

Institutional Traps and Private Housing Sector Adaptation:
A Case Study of the Bangkok Metropolitan Region

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contribution

This thesis is written in a manuscript format. Two chapters are written as independent manuscripts with the intent of publishing them in academic journals. While I am the principle author of all chapters in this thesis, Dr. Carrie Mitchell made contributions to both manuscripts, which comprise of Chapter 3 and Chapter 5 of this thesis.

The first manuscript, *Public Sector Incapacities Lead to Private Sector Adaptation in Thailand*, is co-authored with Dr. Carrie Mitchell. Mitchell contributed 10% in idea feedback and structure improvements.

The second manuscript, *A Flood of Change in Bangkok's Housing Sector: A Case Study on Private Sector Adaptation*, is also co-authored with Dr. Carrie Mitchell. Mitchell contributed 15% in idea feedback, research question feedback, structure improvement, and editing throughout. The manuscript is ready for submission to *Cities*.

Abstract

Southeast Asia is at particular risk of the impacts of climate change which is, and is predicted to continue, causing increased intensity and frequency of extreme weather events. Thailand is particularly vulnerable to these events, as well droughts. In 2011, Thailand experience the worst flood in 50 years, while four years later the county experienced the worst drought in 50 years, as well as continued flooding, particularly in parts of the Bangkok Metropolitan Region (BMR). Flood management, therefore, is a key aspect of Thai planning. Lebel *et al.* (2011), however, identified five institutional traps that hinder effective flood management—fragmentation, rigidity, elite capture, scale, and crisis management. These traps continue to hamper flood management strategies. Unfortunately, little is known about how these institutional traps impact water governance and non-government stakeholders. I interviewed public officials (n=23) and analyzed six newspapers, totalling 924 articles, on flood and drought management and the private housing sector in Thailand, and the BMR in particular. Results demonstrate that institutional traps continue to hinder effective flood and drought management in Thailand and have led to water mismanagement as well as a lack of trust in the government's ability to effectively manage water resources. In turn, this has led to an increase in non-government actors engaging in flood and drought management, specifically the military, royalty, and the private sector. While the involvement of the military and royalty in flood and drought management are viewed positively by the media, the private sector received mixed reviews by the media and respondents. At times the private sector is praised for stepping in to provide flood and drought management techniques, but they are also recognised for acting disreputably.

Due to the mixed evaluation of the private sector's actions to address flood management issues, an in-depth review of the private housing sector's actions to reduce the risk of flooding within the Bangkok Metropolitan Region (BMR) was undertaken. The BMR is especially vulnerable to intense rainfall due to its proximity to the coast and rapid urbanization. Drawing on the interviews with public officials (n=23), I review the current practices used by Bangkok's private housing sector to adapt to the increased risk of floods in the city. Current adaptation strategies are primarily protective in nature, including: elevating land and constructing walls. These strategies can effectively reduce the risk of flooding to private property and adjacent properties, and may lead to co-benefits for networked urban infrastructures, such a stormwater management. Yet if these strategies are implemented poorly, they could be considered maladaptive by increasing the risk of flooding to surrounding properties and communities, and creating conflict between those who have adapted and those that have not. Overall, the results suggest that the private housing sector in the BMR is adapting to flooding. However, with limited government regulations, programs, or incentives, the adaptation process in the BMR is largely uncoordinated and unplanned.

The results of this study demonstrate that poor flood management by the public sector can broaden water governance to other non-public stakeholders, with varying degrees of acceptance. Results indicate that the private housing sector, specifically, can be an effective mechanism to reduce the risk of urban flooding, but only if strong planning initiatives are implemented to manage their actions. Ultimately, this thesis contributes to the literature by outlining how institutional traps that hamper the public sector's ability to effectively manage water resources can encourage a broadening of water governance; however, broader stakeholder involvement ought to be managed to ensure it is in the best interest of all.

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¹ More information available at www.coastalcitiesatrisk.org

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List of Abbreviations

ADB	Asian Development Bank
BFRD	Bangkok Fire and Rescue Department
BMA	Bangkok Metropolitan Administration
BMR	Bangkok Metropolitan Region
CODI	Community Organization Development Institute
CPD	City Planning Department
COP15	Conference of the Parties, 2015
DDPM	Department of Disaster Prevention and Mitigation
DDS	Department of Drainage and Sewerage
DoE	Department of Environment
DTP	Department of Public Works and Town and Country Planning
DWR	Department of Water Resources
EGAT	Energy Generation Authority of Thailand
GHG	Greenhouse Gas
IMD	International Institute for Management Development
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IRP	International Recovery Platform
UCLG	United Cities and Local Governments
MNRE	Ministry of Natural Resources and Environment
NDWC	National Disaster Warning Centre
NGO	Non-Governmental Organization
NHA	National Housing Authority
NRC	National Reform Committee
NSO	National Statistic Office
ONIE	Office of Non-Formal and Informal Education
ONWF	Office of National Water and Flood Management Policy
PAO	Provincial Administration Organization
PD	Planning Department
RID	Royal Irrigation Department
THB	Thailand Baht
TMD	Thai Meteorological Department
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund
UNISDR	United Nations International Strategy for Disaster Reduction
USD	United States Dollar
WFMC	Water and Flood Management Commission

Section 1: Thesis Introduction

1.1 Flood and Drought Management, Public and Private Involvement

Three-quarters of the world population live in areas affected by natural hazards (United Nations Development Programme [UNDP], 2004). The scope and impacts of weather-related hazards are expected to increase due to climate change, particularly through shifts in timing, frequency, and intensity of precipitation (Intergovernmental Panel on Climate Change [IPCC], 2014). As a result, humans must adapt to a changing climate in order cope with, and reduce, the risk to lives and property (World Economic Forum, 2016).

The Asian region is among the most vulnerable to the impacts of climate change (Maplecroft, 2013). The Climate Change Vulnerability Index places nine of the top ten most vulnerable countries in South and Southeast Asia (Maplecroft, 2013). The region is characterized by monsoons and tropical cyclones that can bring intense rainfall and storm surges to a largely coastal area. Economically, most of the countries are less economically developed and rely on climate-sensitive sectors, such as agriculture (United Nations Framework Convention on Climate Change [UNFCCC], 2007). Less developed countries also lack financial resources to facilitate adaptation to climate change (UNFCCC, 2007).

Nevertheless, these countries are striving to mitigate climate change. As part of the Conference of the Parties in Paris, 2015, every member country from Southeast Asia submitted an intended nationally determined contribution (INDC) to reduce greenhouse gas emissions (Climate Brief, 2015). Collectively they pledged to reduce 5.15% of the global share of emission in 2012.² Thailand, for example, pledged to reduce emissions by 20% by 2030, which could increase to 25% with international support (Climate Brief, 2015). Thailand's share of global emission reduction is 0.84%, and is comparable to other middle-income countries around the world, including South Africa (0.86%) and Turkey (0.85%).

Countries are also adapting the impacts of climate change. The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2007, p. 750). If cities and countries fail to adapt, an estimated 100 million more people will experience annual flooding (IPCC, 2007)—a 50% increase from the current 200 million at risk (United Nations Development Programme [UNDP], 2004). Furthermore, the option of inaction will become increasingly costly, as larger disasters cause greater losses and damages and adaptive

² Excluding international aviation and shipping.

options become more extensive (World Bank, 2010b; IPCC, 2007). Adapting to the natural environment is not a new concept though; societies have been adjusting to the environment for as long as it has posed a threat, obstacle, or opportunity to humans (White, G.F., 1936, 1945; White, L., 2012); however, the rate of adaptation required to adjust to current and expected climate changes is unprecedented.

Cities are particularly vulnerable to the impacts of climate change due to their built form and population density. Moreover, many cities are situated along rivers or coastlines, which are especially susceptible to flooding (Revi *et al.*, 2014). In 2008, the global population became 50% urban, with most of the largest cities located in low- or middle-income countries (World Bank, 2008; Satterthwaite *et al.*, 2010). While urbanization is linked to economic prosperity (World Bank, 2008; Satterthwaite *et al.*, 2010), the IPCC highlights that rapid urbanization has made many local governments unable to manage their cities (Revi *et al.*, 2014; see also Roy, 2009). A report by United Cities and Local Governments (2011) noted that adaptation in Asian municipalities are financially hindered, since a high proportion of a municipal budget is already used to maintain the urban system, leaving few funds for adaptive action.

While governments at various levels struggle to adapt to climate change, it is widely accepted that other actors should be, and are, engaged in climate change adaptation, including the private sector (Revi *et al.*, 2014; Leck and Simon, 2013; World Bank, 2010a, 2010b; Satterthwaite *et al.*, 2007; UNISDR, 2007).

Private sector adaptation to disasters and climate change is a relatively new concept. Traditionally, adaptation has been a top-down enterprise where higher levels of government “provide the legislative, financial, and institutional basis within which urban authorities, the private sector, civil society, and other stakeholders act to adapt to climate change” (Dodman *et al.*, 2009, p. 161). However, non-state actors have the capacity to not only boost financial resources to address public budgetary shortfalls, but can also offer expertise in adaptation implementation and, in the case of land owners, have a vested interest in reducing the impacts of climate change.

In major urban centers, particularly those situated along coastlines, in-situ adaptation is often necessary due to the insurmountable cost of moving an entire city. Furthermore, the vast majority of urban land is owned by the private sector in some countries, and therefore are key stakeholders in climate change adaptation. According to the IPCC, “the private sector plays a small, but increasingly important role in disaster risk management and adaptation” (2012, p. 347). Similarly, the United Nations Sendai Framework for Disaster Risk Reduction (UNISDR, 2007) suggests that national agendas for disaster reduction should be built upon existing systems and incorporate various levels of

government and ministries, scientific and academic institutes, civil societies, NGOs, opinion shapers (eg. media), and the private sector.

1.2 Research Objectives

The capacity for the private sector to adapt is independent of the public sector's ability to adapt (Revi *et al.*, 2014). Therefore, while the public sector, particularly in low- and middle-income countries, may lack the resources and capacity to adapt, the private sector is not necessarily afflicted by the same challenges. Nevertheless the public and private sectors are connected. Cities are brittle systems, where disturbance or failure in one infrastructural system can cause a ripple effect across other systems (Graham, 2009). For example, an electrical power outage will impact transportation systems as traffic signals and electric public transit systems are interrupted, which reduces the private sector's ability to serve their clients. Urban residents and businesses are often reliant on municipalities for essential infrastructure; however, if these essential infrastructures fail, a cascading disaster situation can develop.

Natural disasters are often the catalyst for infrastructural failures. For example, floods can wash out transportation infrastructure (Passifiume, 2013); heat waves can crash power networks by increasing demand for electricity (Nelson & Anan, 2016; NY1 News, 2016); high wind from tropical storms can topple trees onto electrical poles, which spark fires during a time of high demand for emergency services and impeded mobility (O'Rourke, 2016); and droughts can lower the water table, reducing the ability to provide tap water (Tang, 2015). In Thailand, for example, a flood crippled the country in 2011, while four years later a drought caused roads and buildings to subside and put over 10 million people in the Bangkok Metropolitan Region at risk of running out of tap water.

On the other hand, private sector development relies on, and affects the public realm. As a result, planning departments at various governmental levels regulate development to ensure it is in the best interest of the public, without unnecessarily constraining private interests. While the private sector relies on public infrastructures to conduct business and protect them from natural disasters, they can also act irrespective of public action to adapt to the risk of natural hazards. However, knowledge of the political and economic environment that promotes private sector adaptation, particularly in the housing sector, and their adaptation strategies are limited. This thesis explores these two key limitations in the literature. A case study was conducted in the Bangkok Metropolitan Region (BMR) of Thailand in 2015 to investigate inefficiencies in the government's ability to manage water influences the private sector, and examine specific strategies the private housing sector employs to adapt to flooding. While there are numerous private sector actors, this thesis focuses on private sector developers, particularly

within the housing industry, who are subject to formal building processes. Individual homebuilders that may or may not hold the title to the land they build on are, therefore, beyond the scope of this research.

1.3 Bangkok Metropolitan Region, Thailand

The Bangkok Metropolitan Region (BMR) is comprised of six provinces: Bangkok, Nonthaburi, Pathum Thani, Samut Prakan, Samut Sakhon, and Nakhon Pathom (Figure 1). The BMR contains 14.6 million residents (Table 1) (NSO, 2010), and an estimated three to four million informal residents (Yap & De Wandeler, 2010; NSO & UNICEF, 2006), The BMR is, therefore, a primate city that is 20 times larger Thailand’s second largest urban center (NSO, 2010).

Since the early 1990s, Thailand has experienced rapid economic growth, primarily in the manufacturing and tourism sectors (World Bank, 2012). As a result, people moved from low productivity agricultural areas to manufacturing and service areas (World Bank, 2012). The majority of manufacturing growth has occurred within the Chao Phraya floodplain (Poaponsakorn & Meethom, 2012; Lebel *et al.*, 2011). Located at the mouth of the Chao Phraya River, which drains a third of Thailand, the BMR is particularly vulnerable to riverine and coastal flooding. With an elevation between 1-2 metres above sea-level, the region is also susceptible to surface floods.

Figure 1: Bangkok Metropolitan Region

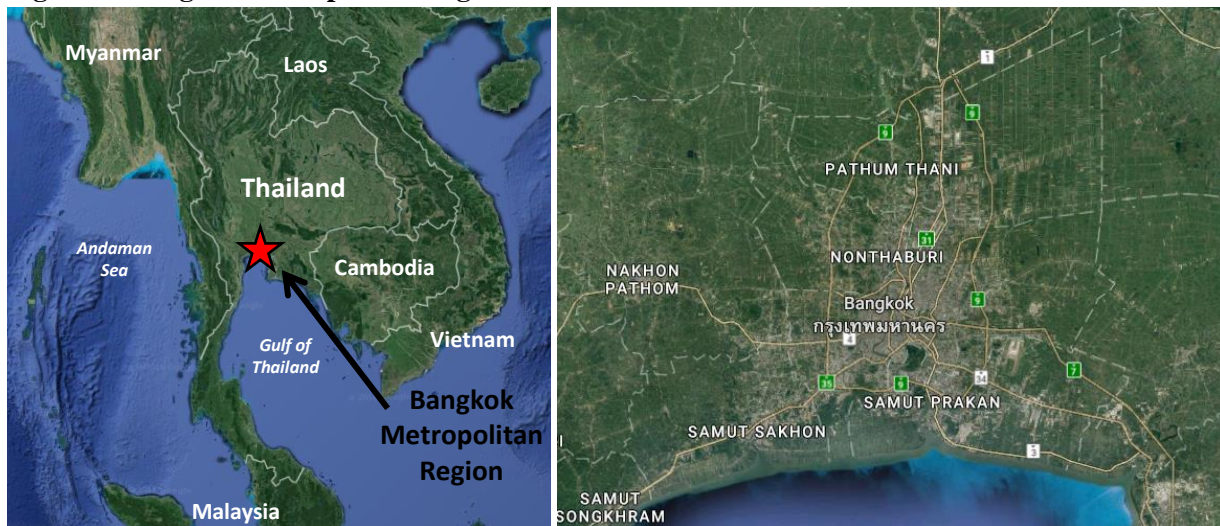


Table 1: Population of the Bangkok Metropolitan Region, 2010 census data (NSO, 2010).

Province	Population (million)	Proportion of the BMR
Bangkok	8.305	56.8%
Nonthaburi	1.334	9.1%
Pathum Thani	1.327	9.1%
Samut Prakan	1.829	12.5%
Samut Sakhon	0.887	6.1%
Nakhon Pathom	0.944	6.5%
Total	14.626	100.0%

1.4 Manuscript 1: Public Sector Incapacities Lead to Private Sector Adaptation in Thailand

This thesis is composed of two independent, but connected, manuscripts. The first investigates flood and drought management in Thailand. Informed by Lebel *et al.*'s (2011) institutional traps that hinder effective flood management, Manuscript 1 broadens the scope to flood management as a whole, and therefore includes not only floods (eg. the 2011 national flood and localized flooding in Bangkok), but droughts as well (eg. the 2015 national drought). Through interviews with public officials (n=23) and an analysis of articles in six local and national newspapers (n= 926), I find that Thailand remains affected by institutional traps, which has opened a window for other actors to participate in flood or drought management, specifically the private sector. However, public officials and the media emphasize that private sector involvement has been ad hoc, and has not necessarily benefited Thailand as a whole.

1.5 Manuscript 2: A Flood of Change in Bangkok's Housing Sector: A Case Study on Private Sector Adaptation

The second manuscript delves deeper into private sector flood management actions, specifically how the private housing sector is adapting to reduce flood risk. A case study of the Bangkok Metropolitan Region (BMR), a megacity of approximately 10.8 million people (NSO, 2010), is presented as a case study. With an average elevation between 1m to 2m above sea level, this lowland megacity is highly susceptible to floods. The flood risk is three-fold. First, floods in 2006 and 2011 illustrate the risk of overland upstream floods; secondly the low elevation makes the city prone to storm surges and sea level rise; and finally, rapid urbanization, the loss of greenspace and canals due to development, and an ineffective stormwater system frequently lead to surface flooding from intense localized precipitation events. The repeated flooding of Bangkok provides an opportunity to investigate private sector actions to protect residents and their property from floodwaters. Interviews with public officials (n=23) between June and July, 2015 inform the paper with the official stance on private housing sector adaptation, and its perceived impacts on flood management within the BMR. Public officials across the BMR acknowledge that the private housing sector is adapting to flood risk; however, public sector officials also contend that these actions are maladaptive to the city and adjacent residents.

1.6 Organization of Thesis

This thesis uses the manuscript option, where research is presented in two complete manuscripts that are ready to be submitted to academic journals. Each manuscript is intended to stand alone; however, collectively they explore the role of the private housing sector in adapting to climate

change and flooding in particular. Chapter 2 is composed of the first manuscript. In Chapter 3, I connect the first and second manuscripts. The second manuscript comprises Chapter 4 of this thesis. Finally, I summarize the key findings from both manuscript and propose avenues for future research in Chapter 5.

Section 2: Methodology

2.1 Mixed Methods Approach

The aim of this research is to explore the role of private adaptation, and its ability to reduce the risk of flooding in the housing sector, which was achieved through a mixed methods approach. A mixed method research design incorporates multiple avenues of investigation into a single study (Creswell, 2014). A mixed methods approach typically combines the strengths of qualitative and quantitative methods, in an attempt to “obtain an authentic representation of the problem through the eyes of participants” (Creswell, 2014, p. 107). This research uses qualitative methods in the form of interviews and quantitative methods to analyze interviews as well as local newspapers.

Interview participants were purposefully selected (Creswell, 2014) based on (1) employment in a department or agency involved in flood management and/or housing, (2) responsibility in at least one of the four provinces, and (3) position of leadership within their organization. Through local academic experts, review of government websites, and using the snowball technique (Charmaz, 2006), we identified 23 agencies and organizations that fit these criteria. Nine of these agencies participated in this study, resulting in 23 interviews, which were conducted between May – August, 2015. The location of responsibility for all respondents is evenly distributed: with two to four respondents having provincial responsibility from each province and 12 respondents with responsibilities across the BMR, or the Central Region of Thailand. Eighteen 30-60 minute interviews were conducted face-to-face; five email interviews were also conducted. At the discretion of the respondents, interviews were conducted in English or Thai with the aid of an interpreter.³ Interview scripts were initially prepared in Canada with questions based on literature. The script was then pre-tested in Bangkok with local researchers and minor adjustments were made to better accommodate Thai culture. The script remained unchanged throughout the fieldwork; however, some current events that emerged through the newspaper review were used to prompt or provide additional context to some questions.

Interviews were conducted in all provinces within the Bangkok Metropolitan Region where the Chao Phraya River transverse its territory, namely: Bangkok, Nonthaburi, Pathum Thani, and Samut Prakan.⁴ These four provinces house 88% of the region’s population (NSO, 2010). After interviews were conducted, data was anonymized, and transcribed, and analyzed with NVivo. Pre-determined codes, based on literature, were developed for potential private housing sector adaptation strategies as

³ Appendix 5 contains confidentiality statements for research assistants with access to confidential material.

⁴ Interviews were conducted with officials from the following agencies: the centralized government departments of the Department of Public Works Town and Country Planning (DTP) and the Department of Disaster Prevention and Mitigation (DDPM); the provincial departments of the Provincial Administration Organization (PAO), City Planning Department (CPD), Department of Environment (DoE), and Bangkok Fire and Rescue Department (BFRD); the municipal department of city planning; and the national housing organizations of the National Housing Authority (NHA) and Community Organization Development Institution (CODI).

well as some flood management codes; while other flood management codes emerged during the analysis process. Transcriptions were coded by myself to minimize variation in applying codes. Codes were then analyzed to determine common themes across interviews.

