 1960 to 2008 in Southeast Asian Countries (Centre for Research on the Epidemiology of Disasters, 2008; Central Committee for Flood and Storm Control, 2005)

In their article *Institutional traps and vulnerability to changes in climate and flood regimes in Thailand* Lebel et al. (2011) claim that floods in Thailand have already caused changes in the lifestyle of people. The article also suggests that the consequences of floods differ and where rising waters might be a cause of worry and misery to a shop keeper, to a fish-farmer, it can mean the loss of food. “The institutional response has been incomplete leaving significant, reducible, vulnerabilities to current

and future climate risks unaddressed" (Lebel et al., 2011, p. 56). The article suggests certain measures to tackle with the institutional traps. These strategies include "expand public participation, build adaptive capacities at multiple levels, integrate with development, prioritize the vulnerable and link knowledge and practice" (Lebel et al., 2011, p. 56). Furthermore, the authors claim that sustainable development also requires reducing the risks of disasters and therefore adaptation to climate change impacts is not sufficient but Thailand also needs mitigation.

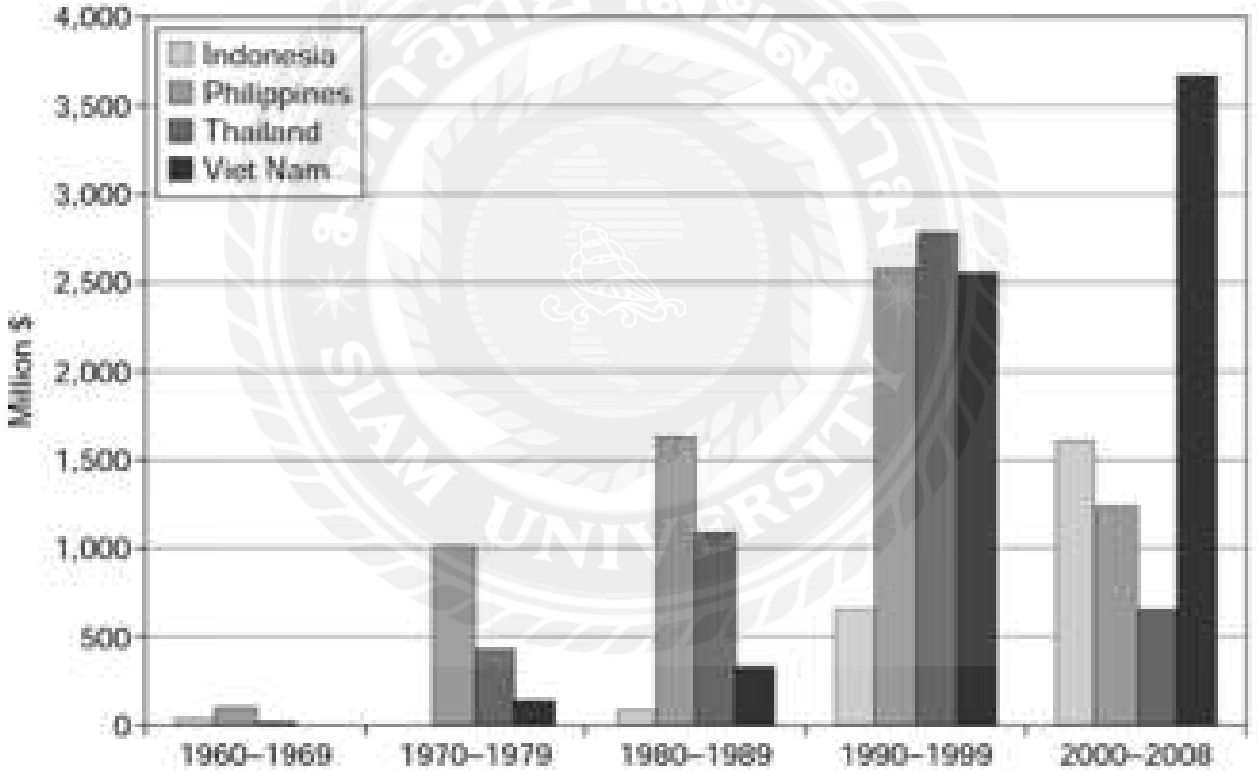

Figure 8. Extent of Damages Due to Floods and Storms from 1960 to 2008 in Southeast Asian Countries (Centre for Research on the Epidemiology of Disasters, 2008; Central Committee for Flood and Storm Control, 2005)

In his article *The Political Ecology of Climate Injustice in Bangkok* Marks talks about the special characteristics of the capital of Thailand:

> Bangkok is exceptionally vulnerable to climate change. The urban population is exposed to coastal flooding as a result of climate change. On average, the city is only one metre above sea level, sinking annually due to anthropogenic land subsidence. Additionally, Bangkok is located next to the Gulf of Thailand, which has been rising a quarter of a centimetre annually. Furthermore, Bangkok continues to experience increasing drought and floods; as seen in 2011, Bangkok experienced its worst floods in decades. (2016, p. 5)

Barnett and Adger (2007) state that climate change is increasingly being recognized as a security problem, and further "climate change increasingly undermines human security in the present day, and will increasingly do so in the future, by reducing access to, and the quality of, natural resources that are important to sustain livelihoods" (Barnett and Adger, 2007, p. 639). The article also claims that climate change will make it more challenging for states to provide services as well as opportunities which would help people to sustain their livelihoods. Barnett and Adger (2007) even claim that climate change could lead to violent conflict. In terms of human security, the article suggests that climate change jeopardized human security by affecting people's well-being in a negative way.

Behnassi et al. (2013) underline how a well-functioning food system is one of the most important pillars of a stable economy. Behnassi et al. also claim that "addressing the challenge of global food security in our era is strongly linked with other global issues, most notably climate change" (2013, p. 4). The authors further list other drivers which are challenging food security as follows: global population growth, social drivers such as urbanization and economic drivers including trade and food markets. Behnassi et al. suggest that global food production should be increased by 70% within the next 35 years in order to feed the growing population. This will be challenging

because climate change impacts such as droughts and floods will make farming conditions more difficult. Therefore, according to Behnassi et al. (2013) climate change poses a serious threat to food security, not only locally and regionally but even globally.

In their article *Loss and damage from climate change: local-level evidence from nine vulnerable countries* Warner and van der Geest (2013) report the findings of an evidence-based study, conducted in nine countries. Table 8, below, draws together the findings of the multi-country study. Research found that weather anomalies such as droughts and floods were the climate stressors various regions were suffering from and furthermore, the societal impacts varied from livelihood and housing to rice production and drinking water.

