



Proceedings of the Resilient Cities 2014 congress

Session F2 : Filling data gaps to address flooding in coastal cities

Mapping and Measuring Social Vulnerabilities of Coastal areas of Bangkok and Periphery (1)

Marome, W. A.

Abstract:

Bangkok and outlying areas are experiencing a need to protect its people, natural and man-made resources and productive capacities in response to the impact of climate change and increasing numbers of extreme weather patterns and events. In particular, due to the 'three waters' of runoff, rain and sea level rise, along with its low-lying topography of 1.0-2.0 meters, much of the capital is prone to inundation. Bangkok must become resilient to a wider profile of risks in order to be prepared for climate change. There is a need to reinvestigate the city as a system, bringing in an urban development approach from the past to the present into context in order to understand urban risks and promote climate resilience. This paper will discuss the spatial and non-spatial circumstances that affect individual and community-level vulnerability to climate change in Bangkok and its surrounds. The use of mapping and field surveys as part of this research will be outlined. Social vulnerabilities will be discussed in terms of risk variables related to floods and socioeconomic change as a result of urbanization. Social capital variables are also included in the understanding of risk which helps build long-term urban resilience. The importance of social capital and its link with social vulnerability at the most local level will be addressed.

Keywords:

Bangkok, Urban Resilience, Social Vulnerability, Flood, Mega City

(1) This paper is part of the research called "Coastal Cities at Risk: Building Adaptive Capacity to Managing Climate Change in Coastal Megacities". Case studies are Vancouver, Manila, Lagos and Bangkok. The research is funded by Canada's International Development Research Centre, the Social Sciences and Humanities Research Council, the Canadian Institute of Health Research, and the Natural Sciences and Engineering Research Council. The author is a team leader for the Bangkok team.

1. Introduction

In 2011, Thailand suffered its worst flooding in more than fifty years, with devastating social and economic consequences for the country. Even though the crisis was the result of an extraordinary confluence of natural factors, including months of unprecedented rainfall, it was also to some extent manmade. In the aftermath, Thailand has been forced to confront some painful lessons about the limitations of its current approach to urban and environmental planning. Bangkok and its peripheries are naturally exposed to flooding due to the geographical location of the lower area of the Chao Phraya River Basin along with its low-lying topography of 1.0-2.0 meters. Nonetheless, ineffective control of Bangkok's urban expansion adds possible socioeconomic impacts on flooding. An OECD report ranking cities (Nicholls et al., 2007) in terms of population and other exposures to sea level rise lists Bangkok among the top ten delta cities presently at risk. To plan for a safer city, social vulnerability seems to be the most challenging aspect for building resilience to climate change and planned adaptation. However, social and environmental effects are often missing from the official data. Damage assessment should be holistic, reflecting not only the economic costs.

This paper unpacks the social vulnerabilities of Bangkok's population and some extended areas in Samut Prakan province by understanding the progression of social risk and urban exposure. The social risk profile from urban exposure to the impacts of climate change, or risks from climate change within the area is different. What circumstances (spatial and non-spatial) place people and local communities at risk is the main research question for this paper. Firstly, the social system of cities is understood in terms of social characteristics and social capital. Secondly, social vulnerability and its progression are explored by the interaction/relationship between and among urban (built environment) and social systems. A mixed method of quantitative and qualitative data was used. Place-based research used mapping and field survey. As a result, a set of proxies for analyzing social vulnerabilities and resilience to environmental hazards was developed.

2. Area under Study: Risk Profile of Community-Case Studies

The environment and physical construct can predispose certain population groups and sectors to various risks which can impact their ability to withstand and efficiently cope with effects of the natural disasters and hazards. The following section discusses the "exposure" to risks posed by various environmental changes in Bangkok, and outer provinces of Samut Prakan. Risks due to exposure to environmental change include:

a) Landscape: Bangkok and peripheries are located in the low-lying area of between 1 to 2 meters above the Mean Sea Level. It is an area with a deep slope close to the ocean, with the Chao Phraya River running through, which was formerly suitable for farming, plantations and aqua culture. However the situation is different today following economic and industrial development and the expansion of urban communities, which has reduced agricultural areas.

b) Settlement areas of communities: The expansion of construction areas illustrates the settlement characteristics of suburban communities, which has changed in terms of concentration. Concentration has increased for areas around Bangkok, Eastern areas of the Chao Phraya River in Nonthaburi district, Samut Prakarn and Pathumthani. These clusters are longitudinal along the main river ways, and dispersed without planning into areas of agriculture. Urbanization has extended along the coastal areas, resulting in coastal communities close to the ocean river delta including coastal agriculture, such as shrimp farming. This reduced the mangrove population, which had acted as a natural protection layer. As a result, water erosion increased along the coastal areas, which has caused loss of land.