To supplement qualitative based interviews, a media review was conducted to provide quantitative, as well as additional qualitative, data. Media is widely recognised as influencing public and policymaker opinion (Ahchong & Dodds, 2012; Wanta, Golan, & Lee, 2004; Cook *et al.*, 1983; McCombs & Shaw, 1972), and provides information on current events. Newspapers were selected for two reasons: (1) Thailand has a high literacy rate of 93.5% (UNICEF, 2013), which allows for a wide readership, and (2) the Office of Non-Formal and Informal Education (ONIE) also has almost 30,000 newspaper reading centres to increase adult learning (ONIE, nd.). For these reasons, newspapers have the widest reaching audience in Thailand. Specific newspapers were purposefully selected to provide a representation of views based on (1) a city versus national focus, (2) English versus Thai language, (3) various audiences, and (4) widespread readership. Six newspapers were selected for review, including two English language newspapers which were reviewed from May 21 to August 7, 2015, and four Thai newspapers which were reviewed from June 7 to August 7, 2015.⁵

Articles were collected on natural disasters (n=723) and climate change (n=56), as well as housing specifically located within the BMR (n= 125), and other relevant topics (n=20). English newspapers were reviewed and coded for latent and manifest content, while Thai newspapers were reviewed and coded for manifest content by a Thai assistant. Latent content is tangible content (such as if an agency was mentioned or not) and manifest content is an underlying meaning (such as if an agency's action was portrayed positively or not). Newspaper codes were predetermined and based on climate change and natural disaster literature (see Houston *et al.*, 2012; Fu *et al.*, 2012; Ahchong & Dodds, 2012; Lebel *et al.*, 2011). The initial coding was completed by two individuals, each responsible for either English or Thai newspapers. The more intensive English newspaper review was further checked by four research assistants to ensure a consistent application of codes. Data was coded and analyzed in Microsoft Excel to determine frequency and significant differences through chi-square tests. However, chi-square test resulted in minimal beneficial results. It is also important to note that media carries an inherent bias, since its primary objective is to report current events for the purpose of selling papers; therefore, results from the media analysis must be critically reviewed.

2.2 Public versus Private Sector Respondents

This research sought to understand the public sector's views and opinions on the state of public flood management, and the actions of the private housing sector, with respect to flooding and climate

⁵ Newspapers reviewed included: Bangkok Post (English, Bangkok focus), The Nation (English, national focus), Post Today (Thai, Bangkok focus), Kom Chand Luek (Thai, national focus), Thai Rath (Thai, national focus), and Matichon (Thai, national focus).

change. Public officials, due to their various positions within the government, are able to provide an insider's perspective on public sector flood management. Many respondents have direct involvement in managing water, either at the local or national level, and are able to provide insight on the institutional traps that hinder effective management of water resources.

Many respondents are also responsible to regulate private sector actions. Therefore, these public officials are able to provide an official view of private sector adaptation. Their intimate knowledge about how the public sector effectively, or ineffectively, manages private sector development provides insight on the strengths and weaknesses of current regulatory systems. Therefore, public sector officials provide a unique perspective on flood management, and the private housing sector's involvement in flood risk reduction.

2.3 Reliability and Validity

Credible studies are required to be reliable and valid. The concept of reliability differs between qualitative research (eg. interviews) and quantitative research (eg. media review). In qualitative research reliability is provided through consistent interviews and data analysis. Interviews are a fundamental qualitative research tool that is used broadly, as well as specifically in Thailand in regards to flood management (Berquist *et al.*, 2015; Lebel *et al.*, 2011). Each interview followed the same set of open-ended questions (Appendix 3) and was audio recorded. For interviews in Thai, transcriptions were based on the original spoke Thai, which allowed for a more reliable translation. Finally, interview data was coded by one individual to provide consistency among transcripts.

Qualitative validity includes the trustworthiness, authenticity, and credibility of the researcher, research methods, and interviewees (Creswell, 2014). I interviewed people in positions of authority who were knowledgeable about the situation of their respective organizations. Furthermore, triangulation was used to validate their comments. Triangulation is where information is compared against other information that has been deemed valid, which for this research includes government documents and newspaper reporting, as well as other interviewees' responses both within and between organizations. Finally, full quotations were used wherever possible in order to capture the original intent of the interviewee. Utilizing interviewees' direct words also reduces issues of personal bias.

For quantitative research validity refers the aspect under study can accurately answer what the research wants to know (Creswell, 2014). The newspaper code sheet used in this study was developed through pre-determined codes, following Houston, Pfefferbaun, & Rosenholtz (2012), Fu *et al.* (2012), and Ahchong & Dodds (2012) models, and modified to accommodate articles relating to housing.

For quantitative research, reliability refers to measurement consistency (Creswell, 2014). For this research, it means that each newspaper coder would code the same news article the same way. To

ensure a consistent understanding and application of codes between the English and Thai newspaper reviewers, codes were discussed in detail between myself and a Thai research assistant who reviewed newspapers in Thai. The in-depth English newspaper review was further verified through the use of four research assistants to check the codes. Each code assistant made minor adjustments and initial changes were checked by the individual who originally coded the news articles to ensure appropriateness of the change. The process resulted in an inter-coder percent agreement of 97.2% for manifest content and 96.6% for latent content, both within Landis & Koch (1977) standard for agreement and is therefore considered reliable.

2.4 Limitation and Bias

It is important to note that qualitative and quantitative research have several limitations (Punch, 1998). Qualitative research, and interviews in particular, can be biased by the respondents as well as the researcher (Creswell, 2014). The respondent's personal opinions may influence their responses and therefore may not accurately reflect the situation. Furthermore, the researcher's positionality may influence how participants respond to questions as well as the research interpretation of those responses (Sultana, 2007). The fact that I am a Caucasian from Canada with the support of a university may have influenced my access to officials I contacted for an interview and the information they were willing to share. Based on conversations with local researchers, my position likely increased access to government officials but was unlikely to influence the information they provided.

While this may be heightened in cross-cultural studies, every effort was made to place the respondent at ease, including conducting interviews in a location and language of their choosing.

Quantitative research bias is generally classified into two types: systematic and random. Systematic bias is when each point is inaccurate. For example, in a media review systematic bias can result from which newspapers were selected for review and reviewers with a different understanding of codes. This type of bias was reduced by selecting a range of newspapers and through discussions about codes with my research assistants. However, this research is biased towards English newspapers which were reviewed in more detail. Random bias is error that is accidental, such as marking the wrong code. This was reduced by only analyzing manifest content in Thai newspapers and employing code checkers for the more in-depth analysis of English newspapers.

An important bias in this research is that respondents were sought from the public sector to understand their level of awareness of private sector adaptations. The thoughts and opinions of private sector stakeholders are not represented here and, therefore, I make no claim that the strategies or motivations discussed are exhaustive or represent private stakeholders' opinion, but are restricted to those that public sector respondents are knowledgeable of.

Section 3: Institutional Traps Lead to Private Sector Flood and Drought Adaptation in Thailand

3.1 Introduction

In 2011, Thailand experienced the worst flood in decades, with impacts felt around the world as supply chains, particularly automotive and rice production, were disrupted by floodwaters (Aon Bonfield, 2012; Philips, 2011). In the aftermath of the 2011 flood, the public outcry for a revision of flood management strategies prompted the Thai government to allocate USD \$3.85 billion in assistance, restoration, and compensation as well as the creation of a Flood Management Master Plan (Poaponsakom & Meethom, 2012).

Four years later, Bangkok remains vulnerable to floods. In 2015, Bangkok experienced repeated surface floods due to heavy localized precipitation. The first event on March 25 stimulated the governor of the Bangkok Metropolitan Administration (BMA), Sukhumbhand Paribatra, to explain the situation, saying, “the downpour was unusually strong, falling at up to 60-70mm/hour” and “the city was holding water in the adjacent Saen Saep canal to cope with the dry season” (Fernquest, 2015). While the precipitation event was approximately 10% of Bangkok’s annual rainfall, the governor concluded by stating, “Hard-hit areas—such as a basement-level supermarket...are private property and not the BMA’s responsibility” (Fernquest, 2015) and people should “move to the mountains if [they] don’t want to get flooded” (Coconut Bangkok, 2015).

Three months later, Bangkok experienced repeated heavy rains in the middle of June that resulted in localized floods and caused public outcry as “frustrated communities and motorists sat there wondering what on earth the BMA had done to prepare for downpours” (Saridet, 2015). Angry at the Governor’s inability to fulfill his 2010 election campaign vow to fix the capital’s flood problem in just five years (Saridet, 2015; Sasithorn, 2015a), many beseeched the Prime Minister to replace the Governor with “someone more competent in flood prevention” (Tanatpong, 2015).

While streets in Bangkok flowed with water during the summer of 2015, rivers and canals were running dry in northern Thailand as the El Nino strengthened, bringing drought conditions to the region. As a result, a government spokesman stated, “It is expected that the drought this year may be worse than last year so we ask all parties not to be complacent and for our farmer brothers to delay planting their crops” (Lefevre, 2015). However, some criticised the government for the mismanagement of water resources, which they claim is the actual cause of the drought (Atiya, 2015; Witatayotin, 2015).

While Thailand has repeatedly faced water-related disasters, from the 2011 flood to recent surface floods in Bangkok and widespread drought in 2015, the government continues to struggle with effective flood and drought management. In defining effective flood and drought management, we take

a utilitarian approach where the impacts of floods and droughts are minimized for the most number of people. Lebel *et al.* (2011) proposed five institutional traps that hinder Thailand's ability to effectively management floods. This paper builds on their argument by providing recent examples from the 2011 and 2015 floods, as well as expanding the argument by applying institutional traps to droughts. We argue that while some progress has been achieved, Lebel *et al.*'s (2011) institutional traps remain major obstacles for flood and drought management in Thailand. As a result, other stakeholders, including the military, royalty, and the private sector, are becoming active in Thailand's flood and drought management. While a multi-stakeholder approach is widely considered as a beneficial characteristic in environmental management, the incapacity of public departments to effectively manage water resources has created an arena that fosters private sector adaptation, which has mixed outcomes for Thailand.

3.2 History of Flood and Drought Management

Water related disasters are not new in Thailand. Seasonal monsoon rains produce annual floods throughout the country. These seasonal floods are vital for rice production, Thailand's largest export good and a significant contributor to the national gross domestic product. The rapid rate of urbanization and industrialization (Poaponsakorn & Meethom, 2012; Lebel *et al.*, 2011) has increased the risk of floods in Bangkok, where canals and permeable areas are built over (Marome, 2012; Poaponsakorn & Meethom, 2012; Kenworthy, 1995).

At the same time, the risk of drought has increased. In rural areas, the standardizing of rice varieties has reduced farmers' ability to select more drought-resistant varieties (Lebel *et al.*, 2011). The increase in industrial development in flood prone areas has also elevated the risk of floods; as well as droughts by increasing the demand for water. Finally hydro-electric dams, which can mitigate both flood and drought conditions, can increase the risk of floods and droughts if mismanaged (Poaponsakorn & Meethom, 2012). While floods and droughts are often considered independently, frequently both will occur within a short timeframe or co-currently in Thailand.

While Thailand experienced floods and droughts in the past, the level of risk is expected to increase with climate change. The Intergovernmental Panel on Climate Change (IPCC) projects a shift in precipitation towards less frequent but more intense storms, sea level rise, and an increase in the number of hot days (IPCC, 2014), particularly in Southeast Asia, and Thailand in particular (Hijioka *et al.*, 2014; Kreft, and Eckstein, 2014; Maplecroft, 2012). Thailand has already experienced an increase in temperature, sea level, and intense precipitation events—a shift that is expected to continue (Marks, 2011).

Traditionally, climate change and flood adaptation have been a top-down enterprise where higher levels of government “provide the legislative, financial, and institutional basis within which

urban authorities, the private sector, civil society, and other stakeholders act to adapt to climate change” (Dodman *et al.*, 2009, p. 161). Nevertheless, there is an understanding that successful adaptation requires multiple actors, including federal, regional, and municipal governments, non-governmental organizations (NGO), citizen groups, and the private sector (Revi *et al.*, 2014; Leck and Simon, 2013; World Bank, 2010a, 2010b; Dodman *et al.*, 2009; Satterthwaite *et al.*, 2007). While various actors are recognised to contribute to adaptation, their involvement is highly polarized. Carmin *et al.* (2012) measured the degree to which each actor is involved in adaptation by surveying 468 cities globally about funding to facilitate adaptation, and found that only 40% of cities received any external funding. Of those, a quarter received assistance from national governments. The cities that received national funds tend to be large cities that dominate the national economy—cities such as Bangkok, Thailand. Only 8% of cities reported receiving support from private foundations or non-government organizations. While the private sector only makes up a small portion of the municipal adaptation fund, it has vast potential to adapt its own properties (Revi *et al.*, 2014; Castán Broto and Belkeley, 2013; IPCC, 2012; O’Brien *et al.*, 2008; Prabhakar *et al.*, 2009). Nevertheless, flood and drought management in Thailand continues to be perceived, almost exclusively, as a public sector responsibility—regardless if other actors, such as the private sector and royalty, are actively engaged as well.

Thailand has numerous agencies tasked with the management of water resources. Table 2 lists the key agencies that are engaged in flood and drought management in Thailand, and the respective responsibilities. Many have overlapping responsibilities. For example, the Department of Public Works and Town and County Planning (DTP) and Provincial Planning Departments (PPDs) are both tasked to create land use plans; however, the DTP is a centralized agency while PPDs are provincial. The Royal Irrigation Department (RID) and the Electric Generation Authority of Thailand (EGAT) are both responsible to manage water level in major dams.

There are also conflicting or competing interests between various agencies. For example, the RID manages dam water levels to ensure a sufficient water supply to provide irrigation throughout the dry season, while EGAT manages water levels to generate hydro-electric power. The RID is primarily responsible for rural flood and drought management and the provision of water for irrigation, while Bangkok’s Department of Drainage and Sewerage (DDS) is tasked with urban flood management and the efficient conveyance of water out of the city.

Regardless of how many agencies are tasked with flood and drought management, or how capable they are to fulfill their mandate, extreme weather events can overload their ability to cope with the overabundance or lack of water. Extreme weather events can represent threshold events where current practices fail to protect society, and lead to the re-evaluating, revising, and changing plans and

Table 2: Key Flood and Drought Management Agencies in Thailand

Agency	Scope	Description of Responsibilities	Source
Office of National Water and Flood Management Policies	National	<ul style="list-style-type: none"> To develop flood and drought management policies 	Maier-Knapp, 2015
Ministry of Natural Resources and the Environment	National	<ul style="list-style-type: none"> To develop flood and drought management plans To provide early warning for water-related disasters 	Maier-Knapp, 2015; Care, 2013
National Water Resources and Flood Policy Committee	National	<ul style="list-style-type: none"> To develop flood and drought management policies 	Maier-Knapp, 2015
Royal Irrigation Department (RID)	National (excluding Bangkok)	<ul style="list-style-type: none"> To manage rivers and canals and their buffer To manage floodgates and small-scale dams, including discharge rates from the nation's major dams To manage the provision of irrigation to agricultural areas To manage artificial rainmaking operations To manage nature buffers 	Marks & Lebel, 2016; Saito, 2014; Care, 2013; Clark & Semmahasak, 2013
Department of Drainage Systems (DDS)	Bangkok	<ul style="list-style-type: none"> To manage flooding and drainage infrastructure improvements. To maintain the urban stormwater management systems, including canals, tunnels, pipes, and pumping stations To effectively convey stormwater out of the city 	Saito, 2014
Department of Public Works and Town and Country Planning (DTP)	Provincial (centralized agency)	<ul style="list-style-type: none"> To creates land use plans, in provinces with weaker provincial planning departments To advises on and approves land use plans, in provinces with stronger provincial planning departments 	Saito, 2014; Care, 2013
Provincial Planning Department (PPD)	Provincial	<ul style="list-style-type: none"> To create land use plans, in provinces with stronger PPDs To advise on the creation of, as well as administer, land use plans created by the DTP, in provinces with weak PPDs 	Saito, 2014
City Planning Department (CPD)	Municipal/District	<ul style="list-style-type: none"> To create land use plans (Bangkok CPD only) To implement land use plan 	Saito, 2014
Thai Meteorology Department (TMD)	National	<ul style="list-style-type: none"> To provides weather forecasts and public weather alerts To provide early warning for extreme weather events 	Maier-Knapp, 2015; Saito, 2014; Care, 2013
Department of Disaster Prevention and Mitigation (DDPM)	National	<ul style="list-style-type: none"> To raise awareness about disaster prevention to create public readiness, in both the public and private spheres To integrate and develop disaster management plans that engages various other departments and agencies To manages the flow of information to the public To set standards for emergency search and rescue efforts 	Maier-Knapp, 2015; Saito, 2014; Care, 2013

Agency	Scope	Description of Responsibilities	Source
National Disaster Warning Center (NDWC)	National	<ul style="list-style-type: none"> • To provide early warning on a wide range of natural disasters 	Maier-Knapp, 2015;
Bangkok Fire and Rescue Department (BFRD)	Bangkok	<ul style="list-style-type: none"> • To plan and respond to emergencies 	Saito, 2014
Electric Generation Authority of Thailand (EGAT)	National Dams	<ul style="list-style-type: none"> • To manage dam water levels to ensure electric generation 	Maier-Knapp, 2015;
Municipal Waterworks Authorities (MWA)	Municipal/District	<ul style="list-style-type: none"> • To provide tap water • To monitor saltwater intrusion in the Chao Phraya River (Bangkok Waterworks Authority) • To manage groundwater extraction 	Saito, 2014; Care, 2013

policies (Birkmann *et al.*, 2010; Pelling *et al.*, 2008; Schneider *et al.*, 2007; IRP, 2007; Polterovich, 2007; UNISDR, 2007; UN, 2005; Birkland, 2001).

As tragic as disasters are, they can provide a “window of opportunity” for change (Birkmann *et al.*, 2010; Kingdon, 1995). Kingdon (1995) argues that critical times foster distinct avenues of problems, policies, and politics that merge to create an advantageous political environment to address urban issues. Birkland (2001) highlights that individual, rapid onset large disasters (such as cyclones and floods) act to direct attention towards change where a clear discourse can be narrated by influential policy actors. In the wake of the 2004 Indian Ocean Tsunami, Birkmann *et al.* (2010) argued that natural disasters can stimulate such a political environment—a claim supported by the increased DDPM budget following the Tsunami.

In a country like Thailand that has continued to experience water-related disasters, change should, in theory, be efficiently incorporated into the policy and planning process. However, disasters do not guarantee change and, therefore, history can repeat itself. For example, coordination among disaster management agencies has been criticized for decades, with little hope for change in the future (Maier-Knap, 2015; Huaisai *et al.*, 2006; Shook, 1997). Beginning with Polterovich (2001), institutional traps have been identified to resist change.

3.3 Institutional Traps

Institutional traps are states that maintain or reinforce a “stable but yet inefficient equilibrium in a system where agents choose a norm of behaviour (an institution) among several options” (Polterovich, 2007, p. 1). Lebel *et al.* (2011) illustrates that institutional traps hinder effective flood management in Thailand, particularly fragmentation, rigidity, scale, elite capture, and crisis management.

Fragmentation, rigidity, and elite capture have been further addressed within the literature. Reynolds (2012, p. 2) characterized the fragmented government network of agencies as “an entangled mass of interlocking relationships, alliance, and struggles between and among many centres of power

often in competition with one another.” This uncoordinated inter-agency web is always present within disaster risk management departments (Maier-Knapp, 2015; Foran *et al.*, 2012; Lebel *et al.*, 2011; Huaisai *et al.*, 2006; Shook, 1997). Marks & Lebel (2016) go further and characterize agencies as “small kingdoms” that vie for power, and are therefore actively defensive rather than simply neglectful. For example, during the 2011 flood, provincial and district authorities were preoccupied with protecting their own constituents, which led to limited coordination and left some evacuation centres with plenty of supplies while centres in an adjacent area lacked food (Maier- Knapp, 2015). Fragmentation can also impede new initiatives to address disaster management. The newly created Department for Disaster Prevention and Mitigation (DDPM), for example, has been curtailed by other established agencies that are unwilling to relinquish responsibilities that had traditionally been theirs (Maier-Knapp, 2015).

The mentality towards the newly formed DDPM is also characteristic of the rigidity trap where agencies believe they know how to handle situations and, therefore, new approaches are unnecessary. Agencies are also averse to surprises and are therefore resistant to trying new approaches (Clark & Semmahasak, 2013; Allen & Gunderson, 2011). Blake (2015) notes that the Royal Irrigation Department (RID) frequently exploits its symbolic connection to royalty to elicit support for projects while silencing opposition or criticism. By invoking a royal connection he concludes that there is “little incentive for the hydraulic bureaucracies or elites to alter the status quo” (2015, p. 660).