Country	*District/region*	*Climate-related stressor*	*Societal impact focus**	*Sample size*
Bangladesh	Sathkira	Salinity intrusion	Rice + drinking water	360
Bhutan	Punakha	Changing monsoon	Rice production	273
Burkina Faso	Sahel	Drought	Livestock + crops	465
Ethiopia	Gambella	Flooding	Habitability + livelihood	431
Gambia	North Bank	Drought	Millet production	373
Kenya	Budalangi	Flooding	Crops, livestock + fish	400
Micronesia	Kosrae	Coastal erosion	Housing, livelihood	363
Mozambique	South and central	Drought and flood	Staple crops	304
Nepal	Udayapur	Flooding	Agricultural livelihood	300

Note: *Each case study focused on one or more particular impact sectors, but also registered impacts in other sectors.

Table 8. Overview of the Case Studies: Research Area, Climate Stressors, Societal Impact and Sample Size (Warner and van der Geest, 2013)

2.3 Conceptual Framework

This research suggests that there is a negative correlation between climate change and human security. This means that when the impacts of climate change increase, the level of human security decreases and vice versa. For example, when climate change causes sea levels to rise, there will be less and less land space for people and animals, hence the livelihoods of people are at stake and the level of human security decreases. Also, arable land could be decreasing through sea-level rise. In this study, the impacts of climate change is the independent variable, whereas human security is the dependent variable. The level of human security is dependent on the severity of the impacts of climate change. Furthermore, these two variables have negative correlation, meaning that they move in the opposite directions. If one increases, the other decreases and vice versa.

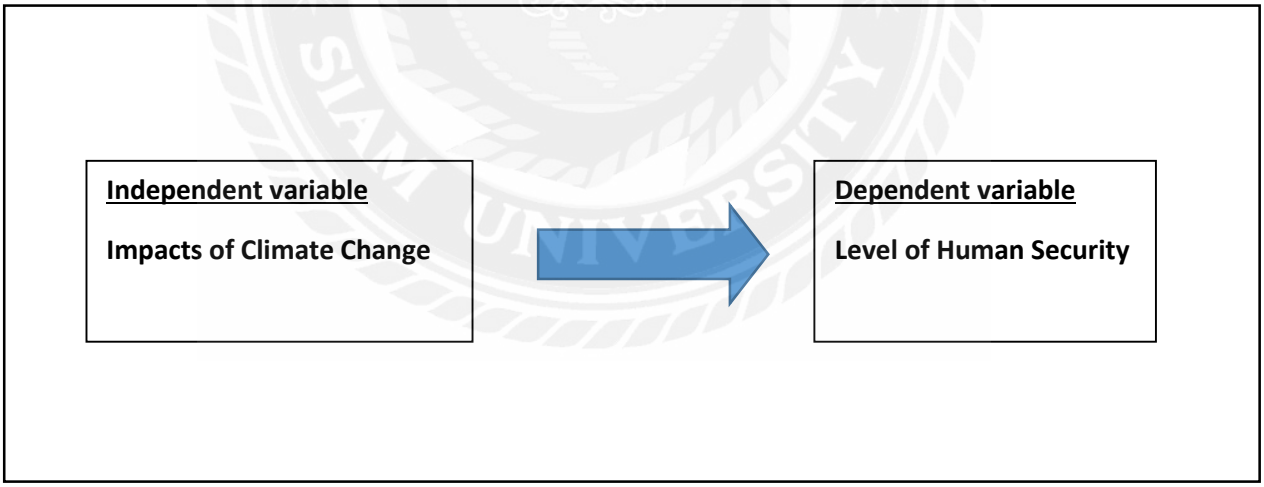

Figure 9. The Conceptual Framework of this Research

CHAPTER 3

Research Methodology

3.1 Methodology

The purpose of this study is to explore the impacts that climate change is having on Thailand and their relationship to human security. The researcher uses qualitative documentary methods, supplemented by interviews. Previous studies, as well as books, reports and journal articles are used as a secondary data. The secondary data also includes statistics which reflect climate change impacts. When it comes to interviews, three professors with expertise in environment as well as climate change were interviewed.

3.2 Data Collection

The volume of information about climate change is immense and this research focuses mostly on academic resources. Peer reviewed academic journal articles, as well as books and publications produced by NGO's are used. In addition, this study uses newspaper articles which provide important information about public opinion relating to climate change. For the primary data, this research conducted three face to face interviews with experts on climate change or environment. The interviewees were selected due to their vast experience of both lecturing and researching the environment and economic aspects of climate change and sustainability issues. Another reason why these three interviewees were selected as a sample is due to their expertise in environmental matters in Southeast Asia and in Thailand in particular.

3.3 Data Processing and Analysis

This research processed the primary data collected first by transcribing the recorded interviews. When all of the information was transcribed, the findings of the personal interviews, and the information found from the secondary data presented in the literature review were compared. The similarities and differences of the primary and secondary data were underlined.

3.4 Data Analysis Methods

Analysis methods for qualitative data differ from those used with quantitative data. Due the non-numerical nature of qualitative data, the methods of analysing the findings of the research include content analysis of the secondary data as well as assessing the primary data, the face-to-face interviews of three key informants. The data analysis methods in this particular study include comparison of primary data, the interviews, and the secondary data, the literature review. The purpose of this study is to find a relationship between climate change impacts and the level of human security. The qualitative data can be analysed at different levels of complexity and various methods of organizing the data can be used. Data coding can be used to help analyse the large amount of data and in this research. To use this method, several sub categories were selected. In order to make sense of the data, and most of all to answer the research questions, the findings were divided into the following sub-categories and the data analysed accordingly: sea-level rise, weather anomalies, agriculture, involuntary migration, and adaptation and mitigation. Also, the recommendations were categorised into three sub-categories in order to enhance the clarity. The sub-categories are as follows: policy and strategy recommendations, management and practices

recommendations, and recommendations for future studies. The unit of analysis of this study was the impacts of climate change, such as sea-level rise, droughts and floods. When conducting qualitative data analysis, the challenge is to stay objective rather than making value judgments (Knight, P. T, 2002).

1.5 List of Questions for Informants:

The questions were developed by identifying the needs of the research questions, as well as using the information found in the literature review. This research aimed to find the most serious challenges climate change is posing to Thailand, and how these challenges can threaten human security. The main components of the questions were developed using existing literature. Globally, climate change impacts vary significantly, however interview questions were designed around the challenges faced regionally in Southeast Asia, particularly in Thailand.

1. Generally, what are the serious challenges that climate change poses to Thailand?
2. Literature suggests that there will be a severe loss of land due to sea-level rise. To what extent will this affect Thailand?
3. Have there been changes in the weather patterns in Thailand during the past ten years? Causing for example more severe droughts or floods than before?
4. To what extent is climate change going to affect the availability of drinkable water in Thailand?
5. To what extent is climate change going to affect the availability of food in Thailand?
6. Do you think that in Thailand, people might need to relocate because of the impacts of climate change (such as floods, droughts or sea-level rise)?
7. If people need to relocate, where will they move?