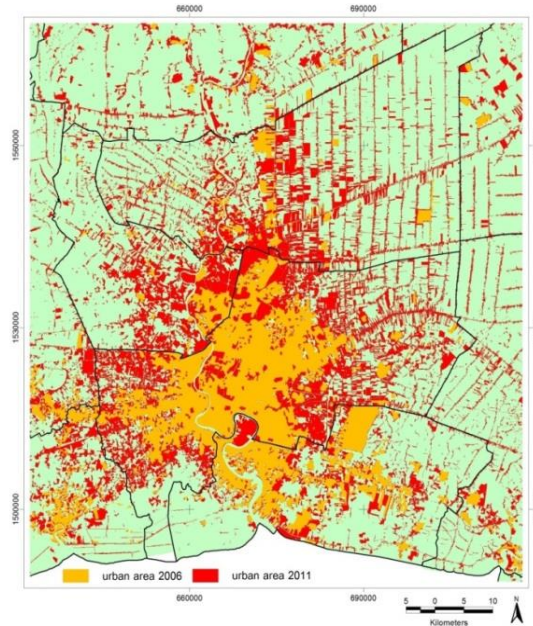
c) City Expansion: Bangkok is in the process of “sub urbanization”. The factors which indicate this are the development of higher population rates outside the city centre than the average within the city, changes to economic activity beyond agriculture, and the continuous and rapid expansion and construction into suburban areas. The provinces which have the highest tendency to develop quickly into urban areas are closely connected to Bangkok with good road networks. These include Nonthaburi, Pathumthani, and Samut Prakarn. As Samut Prakarn is a designated area for the industrial sector, many heavy industries were previously established near the river delta to facilitate logistics of manufacturing parts with Khlong Toei pier of Bangkok. This led to the increase in factories. The growth of the industrial sector also impacted residential areas. Factories relied on the workforce to enter into industrial sectors, which created residential areas and housing estates in the surrounding areas of the province.

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>



Map 1: Urban Area Expansion in Bangkok between 2006 and 2011

Data Source: GISTDA, Thailand (urban areas include buildings and built-up area using Landsat 5 with resolution 30 meters in 2006 and satellite imagery from Thai Chote with resolutions 2 meters in 2011)

The urban area has expanded considerably from 70,502 sq.km. (year 2006) to 228,459 sq.km. (year 2011) in the highest level of flood frequency flooded (equal or greater than 3 times), as shown in figure 1. All flooded area in this level locate in the east of Bangkok including Nong Chok, Min Buri, Lat Krabang and Khlong Samwa. The expansion of the urban area is equal to 52.84%.