Lebel *et al.* (2011) argue that elites strive to maintain a status quo that serves their own interests and hinders positive change in flood management. Maier-Knapp (2015, p. 59) further argues that “political interests of the political and business elite are the most important and constant factor informing decision-making.” Therefore, elites can influence policies in a manner that is self-serving, regardless of the impact their decisions have on others (Kritsanaplan & Sajor, 2011; Lebel *et al.*, 2011). Another form of elite capture is corruption, where those in positions of authority abuse their power, such as changing land use plans and zoning laws to serve personal interests (Meethom *et al.* 2014). Corruptive practices of government officials have led the King to repeatedly criticise the government as “greedy” or “selfish” (Handley, 2006; Blake, 2012).

Berquist *et al.* (2015) applied Lebel *et al.*'s (2011) institutional traps framework to informal settlements in Bangkok. Berquist *et al.* argued that informal settlements are overcoming rigid institutions and private interests through multi-stakeholder networks and integrating scientific knowledge, which is reducing the risk of flooding through spontaneous adaptation. They also proposed a sixth institutional trap: overlapping bureaucracies. However, an institutional network that is fragmented will have limited inter-agency communication, which can lead to overlapping responsibilities and acts. Therefore, overlapping bureaucracies should be a subset of the fragmentation trap.

Lebel *et al.*'s (2011) institutional traps of scale and crisis management have been largely neglected in the literature. Scale has been addressed narrowly within the Bangkok Metropolitan Region (BMR) as the BMA disregards how its actions will affect areas beyond their jurisdiction, and vice versa. During the 2011 flood, for example, the BMA implemented strategies that were detrimental to neighbouring provinces because they unnecessarily refused to lower their floodgates to help release water from upstream provinces (Kamoljev, 2014). On the other hand, while the BMA designated a water catchment area to be left undeveloped, the government of Nonthaburi allowed extensive development on adjacent lands, which greatly reduced the effectiveness of the catchment area (Marks, 2015).

Research on Thailand's focus on crisis management has been minimal. In regards to adapting to climate change, Saito (2014) found that climate change issues have not been effectively incorporated into any government plans or policies. Therefore, adaptation continues to be reactive and with limited planned direction.

Issues of scale and crisis management, however, are vital to flood and drought management. Without recognizing the inter-related aspects of flood and drought management, effective disaster management is impossible. For example, land use upstream affects communities downstream. As our research will demonstrate, the reverse can also be true—that downstream land uses (eg. the formation of a megacity such as Bangkok) can affect upstream communities (eg. by prohibiting irrigation to satisfy urban demand). Furthermore, by perpetually managing crises as they arise, effective preparation and disaster risk reduction strategies are underutilized and fail to address the root causes of vulnerability. Finally, institutional traps in Thailand have been solely applied to flood management: therefore there is a need to review other water-related issues, such as droughts, through the lens of institutional traps.

Research has also focused on public sector actions to manage water resources and how these traps affect public sector actions. We, on the other hand, use Lebel *et al.*'s (2011) institutional traps to evaluate how public sector traps affect the broader community. We argue that institutional traps within public flood and drought management have led to mismanagement and mistrust in the government's ability to manage water, and have fostered broader engagement in flood and drought management, specifically in regards to the military, royalty, and the private sector. However, diversification of stakeholders in flood and drought management has had mixed outcomes for Thailand.

3.4 Methods

As Thailand continues to experience water-related disasters, Lebel *et al.*'s (2011) institutional traps appear to remain firmly entrenched. This paper seeks to provide recent examples of these traps

from the 2011 flood, the 2015 surface floods in Bangkok, and the widespread drought in 2015. We conducted interviews with officials from federal, provincial, and municipal departments and two housing authorities in the Bangkok Metropolitan Region, focusing on the four provinces that abut the Chao Phraya River. Over 40 departments were initially identified to be engaged in flood and drought management, climate change, and housing through consultation with local academics, document review, web search, and snowball sampling technique. From these, respondents were purposefully selected (Creswell, 2014) based on (1) employment in a department or agency involved in flood management and/or housing, (2) responsibility in at least one of the four provinces, and (3) position of leadership within their organization. Nine different agencies responded to this study, which resulted in 23 interviews. Semi-structured interviews were conducted between May and June, 2015.⁶ The area of responsibility was evenly distributed, with two to four responded from each of the four provinces and 12 respondents with regional perspectives. Eighteen 30-60 minute interviews were conducted in-person and five email interviews were conducted. The language these interviews were conducted in was determined by the respondent, which was either in English, or Thai with the aid of an interpreter. After interviews were conducted, we transcribed, coded, and used NVivo to identify reoccurring themes.

To supplement interview responses, a media review was conducted. Media is widely recognised as influencing public and policymaker opinion (Ahchong and Dodds, 2012; Wanta, Golan, & Lee, 2004; Cook *et al.*, 1983; McCombs & Shaw, 1972), and provides information on current events. Since Thailand has a high literacy rate of 93.5% (UNICEF, 2013) and the Office of Non-Formal and Informal Education (ONIE) has almost 30,000 newspaper reading centres to increase adult learning (ONIE, nd.), newspapers were selected for review. Specific newspapers were chosen to provide a representative sample of newspapers with different geographic focus (Bangkok/Thailand), language (Thai/English), and intended audience, as well as widespread readership. This resulted in two newspapers in English (reviewed from May 20—August 7, 2015) and four newspapers in Thai (reviewed from June 7 to August 7, 2015).⁷ Articles were collected on natural disasters (n=723), climate change (n=56), housing (n= 125), and other relevant topics (n=20). English newspapers were reviewed and coded for latent and manifest content, while Thai newspapers were reviewed and coded for manifest content by a Thai assistant. Data were coded and analyzed in Microsoft Excel.

⁶ Interviews were conducted with officials from the following agencies: the centralized government departments of the Department of Public Works Town and Country Planning (DTP) and the Department of Disaster Prevention and Mitigation (DDPM); the provincial departments of the Provincial Administration Organization (PAO), City Planning Department (CPD), Department of Environment (DoE), and Bangkok Fire and Rescue Department (BFRD); the municipal department of city planning; and the national housing organizations of the National Housing Authority (NHA) and Community Organization Development Institution (CODI).

⁷ Newspapers reviewed included: Bangkok Post (English, Bangkok focus), The Nation (English, national focus), Post Today (Thai, Bangkok focus), Kom Chand Luek (Thai, national focus), Thai Rath (Thai, national focus), and Matichon (Thai, national focus).

3.5 Results

Flood and drought management were major topics in Thailand in 2015. A total of 454 articles were associated with water-related articles in Thailand (WRAT), including 198 from English newspapers and 255 from Thai newspapers. Water-related reports which were based in Thailand made the front page 20% of the time in newspapers in English, while for newspapers in Thai the presence of front page reports rises to 43%; with the Kom Chad Luek newspaper placing the highest value on front page reporting at 51% of the days, while water-related reports made the front page of the Bangkok Post only 18% of the time. Within these reports, and confirmed and expanded by interview respondents, the prominence and impact of institutional traps emerged. Table 3 illustrate key examples of institutional traps from the literature and the results of the interviews, while Appendix 6 provides the key results from the newspaper review.

3.5.1 The Presence of Institutional Traps

Fragmentation Trap

The fragmentation trap is based on “assumptions of contest and absence of shared interest” that create a closed environment and limit meaningful participation with other groups (Lebel *et al.*, 2011, p. 47), and remains an obstacle to effective flood management in Thailand (Berquist *et al.*, 2015; Maier-Knap, 2015). Fragmentation can only exist in the presence of multiple organizations (Berquist *et al.*, 2015; Lebel *et al.*, 2011). One respondent commented, “We have too many [agencies], too many” (Respondent #8). Newspapers in Thailand identified over 40 government organizations that are engaged in flood and/or drought management. While two-thirds of water-related articles in Thailand reported on two or more agencies, each agency was reported on separately rather than reporting on the interactions between agencies. Reported interactions between agencies were rare, and limited to the delegation of action from centralized agencies (Saritdet, 2015; The Nation, 2015c) or conflict (Patsara, 2015; Saritdet, 2015). Much more common is the situation highlighted by one respondent who stated, “There is no unity in water management, it concerns many agencies” (Respondent #4).

Instead of working together, agencies compete against each other. As one respondent mentioned in regards to a new ministry that was being formulated, the Ministry of Water Resources:

[Government ministries and departments] push for new initiatives, the big budgets...[but] today we still don't see that structure of administration because they are still fighting against each other, [about] who should be under the new department. Even in our department, it was discussed. (Respondent #6)

Lebel *et al.* (2011) note that without open lines of communication between organizations trust, respect, cooperation, and a myriad of other beneficial inter-agency characteristics cannot develop to create an effective, integrated flood management plan.

Table 3: Institutional Traps. Evidence of Thailand’s Ensnarement (adapted from Lebel *et al.*, 2011, p. 48)

Trap	General Description	Evidence from the literature	Evidence from our research
Fragmentation	Separatism and competition leads to limited interaction between agencies, reduced institutional capacity, and gaps in service provision.	<ul style="list-style-type: none"> The former director of the Thai Meteorological Department claimed the RID, EGAT, and the Thai Meteorological Department failed to submit appropriate retention and release figures (Maier-Knapp, 2015); Line agencies are resistant to having their areas of responsibility or resources infringed upon by the DDPM (Lebel <i>et al.</i>, 2011). 	<ul style="list-style-type: none"> “There is no unity in water management, it concerns many agencies” (Respondent #4); “There’s a canal that drains water into the Chao Phraya river, but [the BMA] shut the canal” to protect themselves (Respondent #3); Media report on department actions independently from each other, if within a single article.
Rigidity	Strict adherence to a modus operandi and aversion to risk that limited flexibility and institutional learning	<ul style="list-style-type: none"> The RID invokes its symbolic royal connection in order to maintain the status quo of project criticism (Blake, 2015); Agencies tend to disregard how their work may impact other agencies (Huaisai <i>et al.</i>, 2006). 	<ul style="list-style-type: none"> Flood and drought management continues to focus on structural measures (Supoj, 2015a; The Nation, 2015g), an approach recognized by 14 respondents; A rigid view of departmental rolls led to mistrust between departments (Patsara, 2015).
Elite Capture	Elites use their power to direct limited resources that serve interests	<ul style="list-style-type: none"> National resources are concentrated towards protecting Bangkok (Maier-Knapp, 2015); Politicians change land use plans and zoning laws to serve personal interests (Meethom <i>et al.</i>, 2014). 	<ul style="list-style-type: none"> Prioritize the residents of Bangkok over rural residents (Sasithorn, 2015b; Respondent #6); “The first group of people made to sacrifice so there is enough water for city dwellers such as Bangkok residents ... are the farmers” (Bangkok Post, 2015g); Informal settlements are used as scapegoats for urban flooding (Holloway, 2015; Respondent #4, 7).
Scale	Responsibility is strictly limited to a single level or geographic area	<ul style="list-style-type: none"> The BMA implemented strategies during the 2011 flood that were inconsiderate of neighbouring provinces (Kamojvey, 2014); While the BMA designated a water catchment area, the government of Nonthaburi to the north allowed extensive development which greatly reduced the effectiveness of the catchment area (Marks, 2015). 	<ul style="list-style-type: none"> A highly hierarchical government structure and limit local governments ability to adapt (Supoj, 2015a; Respondent #12, 23).
Crisis Management	A focus on reacting to current disasters, to the determine to proactive long-term planning	<ul style="list-style-type: none"> Post 2004 Tsunami focus of prevent and preparedness was short lived (Lebel <i>et al.</i>, 2011) Disasters are used for political gain (Lebel <i>et al.</i>, 2011) Focus on relief and repair strategies has cause longer-term initiatives to be neglected (Lebel <i>et al.</i>, 2009) 	<ul style="list-style-type: none"> Policy-makers are present focused (Respondent #6); Media focuses on current events, with 67% of natural disaster reports occurring within a week of rapid on-set events; Only 10% of media reports on water-related disasters mentioned recovery or adaptation initiatives.

Competition can also lead to territorialism where agencies become defensive of their area of activity or influence. Defence of a geographic area was widespread during the 2011 flood as areas attempted to protect themselves from advancing floodwaters. “Everyone was afraid so they block their areas, so there was a buildup of water,” one respondent lamented (Respondent #8). In Nonthaburi, for example, “There’s a canal that drains water into the Chao Phraya river, but [the BMA] shut the canal” saving themselves from flooding, while condemning their neighbours to endure the higher flood waters for a longer period of time (Respondent #3).

A political territorial dispute surfaced in during the June 2015 surface floods in Bangkok between the Bangkok Metropolitan Administration (BMA) and the central government. After successive surface floods, the Prime Minister stepped in and ordered the military to help prepare for and drain any future floods (Saritdet, 2015). While military support is not uncommon during disaster events, for a localized flood to require military assistance is unusual. One report stated, “Future floods might decide who is better at reacting—the military or the BMA. The Democrats are no doubt hoping the soldiers do not outdo officials and workers under [the Governor’s] command when the full-on rainy season arrives” (Saritdet, 2015). Rather than working together, the military and the BMA’s efforts to extend or protect their agency’s responsibility, hinders any meaningful collaboration between the two institutions to reduce flood risk for residents.

There are however, some positive interactions between actors. For example, the King dispatched some of his personal rainmaking aircrafts to help the RID’s effort to artificially generate rainfall (Bangkok Post, 2015c). However, government agencies remain fragmented, which continues to plague Thailand and prolongs any attempt at effective flood and drought management.

Rigidity Trap

The rigidity trap is characterized by inflexible practices or assumptions. Lebel *et al.* (2011, p. 50) state, “Floods are assumed to be bad; even modest perturbations for which learning could occur are excluded” because institutions believe they already know what should be done.

Flood management has traditionally occurred through structural measures in Thailand. Since the 2011 flood, the National Water Resources Committee developed a Water Management Strategies for 2014-2026, which include 12 strategies to address flood management, 11 of these are structural strategies (The Nation, 2015e). Another three-year flood management and flood control plan seeks to improve 75km of waterways and raise 13 embankments to prevent floods (The Nation, 2015e). After the repeated surface floods in Bangkok in 2015, Governor Sukhumbhand attempted to re-instill faith in his administration by highlighting current and planned drainage infrastructure (The Nation, 2015e) and proclaimed that “[we] will seek a budget

of 22 billion baht⁸ from the government to build dams along canals across the city and more giant tunnels to drain floods” (Supoj, 2015a). While we recognize that structural measures are a vital part of flood prevention, Thailand’s rigid approach to focus almost solely on structural measures to reduce flood risk creates an impossible task, since nature cannot be completely controlled.

On the other hand, during the 2015 drought the government was engaged in developing numerous non-structural measures, including compensation, debt-relief, and water conservation practices. There were over twice as many references to non-structural measures than structural in the media (92 to 42 respectively). Unfortunately, their presence in the media was due to their controversial implementation which many deemed ineffective or insufficient (Bangkok Post, 2015k; The Nation, 2015d). Conversely, structural measures, such as well digging, cloud seeding, and expanding irrigation systems, were more broadly reported and generally supported (Tanatpong, 2015; The Nation, 2015d; Wasaman, 2015). Therefore, Thailand continues to focus on structural measures.

It could be argued, however, that learning had occurred after the 2011 flood, particularly in dam management. The 2011 flood was linked to the high water levels in dams, which was used to provide irrigation during the dry season and support power generation (Poaponsakom & Meethom, 2013). Responding to that experience, the government reduced water levels to ensure adequate capacity to retain monsoon rains by releasing the most water in 15 years (Bangkok Post, 2015b). However, fear rather than learning has driven this shift, and led many to consider it an overreaction that led to the 2015 drought. One report noted that the Strategic Committee for Water Resource Management was afraid of a “repeat of the disastrous 2011 flood” and “[ordered] the release of too much water from reservoirs” (Aprinya, 2015). The chief of the Royal Irrigation Department, which is responsible for dam management, stated that the release of 14 billion cubic metres led to the 2015 drought (Bangkok Post, 2015b). Therefore, dam management has not necessarily effectively learned from the 2011 flood.

Rigidity is present in policymaking as well. For example, the National Reform Committee (NRC) was working on a water management bill that merged a bill from the Department of Water Resources (DWR) and members of the public (Patsara, 2015). However, the chairman of the NRC stated that he “did not trust the cabinet to review the NRC bill sensibly,” because “some state organizations were refusing to change the way they handled water management and these groups were likely to influence the cabinet’s decision” (Patsara, 2015). The report goes on to state, “while the NRC was deliberating this merged draft a different bill, tabled by the DWR, was hurriedly proposed and passed by the cabinet” (Patsara, 2015). The political maneuvering by the DWR and the cabinet to undermine the NRC’s joint bill illustrates competition between agencies, as well as limited public

⁸ Approx. 620 million USD.

participation, which Lebel *et al.* (2011) and Berquist *et al.* (2015) argue is a vital component to escape intuitional traps.

Therefore, Thailand remains set in its ways. While some learning has occurred in response the 2011 flood, it produced an overreaction and contributed to the 2015 drought. Nevertheless Thailand remains focused on structural approaches to reduce the risk of floods and droughts, even after repeated failures.

Elite Capture

Elite capture, in regards to disaster management, is when “disaster management is organized in such a way that it makes it easy for elites to deploy experts and technical tools in ways that serve their interest and not those of less politically empowered and socially vulnerable groups” (Lebel *et al.*, 2011, p. 52; see also Graham & Marvin, 2001).

One of the most marginalized groups, informal settlers, are widely blamed for flood problems in Bangkok. One citizen defended the Governor of Bangkok during the surface floods in 2015, saying:

Instead of blaming the governor, authorities should remove all houses built illegally along the river and canal. I am sure that the residents of these illegal structures are the main culprits by throwing their garbage into the canal (Holloway, 2015).

Furthermore, following the 2011 flood, the Bangkok Metropolitan Administration, with support from the central government, has begun a campaign to remove these settlements from riverbanks and alongside canals (Berquist *et al.*, 2015, Respondent #4). However, one respondent, who is responsible for overseeing their resettlement, commented, “How much [informal settlements] obstruct or encroach, isn't academically agreed upon” (Respondent #4). Furthermore, canal encroachment is not limited to the urban poor; as another respondent mentioned, housing developers “always build on top of those canals, you know, they don't care to divert it, they just fill up the area” (Respondent #7). However, only the urban poor are being forced to relocate away from canals, while wealthier residents are allowed continue to fill in canals elsewhere.

Elite capture is also the philosophy that encourages vast infrastructural investment in protecting Bangkok, the nation's economic hub, from flooding. As a city official commented, “People still have a bad image of the big flood so they have the idea, ‘the government has to protect the City of Bangkok so the center of Bangkok is safe’” (Respondent #6). Or as one report articulated, “Bangkok, as the capital, is always in the safe zone whenever there is a crisis” (Sasithorn, 2015b). While the 2011 and 2015 floods in Bangkok illustrate that Bangkok is not an invincible “safe zone,” it is supported by national level interests that continue to invest in improving Bangkok's flood protection. While, there are plenty of valid arguments to protect Bangkok, flood walls and sluice gates can essentially turn Bangkok into a

fortress during a flood, as the gates close and armed guards line the walls to ensure flood waters remain in areas beyond the City limits (Poaponsakom & Meethom, 2012).

The same charge was laid against Bangkok during the 2015 drought when farmers were forced to watch (under military presence at times) water flow past in the canal to quench the desires of Bangkok's residents. The Bangkok Post, for example, reported:

Obviously, most people in Bangkok and other cities are not affected by drought and, therefore, are unaware of the plights of the compatriots in rural areas who struggle almost on a daily basis just to get hold of water for consumption. (Bangkok Post, 2015d)

Or, as another report mentions, "The Prime Minister, like every Thai, refers to farmers as 'the backbone of the nation.' But when it truly matters, meaning now, rural people get less attention when they deserve more" (Bangkok Post, 2015a). The lack of awareness of Bangkok residents is, perhaps, reinforced by the lack of local media coverage, since Bangkok-focused newspapers published 26% fewer reports on the drought than nationally-focused newspapers. On the other hand, the Bangkok Post reported military involvement in flood and drought management issues significantly more than The Nation, largely in an attempt to reassure Bangkok residents of a sufficient water supply. The lack of attention resulted in unchanged water use behaviour, as one report noted, "The first group of people made to sacrifice so there is enough water for city dwellers such as Bangkok residents for consumption—quite freely and wastefully, too—are the farmers" (Bangkok Post, 2015g). That report, and two similar reports, sparked a high-profile criticism of drought management in Thailand, which exposed inequalities in the provision of water. As one report summarized, "the government has forced farmers to bear the burden of the water crisis by banning agricultural water use without substantial water-saving measures in urban areas" (Apinya & Manop, 2015). However, only nine days later the media dropped the subject.

When the interests of the elite are put before everyone else, there is incentive for those in with power to maintain the status quo, which serves those with power and disadvantages the less fortunate (Blake, 2015).

Scale

The scale trap concentrates actions to a single administrative level (Lebel *et al.*, 2011). In a highly centralized country, such as Thailand (Bowornwathana, 2010), scale traps are especially evident, as national agencies have greater involvement at local levels.