8. How will Thailand handle the impacts of climate change? By themselves or through cooperation with other countries or for example regional co-operation within ASEAN?
9. How might the climate change impacts such as sea-level rise or droughts or floods affect human security in Thailand?

1. Economic security
2. Personal security
3. Food security
4. Health security
5. Environmental security
6. Community security
7. Political security

CHAPTER 4

Data Analysis and Research Findings

In this chapter, the collected data, both primary and secondary, are analysed. The analysis is performed according to the conceptual framework presented at the end of Chapter Two. The conceptual framework of this research focuses on finding whether climate change impacts, such as sea-level rise, floods and droughts, have an effect on the level of human security. This chapter analyses findings from articles, books and reports, as well as data collected via face-to-face interviews.

4.1 Sea-Level Rise as a Challenge in Thailand

As Thailand has such a long coastline, it is said that sea-level rise will be one of the most prominent challenges which climate change will cause to the country. Dr. Orapan Nabangchang (Personal Interview, 2016) stated "sea-level rise could be a problem and even a one-meter rise would affect Bangkok and also the economy due the losses of all the investment put in infrastructure". Another way sea-level rise can threaten human security, according to Foster et al. (2011), is the loss of arable land, meaning that some areas which earlier were used for agriculture, will be covered by water. Furthermore, rising sea water will salinate the soil and contaminate the fresh water resources if sea water leaks into the fresh water. The report by ASEAN (2016) lists a few reasons why Southeast Asia is vulnerable to sea-level rise. According to the report, two factors which make Southeast Asia vulnerable to climate change impacts are the fact that economic activities as well as a large portion of the population are concentrated on the coastline. Therefore, not only the livelihoods of people might be in jeopardy but also people might need to relocate or at least change their way of living.

As Thannasupsin (2012) states, one of the consequences of sea-level rise is inundation (land being permanently flooded by sea water) and the effect is regional. When it comes to sea-level rise, Marks suggests that "saline intrusion from the sea has already contaminated some underground water sources" (2011, p. 233). This will have a severe impact on soil productivity in the future. Dr. Nabangchang (Personal Interview, 2016) also discusses how changes in precipitation will affect the crops and furthermore, the loss of crops would also mean economic loss.

Sea-level rise can also have an impact on economic activities. Dr. Nabangchang (Personal Interview, 2016) mentions how rising sea level can affect popular tourist destinations in Thailand and via that, cause a large economic loss. Dr. Nabangchang (Personal Interview, 2016) mentions Koh Tao as one example: "this is one of the top ten diving sites in the world, if sea-level rises there, they will suffer from large scale economic loss". Also, Dr. Surendra (Personal Interview, 2016) suggests that climate change impacts can affect the economy. According to Dr. Surendra, in addition to actual damages, floods can also cause loss and damage to future productive power. Dr. Surendra estimates that economic losses caused by climate change will not only be suffered nationally but globally, when the whole supply chain is affected. Also, loss of infrastructure and the physical separation of people will have an impact on the economy, Dr. Surendra added.

According to Dr. Nabangchang (Personal Interview, 2016) the department of marine and coastal resources use modelling to study coastal erosion. They have some data about the coastline of Thailand, indicating which areas are high risk, medium risk and low risk regarding coastal erosion. With that information some preliminary

calculations were made about how many communities would be affected. The department also has information about districts and sub-districts which have coastlines and if coastal erosion happens, what would be the effect to the value of the built-up areas around the coast and the livelihoods of the people. This is a major challenge. Also, statistics by Doig & Ware (2016) state that the coastal population in Thailand will double by the year 2060, meaning that almost 37 million people will be living in low-lying coastal zones and will be exposed to the effects of sea-level rise. Doig & Ware (2016) also estimate that assets exposed to coastal flooding in Bangkok alone will increase from about US$ 39 million in the year 2010 to US$ 1,117.54 by 2070. These are very significant numbers and will therefore affect the economic security of Thai people.

There are many techniques to prevent coastal erosion and it really depends on the particular site as to which would be most effective. Another aspect which is being studied is the economic value of mangrove. According to Dr. Nabangchan, “Hopefully research will illustrate how much people depend on mangrove and what would happen if mangrove is destroyed by deterioration of environment condition, sea-level rise or infrastructure development among the coastline”.

Dr. Lawrence Surendra (Personal Interview, 2016) discussed that the sea level rises because the ice melts in the Himalayas and in the Arctic and therefore more water ends up in the ocean ecosystems. Another reason why sea level is rising is that the oceans expand as the temperature of the water rises (Climate Reality Project, 2015). According to Dr. Surendra, flooding can occur not only due to sea-level rise but also because of heavy rain. He underlines that even if the amount of rainfall would not differ,

the changes in the rain patterns, mean that rain comes with great intensity within only a few days and can thus cause flooding. Dr. Surendra further mentioned (Personal Interview, 2016) how countries with long coastlines such as Bangladesh are going to lose a significant amount of land because of sea-level rise. Loss of arable land together with extremely high population density means that the country is facing the challenge of feeding more people with less land. Also, the World Bank report (2010) found that some areas might become uninhabitable due to sea-level rise or increases in air temperature. These kinds of changes in the environment might cause a mass movement of people which is already being seen in Bangladesh. The loss of arable land will most definitely pose a threat to food security through involuntary reduction of crop production. According to Dr. Bhaktikul (Personal Interview, 2017), Thailand has been preparing for the past ten years through research and activities relating to sea-level rise. Some studies have indicated that the sea level will rise gradually in the future. If information suggesting that Bangkok or Southern Thailand would be covered by sea water within the next few years were to be announced, it would cause panic in the society. Dr. Bhaktikul also stated that preparedness and awareness are important and further suggests that people could gradually move to the mountain areas and to the higher lands.

Sea-level rise could pose a threat to human security. Even if the most obvious component of human security in jeopardy is environmental security, rising sea levels could also have impact on other aspects of human security. As Dr. Nabangchang mentioned, sea-level rise could have severe impacts on the economy. Moreover, it could be said that sea-level rise threatens economic security. Dr. Surendra on the other hand, discussed that sea-level rise will have an effect not only on present productivity but also

to the future productivity. When sea levels rise, it can ruin the crops or it can destroy buildings and infrastructure. Moreover, it can even force people to relocate. All these factors will pose a threat to economic security when the livelihoods of people are at stake. When sea levels rise and when it destroys people's livelihoods or property, it can lead to unemployment and poverty, which the UNDP (1994) lists to be the main threats to economic security.