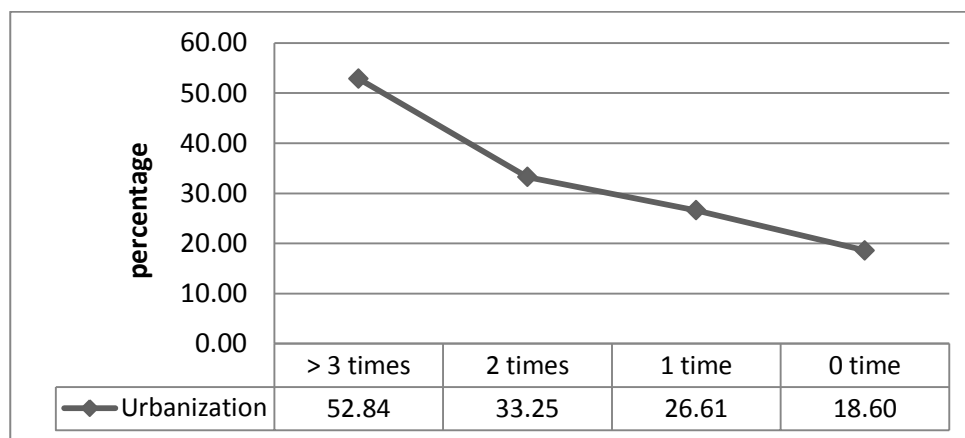


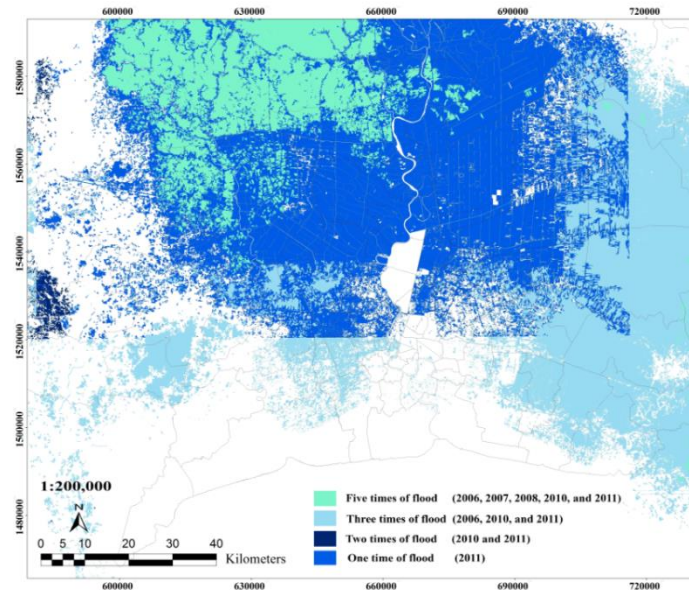
Figure 1: A graph shows a relationship between urbanization rate and flood frequency (2006-2011)

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>



Map 2: Flood Frequencies (Concerning Floods in 2006, 2007, 2008, 2010 and 2011)

Data Sources: GISTDA, Thailand

3. Conceptual Framework of Social Vulnerability

Disaster risk management in recent years has begun to prioritize the interaction between social systems and built-up structures. This approach acknowledges that societal and environmental practices can influence and reduce the resilience of communities (Cutter et al, 2008). This highlights the importance in considering social aspects of vulnerability in disaster-risk reduction measures. The Hyogo Framework for Action 2005-2015 laid out a framework which is crucial to the promotion of resilient nations and communities to natural disasters. The framework emphasizes capacity building, incorporating disaster mitigation within the nation's sustainable development policies, and integrating risk-reduction plans with in disaster-affected communities (ISDR, 2005). There are many methods to measure vulnerability; nevertheless, the main challenges in utilizing it within the local context can overbear the linkages between social vulnerability and resilience (Cutter et al, 2008). Therefore measurements of vulnerability must cover aspects of vulnerability from a socio-ecological view, place-based studies, and a perspective that vulnerability is a human-rights concern. These aspects form a basic foundation for the assessment of pre-vulnerability conditions. (see figure 2)

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>

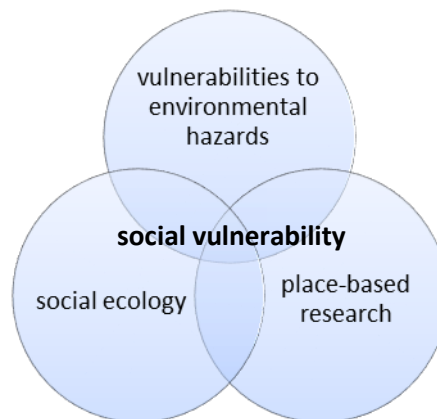


Figure 2: Conceptual Framework of Social Vulnerability

As illustrated in Map 1, Bangkok and its outlying-provinces were severely affected by floods in 2006 and 2010. Including its rapid urbanization rates within the city, it thus becomes important to consider the social aspects and built-up structures that are currently affecting Bangkok and Samut Prakarn's vulnerability and resilience to natural disasters. As the terms "vulnerable" and "resilience" have multiple definitions, it is important to clarify their usage

Vulnerability is defined here as "the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards". (see UN/ISDR. Geneva, 2004 in ISDR, 2005) Vulnerability is a product of the level of exposure of the social group to risks, and the sensitivity of the group to harm (Adger, 2006; Cutter, 1996). Vulnerability can be separated into three types (Cutter et al, 1996):

- a. Individual vulnerability: implying that there are individual or personal losses.
- b. Social vulnerability: social groups and People are also at risk because they have been made marginal in some way by an amalgamation of variables such as class, gender, age, ethnicity, or disability (Bank off, 2010).
- c. Vulnerability of Places: the interaction of the society with biophysical conditions can pose potential losses as it can affect the resilience of the area to respond to disasters or hazards. Thus "place-based" factors such as land usage and household density must also be incorporated into the measurement of vulnerability and risk.