Thailand's centralized control of flood and drought management are evident in interview responses and corroborated by media reports. When respondents were asked who is responsible to reduce flood risk, national agencies were most frequently mentioned, followed by provincial, and then local authorities. Of the over 40 different water-related agencies mentioned in the media, centralized

agencies accounted for 75% of all agencies, and occupied 18 of the top 20 most mentioned agencies. Even in Bangkok, the governor has to request funds from the central government in order to expand the city's drainage infrastructure (Supoj, 2015a).

While centralized control can provide effective management (Macintosh, 2013), it can also slow down a system. Frustrated with central agencies' slow progress, one respondent mentioned,

We have studies, we have satellite photos, we have looked at which area is prone to flood...But regarding implementation, well, there are limitations from the central authorities. Like when we want to study erosion in this area to implement and do something, the central authorities...say that they are studying it. The local authorities cannot conduct an overlapping study. We're waiting for them to do things but they still haven't done anything. (Respondent #23)

Required to wait for centralized direction, local authorities are forced to delay action rather than moving forward on their own to adapt to local flood or, in this case, erosion risk.

In contrast, one respondent mentioned the speed at which the private sector can act. In regards to acquiring land, he/she stated, "For us, it's very time consuming, at least one year. While [the private sector] can buy in one day...But you know, sometimes running a business deals with secrets," while in the public sector, "development must be legal" (Respondent #12). While public agencies have to comply with regulations and a hierarchical chain of command, the private sector can cut through regulations through "secret" deals.

While Lebel *et al.* (2011) and Berquist *et al.* (2015) view the scale trap as hierarchical, it can also be applied geographically and temporally. The geographic scale trap refers to a restricted geographic scope of policies. For example, the Bangkok Metropolitan Administration desires to reduce surface flood risk and has implemented an incentive for developments to collect and store precipitation during a storm and release it afterwards (BMA, 2013). However, this incentive only applies to new high-rise developments. This neglects new low- and medium-density development as well as the vast stock of existing building that could be retrofitted with water collection systems, such as rain barrels or rain gardens, to help reduce the risk of surface flooding.

Nationally, Thailand's Environment Impact Assessment's requirement of stormwater retention ponds applies to housing projects greater than 500 plots or 16 ha and condominiums with 80 units or more or which are at least 0.4ha in size (MNRE, 2010, Article 3, Annex 1.3.28,31). Therefore, many developers will build 79 units to avoid this requirement (Respondent #13). By ignoring small and medium-size developments a vast amount of developments are released from providing public benefits of water retention.

Temporally, officials seek immediate actions. Following the 2011 flood, the Flood Management Master Plan was hastily completed in a few months (Poaponsakom & Meethom, 2012).

However, its quick completion has resulted in it being repeatedly “delayed and changed,” which lowered the public’s trust in the government’s ability to manage water (Erich, 2015). In Bangkok, “The Governor had vowed in 2010 to solve the capital’s flood problem in the next five years” (Sasithorn, 2015a), but addressing such a complex issue is an ambitious statement that reflects Lebel *et al.*’s (2011) assessment of government officials providing simplistic promises.

Therefore, Thailand’s policy framework regarding various water-related issues remains narrowly focused, hierarchically, geographically, and temporally.

Crisis Management

Crisis management is when “policy and political attention only focuses on flood and disaster management in emergencies and immediately after serious events” (Lebel *et al.*, 2011, p. 53) rather than on preparation and prevention. Policy- and decision-makers continue to focus on the present, which hinders the formation and implementation of long-term plans. As one respondent commented:

[Decision-makers] don’t think about future, just tomorrow, not next year or the next five years....For my colleagues it is just next week... and that’s the weak point for decision making and because most decision-makers cannot think about long future. That’s a problem...they are still talking about short term solutions, everything is short term. We are planners, we have to be able to see the future, really, really far future, and so that we can tell what should be done today to stop problems in the future. (Respondent #6)

Short-sighted views of disaster management have, in part, been attributed to the media’s focus on disaster crises (Quarantelli, 1991). In Thailand, 67% of news reports of rapid onset natural disasters (such as surface floods, landslides, and subsidence) occurred within the first week after the event and then interest moved to the next story. Furthermore, only 20% of water-related English newspaper articles mentioned efforts to recover to pre-event status and 16% mentioned actions to adapt or improve beyond the pre-event condition. In Thai newspapers, only 2.7% of articles noted attempts to improve conditions in order to prepare for another event. Newspapers therefore either neglect to report adaptation or build-back-better actions, or there is limited action taken by the government to facilitate long-term actions to reduce risk. Either way, since media is an influential source for policy-makers (Ahchong and Dodds, 2013), the lack of long-term planning in the media hinders improvements in flood and drought management and perpetuates a crisis mentality.

Lebel *et al.* (2011) argue that there is limited preparation taken to reduce the risk of flash and seasonal floods, which is evident in responses to the 2015 surface floods in Bangkok. The first surface flood, in March, could be argued as unexpected and thus caught the BMA unprepared, since 10% of Bangkok’s annual rainfall (141mm) fell in just four hours two months before the typical start of the rainy season (Fernquest, 2015; Supoj, 2015a). The June flash floods, however, are evidence of a crisis management mentality. As one report noted, “The BMA has retrieved more than 10 tonnes of garbage

from pipes and sieves at Bangkok pump stations every time city officials rush to facilitate the flow of water out of the capital” (Natthapat, 2015). The fact that the drainage system had 10 tonnes of debris clogging the system illustrates a lack of preparation, even towards a known risk such as regular monsoon rains.

On the other end of the water spectrum, the drought in 2015 also caught the Thai government seemingly unprepared, regardless of early reports of an El Nino year, which would delay and reduce rainfall. There was no systematic response to help farmers cope with the drought, as disaster relief actions were debated during the event. Two months after the failed start of the monsoon season, a news report dated July 30, 2015 outlined the Government’s water conservation plan: “a set of short-term water conservation measures to be applicable at all government units and state enterprises effective Oct. 1” (Bangkok Post, 2015m). Essentially, the water conservation plan consisted of a 10% reduction in water consumption in state agencies, which could be achieved through fixing leaks and no longer providing tea or coffee at meetings and only encouraging the public to reduce water consumption. Therefore, two months after the failed start of the monsoon season, the government approved a highly focused water conservation plan (scale trap), to commence in another two months to coincide with a new fiscal year. To add perspective, the announcement of the government’s water conservation plan comes on the same day that the governor of Chaiyaphum, in northeast Thailand, declared over 80% of his province a disaster zone due to the drought (Bangkok Post, 2015m).

Therefore, the Thai government, as well as the BMA, continue to focus on crisis management rather than disaster prevention. Even though seasonal monsoons bring predictable rainfall, the BMA continues to react to heavy rainfalls rather than proactively maintaining drainage infrastructure. Thailand, similarly, has experienced numerous droughts in the past, but has failed to pre-emptively develop a systematic plan to ease the impacts, particularly for farmers. Furthermore, as climate change increases the potential for both floods and droughts, under the current crisis management framework, the government will continue manage one crises to the next (Achakulwisut, 2015a).

A report in *The Nation* (2015f) summarizes these institutional traps and calls for action:

It is astonishing in this day and age that the country’s resource management remains at the mercy of nature’s whims. Surely we have suffered needlessly through enough crises by now that the authorities in charge are acutely aware of the need for sweeping improvements. The management of our water resources must become more effective and more systematic. If not, Thailand is destined to endure the same alternating problems—drought and flood—endlessly or at least until the forecast effects of climate change render such seasonal difficulties moot...It is clear that out state agencies must begin working together more effectively to ensure that measures to prevent drought and flooding are in place and poised to be implemented promptly. They should be looking ahead and preparing in advance so they’re ready to head off these problems before they turn into national emergencies...What the authorities must cease doing is reacting to a problem only when it becomes a crisis that can no longer be ignored. We need wholesale, practice crisis

management not the cumulative, after-the-fact, reactions that only serve to fatigue resources and deflate public confidence. Above all, we need a clear and decisive policy on water-resource management.

Without “clear and decisive” flood and drought management policies, the public sector remains ensnared and the government continues as usual.

3.5.2 Outcomes of Institutional Traps

In addition to the presence of institutional traps in flood and drought management, newspapers and interview respondents mentioned how these traps influence broader land-use practices. Three issues in particular stand out: the mismanagement of water, a lack of trust in the government, and a broader framework of water governance.

Flood and Drought Mismanagement

Flood and drought management, or mismanagement, were a popular topic in the media and among interview respondents. In newspaper reports on water-related topics within Thailand, 10% of English news articles and 5% of Thai news articles reported water mismanagement as the reason for impacts from water-related events. On the other hand, mismanagement was never mentioned as a reason for impacts in news articles from beyond Thailand. Water mismanagement include developing on floodplains (Witpatayotin, 2015), neglecting forecasts (Wancharoen & Jikkham, 2015; Yongcharoenchai, 2015; Respondent #20); mismanaging dam and water supply (Achakuwisut, 2015; Bangkok Post, 201e), and exploiting groundwater (Osathanon, 2015).

During the 2011 flood, one respondent mentioned that the “government [water] management isn’t good enough because the affected area was a large area, so [people] have to help themselves, some stayed in the same house” (Respondent #1). Four years later, during the drought, another respondent stated:

The cause of natural disasters is ineffective management to deal with it. Let me point out the universal image which is the water management, both for flooding and drought. It should be done urgently. At this time we’re experiencing drought which can lead to famine because farmers cannot plant anything. It’s because we don’t have a reservoir to store water when it doesn’t rain. You can look at the map of Thailand to see that there are lots of lowland areas but we cannot manage to build water reservoirs or dams as we’ve planned. And that’s the reason for flooding and droughts in Thailand. (Respondent #14)

An inability to develop planned infrastructure or implement flood or drought relief is further evident in a simple review of newspaper headlines: “Water management has been neglected for too long” (Sasithorn, 2015b), “Drought ideas smack of desperation” (Achakulwisut, 2015b),

“Flood, then drought—the never-ending cycle” (The Nation, 2015f), and “[Government] stumbles from one crises to another” (Achakulwisut, 2015a).

Lack of Trust

The Thai government continues to struggle to effectively manage water, and it is in the presence of poor management that mistrust toward the government’s ability to protect the nation against water-related disasters has developed. One responded stated:

Every year we may have one or two storms; most of them are just tropical...but in that year there were five to six storms passing Thailand. And still they say ‘it’s uncommon, [or a] unusual case, so don’t talk about risk.’ I remember in May I presented about climate change and the impact on storms. By that time I was sure there were big storms coming from the east. And in that year in May, the provinces north of Bangkok like Pichit were already under water. If you look at the water table, if you were working in this field you could tell that something is unusual...And in the first week of October, [it was] absolutely clear that water would come to the inner city. In the first week of October, Nonthaburi, the upper part of Bangkok, many districts have been underwater. But the Governor of Bangkok kept saying ‘no problem, no problem’... In short I can tell you that the people don’t believe in the government because of the poor structure of management.
(Respondent #6)

Or as another respondent commented about the flow of information during the 2011 flood: “Quite often the government doesn’t give factual information... even just how much water is going to come is not revealed in the facts” (Respondent #23).

As noted above, the Chairman of the National Reform Committee mistrusted the government due to influential people or organizations; mistrust, however, is not confined to the public sector. Eight news articles, seven of which were from the municipally-focused Bangkok Post, explicitly noted mistrust towards the Central Government. A research director at the Thailand Development Research Institution (TDRI), for example, stated, “Manufacturers in the flood-troubled region do not have confidence in the government’s Bt350-billion water management plan, because it has been delayed and changed so often” (Erich, 2015).

On the other end of the water spectrum, during the 2015 drought, industries and individuals work to supply their own water needs. Amata, a company that manages 7,500ha of industrial property across three estates notes that “supply is often a concern in Thailand. Although the country has a monsoon season when it rains heavily, there is also a dry season when it may not rain for weeks or even months. This often creates critical water shortages throughout the country” (Amata, 2010). As a result they have created a 14 million m³ reservoir at their Nakorn facility and a 3.5 million m³ reservoir at the Amata City facility. During the 2015 drought, they reassured investors that their properties “[would] not run dry” (Apsitniran, 2015).

Farmers on the other hand were forced to watch canals and river slowly run dry. As a result, Farmers are experimenting with desalination strategies in an effort to become self-sufficient (Jikkam, 2015). While the successes of these experiments were limited, the fact that they desired to become self-reliant illustrates a lack of trust in the public sector's ability to provide water to irrigate their fields.

The lack of trust in the government should not be a surprise since the International Institute for Management Development (IMD) ranked Thailand's "trust in politicians" a mere 129 out of 144 and "transparency of government policymaking" a 100 out of 144 (IMD, 2015).

Broadening Flood and Drought Governance

While government authorities remained trapped, other actors have begun to fill the void, in part, due to water mismanagement and lack of trust in the government. They include the military, royalty, and the private sector. The military are also taking a larger role in flood and drought management, beyond their current role as governing the country through a Junta government. While the military was never mentioned by interview respondents, in English 7.6% of water-related reports in Thailand noted military involvement in three key roles; disaster relief, enforcement, and planning. The military is frequently called upon during natural disasters to help provide aid and relief, and this continues to be a role for the Thai military during the 2015 surface floods in Bangkok (The Nation, 2015b) and the drought (Bangkok Post, 2015j). The military was also used during the drought to maintain order and compliance with government directives, especially in regards to bans on pumping water from canals for agricultural purposes (Bangkok Post, 2015f). While disaster relief and enforcement have been a traditional role for the Thai military, they are also moving into a planning role. Following the surface floods in Bangkok in June, 2015, the Central Government proposed that if the Bangkok Metropolitan Authority could not plan and implement an effective flood management system, the role to protect Bangkok from floods would be shifted to the military (Wancharoen & Jikkham, 2015). Furthermore, the military are portrayed positively as an institution that gets things done. However, it is important to note that at the time of writing Thailand was ruled by a Junta government, and therefore speaking negatively about the military is highly suppressed (see Bhromsuthi *et al.*, 2015). Therefore, the military is posed to step into a planned role that has traditionally been publically helped.

The Thai Royal Family, especially King Bhumibol Adulyadej, has also become active in water management. Blake (2015) highlights how the Royal Irrigation Department (RID) involves a symbolic connection to royalty to maintain the status quo. Aligning oneself with royalty could be advantageous since all media reports that mentioned royal initiated flood and

drought management schemes, and provided a critic of their actions, portrayed royalty positively,⁹ while only 38% of government actions were viewed positively. For example, the government's attempt to create rain was criticized as insufficient and unsuccessful (Taylor, 2015); however, when the king dispatches some of his personal rainmaking planes to Northern Thailand his actions were praised (Bangkok Post, 2015c). While action by the military and royalty are widely praised, the government's actions are only praised 38% of the time.

The private sector has also stepped into managing water. Evaluation from the media and interview respondents of the private sectors involvement in water management is split between positive and negative assessments. Therefore, we will review both in detail in the following sections.

Disreputable Practices

Media and interview respondents noted numerous illegal or disreputable practices, including developers taking advantage of loopholes in land use polices, corruption, and theft. While not illegal, three interview respondents noted housing developers exploiting loopholes in planning regulations. Comprehensive plans, for example, are created to direct orderly development through defining land uses, typically at the provincial level. However, as one respondent explained, comprehensive plans are only in effect for a particular period of time and when they expire any development can occur on any land, unless the local authorities voluntarily maintain the land use (Respondent #20). The same respondent noted that developers will delay construction, knowing a plan will expire and they will be freed from land use constraints. In fact, one news report stated, "There were 195 city plans nationwide, 93 of which have expired and are in a vacuum period" (Katharangsiporn, 2015). Therefore, another respondent stated:

There's a mixed use of industries and housing, the issue of using containers, issue of using agricultural land to build houses, because there were no urban plans. Like the Rojana industrial complex, [it was] built when the urban planning law wasn't in place, [the developers] knew but [they] just want to do it. So there are problems, always. (Respondent #8)

Therefore the lack of strong land use policies has led to uncoordinated development, much of which has been within the central floodplain (Lebel *et al.*, 2012; Poaponsakorn & Meethom, 2012). However, in July, 2015 the government amended the comprehensive plan legislation, and removed the expiration clause, thus ensuring that current land use plans will not expire; however, the status of plans that have lapsed is unknown (Katharangsiporn, 2015).

⁹ However, it is important to note that defaming royalty is illegal in Thailand, and therefore it should be unexpected that there was not negative comments regarding actions taken by royalty.

While exploiting legislation loopholes is not illegal, illegal actions abound in the media reports and comments from interview respondents. The ability to “influence” decision-making process, as the chair of the National Reform Committee stated, is not limited to intergovernmental interactions. One respondent stated, “Sometimes running a business deals with secrets” (Respondent #11) or, more explicitly, a concerned citizen wrote, “large brown envelopes” can alter Environmental Impact Assessment reports (Shepherd, 2015). During the rebuilding phase after the 2011 flood, road repair contracts were criticized as being awarded disruptively and to firms that use substandard practices and as a result, many roads failed during the 2015 drought as land next to waterways subsided with the dropping water table (Prateepchaikul & Attakor, 2015).

Influencing the decision-making process does not only come from outside of public agencies, as one respondent commented:

The bigger constraint or problem for us is that [owners of industrial estates] are sitting in the planning committee in our department; maybe two to three of the 10. And they have strong voices, and anytime we would like to ask them [to cooperate], (laugh) no don't hope or don't expect to see cooperation from these people” (Respondent #6).

Or as another respondent stated, “The BMA has already developed this open space plan, but of course, implementation is a different story...when you want to designate this area as a floodway but the land has been bought by politicians...who can pass the law” (Respondent #7).

Not everyone seeks to influence policy-makers though; some resort to theft. During the 2015 drought, stealing water was a national concern which required military patrons along canals and river to ensure water continued to flow downstream to supply water to Bangkok (Bangkok Post, 2015f). Nevertheless, media reports were rife with stories of farmers stealing water (Achakulwisut, 2015a, 2015b; Bangkok Post, 2015h; The Nation, 2015g, 2015h; Yongcharoenchai, 2015). However, water theft was not limited to farmers. A power station illegally drained a pond once its water reservoir dried up (Bangkok Post, 2015i).

Positive Outcomes

While institutional traps have created a lack of trust in the government and have led some to act disreputably, there are positive outcomes from a government that is incapable of providing effective flood and drought management. As mentioned, farmers are attempting to adapt spontaneously, specifically through desalination experiments (Jikkam, 2015), as Berquist (2015) proposed. On a larger scale, corporations are getting involved in flood and drought management. Some have suggested farmers switch to more drought resistant crops, such as *ma mui*, or velvet bean, which has medicinal properties (Pisuthipan, 2015). At the community level, after feeling ignored by the government, a

village rallied together to provide community benefits for themselves, including a library, a police kiosk, and banded together during the 2011 flood to construct a sandbag wall to protect their community (Wancharoen, 2015).

In the private housing sector, some developers have begun to set aside a larger portion of their annual revenue to a fund dedicated to repairs (Srimalee, 2015). Setting funds aside will increase a firm's resilience to natural disasters through a quicker recovery time rather than waiting for external financial support to arrive. However, saving money rather than investing it can prove more costly in the future if repairs are unnecessary or where proactive adaptation would have reduced damages from a disaster (Kreibich *et al.*, 2005).

Non-government organizations have created programs to help with water-related issues. For example, the Coca-Cola Foundation Thailand Launched *RAKNAM* ('Love Water'), a community flood management project, in 2007 to educate and support sustainable flood management in local communities (Pimsa-noh, 2015; The Nation, 2015a).

While there are examples of positive outcomes from the government's inability to address water issues, they are few. In fact, the examples above are an exhaustive list of positive outcomes that the media reported during the study period, and account for only 3% of water-related articles. Moreover, not all private companies choose to adapt. For example, for large condominium developers in Bangkok the aspect that garners the most attention and influence in development practice is mass transit lines (Saikapurta, 2015; Srimalee, 2015). Srimalee (2015) stated, "A number of property firms have also launched residential projects in Rangsit, even though the location was affected by the devastating flood of 2011," and goes on to quote the Managing Director of Condominiums who believes "home-buyers view the 2011 flood as a natural disaster, and it has not affected their decision to buy a home in this location." Media reports on housing in Bangkok highlighted location as a key feature; the most reported indicator of location was a development's proximity to mass transit, as reported by 40% of the articles, followed by being located within the central business district at 29%. Furthermore, the potential of floods was never stated as a deterrent in building location.