4.2 Weather Anomalies as a Challenge in Thailand

During a personal interview, Dr. Nabangchang (2016) discussed her concerns how climate change related weather anomalies such as floods and storms could be a challenge to Thailand in the shorter timeframe than sea-level rise. Dr. Nabangchang mentioned the major floods in Thailand which occurred in 2011 and affected almost all of the provinces throughout the country, and referenced a study which she took part in. That particular study was micro level research and found that the average economic loss on a household level was 100,000 Baht. "These kinds of floods are likely to occur more often in the current climate condition" Dr. Nabangchang claimed (Personal Interview, 2016). Also, Figures 7 and 8 mentioned earlier in this research illustrate the rising trends of the number of both floods and storms in Southeast Asia from 1960 to 2008. For example, the Philippines which seems to have the highest number of floods and storms throughout the time period has experienced an increased number of weather anomalies during the past fifty years. On the other hand, according to Figure 8, Vietnam seems to have the most serious economic losses caused by the storms and floods due to their inability to adapt (Centre for Research on the Epidemiology of Disasters, 2008 & Central Committee for Flood and Storm Control, 2005). According to Dr. Bhaktikul (Personal Interview, 2017) when it comes to drought and floods in Thailand, the big

challenges are the frequency and the intensity. The events will be more frequent and more intense as well as more severe than before. However, Dr. Bhaktikul underlines that the situation in Thailand is not as bad as in some other countries. Maintaining mangrove forest as a natural front to block the worst storms is a good preparation measure.

According to Dr. Surendra (Personal Interview, 2016) weather anomalies will also affect the availability of drinkable water. In other words, droughts as well as floods have a serious impact on ground water resources. All water depends on precipitation and if there is not enough rain, it means also that the ground water levels will be low. Moreover, floods have an impact on availability of drinkable water. Flooding contaminates the ground water and in the case of sea-level rise, there is a problem of salination. In addition to Dr. Surendra, Lutvey et al. (2015) claim that droughts and changes in weather patterns impact the availability of drinkable water, especially in the areas where people rely on rain for drinking water. Other scholars also agree about the challenges weather anomalies can bring with them.

> Global warming, climate change and sea-level rise are expected to intensify the resource sustainability issue in many water-stressed regions of the world by reducing the annual supply of renewable fresh water and promoting the intrusion of saline water into aquifers along sea coasts where 50% of the global population reside. (Baba et al, 2011, p. v)

Interestingly, other sources also claim that the availability of drinkable water will be a challenge, Dr. Bhaktikul (Personal Interview, 2017) stated that in the case of Thailand, this will not be a problem. He suggested that Thailand has plenty of water resources, hence the situation is very different from other dry countries such as Israel.

Dr. Bhaktikul explained that when climate change related disasters such as floods occur, there could be a short period of time when availability of drinkable water might be in jeopardy, but after four or five days the situation would be under control because in Thailand, everyone helps each other.

According to a UNDP report (1994) natural disasters pose a threat to environmental security. In addition, floods for example, as Dr. Nabangchang mentioned earlier, can have large scale impacts on the economy. Therefore, weather anomalies such as droughts and floods can also threaten economic security. Furthermore, if droughts, for instance, ruin the crops it also can cause food insecurity. UNPD (1994) confirms that hunger and famine are the main consequences of a loss of food security, and climate related weather anomalies, which destroy the crops for example, can lead to that. The climate change related weather anomalies might have surprising economic impacts.

4.3 Agriculture at Stake

According to Dr. Surendra, first and foremost climate change is going to pose a challenge to agriculture. Due to the fact that Thailand is one of the biggest exporters of rice, the whole global food chain could be in jeopardy, not only food security in Thailand itself. Furthermore, if agriculture is affected, it also means that livestock feed will be affected and therefore the impacts will be on a larger scale, not only to the crops. Also, the World Bank study about regional risks of climate change in Asia claims that "…the large contribution of irrigated agriculture to food production and rural economies leaves this region highly vulnerable to predicted changes in the runoff of major rivers" (2010, p. 1). The same study also suggests that Southeast Asia is

exceptionally vulnerable to climate change due the fact that its economies rely heavily on agriculture. It is common in this region that the agriculture sector employs over half of the population in respective countries (World Bank, 2010). In terms of food security, climate change threatens not only those working in the agriculture sector but all of the population in the countries. If droughts, floods or sea-level rise ruin the crops, the agriculture sector cannot supply their products to the national, regional and global food chain. According to Dr. Bhaktikul (Personal Interview, 2017) some simulation models suggest that in Thailand, the production of rice could either decline or increase within the next 30 or 40 years. This is related to the fact that Thailand is a monsoon country and a one or two-degree Celsius increase in the temperature might already mean the crops would decline. The situation is very different in cold countries, for example in Europe, where one or two-degree rise in temperature could mean better crops. However, at times of climate related disasters such as floods or droughts, rice production will be affected in Thailand. Therefore, climate change related weather anomalies pose a threat to food security and this is also related to economic security. Thai farmers are already poor and according to Dr. Bhaktikul, disasters such as floods and droughts if ruining crops, also affect the livelihoods of the Thai farmers.

In addition to the findings of the World Bank and Dr. Surendra, Maplecroft (2015) claim that Thailand is one of the countries which will suffer the most from climate change impacts. According to the New Climate Change Vulnerability Index (CCVI), Thailand holds the ranking of 14th most vulnerable country to the effects of climate change, out of 170 countries which are included in this particular index. Another piece of research, conducted by Standard & Poor's (2014) suggests that Thailand, among other Southeast Asian countries, is vulnerable to climate change

impacts due to its high dependency on agriculture and fishery as well as its long coast-lines which make it vulnerable to sea-level rise. Also, the ASEAN report (2016) expressed concern about the more frequent and severe droughts, heat waves, floods and tropical cyclones. The region is dependent on agriculture, forestry as well as natural resources. The regional organization is trying to mitigate the devastating consequences by creating co-operation and common policies.