Vulnerabilities, for this paper, are social process of 2 factors of social burden of risk and how these factors affect the distribution of risk. These two factors include social characteristic and social capital of

urban population. Social characteristics (of national census) concerns population characteristic that influence social burden of risk; and social capital (of local community) concerns inherent condition of social vulnerabilities at the most local level. This approach allows an intersection of key challenges of social vulnerabilities and urban development. Social vulnerability in urban areas requires an innovative approach of place-based and risk-based research in order to explore socioeconomic dynamics of urban development and distribution of risk posed by the impact of climate change.

To measure vulnerability, risk variables are assessed by taking into consideration the predisposition of urban risks and exposure and current social characteristics of the case-study communities to map the social vulnerability relative to social capital. Social capitals are treated as measures to reduce pre-condition to risk. The distribution of risks will be then be measured according to the level or adequacy of social capital in the assessed case-study communities. The assessment criterion under the four overarching risks variables are further explained as follows (see figure 3)

Urban risk sand exposure issued to measure area or community pre disposition to risks posed by environment, climate change impacts, and built environment. Social characteristics of case-study community consider demographic in terms of age and urban density. People at age below 5 and above 60 years are likely to be more vulnerable than adults. Numbers of population and households are factored in level of urban density. Land tenancy is a crucial variable to sensitivity of social system, urban population with unsecure land tenancy and lower income is likely to be more vulnerable than population with secured tenancy. However, social cohesion and community's ability to share and plan for disaster management are able to reduce risks posed by the impact of climate change.

Resilience is defined as *"a system's capacity to absorb disturbance and re-organize into a fully functioning system"* (Cutter et al, 2008). It includes not only a system's capacity to return to the state (or multiple states) that existed before the disturbance, but also to advance the state through learning and adaptation. Resilience can therefore be considered as the "post-disaster" ability for social structure to cope, respond and recover from disasters .Moreover, the reliance of the community is the product of the links between the social condition and its resource management. Resilient communities are considered less vulnerable to the impacts of hazards and natural disasters than less resilient communities, thus the concept of sustainability is central to studies of resilience. Therefore the measurement of resilience should include two qualities; the inherent structures of the community and area during non-disaster periods, and the adaptiveness or responses during disasters. (Cutter et al, 2003; Cutter et al 2008)

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>

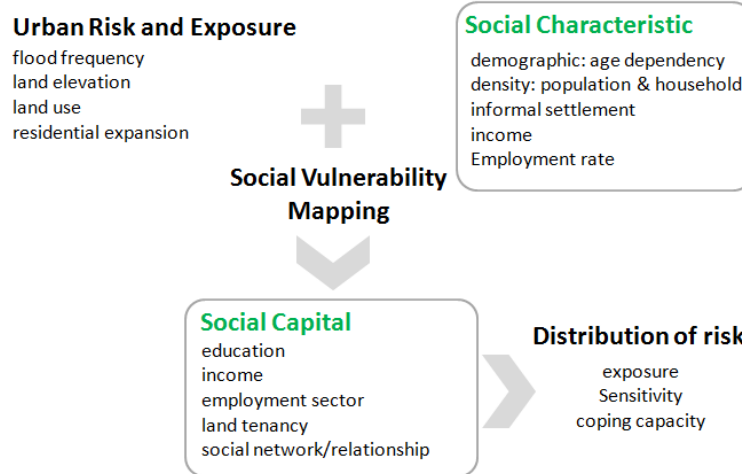
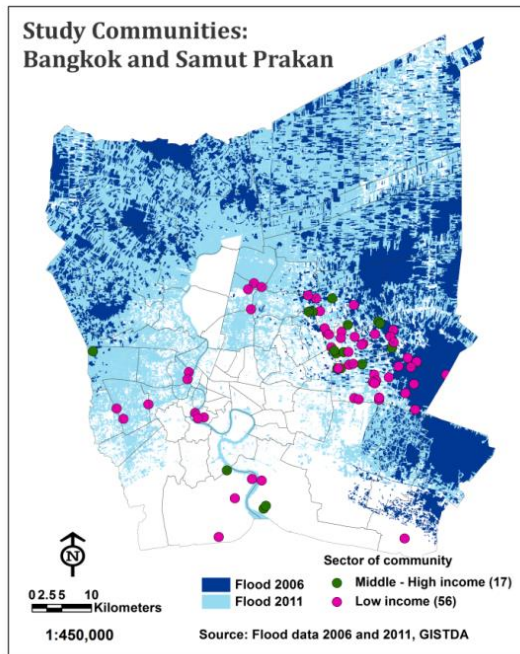