3.6 Discussion

3.6.1 Land use planning and incomplete decentralization of flood and drought management

Institutional traps remain deeply rooted in Thailand (Marks & Lebel, 2016; Blake, 2015; Mainer-Knapp, 2015; Marks, 2015; Meetham *et al.*, 2014; Clark & Semmahasak, 2013). In recent years the government has downloaded responsibility for local sluice gates and the management of canal levels to local authorities; however Marks and Lebel (2016) argue that the

process has been incomplete. As a result, local authorities are left with more responsibility without upper-tier support. Marks and Lebel (2016) argue that this has contributed to a lack of land use planning in Central Thailand. While they, and Saito (2011), argue that government gives priority to infrastructure and income generating projects, we have found that officials can be influenced on an individual level, such as through corruption. Results indicate that floods have rarely been considered in land use planning, and as a result the Thai government is unprepared when floods occur.

The opposite also appears to be true, that droughts have not been considered, particularly in rural land use planning. When droughts are considered, they are done in connection to irrigation and strategies to distribute water to a larger area in order to increase farming capacity. However, this assumes an unlimited supply of water, which was not the case in 2015. Nevertheless, the Central Government continued to promote irrigation expansion during the drought.

The drought, as it affects Bangkok, was never viewed as a crisis even though the water level of the Chao Phraya River was consistently monitored to ensure adequate water supply. It was not until two months into the drought, when the media began reporting the plight of farmers in contrast to an unchanged consumption of water in Bangkok, that attention was directed towards urban drought management. Even when a water conservation program was developed, it was limited to government offices and implementation was further delayed.

Similarly, when land use plans include flood management, Thai agencies lack the capacity to enforce them (Maneepong & Webster, 2008). Lack of enforcement was widely acknowledged among interview respondents; however, this was connected to the incapacity of officials to ensure compliance with building plans and/or the ability to sway the official opinion through “secret deals”, rather than a lack of legislated authority to control development. This aligns with Kritsanaplan & Sajor (2011), who found that large land owners or developers have maintained close connections with elected officials in order to maintain their development freedoms.

As a result of weak land use planning and poor flood and drought management, other actors are filling the role that the government is not, notably the military, royalty, and the private sector.

3.6.2 Stepping into the Flood and Drought Management Vacuum

Military

In most countries the military’s presence in times of natural disaster means there has been a national emergency that exceeds the local capacity to cope. In Thailand, the military is viewed as a method to get things done, at least in regards to flood and drought response. After the June 2015 localized floods in Bangkok, many residents began to call on the Junta government to remove the

governor of Bangkok and replace him with someone more competent in flood management. This is not to say that the Junta government is widely supported; however, the increased provisions they are granted has been recognised as a way to make lasting change in the way water is managed.

The military in general, are seen to be ready to step in when local authorities are incapable to deal with flooding. The surface floods in Bangkok, which resulted from short, but intense, localized precipitation overwhelmed Bangkok's ability to convey water off of the streets. As a result, the military was called in to create flood management plans and prepare for the possibility that they, rather than the Bangkok Metropolitan Administration, would be charged with defending Bangkok from floods.

Royalty

Bhumibol Adulyadej became King in 1946 and ruled until October 2016. He was active in water management for much of his reign and many of Thailand's flood management features honour his involvement (Blake, 2015). The Royal Irrigation Department, the King's Dyke (which bars floodwater to the north from entering Bangkok), water diversion canals around the City of Hua Hin, the royal rainmaking aircrafts, and the royal non-profit organization which lend aid during disaster times all have connections to the royal family. Blake (2015) argues that the King Bhumibol's reputation and near-deified status was directly linked to his increasing involvement in water management. However, if the government were capable of managing water, his involvement would be unnecessary. The repeated failure of the Thai government to manage water has created a need which Bhumibol deemed his personal mission to fill (Blake, 2015).

By striving to transverse the traps that the government is stuck in, King Bhumibol garnered support and solidified his position in a world that is quickly viewing royalty as strictly symbolic (Blake, 2015). For example, he sent rainmaking planes to the North and providing bottled water during the drought and was therefore viewed as a saviour. As a result, his involvement in flood and drought management was essentially unquestioned—regardless of the actual outcome of projects (Blake, 2015). However, whether this status was connected to him personally or to his is Kingship is unknown, and therefore whether his successor, King Maha Vajiralongkorn, will maintain the status that King Bhumibol gained is questionable.

Private Sector

The private sector's involvement in flood and drought management in Thailand has largely been neglected by researchers. Nevertheless, the inability of the government has created an environment that is stimulating private sector actions. As the private sector loses trust in the government's ability to protect against floods and droughts, they are stepping in to become more self-

reliant. Farmers are experimenting with desalination techniques in order to provide water to their crops rather than relying on the government to store, and effectively manage, dams and canals. Media results indicate that industries have also increased their capacity to cope with droughts and floods by stockpiling for their facilities. While the government fought with falling water levels and the concerned public, industries reassured investors that the 2015 drought would not adversely affect them.

The private sector is, therefore, adapting in Thailand. While Birkland *et al.* (2010) and Kingdon (1995) argue that natural disasters can be a catalyst for change within the public sector, we found that limited change in the public sector approach has occurred in response to water-related disasters due to institutional traps. It is the private sector, and the military, that are adapting their practices in the aftermath of natural disasters.

The traps that hinder effective public sector flood and drought management largely do not appear to apply to the private sector. For example, communication between landowners or developers is not necessary in order to develop a site, although it may occur if deemed advantageous. Firms are not as rigid as government agencies and are able to change their practices without relying on government direction (Keenan, 2015). Large landowners are, in fact, the elite that influence public policies that favour their interest rather than the ones being influenced by public policy (Maier-Knapp 2015; Kritsanaplan & Sajor, 2011; Lebel *et al.*, 2011). Furthermore, the private sector is separate from issues of scale, insofar as it affects their properties. Through securing water sources, or increasing flood defences, the private sector is adapting to the water-related risks, as opposed to the public sector which continues to deal with crises as they arise.

In this regard, the private sector is better positioned to adapt to water-related risk than the public sector which is ensnared by institutional traps. However, their adaptations can both hinder and help flood and drought management issues. Private sector actions are driven by a multitude of pressures (Hertin, 2003), most of which are self-serving. As a result, some have employed disreputable practice to facilitate actions that support their interests. For example, by lobbying for greater water-taking rights, industrial firms guarantee water supply for themselves; while, in the case of the 2015 drought, farmers experienced delayed or lost income since water was promised to industrial estates.

The lack of public oversight in land use planning has, inadvertently, increased the risk to private firms by encouraging development in floodplains (Poaponsakorn & Meethom, 2012), and created a need for private sector adaptation in these areas. However, not all private companies have chosen to adapt, not only that, but some are choosing to develop in areas that were flooded in 2011 even though little has been done to reduce the risk of flooding to the area.

3.7 Conclusion

Incapacitated by fragmented departments, rigid approaches to flood and drought management, prioritized elite, limited scope, and present-oriented planning, the government continues to struggle to address a wide range of water-related issues, including floods and droughts. Results indicate that the inability of the public sector to effectively manage water resources has led to water mismanagement and lack of trust in the government's ability to manage water, and as a result flood and drought management are moving beyond the public sector and includes the military, royalty, and, most recently, the private sector.

The lack of effective flood and drought management plans have allowed the private sector to develop strategies to cope with floods and droughts which may be harmful to areas beyond their properties. Private sector strategies to address floods include circumventing land use plans and using corruption to achieve corporate interests, while strategies to address droughts including increasing water storage capacity and stealing water if needed.

However, there are some positive aspects to the limited guidance provided by the government. Companies, communities, and individuals are striving to become self-reliant by supplying their own water supply or protection measures. Non-government organizations have also taken up the task to improve water resilience, both in terms of supply and protection from floods. Nevertheless, more research is required to understand the long-term implications of increased ad hoc private sector participation in flood and drought management.

Section 4: Connecting Private Sector Engagement to Practice

Manuscript 1 built on Lebel *et al.*'s (2011) institutional traps and found that public institutions in Thailand remain trapped by fragmentation, rigidity, elite capture, scale, and crisis management. Not only is Thailand trapped in flood management as Lebel *et al.* (2011) argued, but agencies engaged in water management more broadly, such as drought management, are similarly trapped. As a result, institutional traps hinder effective public flood and drought management and have led to water mismanagement and subsequently a lack of trust in the government's ability to effectively manage water. It has also encouraged other actors, specifically royalty, the military, and the private sector, to become engaged in flood and drought management. Regarding the private sector, interview respondents and the media provided mixed reviews on the private sector's involvement in flood and drought management. While the private sector can provide innovative solutions to complicated problems, they can also create problems through their flood and drought management approaches. Manuscript 2, therefore, seeks to understand strategies a specific sector is using to respond to the government's inability to effectively manage water resources.

The private sector has widely been recognized as a stakeholder in flood management and climate change adaptation (Revi *et al.*, 2014; Leck and Simon, 2013; World Bank, 2010a, 2010b; Satterthwaite *et al.*, 2007), but little research has been conducted in Thailand to understand what actions the private sector are utilizing to participate in adaptation. The private housing sector is specifically reviewed due to its wide geographic presence, its susceptibility to public pressure, and the ability for public sector management through land use planning and building codes. Manuscript 2, therefore, seeks to answer the following questions:

1. What strategies is the private housing sector employing to reduce their risk of flooding?
2. How are these strategies perceived by public officials?
3. What are the potential outcomes of the private housing sector's adaptation strategies?

In order to answer these questions, the 2011 flood provides an opportunity to investigate private sector adaptation strategies after the public sector failed to manage floodwaters effectively.

While Manuscript 1 remained broadly focused on Thailand as a whole, Manuscript 2 focuses on the Bangkok Metropolitan Region (BMR). The BMR, a rapidly urbanizing megacity, provides an ideal case study because the proliferation of housing developments, especially after the 2011 flood which inundated parts of the city, and which was never expected to experience widespread riverine flooding.

Manuscript 2, therefore, investigates what the private housing sector is doing to adapt to increased flood risk. Adaptation strategies are presented and their current and potential impacts to the Bangkok Metropolitan Region are reviewed.

Section 5: A Flood of Change in Bangkok's Housing Sector: A Case Study on Private Sector Adaptation

5.1 Introduction

In 2011, Thailand experienced above average rainfall in every month of the monsoon season, but particularly in the second half of the rainy season when rainfall was as high as 128% above the normal volume (Takahashi *et al.*, 2015). As a result, more than two-thirds of the country was flooded, which left three million people affected and 1.9 million homes damaged as the floodwater flowed along the Chao Phraya River system and Bangkok on its journey to the ocean (World Bank, 2012). Reports of flooding in Bangkok made international headlines (Mydnas, 2011; Tass, 2011; Taylor, 2011), partly because of the decision of city officials to spare the central business district by releasing flood waters in surrounding areas of the Bangkok Metropolitan Region (BMA) (Poaponsakorn & Meethom, 2013; Fuller, 2011).

While the 2011 flood was the worst flood in recent history, flooding is not new to Thailand, with other major floods in 1995, 1983, and 1942. On a smaller scale, annual floods occur throughout Thailand and replenish agricultural areas—a vital ecological function for the world's largest rice producing country (ADB, 2012). However, shifts in the frequency, timing, and magnitude of rainfall are increasing the risk of floods.

The Intergovernmental Panel on Climate Change (2014) projects, with high confidence, an increase in extreme weather events and ensuing floods, and the United Nations Development Programme (2015) concludes climate change will increase losses from natural disasters. Currently, floods are the most significant natural hazard that affects people around the world (Jonkman, 2005; UNISDR, 2015). In an average year, there are approximately 200 million people exposed to catastrophic flooding across 90 countries (UNDP, 2004), with many times more at risk of minor or localized flooding, resulting in approximately 6,300 deaths and over \$100 billion in losses (UNISDR, 2015). Due to increased risk of flooding, urban centres around the world have started to adapt.

In Thailand, many of the projected changes in climate are already underway (Marks, 2012) and have led to calls for action. Bangkok, in particular, is vulnerable to the impacts of climate change and has been designated a climate change hotspot (Hijioka *et al.*, 2014; Kreft, and Eckstein, 2014; Maplecroft, 2012). Shift in precipitation regimes, as well as deforestation and urbanization, have contributed to flooding becoming commonplace (Poaponsakorn & Meethom, 2013). This shift in precipitation has tested Thailand's ability to cope with floods and has led to calls to change how water is managed from government agencies (Saito, 2014), academics (Lebel *et al.*, 2011), international organizations (World Bank, 2012), non-government organizations (Tanatpong, 2015), and the public

(Saridet, 2015). While it is widely recognized that there should be numerous actors engaged in flood management, including federal, regional, and municipal governments, non-government organizations (NGO), citizen groups, and the private sector (Revi *et al.*, 2014; Leck and Simon, 2013; World Bank, 2010a, 2010b; Dodman *et al.*, 2009; Satterthwaite *et al.*, 2007), flood management in Thailand continues to be viewed, almost exclusively, as a public sector responsibility. Thailand's centralized government structure means that agencies, such as the Department of Disaster Prevention and Mitigation, the Royal Irrigation Department, National Water Management Committee, and municipal departments, dominate water governance, and leave little space for non-government actors to be incorporated into flood management. As a result, literature has primarily focused on the role of the public sector to reduce the risk of flooding. The private sector is, however, mentioned less frequently in regards to flood management, and when it has been reviewed it is predominantly related to industrial development (Haraguchi & Lall, 2013; Aon Bonfield, 2012).

The private sector, specifically the housing sector, has begun to adapt to the increased risk of floods. Through this paper we demonstrate that the private housing sector *is* engaged in adaptation strategies to reduce the risk of flooding in Bangkok, Thailand. However, according to public officials interviewed, this adaptation is ad hoc, and may prove maladaptive and lead to splintering urbanism.

5.2 Urban adaption responses to climate change

5.2.1 Urban Flood Risk

Urban centers are extremely vulnerable to climate change, with 3,300 coastal cities threatened by sea level rise, coastal and riverine flooding, and salinization. The IPCC (2007, p. 12) notes: “the most vulnerable industries, settlements and societies are generally those in coastal and river flood plains, those whose economies are closely linked with climate-sensitive resources, and those in areas prone to extreme weather events, especially where rapid urbanization is occurring.” All of these factors are present in many Southeast Asian cities where coastal urbanization is the norm. A vulnerability assessment of 50 cities worldwide by Maplecroft (2013) determined that nine of the top 10 most at risk cities were in South and Southeast Asia, with Bangkok, Thailand ranked second (after Manila, Philippines). Cities that are rapidly urbanizing struggle to manage growth (Roy, 2009), and are therefore at an increased risk due to the inability to direct climate change adaptation.

In Thailand, changes in lifestyle and livelihood, and the rapid growth of the economy and urban centers have increased vulnerabilities to floods across demographics and economic sectors (World Bank, 2012; Lebel *et al.*, 2011; Marks, 2011; Lebel & Sinh, 2007). While rural areas remain vulnerable to flooding, land use changes (including deforestation and urban expansion into floodplains) have increased the flood risk in urban areas. Economic transition from agriculture to manufacturing and industrial sectors has similarly increased vulnerabilities through industrial promotion policies of the

1980s, which located industrial estates on floodplains (Lebel *et al.*, 2012; Poaponsakorn & Meethom, 2012). The trend away from primary industries is predicted to increase as climate change reduces the viability of agricultural pursuits (IPCC, 2014; Marks, 2011; Kerdsuk, 2009), which will only promote the process of rapid urbanization which is currently underway.

Increased urbanization, primarily in and around Bangkok, has led to changes in urban vulnerability to floods (Poaponsakorn & Meethom, 2012; World Bank, 2012). Between 2000 and 2010 the population of Bangkok grew from 6.4 million to 8.3 million, a growth of 31% (NSO, 2010). When the whole Bangkok Metropolitan Region (BMR) is considered, another 2.5 million people moved to the area during the same period. The additional 4.4 million people represent an average annual increase of 230,000 private households (NSO, 2010). In an attempt to cope with this influx of residents, many canals have been built or paved over, or converted into road to accommodate increased traffic volumes, a process that has continued to reduce the city's ability to convey stormwater for decades (Marome, 2012; Poaponsakorn & Meethom, 2012; Kenworthy, 1995). Many new residents, for various economic reasons, cannot find adequate housing and end up in informal settlements perched along the edges or over of canals and are highly vulnerable to flooding (Yap & De Wanderler, 2010).

Rapid urbanization has also increased the demand for fresh water for household and industrial purposes. Traditionally, this demand has in large part been fulfilled through exploiting groundwater resources. Excessive groundwater extraction resulted in land subsidence throughout the BMR. By the late 1980s, the BMR had subsided between of 20cm to 160cm, with a maximum rate of 12cm/year (Dutta, 2011). Due to government initiatives, subsidence has slowed, which has led the World Bank (2012) to hail Bangkok as a success story for groundwater control. Yet it also recognizes that the megacity continues to subside at a rate of 1cm/year, primarily due to groundwater extraction (World Bank, 2010a), which continues to increase the risk of flooding.

In lowlands, like the BMR, with an elevation of 1-2m above sea level, any subsidence will increase the risk of floods. As the land continues to subside, the ability to drain the area is hampered, an effect that is compounded by the loss of permeable surfaces and stormwater conveyance capacity. Furthermore, as the land sinks, rising sea levels will increase the risk of coastal flooding and storm surges (IPCC, 2014). Bangkok is also especially susceptible to flooding during high tides as sea water slows drainage as far as 150km upstream (Ziegler *et al.*, 2012). This effect will reach further inland as sea levels rise, increasing the risk of inland floods.

5.2.2 Public and private sector adaptation responses

Due to the impact of climate change, adaptation is necessary (IPCC, 2007). Adaptation is the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their

effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2014, p. 5). Adaptation can be anticipatory (action taken before impacts are felt), autonomous (action taken in response to climatic stimuli), or planned (action taken due to deliberate policy decisions) (IPCC, 2007). In regards to adaptation to flood risk, anticipatory and planned adaptations are most common.

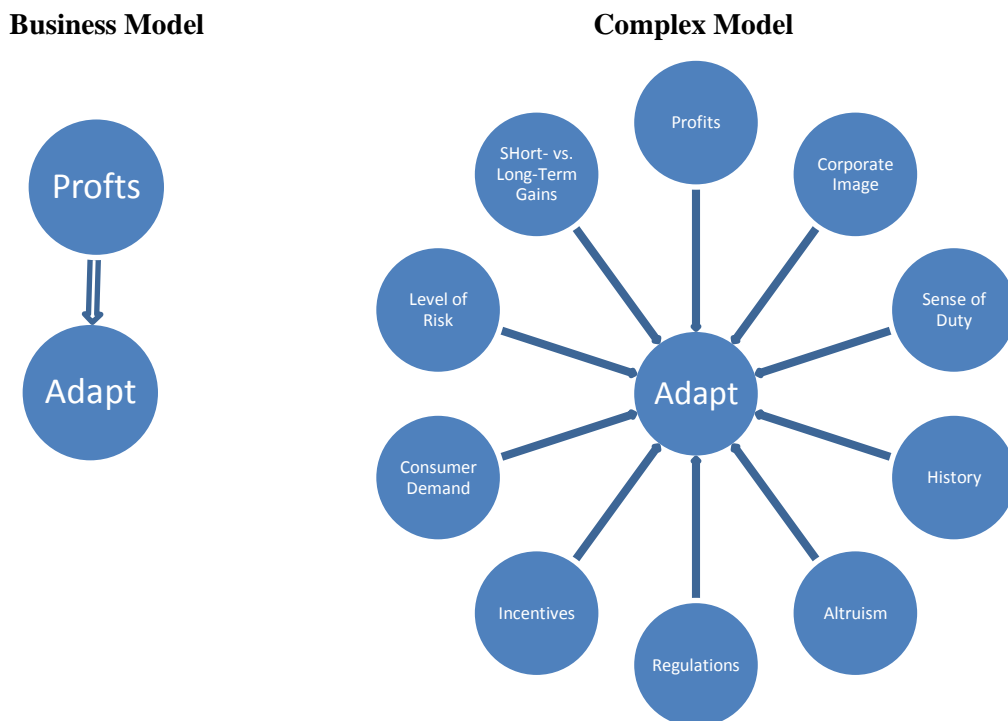
Flood adaptations can further be defined by strategies that protect, accommodate, or retreat from flood risk (IPCC, 2000). Protective strategies seek to defend current natural or built environments through hard measures, such as dykes, seawall, floodgates, and watershed transfers (Penning-Rowsell *et al.*, 1998; Pilarczyk, 1990), or soft structural measures, such as wetland and mangrove restoration (Tri *et al.*, 1998; Boesch *et al.*, 1994). Strategies to accommodate floods seek to adjust the built environment to adapt to a new climate regime, such as through improving drainage, emergency planning, or flood insurance (Porio, 2011; Muller, 2007; Cummins & Mahul, 2009; Rosenthal & ‘t Hart, 1998). Retreating from flood risk seeks to remove the risk of flooding completely by moving away from the hazard, and can be achieved through resettlement, increasing building setback or zones (Porio, 2011; Parnell *et al.*, 2007).