Hollo et al. (2013) suggest that mitigation of greenhouse gases as well as energy policies have an important role in the field of environmental protection. In addition to mitigation policies Hollo et al. also claim that various adaptation measures are necessary in terms of water management, health policies as well as agriculture. Salamanca and Nguyen (2016), on the other hand, state that in ASEAN countries agriculture makes up approximately 10% of Gross National Product (GNP). Therefore, the impacts of climate change will also hit the economy through agriculture. The Intergovernmental Panel on Climate Change (IPCC) noted in their Fourth Assessment Report (2007) that climate change could undermine the living conditions of people all over the world and at risk sectors include agriculture, forestry, water resources as well as energy systems, human health and economy (Scheffran & Battaglini, 2010). All in all, the data collected from both primary and secondary sources are in line with one another. The informants, as well as findings drawn from the literature review (Chapter 2), claim that climate change will have serious impacts on agriculture. Droughts and floods as well as sea-level rise will affect the crops and the productivity of land and further impact to the local, regional and global food chain as well as the economy. It can be concluded that climate change poses a threat to food security in Thailand. According to scholars Lobell & Burke (2010) due to the fact that agriculture is

dependent on weather, the changes in climate will also affect the crops. When climate change threatens agriculture, food security is in jeopardy. Furthermore, economic security is at stake because the agriculture sector employs more than fifty percent of the Thai population. UNDP report (1994) categorizes unsafe food and malnutrition as examples of threats to health security. Dr. Bhaktikul (Personal Interview, 2017) discussed that climate change impacts not only pose threat to health security but also can cause death. He suggests that ten percent of the casualties happening during floods are caused by electric shocks.

4.4 Involuntary Migration due to Climate Change

As mentioned earlier, climate change impacts such as sea-level rise, droughts and floods might make some areas uninhabitable. This could cause involuntary migration, meaning that people have to relocate from their homes even if their livelihoods rely on their current location. According to Dr. Surendra (Personal Interview, 2016) climate change played a role in the conflict in Syria. The country suffered from long droughts and people from the countryside lost their livelihoods and relocated to the cities. The cities did not have the capacity to cater all these people and that situation caused unrest and was a factor which accelerated the commencement of the conflict. In addition to Dr. Surendra, other scholars claim that climate change will cause an increasing number of refugees as well as migrants. Marks (2011) suggests that climate change related issues such as refugee settlement, water management and energy policies might cause friction between Thailand and its neighbouring countries. These aspects may contribute to the political instability of the region. People do not only relocate within their own countries, as Dr. Surendra (Personal Interview, 2016) discussed, refugees from Syria and Africa have headed to Europe too. Gemenne et al.

(2014) suggest that due to the fact that climate change is causing human suffering, it should be studied through the lens of human security.

The International Organization for Migration (IOM) has estimated that climate change could cause a large scale migration and the number of people who need to relocate in the future due to climate change impacts varies from 25 million to 1 billion by the year 2050. Due to the fact that people will need to migrate, their position will become more vulnerable and this will also see an increase in human rights violations such as human trafficking and modern day slavery, claims The Office of the High Commissioner for Human Rights (OHCHR). Faist and Schade (2013) also argue that some parts of the world will become challenging to live in because of climate change impacts, and this could cause major migration. In other words, Faist and Schade (2013) suggest that climate change will create a "push-factor" which they call "climate-push". Dr. Nabangchang (Personal Interview, 2016) claims that certain areas in North Eastern Thailand could become unproductive and therefore people would need to migrate. According to Dr. Nabangchang, forced migration is already happening due to the coastal erosion in Samut Sakhon for example. Some people will be more vulnerable, depending on their geographical location and economic means. "Climate change is expected to have severe consequences on the lives and livelihoods of millions of people around the world, but its effects will not be evenly distributed" (Busby et al., 2014, p. 51). Dr. Bhaktikul (Personal Interview, 2017) suggested that in Thailand, people will gradually move from the South and from the Bangkok area to the mountains and higher lands.

4.5 Adaptation and Mitigation

According to Dr. Bhaktikul (Personal Interview, 2017) adaptation to climate change impacts is very important. Even if the world could stop producing greenhouse gases now, it would take another 20 years to stop climate change. Of course it is not possible to stop producing greenhouse gases; therefore, adaptation to climate change impacts such as floods and droughts is crucial. Dr Bhaktikul discussed that in Thailand, the research data from IPCCC working groups has been available already for twenty years and therefore at least academia is familiar with the impacts of climate change. However, the awareness of the public is not very high. This includes the NGO's and government sector. Dr. Bhaktikul pointed out that adaptation measures include new designs for regulations and also infrastructure. In addition to adaptation, Dr. Bhaktikul also underlined the importance of mitigation. These functions should be harmonized and executed in parallel to the adaptation measures. In other words, the current situation calls for practical actions, not only theories. When it comes to mitigation plans, according to Dr. Bhaktikul, zero waste industrial plants, which turns waste into energy would be a good example.

Adaptation to climate change impacts covers both preparedness and readiness. According to Dr. Bhaktikul, these are the two weaknesses when it comes to temporary climate change related disasters such as floods. Furthermore, Thailand lacks a warning system, which would circulate the information from person to person about the upcoming storms and so forth. On the other hand, the strengths of Thailand are response and recovery. Meaning that when disasters, such as floods, occur people work together and help each other.

Another adaptation measure according to Dr. Bhaktikul (Personal Interview, 2017) is new infrastructure design. These designs could mean, for example, that the roads would have two functions in future. If they are built parallel to the rivers and channels, during the dry season they would function as roads and during the rainy season, they would function as a drainage system leading excess water to the ocean. When talking about adaptation and mitigation, no nation can work by themselves, but cooperation at different levels is necessary. In the case of Thailand, regional cooperation within ASEAN states mostly includes training and capacity building. Cooperation with non-ASEAN countries mainly focuses on input data for modelling. Thailand has used research data from, for example, the United Kingdom, the United States, Japan, China, and the Netherlands. Also, local communities have a big role in the climate change adaptation (Dr. Bhaktikul, Personal Interview, 2017).

Dr. Bhaktikul underlines that the current challenge for adaptation in Thailand is the fact that different ministries are in charge of different functions. Therefore, it would be very important for them to work together. For example, highways are designed by the ministry of transportation but drainage systems are planned by the ministry of agriculture. In order to follow the new design where roads would have two functions, the two ministries must be able to work together.

CHAPTER 5

Conclusions and Recommendations

5.1 Conclusions

Climate change is a global problem and its impacts take various forms. Whereas the Himalayas and the Arctic are facing the challenge of melting snow and ice, the Middle East and parts of Africa suffer from desertification, Southeast Asia will need to adapt to sea-level rise, droughts and floods. This research has demonstrated that climate change impacts could pose a threat to human security in Thailand. Climate related disasters such as floods, droughts and sea-level rise are the most serious challenges that Thailand has to face in the era of global warming. According to the interviews this research conducted, as well as the data collected from secondary sources, agriculture is one of the sectors which will suffer the most from climate change. Droughts, floods and sea-level rise can ruin the crops or the soil making it challenging to grow crops. Thailand being a large rice exporter and agriculture employing more than half of the Thai population (World Bank, 2010), in addition to food security, climate change will also threaten economic security. According to UNDP (1994) unsafe food and malnutrition are examples of health insecurity. When climate change impacts threaten agriculture, health security could also be at risk.