Figure 3: Social vulnerability variables and the development of risk

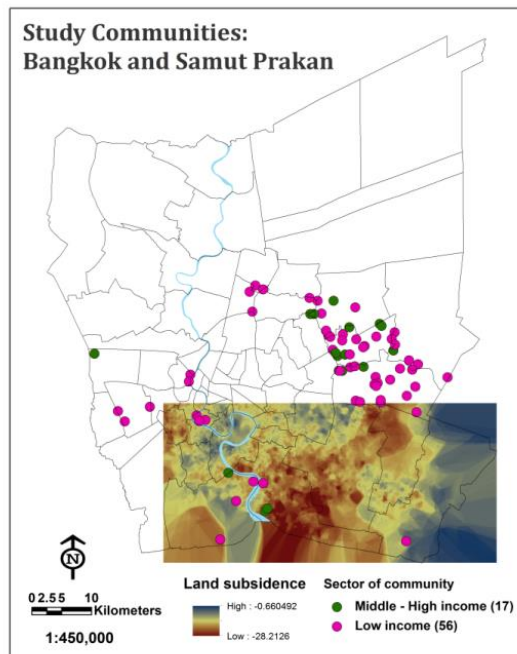
4. Methodology

The sample consists of community representatives from 83 communities within Bangkok and Samut Prakarn area. Cluster samples were selected randomly based on the socio- economic characteristics within risk areas. Since the information was derived from a large sample, the sampling units vary according to the economic and social structure characteristics. This is a preliminary study on citizens and the impacts on property, such as impacts from recurring floods on property and the community structures. The factors used to distinguish the location of study were income range and societal sectors, such as low-income communities, middle to high income communities, and industrial sectors, within areas that are predisposed to city expansion, suburbs, flood way, and coastal areas.

The sample was selected based on two place-based methodologies. Firstly, low and middle-high income communities within Bangkok and outlying areas of Samut Prakarn were recruited to participate in the survey. These communities are located in provinces within ranges of low to extremely flood frequent districts were chosen as case-studies to assess their vulnerability and risks (Map 3). The second place-based methodology used levels of land subsidence, sea-level rise, and other environmental hazards to assess the risk posed to the sample communities (Map 4).



Map 3: Sampling analysis by considering flood frequency



Map 4: Sampling analysis by considering environmental hazards: land subsidence & sea level rise

Mapping of Social Vulnerability

The first process to assess social vulnerability considers the predisposition of urban risks and exposure and current social characteristics of the case-study. All data is acquired from the national census and is classified in relation to vulnerability from low to extreme levels with equal intervals. Urban areas are susceptible to risk from the number of disaster events and low lying levels, and the rate of urban expansions and change in land usage. (see table 1 and 2)

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>

Factor	4	3	2	1
	Extreme	High	Moderate	Low
Factors of Urban Risk and Exposure				
No. of Flood frequency (considering floods in 2006, 2010 ,and 2011)¹	≥ 3 Times	2 Times	1 Times	0 Time
Land Elevation above MSL (data in 2013)²	< 1 M.	1 – 2 M.	2 – 3 M.	> 3 M.
Exposure of Land Usage (data in 2010)¹	Residential Area	Agricultural Area, Open Space and Park	Commercial Area, Industrial Area	Infrastructure
Residential expansion (2007 and 2011)	> 150 %	50 – 150 %	- 50 - 50 %	< -50 %

Table 1: Risk Variables of Urban Risk and Exposure to Mapping Social Vulnerabilities

¹ Geo-Informatics and Space Technology Development Agency (Public Organization)

² Bangkok Metropolitan Administration

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>

Factor	4	3	2	1
	Extreme	High	Moderate	Low
Factors of Social Characteristics				
Dependency rate: No. of people aged under 5 and above 60 comparing to all population (data in 2013) ³	> 32%	31% - 32%	30% - 31%	< 30%
Population Density (2011) ³	> 10,000 Persons/sq.km.	5,000 – 10,000 Persons/sq.km.	3,000 – 5,000 Persons/sq.km.	< 3,000 Persons/sq.km.
Informal settlement (2011) ⁴ - Number of informal settlement - Population in informal settlement - Household in informal settlement	> 60 units	40 – 60 units	20 – 40 units	< 20 units
	> 75,000 persons	50,000 – 75,000 persons	25,000 – 50,000 persons	< 25,000 persons
	> 15,000 households	10,000 – 15,000 households	5,000 – 10,000 households	< 5,000 households
Average Income (Baht per month, data in 2007) ⁵	< 10,000	10,000 – 12,000	12,000 – 14,000	> 14,000
Gini (2007) ⁵	>50%	45% - 50%	40% - 45%	<40%
Rate of employment (data in 2007) ⁶	> 150,000 persons	100,000 – 150,000 persons	50,000 – 100,000 persons	< 50,000 persons