In Thailand, while all three adaptation approaches are present, protection and accommodate adaptations dominate public approaches to flood risk reduction strategies (Poaponsakorn & Meethom, 2012). For example, after the 2011 flood the Bangkok Metropolitan Administration (BMA) began raising the level of dykes along the Chao Phraya River and many of its canals, and continues to increase its drainage capacity through constructing underground tunnels (Tantikom, 2013). Retreat has only recently begun and is confined to relocating informal settlement from canals (Berquist *et al.*, 2015), while more affluent areas continue to expand waterfront developments (Srirojanapinyo, 2009). Ultimately, Thailand’s “institutional response has been incomplete leaving significant, reducible, vulnerabilities to current and future climate risks unaddressed” (Lebel *et al.*, 2012, p. 56).

Research on private sector adaptation in Thailand has largely been neglected, with industrial estates being a notable exception. After the 2011 flood, industrial estates in Central Thailand have constructed dykes around their properties, improved drainage capacity, elevated essential and expensive machinery to higher floors, and/or relocated to other locations within and beyond Thailand (Aon Bonfield, 2012). While housing developments generally come after industrial developments, adaptation on industrial estates usually only considers their individual properties, rather than including adjacent properties that generally house industrial workers. Housing adaptation is not only vital to individual health and prosperity but also the local and national economy (Poaponsakorn & Meethom, 2012). Aon Bonfield (2012) found that damages to capital investments and inventory from the 2011 flood only accounted for 23% of losses, while business interruption, including lack of employees, account for the other 77% of losses. Research on the private housing sector, however, is limited.

Adaptation can be autonomous or planned (Smit *et al.*, 2000). Within the private sector, adaptation has also been further categorized into two groups (Hertin *et al.*, 2003): those that see adaptation as a business model, which seeks to maximize profits (Keenan, 2015; Roeth, 2009; Warhurst, 2006; Mehndelsohn *et al.*, 1994; Mendelsohn, 2000) and those who reject the model as simplistic and see adaptation as part of a larger social and political initiative (Hertin *et al.*, 2003; Scheider *et al.*, 2000; Kandlikar & Risbey, 2000) (Figure 2). Within the private housing sector, Keenan (2015) found large firms and those most at risk had the greatest capacity to adapt and, when adaptation occurred, it happened autonomously through protective measures (such as flood proofing) and accommodation measures (such as improving generator capacity and elevating electrical features). Keenan also found that private commercial real estate firms choose to adapt irrespective of public policy initiatives and were rather motivated by maximizing profits and minimizing damages. Whatever the motivation is to adapt, a certain level of financial capital is required to turn motivation into action. Unfortunately this can lead to private sector adaptation being disproportionately implemented across a city.

Figure 2: Private Sector Adaptation Models: Influencing Factors



Graham & Marvin (2001) reveal that new technologies and infrastructure in general, and their increased privatization, lead to dividing metropolitan areas and creating social polarization. Essentially, two classes of urban residents emerge: those who can, and have adapted, and those that cannot. Those

who can afford to adapt may develop “spaces of seduction,” which are attractive for development, or “fortress spaces,” which protect those within from outside threats (Graham & Marvin, 2001). Applying Graham & Marvin’s (2004) framework to technology and infrastructure to reduce flooding, spaces of seduction can have effective networked infrastructure to manage stormwater, whereas fortress spaces protect against outside world, including infrastructural limitations it may possess. On the other hand, those who cannot adapt are relegated to areas “beyond spaces of secession” and become marginalized, ghettos, and trapped in relative and absolute poverty (Graham & Marvin, 2001). However, climate change adaptation and flood risk reduction strategies of the private housing sector and their involvement in splintering urban areas, have not been reviewed by the literature.

Furthermore, studies on private housing sector adaptation have focused on motivations for adaptation, and are largely limited to developed countries (Keenan, 2015; Hertin *et al.*, 2003). There is therefore a need to study private sector adaptation in a developing and rapidly urbanizing context.

5.3 Methods

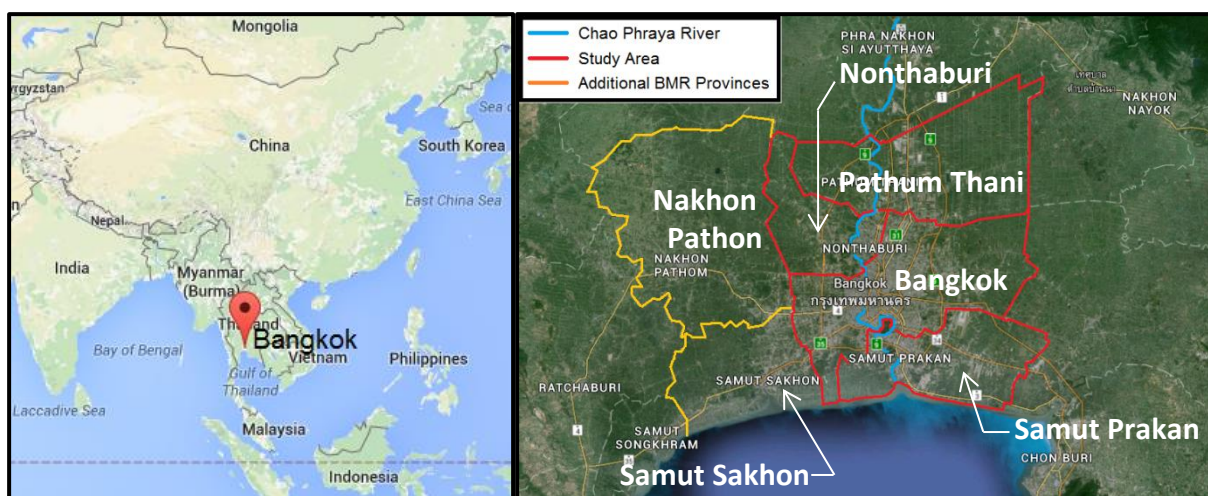
In response to the risk of natural disasters and climate change, stakeholders in Thailand have initiated a number of adaptation strategies. Among them is adaptation of housing stock to cope with increased risk of flooding. In this paper we aim to demonstrate that the private housing sector is adapting to address the risk of flooding in the Bangkok Metropolitan Region (BMR). Key informant interviews were conducted in Bangkok, Nonthaburi, Pathum Thani, and Samut Prakan—the four provinces of the BMR that surround the Chao Phraya River and house 88% of the region’s population (Figure 3). Respondents were purposefully selected (Creswell, 2014) based on (1) employment in a department or agency involved in flood management and/or housing, (2) responsibility in at least one of the four provinces, and (3) position of leadership within their organization.

Through consultation with local academics, document reviews, Internet searches, and snowball sampling techniques, we identified over 40 government agencies engaged in housing, flood management, and climate change adaptation, as well as six housing organizations. Of these, 17 departments and organizations have responsibility to address flooding within the BMR; nine of these participated in this study, resulting in 23 interviews conducted between May – August, 2015.¹⁰ The location of responsibility for all respondents is evenly distributed; with two to four respondents having provincial responsibility within each province and 12 respondents with responsibilities across the BMR, or the Central Region of Thailand. Eighteen 30-60 minute interviews were conducted face-to-face; five

¹⁰ Interviews were conducted with officials from the following agencies: the centralized government departments of the Department of Public Works Town and Country Planning (DTP) and the Department of Disaster Prevention and Mitigation (DDPM); the provincial departments of the Provincial Administration Organization (PAO), City Planning Department (CPD), Department of Environment (DoE), and Bangkok Fire and Rescue Department (BFRD); the municipal department of city planning; and the national housing organizations of the National Housing Authority (NHA) and Community Organization Development Institution (CODI).

email interviews were also conducted. The respondents chose their preferred language for interviews; interviews conducted in Thai were subsequently translated into English with the aid of a Thai research assistant. After interviews were conducted, we transcribed and coded data with Nvivo to identify common themes. Respondents were sought from the public sector to understand their level of awareness of private sector adaptation initiatives. The thoughts and opinion of private sector stakeholders are not represented here and, therefore, we make no claim that the strategies discussed are exhaustive, but rather are restricted to public sector respondents who were willing to participate in the study.

Figure 3: Study Area: Bangkok, Nonthaburi, Pathum Thani, and Samut Prakan (Google Maps, 2016)



5.4 Results

5.4.1 Private Sector Involvement

While literature widely recognizes the private sector as a key stakeholder in climate adaptation and disaster risk reduction (Revi *et al.*, 2014; Leck and Simon, 2013; World Bank, 2010a; Dodman *et al.*, 2009; Satterthwaite *et al.*, 2007), only 11/23 of respondents in this study considered the private housing sector a key stakeholder in reducing flood risk. This lack of public sector acknowledgement of the private sector’s responsibility to adapt, however, has not prohibited the private sector to adapt. In fact, 20 respondents were aware of efforts by the private housing sector to adapt to the risks of flooding in the Bangkok Metropolitan Region (BMR).

Due to seasonal floods, adaptation to flooding is not new (Sthapitanonda & Mertens, 2012). Traditionally, Thai’s have built houses on stilts to escape floodwaters and, more recently, have elevated their land before construction by importing soil from elsewhere to ensure properties are above flood levels. The 2011 flood, however, was a key catalyst for greater private sector adaptation. Now, land is elevated higher than traditional levels, as one respondent explained, “For the newly constructed housing areas, those constructed after 2011, they take the flood level in 2011 as the benchmark that they need to

be higher [than] so that their housing areas will not be flooded” (Respondent #22). Or as another respondent mentioned: “The walls around expensive gated communities are already very high, but the ones built after the flood are even higher” (Respondent #3). The extent of adaptation since the 2011 flood led one respondent to conclude, “Everywhere is raised higher” (Respondent #21).

Even in areas relatively protected during the flood, adaptations are occurring. Security walls are being repurposed to also guard against floods. As one respondent mentioned, “We have been doing some surveys [since 2011] and we found that the walls are higher. First of all, you know, industrial settings are building higher walls, and of course the land developments, the gated communities, are building high walls, thick walls” (Respondent #7). Therefore, flood protection strategies, while traditionally used, have increased in scale.

5.4.2 Protection Adaptation

Flood adaptation strategies can be divided into three categories: protect, accommodate, and retreat (IPCC, 2007). Each category was mentioned by respondents: with two protection strategies mentioned by 16 respondents, seven accommodation strategies mentioned by 20 respondents, and two retreat options mentioned by 11 respondents. While accommodation strategies in general garnered the most attention, the two protection strategies were discussed twice as often as any other strategy. The focus on protection measures mirrors the Bangkok Metropolitan Administration (BMA) approach of hard protective strategies, such as dykes and ditches (BMA *et al.*, 2009). The construction of walls, elevating the ground level, and elevating the first storey were widely recognized among respondents; less frequently mentioned strategies are also important options and includes: various architectural designs, improved drainage systems, and lot-level stormwater management techniques.

Protection strategies, such as elevating the land and building walls, were mentioned by 10 and 13 respondents respectively. As one respondent stated, “At first [developers] elevated the land to level for construction but after the flood they filled up more soil to avoid floods because all areas flooded” (respondent #21). Or as another respondent noted, “All [developers] can do is just raise the land as high as possible” (respondent #12). Raising the land can be expensive, and respondents mentioned walls can be a cheaper option, at least initially. One respondent stated: “It’s cheaper in the first place because you don’t have to fill up the land with huge amount of soil.” However, “you have to use more energy for the water pumping system to drain water from within the dyke so it seems to be more expensive” (respondent #13).

While elevating the land is exclusively used in new developments, walls can be added to existing developments. For existing buildings one respondent believed walls to be the only option for existing housing, “All [developers] can do is to build walls but this will affect [the] drainage system”

(respondent #12). Nevertheless, new developments also use walls to protect against floods. Walls are utilized across the region and many respondents mentioned their dual purpose: “They're scattered all over but mainly in the areas that flooded in 2011... In other areas there are also many with the walls, [since] they already need [them for] security and also for floods” (respondent #3). One respondent preferred permeable walls (chain link or openings) to allow floodwater to pass through instead of blocking floodwater (respondent #22).

5.4.3 Accommodation Strategies

Respondents also recognized seven flood accommodation strategies. Elevating the first floor was the most mentioned accommodation strategy, with 11 respondents discussing it. Elevating the first floor traditionally includes building on stilts, but has also come to encompass ground floors that are designed to be floodable. As one respondent stated, “we want raised basements, opening the lower floor for the flow of the river” (respondent #8). Operational equipment, such as water tanks, pumps, and heater are being moved to higher storeys. As one respondent explained, “the boiler room will also be raised higher so that it can still function when there is a flood” (respondent #13). To prepare the first floor to be flooded, one respondent promoted the use of “materials that are less likely to be damaged by water, [such as] not covering the floor with parquet” (respondent #11). Adaptive techniques, such as these, are already widely utilized in rural areas of Thailand where annual floods occur as a matter of course (World Bank, 2012). By building sacrificial first floors, the impact of flooding can be greatly reduced. Kreibich *et al.*, (2005) found that these strategies can reduce damages to household goods by 48% and to buildings by 53%. In regards to the 2011 flood in Thailand, where damages to household goods and structures were estimated are THB 38 billion and 7.8 billion respectively (USD1.24 billion and USD250 million) (World Bank, 2012), the reduction in damages would have been substantial.

Floating houses were mentioned by five respondents, but are still in the research and development stage within the National Housing Authority and Silpakorn University. However, when students from Silpakorn University presented their project to the public and private stakeholders, the response was indifference (respondent #10). Even between respondents, their practicality was questioned: with one respondent waiting to “see whether it’s practical” (respondent #13) and another relegating them to “a water park for entertainment” (respondent #12). Nevertheless, the projects are still in their infancy, and only time will tell if and how floating houses will be part of Bangkok’s built environment.

In an attempt to be inclusive in our definition of the housing sector, informal settlements are included. One respondent discussed adaptation within redevelopment strategies of informal settlements. While many public land owners have tolerated informal encroachment of canals in the past

(Yap & De Wanderler, 2010), since the 2011 flood Bangkok has increased its resolve to improve urban waterways. In regards to upgrading informal communities along the canals, one respondent commented:

We want them to be able to live with the canal so we make them face the canal, before that their backs were turned to it. They will take care of the canal better now that it is the front of their house and not the back where they throw rubbish. When it's the front of their house it needs to be clean (respondent #4).

This type of intervention encourages a sense of place or personal ownership in order to maintain a healthy canal (Thaitakoo & McGrath, 2008), and therefore reduces the likelihood of a flood. To adapt to flooding, the same respondent mentioned that upgraded houses are built stronger in order to withstand potential floodwaters.

Some developers of new housing are also improving their properties' ability to manage stormwater on-site, through stormwater retention ponds, water collection, and permeable surfaces. As one respondent explained:

Many big projects reduce [their] cost[s] by digging up soil from on area and moving it to another and it costs nothing. You can see in Sappakorn village that there's pond looking like a natural pond but it's not. It's dug (respondent #12).

Thailand's Environmental Impact Assessment Act (EIA) requires an assessment for housing projects equal to or greater than 500 plots or 16ha, and condominium projects that are equal to or greater than 80 units or 0.4ha (MNRE, 2010, Article 3, Annex 1.3.28,31). However, as one respondent noted, developers "just always keep [their developments] at 79 units" (respondent #13). Therefore, one respondent summarized: "Housing development smaller than 500 units should also have a pond too" (respondent #12). While respondents recognize that stormwater retention ponds are confined to large residential projects, which must conform to the EIA requirements, they also desire that this practice become more widespread.

The Bangkok Metropolitan Administration (BMA), which governs the provincial city of Bangkok, has begun to recognize the advantages of on-site stormwater management. The BMA has implemented a strategy to increase water collection and permeable surfaces in order to integrate the private sector into its flood management plan by allowing developments to build additional floors if either method is utilized (BMA, 2013). Five respondents noted that both of these strategies are being used by the private housing sector. However, the degree of implementation are speculative and range from the idea that "there are many projects, It's very popular" (respondent #3) to "people won't accept that" (respondent #12), since evaluation of these initiatives had yet to occur.

In addition to increasing stormwater management at the source, almost a third of the respondents mentioned that developers are also improving the ability to drain stormwater. Kreibich *et*

al. (2005) and King *et al.* (2015) recognize this trend among households, and therefore it is not surprising that developers are including this strategy during construction.

5.4.4 Retreat Adaptation

Retreating from flood prone areas is gaining wide support among academics; however in practice it can be difficult to implement. Nevertheless, eleven respondents mentioned that immediately after the 2011 flood homebuyers sought to relocate away from flooded areas, choosing to buy primary and secondary residences within Bangkok's protected area, on naturally elevated land, or in condominiums to avoid future floods. Therefore, private sector adaptation strategies are not solely based on the reduction of risk or damages, they are also in response to consumer demand. Of the four respondents that reported a rise in condominium development, one respondent explained:

One of the important reasons why condominiums are booming in the City of Bangkok is the great flood of 2011. People still have a bad image of the big flood, so they had the idea, 'the government has to protect the city of Bangkok, so the center of Bangkok is safe,' so we see many condominiums here (respondent #6).

Bangkok's structural flood protection measures also benefit the downstream province of Samut Prakan, which was largely spared from flooding in 2011. Therefore, another respondent mentioned, "[Developers] knew that Samut Prakan didn't flood in 2011; they came here to develop housing communities, while people didn't buy houses in Bangbuathong and Nonthaburi which flooded" (respondent #10). Therefore, consumer demand for housing located in safer locations has led to adjustments in private sector actions. However, this strategy was short-lived, as the previous respondent further explained: "Many people wouldn't buy a [house in low areas], especially in 2011 and 2012, but nowadays people are getting back to [buying] them. Their attention is towards the train lines and power plant, so now flooding is overlooked" (respondent #10).

5.4.5 Adaptation Funding

Five respondents reported the private housing sector provides resources for public projects. They also noted that the private housing sector provided relief aid, volunteers, and equipment during past flood events. While private sector funding, and support, of disaster relief, and private-public partnerships, are discussed in disaster risk reduction literature (Carmin *et al.*, 2012; IPCC, 2012; Roeth, 2009), there is limited information on how companies that are not directly engaged with constructing or operating these projects, such as housing developers, could be included. As one respondent mentioned, private firms "just donate when something bad happens" (respondent #1) or as another added, "Only during times of emergency, there isn't really a system. Usually the private sector would sponsor the food for the volunteers. Then they go on TV to talk about it" (respondent #3). One respondent mentioned a desire to formalise monetary contributions for proactive adaptation by "[setting] up a fund

for flood prevention,” with the idea that “if everyone is responsible for the area, flooding will not happen. We can use money from the fund to build a bypass to drain water out” (respondent #21). By incorporating the private sector as a source of funding for public flood protection, as well as their adaptation strategies to reduce the risk of flooding their own properties, the benefits from private sector adaptation can extend beyond a single property (IPCC, 2014; Carmin *et al.*, 2012; United Cities and Local Governments, 2011).

5.4.6 Limited Adaptation

As mentioned, only a few respondents attributed some responsibility for flood risk reduction to the private sector, yet the private sector is adapting. Perhaps this is due to a general lack of faith in the government’s ability to protect the city, as one respondent mentioned:

If the central government provides alternative measure[s] to prevent the flood efficiently, it would be much better. But the government themselves cannot do that so private housing sectors have to protect their properties in their own ways; otherwise they will be responsible if it’s damaged (Respondent #13).

While the majority of respondents agreed that the private housing sector is adapting, six respondents reported that this is very limited in scope. Non-traditional approaches to reduce the risk of flooding, such as constructing floating houses, improving drainage and stormwater management systems, and elevating electrical panels, remain underutilized. Respondents provided two possible explanations for the limited uptake of adaptation strategies since the 2011 flood: the infrequency of extreme weather events and a trust in public protection measures. One respondent noted, “There is not much [that has] change[d] because people think that a large flood like the one in 2011 does not happen often” (respondent #5). Since extreme events are very infrequent, developers lack the immediate motivation to adapt (Hertin et al, 2003). Or, as another respondent noted, “residents have a strong belief that the local administrations have prepared in advance, and the government have allocated budgets for that” (Respondent #22). Nevertheless, the 2011 flood illustrates that large floods are possible, and can cause significant damage to the BMR.

Private sector adaptations have developed regardless of a lack of public sector direction/policy. Multiple respondents mentioned that developers adapt out of a desire to do so rather than being required or incentivized to do so. One respondent commented: “If [developers] have the idea that they want residents to live safely, then they should choose locations that are safe” (Respondent #8). Or as another stated: “[Developers] should consider their location well before building” (Respondent #10). Developers are also left to “[choose] material” that is flood resistant (Respondent #15). Furthermore, departmental websites and publically available documents (in English and Thai) provide very limited, if any, guidance for housing adaptations to flood risk.

Private sector adaptation to flood risk has increased after the 2011 flood, with numerous strategies employed regardless of government direction. These strategies have implications, not only for the adapted property, but that surrounding community as well (Tompkins & Eakin, 2012).