Sea-level rise can affect economic security due the fact that Thailand has a long coastline and tourism is a very important part of the country's economy. Also, droughts and floods can pose a threat to the economy. Droughts can ruin the crops and people whose livelihoods depend on farming will suffer. Furthermore, larger scale droughts can also affect the macro level economy, because Thailand is a large rice exporter.

Floods can have similar consequences of ruining crops but also damaging infrastructure and property. In addition to economic insecurity, climate change weather anomalies can also threaten food security. This research found that climate change impacts will also affect the availability of drinkable water; however, in the case of Thailand, this challenge will not be so serious because of the existence of the vast water resources of the country.

This research has also found that climate change can cause involuntary relocation of people. This study suggests that some parts of Thailand could become agriculturally unproductive and how the Central and Southern regions will suffer from sea-level rise, and river areas, from floods. The findings of this research also pointed out that in other countries when some areas become uninhabitable and when people cannot support themselves in traditional ways, usually they move to the capital city or other big cities. However, in the case of Thailand, people might rather move to the higher lands and mountain areas.

5.2 Recommendations

The impacts of climate change, such as floods, droughts and sea-level rise could pose a challenge to human security in Thailand. Therefore, the following recommendations can be drawn from the findings of this research:

Policy and Strategy recommendations

1. It would be recommended to spread awareness not only in the government and NGO sectors but also throughout the society. Whereas new designs and regulations are in order, also people can slow down the climate change impacts if awareness is spread. This means that environmental legislation and green innovations are important but also grassroots level actions can make a difference if people are educated to consume in a sustainable way.
2. As a member of ASEAN, Thailand should continue to develop regional cooperation and also engage in cooperation with other countries too.
3. Thailand could also invest in renewable energy sources, as one example; building zero waste industrial plants which would turn waste to energy.

Management and Practices recommendations

4. Very important measures of adaptation and mitigation should be enforced. For example, Thailand could grow crops which are resilient to the future climate. Thailand could also take into account the flood and drought risk, as well as sea-level rise, when planning infrastructure development.
5. When it comes to adaptation, the warning system, which allows information to flow from person to person would be crucial to the survival of the communities which live in the disaster prone areas.
6. Cooperation between different ministries in order to design infrastructure is very important. A model of roads with a double function could be one solution to the flooding during the rainy season. Roads which would function as a drainage system to enable excess water to exit to the ocean could be a way to manage the flooding.

7. Also, maintaining mangrove as a natural front to protect from storms would be recommended.
8. It would be reasonable for Thailand to also prepare for a climate change related mass movement of people.
9. The tourism sector should be prepared for climate change related challenges such as sea-level rise.

Recommendations for future studies

10. Climate change should be taken seriously and it would be recommended for Thailand to invest in climate change related research. This will raise the level of preparedness which is one of Thailand's weaknesses.

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Appendixes

NOTE: To ensure accuracy, the transcripts of oral interviews contained within these appendixes have not been edited for length or clarity.

1. Interview Transcript of Dr. Orapan Nabangchang

- *Associate Professor of Economics, Sukhothai Thammatirat Open University*
- *Deputy Director of the Economic and Environment Program for Southeast Asia (EEPSEA)*
- *Director of Economy and Environment Institute of the Lower Mekong Sub-Region (EEI-LMS)*
- *Research Background: Land and Environmental issues in Thailand and Southeast Asia*

Question 1. "What are the most serious challenges that climate change is posing to Thailand?"

Answer 1: "Two aspects: first one is related to coastal areas, sea-level rise could be a problem. There has been some simulations by IPCC what will happen if sea-level will rise 1 meter or 2 metres or 5 metres and how it would affect the economy. Even one metre or two meter would also affect Bangkok, which is the economic centre of Thailand. All those infrastructures that we have invested would be lost and would be an economic loss. That's in a longer time frame. In a shorter time frame there is all these climatic turbulence: storms, floods and things like that. In 2011 there was a major flood in Thailand and it affected nearly most of the provinces. We did a study which estimated the loss on household level in the three districts which had highest level of floods, about 2.5 metres. As a result of the study it was found that on average, the economic loss on household level was 100 000 baht. That was a micro level study. Another study which was made by Thailand Development Research Institute (TDRI) and was initiated by the World Bank estimated also the economic loss of the severe flood in Thailand 2011. These kind of floods are likely to occur more often in the current climate condition. Although, in that particular year the scientific information was that there was more rain than average year but on top of that there was a lot of

mismanagement of how the water was regulated and the decisions about opening the gates of the dam. So by the time they decided to open the gates there was too much water in the dam. These kind of extreme weather events come with climate change. There have also been studies how island (tourist) destinations would be affected. One of the islands was Ko Tao. This is one of the top ten diving sites in the world. If sea-level rises there will be severe economic loss. Another research that has been made is how agriculture sector will be affected by climate change. It was studied how the number of hot days, cold days and changes in precipitation will affect the crops. The loss of crops would also mean economic loss. If climate change will hit the agriculture sector, this would affect a large number of households."

Question 2: "To what extent is sea-level rise going to affect Thailand?"

Answer 2: "The department of marine and coastal resources use modelling to study coastal erosion. They have some data about the coastline of Thailand, which area is high risk, medium risk, low risk of coastal erosion, kind of an another aspect. With that information they made some preliminary calculations about how many communities would be affected because they also have information about how many districts and sub-districts have a coastline and if coastal erosion happens, what would happen to the value of the build-up areas around the coast, the livelihood of the people. That is a major thing that is going on. There are many techniques to prevent coastal erosion and it really depends on the particular site which one would be most effective. Another aspect is an economic value of mangrove which is being studied. Hopefully that research will illustrate how much people depend on mangrove and what would happen if mangrove is destroyed by deterioration of environment condition, sea-level rise or infrastructure development among the coastline."

Question 3: "What kind of impacts droughts could have in Thailand?"

Answer 3: "EEPSEA has made a vulnerability mapping by using the climate information and overlaying it with socio-economic information about protected areas, population density and availability of infrastructure. Layers and layers of data were used to produce a vulnerability index map. Vulnerability would be an outcome of the

severity of the impact and the ability of a country to adapt or to undertake some measures. The map was used for only the countries in Southeast Asia. The first round of information was that the Mekong delta, Cambodia, Bangkok and Manila are vulnerable. Bangkok because of the sea-level rise and the concentration of the economic activities. Mekong delta in Vietnam, because it is a major production area and because of the elevation of the area they would be more affected by se-level rise. Cambodia is vulnerable because of the level of ability to adapt to the problems. These are some variations why some cities are vulnerable to climate change."

Question 4: "How could climate change affect to food security in Thailand?"

Answer 4: "The demographic structure in agriculture is somewhat changing. The agricultural sector is facing an outmigration of younger people. One driver of land degradation will be climate change. For example at the North eastern part has a problem of salinity, in this case the salinity is caused by the way people use the land. It will affect livelihood, because in this region they are planting food crops. In the northern region, even before climate change comes there is an issue of deforestation and the fact that they are using the soil like it was a non-renewable source. There is no conservation due the fact that number of people do not see that conservation pays. Number of farmers are not planting rice to their household consumption but they are planting commercial crops, this is where food security comes in to picture. And they are buying rice, in the long run this could be difficult. Especially if they are doing mono cropping and something happens to the production mechanism, the food security is down the drain because they are now buying rice to eat."

Question 5: "Can climate change impacts such as sea-level rise, cause migration in Thailand?"

Answer 5: "If the climate model is accurate, the one that is predicting the number of cold days and hot days, certain areas of the north eastern areas might become unproductive and this could necessitate migration. At the moment forced migration is happening because of coastal erosion in certain places in Thailand like Samut Sakhon, where you can actually see that even few decades ago where land is completely under

water, which used to be productive. Which bring to the question whether all these measures to prevent coastal erosion is economically feasible when you take into account all these social disruptions, people might need to move and things like that."

Question 6: "How could climate change impacts affect economic and environmental security?"

Answer 6: "We are trading the long term benefits for short term economic gains, especially in the major economic sector like the tourism sector. We are signatories to number of international conventions but we need to find concrete measures. Like biodiversity, what have we done, or what have we invested in biodiversity complies with the convention. We need to know how much money we need in order to satisfy those commitments. At the moment the challenge is that all this talk about climate change, it is in fashion to talk about it. People find climate change always in top three concerns, even if there are many other environmental problems in Thailand, but it is not clear whether people really understand what we mean by climate change. It is in peoples mind but how do they respond to it, by wearing t-shirts or using fabric bags instead of plastic bags. But we have really not done something active like in France where plastic bags are now banned. Furthermore, it is very difficult to convince the private sector that ecosystem sustainability is also a key to their business. At the moment they are investing a tiny tiny part of their profit, so there is still lot to do. I think that Thailand has to be strategic, we can appeal to the consumers but we also need to get the private sector on board too."

2. Interview Transcript of Dr. Lawrence Surendra

- *Chairman and Professor at The Sustainability Platform*

- *Guest Lecturer in Chulalongkorn University*

- *Deputy Director and Regional Adviser UNESCO-APCEIU*

- *HRD Expert UN-ESCAP*

Question 1: "What are the greatest challenges climate change is posing to Asia and Thailand in particular?"

Answer 1: First and foremost is the agriculture because Asia is a big agricultural region. Not only in terms of food security but for example Thailand is one of the biggest exporters of rice, India is one of the biggest producers of wheat, agriculture export is very big in Thailand, Vietnam and for example the Philippines and Malaysia. So even livestock feed, so it's not only food security but also the whole global food chain. That's the major one impact. We make a distinction cc impacts in terms of flooding, natural disasters, and so on. Which are more of the signals of warnings, resulting from cc. So, if countries have excess flooding and so on, then they know that there are changes happening. It is very difficult to talk about the impacts of cc because it is a global phenomenal. But there are both global and local causes. Most of the terminology in cc is little inaccurate. It's very interesting, this whole discourse started with global warming. The first concern was global warming and with warming comes droughts.

Question 2: "Literature suggests that sea-level rise could mean loss of land, do you agree?"

Answer 2: Sea-level rise because Himalayan snow melting in Asia and Artic snow melting, so more water comes into the ocean ecosystems. As the result of cc the number of and dry days become longer and longer and number of wet days become shorter and shorter. So what happens is that you don't have a change in the actual rainfall, but that

rainfall comes with great intensity within four days or five days and causes the flooding. Flooding can happen because of the sea-level rise or because of the changes in the rainfall pattern. In countries with long coastlines like Bangladesh, they are going to lose a lot of land because of sea-level rise. Which means, the area of arable land, the land available for agriculture is also going to get smaller. Bangladesh has a huge population density, number of people per land and that is going to increase more. Another aspect, you going to have to feed more people with less land. Vietnam peninsula faces a possibility of sea on both sides, covering it up. Vietnam perhaps faces the greatest danger with cc than any other country. Bangladesh to some extent as well as Maledives. Small islands will disappear.

Question 3: "To what extent is climate change going to affect the availability of drinkable water, and what kind of consequences could this have?"

Answer 3: If there is a drought it already means that groundwater sources will be very badly affected. Because all water depends on precipitation. If precipitation is low it means also the groundwater sources will be very low. Then on the other hand, floods contaminates the ground water, you cannot do much with it. It is disaster water. Sea-level rise also affects to the water sources through salination. Both the water shortage and damage to water sources.

Question 4: "How could climate change affect food security?"

Answer 4: Agricultural production will be badly affected by actual crop loss but also biodiversity loss. If you lose biodiversity, it also going to be long term loss. Definitely the first impact will be on food security.

Question 5: "Do you think people will need to relocate because of climate change?"

Answer 5: What we call is climate refugees. Well they say that the war in Syria in due to cc. After the long droughts, people moved to the cities and that's how the refugees happen. Also in Africa this might happen that people need to move to the cities. When

cities cannot manage, trouble starts, conflict starts. Whether they will migrate to other places, one doesn't know.

Question 6: "How should the impacts of climate change be handled, can all the countries have their own plan?"

Answer 6: Countries cannot defeat cc on national bases because it is a global problem. At first, impacts of cc affect largely on poor and developing countries. So, the western countries were quite insensitive and didn't worry about it. Now cc is starting to effect on western countries also because very hot summers, huge rains and floods. Even Europe is now affected. The global effects of cc are now becoming more universal than it was earlier. While developing countries are affected and there will be refugees and so on, but also developed countries will suffer the consequences of cc.

Question 7: "What kind of impacts could climate change have on the economy?"

Answer 7: Insurances for one, while the disasters will be more frequent, there will be big economic losses. Also due agricultural production, as well as increased internal migration. For example the Thai floods, both actual damage and also loss and damage on future productive power. The whole global supply chain was affected. So economically it will not only be the national damages but also international damages. The cost is so high, so all kind of numbers float around. Dislocation of people, loss of infrastructure, loss of productive capacity both present and future, loss of assets and so on.

3. Interview Transcript of Dr. Kampanad Bhaktikul

- *Associate Professor Faculty of Environment and Resource studies Mahidol University*

- *Dean Faculty of Environment and Resource studies Mahidol University*

- *University Council Member Mahidol University*

Question 1: "What are the most serious challenges climate change is posing to Thailand?"