5.4.7 Impact of Private Housing Sector Adaptation

As the private housing sector adapts to the increasing flood risk, its actions may have negative repercussions for the surrounding community. One respondent summarized the state of the private housing sector's adaptation strategies in Bangkok by stating:

Each person tries to elevate their own house to fix problems of flooding and lowlands. They just care only themselves and how to be better and higher than others. They don't pay attention to the rights and negative effect on others at all (respondent #10).

Five respondents cited unappealing urban design (e.g. high flood wall barriers) and destroying cultural values (e.g. reduced fishing livelihood) as negative impacts. While urban design is important to cities, twice as many respondents recognized that private sector adaptation can increase flood risk within networked infrastructures. For example, if one property is elevated while adjacent properties are not, when it rains stormwater will run off the raised property and pool in low-lying properties. As one respondent stated:

The lower land may face flooding and drainage problems because water from the higher area will flow downwards to the lower area and into their house and the owner of the lower house has to find their own way to drain water out. (respondent #10)

In addition to elevated ground, another respondent used Amata Nakorn, an industrial estate in Chon Buri, as a recent example of the impact of walls and effective internal pumping capacity, "The industrial estate [has] very high walls around them. During the last heavy rain, they pumped out the water and flooded the communities nearby" (respondent #3). The private housing sector, therefore, is adapting in a way that serves their interests, with little regard of how their action can impact surrounding properties or the community.

5.5 Discussion

5.5.1 Ad Hoc Adaptation

In a rapidly developing city, planning orderly development is a constant struggle (Roy, 2009). This is particularly true in Southeast Asia where high proportions of municipal budgets are used to maintain the status quo, leaving few resources to monitor, evaluate, or update plans and policies (United Cities and Local Governments, 2011), including those to direct private sector flood adaptation strategies. Reducing flood risk must, therefore, compete with other major concerns, such as transportation issues and the growing divide between the rich and the poor (see BMA, 2013). Building codes regarding stormwater management in Bangkok, for example, have remained unchanged since

they were first implemented in 1979 (Babel & Rivas, 2012). As such, developments need only to connect their drainage systems to the municipal network. Twenty years ago, NEDECO *et al.* (1996) recommended modifications to the Bangkok Metropolitan Administration Act on Building Control to including front yard setbacks and lot coverage to help address stormwater issues; however they have yet to be implemented (Babel & Rivas, 2012). The highly centralized political context can further impede appropriate measures to direct adaptation, since changes that may be necessary or beneficial in Bangkok may not be relevant in other areas of Thailand.

The BMA has only recently begun to encourage flood risk reduction schemes, albeit limited to new high-rise developments (BMA, 2013). By providing community benefits a high-density building can increase its floor area ratio up to 20 per cent. The BMA has community benefits that are incentivized, two of which are flood-related: short-term water retention and increased permeable surfaces. The increased uptake of these strategies can have two positive outcomes to reduce flood risk (Chocat *et al.*, 2007; Mitchell *et al.*, 2007). First, it will reduce the risk of flooding by retained water on-site and not allowing it to escape and become floodwater. Secondly, by retaining stormwater for a period of time or allowing it to infiltrate into the ground, the demand on municipal drainage system is reduced. This will lower the immediate demand on drainage infrastructure during a rain event, and therefore lower citywide flood risk, as well as lowering infrastructure costs of the city (Chocat *et al.*, 2007). However, the limited scope of these incentives curtails their potential benefits.

Bangkok, and Thailand more generally, has been unwilling and/or unable to direct urban growth away from flood prone areas, and at times actively work against creating a more flood-resilient environment. By allowing ad hoc development—and even promoting development in floodplains—the government reduces the City’s resilience to flooding. While Bangkok was once referred to as the Venice of the East with its meandering Chao Phraya River and network of canals, most of the canals have been paved over with roads (Poaponsakorn & Meethom, 2013; Marome, 2012; Kenworthy, 1995), reducing the city’s ability to convey stormwater out of the city. Centralized policies have encouraged development within floodplains, especially within the industrial sector, and overruled local advice when it built Suvarnabhumi Airport within a floodway (Lebel *et al.*, 2011).

With limited oversight or direction, the private housing sector has adapted on an ad hoc basis. Respondents commented that limited enforcement, corruption, and nepotism allow the private sector to develop with minimal restrictions or repercussions for their actions.

5.5.2 Networked Urban Infrastructures

The private housing sector’s involvement in reducing the risk of flooding can provide co-benefits that the public sector may not be able to provide, such as increased investment potential, site-

specific plans, widespread uptake, and quicker development and implementation of strategies (Tompkins & Eakin, 2012). Private housing adaptation can also act to reduce flood risk to not only their property but the surrounding area as well, and reduce the overall infrastructure needs of the city (Tompkins & Eakin, 2012). As a result, changes in housing infrastructure can have a ripple effect on other infrastructure systems that are connected to it (such as drainage or transportation) (Omer, 2013).

The practice of building on higher ground is, in theory, the best option (Hooijer *et al.*, 2004). River and coastal flood risk would be virtually eliminated and surface flooding greatly reduced by conveying water to waterways. However, in coastal metropolitan areas, such as the BMR, high ground is scarce. Due to poor land use planning and rapid population and economic growth, development has been allowed, and often encouraged to develop on hazardous floodplains (Lebel *et al.*, 2011). While ideas of relocating the capital city to higher ground have been around for decades, the resources to implement such an adaptation strategy would be enormous. Nevertheless, as Bangkok continues to sprawl into adjacent provinces, particularly Nonthaburi, Pathum Thani, and Samut Prakan, high ground will continue to be sought along the urban fringe. Urban sprawl across a floodplain may perpetuate the negative effects of future flooding, as greater concentrations of people are situated in flood prone areas. Therefore, for the BMR, relying on higher ground to build can only be part of the city's adaptation strategy.

Respondents recognized that the actions taken by the private housing sector can increase the risk of flooding to adjacent properties. The increased flood risk to adjacent areas has two forms. First, respondents commented the elevated lands will increase the rate of runoff to non-elevated lands where it will begin to pool if effective drainage is not available. Secondly, the potential for flooding increases as properties improve or construct more efficient drainage systems, which increase the rate of stormwater conveyance off of a property. An increase in efficient conveyance has numerous negative environmental impacts, in addition to increased flood risk for areas downstream. This can be two-fold. First, municipal drainage capacity can be exceeded and cause storm drains and canals to overflow. Second, private drainage systems may not be fully connected to the municipal system, and instead discharge stormwater directly onto adjacent properties or sensitive environmental areas.

Elevated lands, therefore, can increase the burden of the low-lying residents, who did not have the financial resources to elevate their land in the first place and would likely also have limited funds to cope with increase runoff. For example, theoretically if half of the properties are elevated or have evasion strategies coupled with an efficient drainage system, then during a localized storm event the low-lying properties would experience up to twice as much surface floodwater than otherwise would occur if all properties were at the same elevation and drainage capacity.

As certain actors in the private housing sector adapt, others cannot. Graham & Marvin (2001) argue the new technologies, such as advance in site-specific flood management strategies, can widen the gap between the rich and the poor. The value of naturally higher lands will likely increase with demand and floods continue to plague the region, and therefore could become “spaces of seduction” for those who can afford them, while the urban poor and working classes remain on more vulnerable low-lying land, perpetuating the divide between the rich and the poor in the BMA (Graham and Marvin, 2001). Beyond the safety of higher ground, “fortress spaces” (Graham & Marvin, 2001) have developed in Bangkok where private properties literally construct walls in case municipal stormwater infrastructures fail.

Inequality in stormwater management that increases the risk of flooding to others can also lead to ‘water wars.’ While water wars are generally discussed as a conflict of water scarcity (Chellaney, 2013), the BMR provides an example of water conflict due to an overabundance of water. Conflict of this nature has already been witnessed in the BMR during the 2011 flood between those who were safe behind protective measures and those who were flooded (Poaponsakorn & Meethom, 2012). On a number of occasions, and in various locations across the region, conflict erupted along sandbag walls and water gates, as those who were subject to mandatory flooding looked on to those whom the city deemed worthy of keeping dry (Poaponsakorn & Meethom, 2012; Fuller, 2011). As the province-wide public system of dykes, canals, and water gates is matched by site-specific private system of protection walls and drainage systems, conflict could become more localized, pitting neighbours against neighbours. The 2011 flood, and more recently the localized surface flooding in Bangkok in March and June 2015, should be a catalyst for action among officials who continue to believe that residents should be content living with floods (Fernquest, 2015).

The second way the risk of flooding is increased is through blocking natural water pathways. As one respondent noted, “at the moment there are not many [elevated] houses yet [in Pathum Thani], so elevation will not be a problem. But if there are many dwellings, the elevation will definitely obstruct the flow of water and waterways” and “in populous areas, if everyone put up walls, these walls will obstruct the waterways” (respondent #9). Exacerbating this issue, in some instances, is the practice of filling in, and constructing over, natural waterways. The length of the 2011 flood has been, partly, blamed on an increase in obstacles that inhibit overland floodwater from reaching the ocean (Poaponsakorn & Meethom, 2012).

Private sector adaptation can, therefore, be maladaptive and ultimately increase flood risk for the city (Kindornay & Twigg, 2015; Barnett & O’Neill, 2009). This should not be a surprise if profit is the key motivator for adaptation in Bangkok, especially in the housing sector where long-term

investment in a property is rare among developers. In order to curb the negative externalities of private development, stronger urban planning is needed.

5.5.3 Urbanization and Densification

There has been a growing trend in planning, in theory and practice, for densification (Clark, 2013; Anas, & Hyok-Joo, 2006; Weitz & Moore, 1998; Gail, 1992). While there are notable benefits for limiting urban sprawl through creating denser communities, increased density could prove maladaptive for certain urban areas, such as the BMR. The trend of greater density through increased construction of condominiums within Bangkok could lead to an increased risk of flooding. The threat is two-fold. One respondent worried that a greater concentration of high-rises “might be a worse decision” (respondent #6) since it would put more people in the vulnerable floodplain under the illusion of full protection. Therefore, if the protective measures ever fail again there will be even more people affected by a flood, needing vastly more resources to cope and respond to the situation, and higher cost of damages. Secondly, as density increases the weight of buildings will increase. As mentioned above, Bangkok currently subsides at a rate of 1cm/year (World Bank, 2010a) and the added weight of more condominiums (not to mention fill to elevate properties) will compound this existing problem. Not only will this increase the risk of construction failure as buildings shift on sinking land, but it will also increase the risk of coastal flooding and may prolong drainage during storms or a flood (Taramelli *et al.*, 2015). Furthermore, when sea level rise is accounted for the impact of subsidence is multiplied.

5.5.4 A Case for Stronger Planning Institutions

Overall, our research illustrates that the private housing sector in the Bangkok Metropolitan Region (BMR) is adapting to flooding. With limited government regulations, programs, or incentives the adaptation process in the BMR is largely independent of government direction. Hertin *et al.* (2003) found incentives to adapt to climate change among home-building companies in the United Kingdom were ineffective due to a limited perceived need to adapt at the beginning of the supply chain, which only experience minimal impacts of climate change. Furthermore, Keenan (2014) determined that among commercial real estate firms in New York City, adaptation to flooding occurred regardless of municipal incentives or regulations. However, in Bangkok the lack of government direction has also resulted in negative externalities, or maladaptation, of private sector adaptation, a concept that Hertin *et al.* (2003) and Keenan (2014) largely neglect. Managing development in rapidly urbanizing cities can be extremely difficult and traditional planning approaches—such as building codes, design guides, by-laws, zoning, urban boundaries, incentives, and educational programs which are widely promoted in the literature (Brown *et al.*, 2012; Aerts & Botsen, 2011; Blanco *et al.*, 2009; Kreicbich *et al.*, 2005;

Mendelsohn, 2000; Mehndelsohn *et al.*, 1994; Gail, 1992)—must be accompanied by strong institutions that are able to enforce legislation, coordinate multiple jurisdictions, and competing interests.

Respondents highlighted the lack of institutional capacity to enforce current regulations in the BMR. For example, in Nonthaburi, a province with 1.33 million residents in 2010 (NSO, 2010), there are only six urban planners, four at the province's City Planning Department (CPD) to develop plans and policies, and one for each of the municipalities of Nonthaburi and Pak Kret to implement provincial plans. Similarly, the centralized Department of Public Works and Town and Country Planning (DPT), which has the mandate to advise provincial urban development, has five planners for the BMR. As a point of comparison, the city of St. Catharines in Ontario, Canada, has six planners for a population of 130,000. In regards to climate change, Saito (2014) found that it has not been integrated effectively into any plans or policies in Bangkok; however, integrating climate change into policies and plans is moot if policies and plans cannot be enforced.

5.6 Conclusion

Climate change is predicted to increase extreme weather events, which will result in increased risk of flooding in Southeast Asia (IPCC, 2014). The 2011 flood in Thailand, which has been linked to climate change (Hoffmaister *et al.*, 2012), provided an opportunity to investigate the housing sector's adaptation strategies used to reduce the risk of floods. Through interviews with public officials at various agencies engaged in flood management, housing, and/or climate change we determined that the private housing sector is adapting primarily through elevating land, building higher walls, and increasing a property's ability to drain stormwater.

These actions, if implemented well, can effectively reduce the risk of flooding on private property, as well as nearby properties. However, due to rapid urbanization and an inability for the government to manage private action, the private housing sector has adapted in an ad hoc manner. As a result, its adaptation strategies can have negative impacts on surrounding properties, infrastructures, and communities, including an increased risk of flooding and conflict between those who have the capacity to adapt and those who do not.

More research is required, therefore, to understand the dynamic nature of urban climate change adaptation in rapidly globalizing cities, such as Bangkok. If traditional planning practice cannot manage private sector adaptation in rapidly developing cities, new and innovative strategies need to be developed to effectively manage urban adaptation. This paper provides a necessary first step to achieve this end; however, more research is needed to understand what can trigger sustainable and equitable adaptation options within the private sector.

Section 6: Thesis Conclusion

Climate change is increasing the frequency and severity of natural disasters around the world. While both rural and urban area will feel the impact of climate change. Due to the density of people and investment in infrastructure, cities will experience unique challenges to adapt (Revi *et al.*, 2014). Unfortunately most municipalities, for one reason or another, struggle to adapt—especially those in low- and middle-income countries, such as Thailand.

In Thailand, climate change has resulted in a shift in precipitation that results in fewer, but more intense, rainfall events. Current flood and drought management systems are not sufficient to cope with a new climate regime, and have led, in part, to the national flood in 2011 and localized urban flooding in Bangkok in 2015, as well as a national drought in 2015. This thesis explored the ramifications of ineffective public management of water resources, and has argued that this ineffective management has led to increased involvement of the private sector in flood management, particularly in the private housing sector. The involvement of the private sector has produced mixed results. I interviewed public officials working in flood management, housing, and climate change agencies within the Bangkok Metropolitan Region (BMR) (n=23) and reviewed articles in six newspapers (n=926) to understand the current context of flood management and private sector adaptation in Thailand, and the BMR specifically.

6.1 Key Findings

6.1.1 Institutional Traps and Private Sector Engagement in Flood and Drought Management

Cities around the world are struggling to adapt to the impacts of climate change (Revi *et al.*, 2014). This is especially true in low and middle income countries, such as Thailand, where public institutions are ensnared by traps that hinder effective actions to address flood and drought management in a changing climate (Lebel *et al.*, 2011). Interview respondents and an analysis of newspaper articles confirm previous research, which found that government organizations are hindered by issues of fragmentation, rigidity, and elite capture (Maier-Knap, 2015; Foran *et al.*, 2012; Reynolds & Team, 2012; Lebel *et al.*, 2011; Huaisai *et al.*, 2006; Shook, 1997). Furthermore, this research also confirmed and expanded on scale and crisis management traps, which are less prominent in the literature. Institutional traps have led to water mismanagement, which is frequently cited in existing literature, as well as by interview respondents. Results indicate that the 2015 urban floods and national drought can also be attributed to poor flood and drought management by various government agencies, from local administrative organizations to centralized ministries. This has, in part, led to mistrust in the government's ability to manage water, and has inadvertently encouraged other stakeholder involvement in flood and drought management—notably the military, royalty, and the private sector. While, for one

reason or another, the military and royalty were frequently praised by the media for their involvement, the private sector garnered mixed reviews.

Newspaper reports on the private sector's strategies to cope with or prepare for floods and droughts highlight positive and negative aspects. In an attempt to satisfy personal or corporate interests, some property owners have acted disreputably in order to obtain a secure water supply during droughts or implement flood protection measures, through strategies including exploiting policy loopholes and participating in corruption and theft. However, lack of effective public flood and drought management has also stimulated non-governmental organizations, many of which have corporate ties such as the Coca-Cola Foundation, to promote sustainable water practices. Some private housing firms are also setting a larger section of land for stormwater management and establishing a fund to be better prepared for disaster events.

Therefore, while institutional traps hinder effective flood and drought management by the public sector, they can also stimulate action in non-government agencies and sectors. However, how other actors engage in flood and drought management must be managed to insure that their actions are in the best interest of the wider population.

6.1.2 Private Housing Sector's Flood Adaptation Strategies

Following the first manuscript, which found that the private sector is a key stakeholder in climate change adaptation in Thailand, the second manuscript investigated and evaluated the strategies the private housing sector currently employs in the Bangkok Metropolitan Region (BMR) to reduce the risk of floods. The private sector is widely recognized as a stakeholder in climate change adaptation, but there is limited knowledge about their actions to reduce flooding within the BMR. Interview respondents listed numerous strategies that the private housing sector employs to cope with and adapt to flooding within the BMR, including strategies to protect, accommodate, and retreat. Their adaptive strategies can effectively reduce the risk of flooding to their properties; however, the majority of respondents are concerned that the private housing sector's strategies to reduce flooding are ad hoc and will negatively impact the city now and in the future. With limited government oversight, the adaptation process is largely uncoordinated and unplanned. Therefore, stronger urban planning is required in order to reduce or mitigate the negative impacts of private sector adaptation, and capitalize on its positive outcomes. As the national economic hub, Bangkok is privileged with a close connection to the centralized government, especially with the funds they possess. However, making the connection between federal resources and municipal planning can be complicated. Nevertheless, in the case of Bangkok there is added personal incentive by the governing elite to improve flood and drought management within the city and beyond, in order to protect their own houses and communities from the

impacts of floods and droughts. In this regard, elite capture could prove beneficial in provided increased support for flood and drought management in Bangkok. However, this should be done with regard for areas beyond Bangkok.

6.2 Cyclical Poor Flood and Drought Management and Private Sector Adaptation: Future Research

When the two manuscripts are reviewed collectively, a feedback loop could exist. When government institutions are trapped and unable to provide effective flood and drought management, other stakeholders will act to cope with and adapt to increase risk of water-related disasters. However, the private housing sector's actions may lead to increased water-related disasters themselves, thus perpetuating the cycle. While Lebel *et al.* (2011), as well as this thesis, utilised institutional traps as a framework to evaluate flood management, institutional traps can apply to other institutions as well (Polterovich, 2007, 2001). Therefore, more research is needed to determine if planning institutions in the Bangkok Metropolitan Region are similarly trapped or if they can effectively manage private sector development and help the BMR escape from snare of institutional traps and poor flood and drought management.

6.3 The Private Sector's Voice

This research interviewed public officials on their perception of impacts of private sector adaptations and, with support from newspapers, presented a rationale for private sector involvement. While the public sector is a necessary actor and regulatory body, the private sector must also be engaged directly. Specifically, there is a need to understand how the private sector views their own actions, and the actions of other private sector actors, as well as what motivates them to adapt. Such research would inform public institutions on how the private sector could be motivated to adapt in way that is beneficial to the community beyond a landowner's property line.

6.4 Looking Beyond Bangkok

This research is relevant to cities and regions beyond Bangkok and Southeast Asia. With an estimated 200 million people at risk of annual flooding around the world (UNDP, 2004), and another 100 million are projected to be at risk if no action is taken to adapt to climate change (IPCC, 2007), flooding is a common natural hazard that numerous nations and cities must address. With the impacts of climate change, annual flood risk will increase and shift geographic locations based on a new precipitation regime. Extreme weather events are also projected to increase around the world (IPCC, 2007). Many low and middle income countries suffer from some or all of the institutional traps that

Lebel *et al.* (2011) identified, therefore this thesis presents a possible outcome of those traps in other locations with similarly weak public institutions.

Cities in high income countries may also find this research relevant. Primarily, it provides a foundation to maintain strong institutions and public sector involvement in private sector affairs. In a time where national level governments are downloading more responsibility to lower level governments (United Cities and Local Governments, 2011), especially when climate change adaptation is involved (Kehew *et al.*, 2012; Tavares & Santos, 2013; Lesnikowski *et al.*, 2011), mechanisms must be in place to ensure that lower level governments remain strong and capable to fulfill their new responsibilities.

This thesis has provided a basis to understand the private sector's involvement in flood management. It is hoped that this research will inform practice and contribute to stronger planning institutions to encourage positive private sector adaptation to water-related risks, while discouraging maladaptive practices.