Answer 1: Even if all around the world, we would stop the activities now which produce greenhouse gases, it would take another 20 years to stop the climate impact. That is what IPCCC said. But because we never stop the activities which causes greenhouse gases, the climate change impacts are seen all around the world, even Thailand. The most important thing, this is from the research that I have done, is adaptation. Adaptation to climate change is the most activities that actually Thailand has known this already from the IPCCC working group or for the documentation, over 20 years. But the action for the people to deal with it, to know it, to understand it is less. This includes the government sectors and NGO's. Of course the adaptation measure, adaptation activities among the people has to have a new design, new regulations and new infrastructures. Everything should be included to this. From the research, it is important to harmonize, to work together, not only with adaptation but also together with mitigation. The mitigation plan, you need for example, industrial plant that make the waste to energy, zero waste technology. Many other things like this is mitigation. Mitigation measures. Need to work parallel with the adaptation activities. Not only give the knowledge to the people but also practice it, to make it in practicality. Not only in the theory, not only in the books. Yesterday, Thai PPS news came here to interview me, ask me about the Southern storm which occur. This is the clear evidence that Thailand have not been prepared. Readiness to this storm is hardly informed to the people. Sure, we have technology to say that there is a cloud of low pressure, coming to Southern part of Thailand in the next 2 days or 1 day or next 12 hours. This is correct but after that, what happened. There is no warning system under ground. I mean the people who

stay in the mountain area, they cannot access to that information. The thing is that there must be a warning system underground. Among people to the people. People in the area has said that there is no sufficient warning system. Maybe some warning have been done but not enough. Vastly damaged now. In addition to climate change adaptation, also adaptation to water management as well. The other thing is that we need to be prepared with the new design for the climate change. For example, transportation road and the highway and everything. About the new plan for the infrastructure, we need the roads which goes the same direction as the rivers flow. So the roads must be redesigned as a channel for the river to help the flooding river to drain out to the sea. In short, the infrastructure needs a new design, the roads cannot be built like they have been for the last hundred years. From now on, the roads will have two functions, during dry season, they will be roads and during rainy season, they will function as drainage to the flooding water to exit to sea. This is the new design to adaptation to the climate change.

Question 2: "To what extent will sea-level rise affect Thailand?"

Answer 2: We have been prepared through the research and through the activities for more than 10 years. We are already aware that it will happen but however we cannot say that within the next 50 years a certain area in the Southern part or Bangkok area will be full of water. We cannot clearly say that because otherwise there will be hectic in the society. Even though if you visit certain areas, you will see that the land area is set up for the preparing for the flood. Therefore, higher land areas could invite people from Bangkok area and Southern Thailand to move there. These land areas are already getting more expensive. That means that some people already know and are already aware about the impacts of sea-level rise but not everyone think that this could be happening within next 50 years. Sea-level is gradually rising up but not immediately flood. Preparedness and awareness are very important but not to be hectic.

Question 3: "What kind of challenges can droughts and floods cause to Thailand?"

Answer 3: The challenges of floods and droughts is the frequency. And the second one is intensity. The droughts year and floods year could be more intensity to occur in Thailand. More severe event. In the past maybe once in 50 years or once in 60 years but now floods occur more frequently. It was 2011 when big floods occur in Thailand and now, once again, the Southern floods. However, if we compare the situation in Thailand and some other countries, the situation is more severe. Maintaining Mangrove forest as a natural front is important, it can at least protect from the most serious storms. Thailand is preparing like this.

Question 4: "How can climate change impacts affect the availability of drinkable water?"

Answer 4: I think in the damage area it could be a problem but after 5 days 4 days it would be ok because we have plenty of water. And when disaster occur, we help each other. Preparedness and readiness (before floods) are the weak points of Thailand whereas response and recovery (after the floods) are the strengths (see figure.10). In short, the drinking water is not a problem because Thailand has plenty of water, not like some dry countries like Israel.

Question 5: "How can climate change affect to availability of food?"

Answer 5: From the simulation model, it can be said that climate change effects some period in the future, the production of rice could increase and then decline. Both could be happening in Thailand. In the monsoon country, hot country, not in the cold country like Europe. If the temperature increase only 1 or 2 degrees, the production of the crop could decline. But in the cold country, if the temperature increase 1 or 2 degree, production will be increase. Simulation model of Thailand tells us that in the next 30 or 40 years, the rice production could increase and also decline. But in the time of the storm caused by climate change, of course, the damage of the harvesting period will occur.

Question 6: "Do you think that in Thailand, people would need to relocate because of the impacts of climate change such as droughts, floods and sea-level rise?"

Answer 6: It will happen gradually. Some people have already requested some land areas in the mountains, to be higher, so the floods will not occur there. Simulation models of Thailand suggest that some low lying areas will be flooded and therefore people need to move away from these areas. People will move to the mountains because of sea-level rise and floods. Gradually, not hectically.

Question 7: "How will Thailand handle the impacts of climate change, by itself or with the cooperation of other countries or for example regional cooperation within ASEAN?"

Answer 7: The cooperation within ASEAN is mostly training and capacity building. When it comes to cooperation with other countries, other than ASEAN, we use the input data for modelling. For example research data from UK, Netherlands, Japan, United States and China are used in Thailand.

Question 8: "How could climate change impacts such as sea-level rise, droughts and floods affect the following 7 human security components in Thailand?"

Economic: when disasters happen, the economic growth will slow down. For example 2011 big flood in Thailand, that also affected to the research fund given to the Faculty of Environment in Mahidol University. Usually the fund is 70 million baht but that year it was cut with 20 million and the faculty was granted 50 million bath for research. Impact was very vast, also tourism and everything was declined.

Personal: Transportation and communication could be affected for a shorter time, 50 days or two months.

Food: The plant and crop area will be affected by both droughts and floods. Large areas will be affected, this is also linked to the economic security of the farmers, because they are already poor and droughts and floods can make them poorer.

Health: Some evidence that floods and drought could have impact on people's health. Disasters also cause deaths, for example accidents such as electrical shocks may occur in the time of floods. Around 10 percent of the people who die during the floods die because of electric shocks.

Community: Has a big role in adaptation to climate change

Political: The most important of all, because if we can change the political view, the planning and working together, integrated. If all could work together against climate change, it would be wonderful. For example the highways are designed by the ministry of transportation but drainage system is designed by the ministry of agriculture. So if the different ministries cannot sit down and talk together and design the roads and the drainage channel systems together, there will be no point. It depends of the government, if they can work together, they can solve the problems but if not, it can be very difficult.