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Appendices

Appendix 1: Email Recruitment

Email Subject Line: Interview: Private sector involvement in flood risk reduction

Dear _____:

My name is Karmen Whitbread and I am a Masters student from the University of Waterloo, Canada in the School of Planning. I am working locally with the support of Professor Wijitbusaba Marome at the Thammasat University who, I believe, has recently contacted you in regards to my Master's research project. I am inviting you to be involved in my research project by participating in an interview that will take about 45-60min.

To follow up with Prof. Marome's contact I would like to request your participation in the project I am conducting as part of my Master's. The devastating flood of 2011 highlights the need to adapt to flood risk. While the public sector has a major role in protecting its citizens from flood hazards, the private sector has been increasingly recognized as having a large potential to self-adapt. As climate change threatens increase the severity of floods, a better understanding of the role that the private sector can take in reducing flood risk is necessary, not only to save lives and a livelihoods, but also to maintain the local and national economy. Therefore, this study seeks to understand the role that the private housing sector can take to reduce flood risk and how the city can support such efforts.

It is my hope to connect with people who are engaged in the *[housing/flood management]* to invite them to participate in this research project. I believe that you have a unique understanding and experiences relating to the risk of flooding in Bangkok. Participation in this study would entail an interview, during which we would discuss the role of the private housing sector in reducing flood risk and how city planning and policies can support private sector flood adaptation. Interviews will take about 45-60min; however the amount of time can be adjusted to meet your availability. Participation in this study is completely voluntary.

All information you provide through your participation in this study will be kept confidential. Neither your choice to participate nor the content of the interview will be shared with your employer. You will not be identified in any report or publication based on this research. Furthermore, I do not anticipate any risks in participating in this research. If you'd permit the use of audio recording, the recording will be destroyed immediately after the interview has been transcribed. All other data will be kept in a secure location for 6 years and then destroyed.

If you have any questions regarding this study, or would like additional information, please contact me at 095-510-7983 or email at kwhitbread@uwaterloo.ca. You may also contact my supervisor, Carrie Mitchell, at 0011-519-888-4567 ext. 33027 or by email carrie.mitchell@uwaterloo.ca. If you would prefer, collect calls will be accepted and, if necessary, a translator will be employed.

I would like to assure you that this study has been reviewed and received ethics approval by a University of Waterloo Research Ethics Committee. However, the final decision about participation is yours. If you have any comments or concerns with this study, please feel free to contact Dr. Maureen Nummelin, the Director, Office of Research Ethics, at 0011-519-888-4567, Ext. 36005 or maureen.nummelin@uwaterloo.ca.

I hope that the results of my study will be beneficial to your *[organization/department]* and to the City of Bangkok, as well as other municipalities and urban planning, disaster risk reduction, and climate change researchers and private sector developers. I very much look forward to speaking with you and thank you in advance for your assistance with this project.

Yours sincerely,

Karmen Whitbread
Master's Candidate, School of Planning
University of Waterloo, Canada

Appendix 2: Project Information and Verbal Consent Script

Hello,

My name is Karmen Whitbread and I am a Masters student at the University of Waterloo, Canada. Thank you for taking the time to meet with me today. This interview is for my research on the role of the private housing sector in reducing flood risk and how municipal policies can support it. This study is funded through the Coastal Cities at Risk (CCaR) project and is supported locally by Professor Wijitbusaba (Ann) Marome at the Thammasat University.

This study will address how the private housing sector responds to the risk of flooding globally and specifically within Bangkok. It also seeks to understand how municipal policies can aid in the private sectors in this matter. Participants from various housing associations and city departments which engage in flood management have been selected to be interviewed. Participation in this study is voluntary and you may withdrawal at any point. The interview will take 45-60 minutes to complete and may decline to respond to any question.

All information you provide while participating in this study will be kept confidential. Neither your choice to participate nor the content of the interview will be shared with your employer. You will not be identified in any report or publication based on this research. I do not anticipate any risk to you for your participation in the study. To ensure an accurate recording of your responses, the interview may be audio recorded. All recordings will be destroyed after transcription, and all other data will be kept five years after the completion of my Master's degree, which is anticipated to occur during the summer of 2016, or 2559 in the Thai calendar. Excerpts from this interview may be included in my thesis and/or publications that come from this research; however any use of quotations will be anonymous

I would like to inform you that this study has been approved by a University of Waterloo Research Ethics Committee. Nevertheless, the decision to participate is yours. If you have any comments or concerns with this study, please feel free to contact Dr. Maureen Nummelin, the Director, Office of Research Ethics, at 0011-519-888-4567, Ext. 36005 or maureen.nummelin@uwaterloo.ca. If you would prefer, collect calls will be accepted and, if necessary, a translator will be employed. If you have any questions or comments about this study after our meeting today, here is my business card with my contact information on it.¹¹

- Do you have any questions?
- Do you agree, of your own free will, to participate in this study?
- Do you agree to have the interview audio recorded?
- Do you agree to the use of anonymous quotations in any thesis or publication that comes from this research?

Thank you for your cooperation in this study.

¹¹ My business card will contain my email, phone number in Thailand and Canada, and the University of Waterloo's mailing address. It will be double sided with English on one side and Thai on the other.

Appendix 3: Interview Questions

Interviewer: _____ Date: _____

Translator: _____ Time: _____

Participant: _____ Position: _____

Agency: _____ Gender: _____

Introductory Questions

1. What are your responsibilities within the organization?
2. How many people work for the organization?
 - a. How many fall under your direction?

General Flood Questions

3. Can you describe the current state of residential flooding in the Bangkok Metropolitan Region?
 - a. What kind of flood occurs where?
4. Can you describe who is currently responsible to reduce the risk of residential flooding?
 - a. Whose responsibility do you think it should be?
 - b. Do you feel the private sector is responsible to provide flood protection?
5. What does your organization do to reduce the risk of flooding in residential areas within BMR and how do you do it?
6. How do you currently provide information about flood risk to private housing stakeholders?

Window of Opportunity

7. In your opinion, what was the cause(s) of the 2011 flood?
8. How has the housing sector responded to the flood of 2011, both formally and informally?
9. How have these changes been evaluated?
10. What is your view towards climate change and the risk of flooding?

Adaptation

11. How can new private sector housing be constructed to reduce the risk of flooding?
12. How can the existing housing stock be adapted to reduce the risk of flooding?
13. What are the impact of private housing sectors adaptation to flooding?
 - a. How can private housing sector adaptation influence, either positively or negatively, the risk of flooding to nearby areas?
14. Do residential properties work with neighbouring properties to reduce the risk of flooding? If so, how?

Policies

15. Does Thailand or the City of Bangkok/BMR have any policies, by-laws, or guidelines for best practice regarding private housing sector flood protection? If so, what ones?
 - a. If so, do you think they are effective? How could they be improved?
 - b. If not, do you think there should be? How could they help your association?
 - c. Do you have a copy that I could have?
16. What new policies could be implemented to promote reducing the risk of flooding by the private housing sectors?

- a. How can positive new or existing housing developments be encouraged to positively adapt to reduce the risk of flooding?
- b. How can negative adaptations be discouraged?

Normative View

17. Ideally, what role should the private housing sector take to protect against flooding?
 - a. What can the City of Bangkok/Nonthaburi do to support this role?
18. What are the barriers/challenges for the private sector to provide flood protection in the housing sector?

Site Visits

19. Are there any specific sites that you think demonstrate either good or poor private housing sector adaptation?

Snowball

20. Do you know of anyone else who may be interested in participating in this study and share their knowledge on this topic?

Appendix 4: Newspapers Review Procedure

Newspapers Information

1. Record newspaper, date, and weekday/weekend/holiday
2. Record total number of pages (including classifieds, comics, etc.)
3. Record number of pages in general news, business, and opinion sections, as well as any other relevant sections.

Obtain Relevant Articles

4. Read headlines
 - a. Look for articles about natural disasters, housing, or climate change
 - i. Article about non-flood related canals were ignored (eg. the Kra Canal in Thailand that would facilitate a shorter shipping route, similar to the Suez Canal in Egypt)
 - b. If an article is ambiguous, skim/review article until its relevancy can be determined
5. Retain the article, with date and page number identified on the newspaper clipping

Review & Code

6. Record article codes
7. Record key information/quotes
8. Add any relevant comments

Appendix 5: Confidentiality Statements

Confidentiality Statements were signed by research assistants that had access to confidential information, such as respondents' identity, position, and audio recording. The four Canadian research assistants assisted with the newspaper review and analysis, which are publicly accessible; therefore confidential forms were not required. Below are the required signed Confidential Statements.

CONFIDENTIALITY STATEMENT

I understand that as an interpreter, transcriber, and research assistant for a study being conducted by Karmen Whitbread of the Department of Planning, University of Waterloo, Canada under the supervision of Professor Carrie Mitchell, I am privy to confidential information. I agree to keep all data collected during this study confidential and will not reveal it to anyone outside the research team. I agree to delete all audio recordings after transcriptions have been approved by Mr. Whitbread.

Name: Thitirat Pholcharoen Signature: Thitirat Pholcharoen

Date: 6/6/2015 Witness Signature: [Signature]

CONFIDENTIALITY STATEMENT

I understand that as an interpreter, transcriber, and research assistant for a study being conducted by Karmen Whitbread of the Department of Planning, University of Waterloo, Canada under the supervision of Professor Carrie Mitchell, I am privy to confidential information. I agree to keep all data collected during this study confidential and will not reveal it to anyone outside the research team. I agree to delete all audio recordings after transcriptions have been approved by Mr. Whitbread.

Name: Putthita Nimsawaeng Signature: [Signature]

Date: 7/8/2015 Witness Signature: [Signature]

Appendix 6: Key Newspaper Review Results

Key Quantitative Data from Newspapers

“WRA” Water-Related Articles (with articles about Thailand, elsewhere, or everywhere)	Newspaper						Total
	Bangkok Post	The Nation	Post Today	Thai Rath	Kom Chad Luek	Matichon	
Newspaper Characteristics:							
Language	English	English	Thai	Thai	Thai	Thai	
Geographic Scope	Bangkok	National	Bangkok	National	National	National	
No. of Natural Disaster Articles:							
All Disasters	219	174	111	65	70	84	726
WRA*-Thailand	106	92	92	49	53	61	453
WRA-Anywhere	153	120	96	50	58	64	541
Summary: Water-related articles comprise of 74.5% of all disaster reports, and of those approximate 4 out of 5 articles are about events within Thailand.							
Relative importance of WRA-Thailand reporting							
Days that WRA-Thailand made the front page	14	19	21	28	32	26	150
Percent of days	18%	24%	34%	45%	52%	42%	-
Summary: WRA-Thailand make the front page approximately twice as often in newspapers in Thai than in English. Additionally, 67% of natural disaster reports occur within a week of a rapid on-set event.							
No. of WRA that specifically mentions to flood and drought mismanagement:							
WRA-Thailand	20		14			34	
WRA- Outside Thailand	0		0			0	
Summary: Floods and droughts are reported to be mismanaged within Thailand while flood and drought management beyond Thailand are either reported uncritically or positively.							
No. of WRA-Thailand that mention various disaster stages:							
Cause	64	38	11	14	7	4	138
Impact	80	60	55	28	25	29	277
Response	72	63	34	19	23	29	240
Recovery	16	15	-	-	-	-	-
Prepare for another disaster	22	17	4	0	1	2	46
Summary: Reports focus on impacts and responses, with only 10% of articles mentioning recovery or adaptive measure to prepare for another water-related event.							
No. of WRA-Thailand that mention public and non-public actors in flood and drought management							
Public Agencies	76	64	-	-	-	-	140
No. of agencies mentioned	33	34	-	-	-	-	41
Military	11	5	-	-	-	-	16
Royalty	6	2	-	-	-	-	8
Private Sector	21	26	-	-	-	-	47
Summary: WRA-Thailand focuses on the actions of 41 public agencies, which appear in 70% of all WRA-Thailand. The private sector also makes a notable appearance in 24% of WRA-Thailand. Additionally, when multiple actors are mentioned within the same article, they are largely discussed independently of each other.							
No. of reports on climate change that mention:							
Mitigation	6	19	3	3	0	1	32
Adaptation	6	7	1	0	0	0	14
Summary: Adaptation is highlighted half as often as mitigation							

Key Themes Regarding Institutional Traps in Thai Newspapers

Sources

Institutional Traps	
Fragmentation	
Media report on the actions of government agency independent from each other, even when cited within a single article	Patsara, 2015; Saritdet, 2015; The Nation, 2015c
Rigidity	
A rigid view of agency roles leads to mistrust between agencies	Patsara, 2015
Flood management strategies focus on structural measures	The Nation, 2015e
Non-structural approaches are criticized for being ineffective to address flood and drought issues, while structure measures are presented positively	Bangkok Post, 201k; Tanatpong, 2015; The Nation, 2015d; Wasaman, 2015
There is lack of trust between agencies	Patsara, 2015
Elite Capture	
Urban centres (i.e. Bangkok) are prioritized over rural areas	Apinya & Manop, 2015; Bangkok Post, 2015d, 2015g; Sasithorn, 2015b; Supoj, 2015a
Urban poor are unsubstantially blamed for flooding in Bangkok	Holloway, 2015
Scale	
A highly hierarchical government structure limits local governments ability to adapt	Supoj, 2015a
Crisis Management	
There is limited planning for floods and droughts	Achakulwisut, 2015a; The Nation, 2015f
The BMA maintains their drainage system as a react to floods rather in preparation for the annual rainy season	Natthapat, 2015
Strategies to reduce the impact of the 2015 drought were developed during the event with minimal pre-planned drought measures (such as water conservation schemes)	Achakulwisut, 2015b; Bangkok Post, 2015m; Sasithorn, 2015b; The Nation, 2015d, 2015f
Impacts of Institutional Traps	
Flood and Drought Mismanagement	
Flood and drought mismanagement include: <ul style="list-style-type: none"> developing on floodplains; neglecting forecasts; mismanaging dam and water supply; and, exploiting groundwater extraction 	Achakuwisut, 2015; Bangkok Post, 201e; Osathanon, 2015; Witpatayotin, 2015; Wancharoen & Jikkham, 2015; Yongcharoenchai, 2015
Lack of Trust in Government Strategies	
Manufactures have lost faith in the government's water management plans	Apisitniran, 2015; Erich, 2015
Broadening of Flood and Drought Governance	
The military has become involved with localized floods	The Nation, 2015b; Wancharoen & Jikkham, 2015
The military was a key actor in the 2015 drought	Bangkok Post, 2015f, 2015j
Private sector actions are largely represented negatively	Bangkok Post, 2015l ; Katharangsiporn, 2015; Prateepchaikul & Attakor, 2015; Shepherd, 2015
The private housing sector disregards flood risk	Srimalee, 2015
The private sector can produce positive community outcomes by engaging in flood and drought management	Pimsa-noh, 2015; Srimalee, 2015; The Nation, 2015a

Appendix 7: List of Respondents

1. Chief Official. A Bangkok Metropolitan department. Bangkok. Interviewed in English on August 7, 2015
2. Division Manager. A national housing association. Bangkok. Interviewed in English on July 15, 2015.
3. Senior Official. A Bangkok Metropolitan Administration department. Bangkok. Interviewed on July 23, 2015.
4. Director. A Bangkok Metropolitan Administration department. Bangkok. Interviewed in Thai on July 14, 2015
5. Senior Analyst. A national agency. Email interview in Thai on July 14, 2015.
6. Director. A Bangkok Metropolitan Administration department. Bangkok. Interviewed in English on July 10, 2015
7. Senior Official. A national agency. Central Thailand and Bangkok Metropolitan Region. Interviewed in English on July 8, 2015.
8. Senior official. A Bangkok Metropolitan Administration department. Bangkok. Interviewed in Thai on July 10, 2015
9. Senior official. A Bangkok Metropolitan Administration department. Bangkok. Interviewed in Thai on July 10, 2015
10. Senior Planner. A Bangkok Metropolitan Region Planning Department. Interview in Thai on July 8, 2015.
11. Division Director. A national housing association. Central Thailand. Interviewed in English on July 7, 2015.
12. Division Director. A national housing association. Central Thailand. Interviewed in Thai on July 7, 2015.
13. Division Director. A national housing association. Central Thailand. Interviewed in Thai on July 7, 2015.
14. Division Director. A national housing association. Central Thailand. Interviewed in Thai on July 7, 2015.
15. Senior Official. A national housing association. Bangkok. Email interview in Thai on July 23, 2015.
16. Senior Official. A national housing association. Bangkok. Email interview in Thai on July 23, 2015.
17. Senior Official. A national housing association. Bangkok. Email interview in Thai on July 23, 2015.
18. Senior Official. A national housing association. Bangkok. Email interview in Thai on July 23, 2015.
19. Municipal Planner. A Bangkok Metropolitan Region municipality. Interviewed on July 24, 2015.
20. Senior Planner. A Bangkok Metropolitan Region Planning Department. Interview in Thai on July 24, 2015.
21. Senior Official. A Bangkok Metropolitan Region Department of Environment. Interviewed in Thai on July 24, 2015.
22. Chief Executive. A Bangkok Metropolitan Region Provincial Administration Organization. Interviewed in Thai on July 23, 2015.
23. Senior Planner. A Bangkok Metropolitan Region Planning Department. Interviewed in Thai on July 3, 2015.

Appendix 8: Fieldwork Pictures



Figure I: A Type Bangkok Canal.



Figure II: Larger Canal. Smaller canals, such as figure I, lead to larger waterways.



Figure III: Encroachment of Waterways. Many canals and rivers are encroached on by formal and informal settlements. The community depicted here were severely affected by the 2011 flood, since the sandbag wall to protect Nonthaburi was constructed further inland from the Chao Phraya River.



Figure IV: Encroachment of Canals. While newspaper articles blame Bangkok flooding on informal settlements that have developed along and over the majority of canals in Bangkok, respondents (#4 & #7) commented that the actual impact of these developments are unknown.

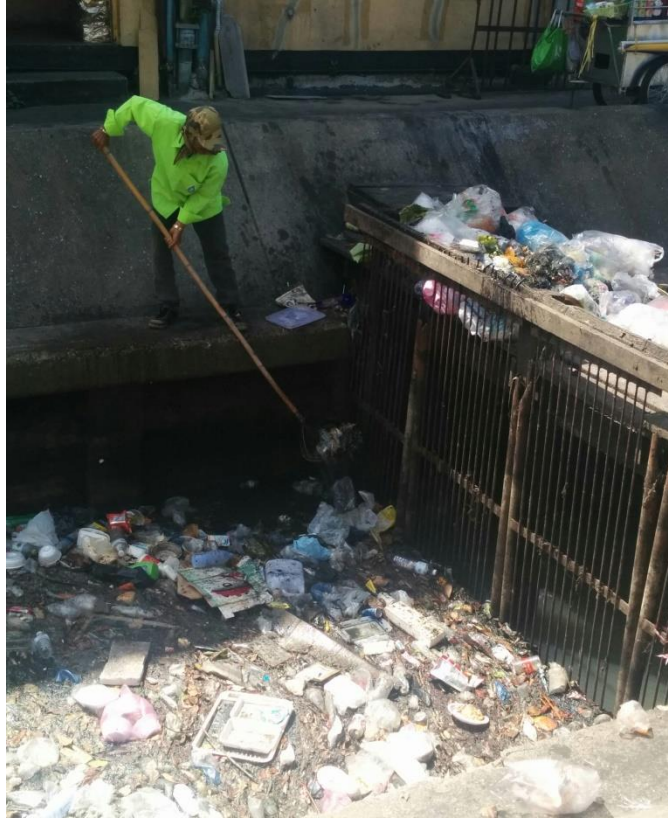


Figure V: Challenges of Canal Maintenance. This canal was cleaned approximately twice a month while I conducted fieldwork research, each time removing large quantities of garbage.



Figure VI: Weekly Garbage Pickup. Over 20 large baskets of garbage were collected weekly from approximately 1ha of four-storey residential buildings.



Figure VII: Development Over Canals. On the right of the chain-link fence with a green railing is a canal, which flows beneath a platform that residents use for various purposes.



Figure VIII: Industrial Sector Adaptation to Flooding. This industrial estate has built an approximately 2.0m earthen berm topped with an approximately 1.0m concrete wall. The estate also improved its pumping capacity. The 2011 flood line is visible approximately 2.5m up the power pole.



Figure IX: Splintering Adaptation. While the industrial estate from Figure II has reduced the risk of floods to their property, those beyond the wall remain at risk, and possible at greater risk than before the wall was constructed.



Figure X: Fortress Place. This residential community in Nonthaburi has constructed a wall to protect against both intruders and floods.



Figure XI: Monsoon Rains Roll In. Frequent short-duration, localized storms bring large volumes of precipitation areas of Bangkok which overwhelms the areas capacity to convey stormwater and leads to flooding typically between one to four hours.