Table 2: Risk Variables of Social Characteristic to Mapping Social Vulnerabilities

5. Discussion of Result

Furthermore, to map social vulnerabilities, levels of the predisposition of urban exposure and current conditions of social characteristics are classified spatially by areas and districts. An assessment of vulnerabilities is, then, ranged from low, moderate, high to extreme level. Our research demonstrates that

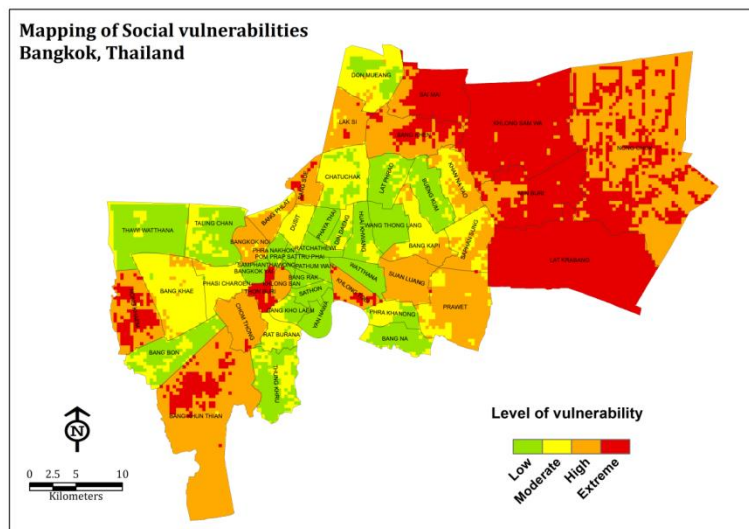
³ Data Statistics of Population Thailand, Department of Provincial Administration, Ministry of Interior

⁴ Community Development Division, Social Development Department

⁵ National Statistical Office of Thailand

⁶ Thai Labour Standard: Labour Standard Development Bureau

most parts of Bangkok are classified as moderate and high levels of vulnerabilities. The result is also varied by areas and district. By area classification, most areas (540 sq.km. of approximately 1,600 sq.km.) are classified to a high level of vulnerability, and most districts (21 out of 50 districts) are classified to a moderate level of vulnerability. The districts which are extremely vulnerable are mostly situated in the flood way areas without dyke protection, whereas the districts which are least vulnerable are mostly located in inner areas of Bangkok. (Maps 5 and 6) However, it is important to note that the result of social vulnerability mapping is considered as a predisposed condition of social vulnerabilities. The distribution of risk also varies as a function of inherent conditions of social structure. The degree in which population can cope with impacts is important to the progression or the development of social vulnerability which will be discussed in the next section.



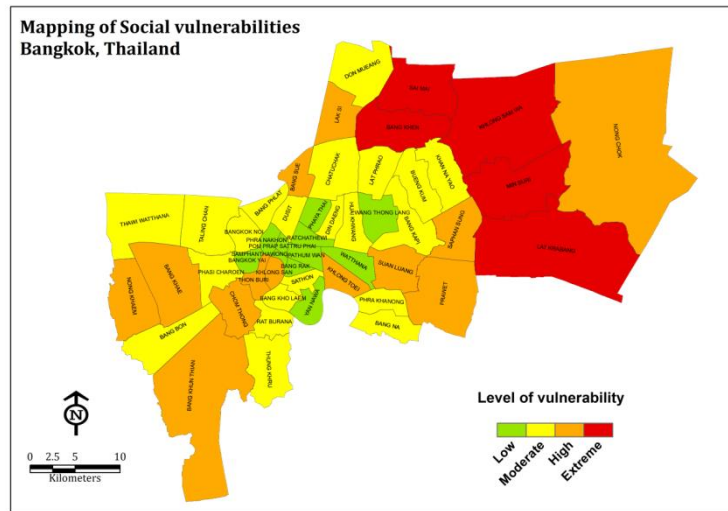
Map 5: Mapping of Social Vulnerability by Areas

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>



Map 6: Mapping of Social Vulnerability by Districts

This research also found that people and communities are vulnerable not only due to the direct immediate impacts of the disaster or environmental effects, but their inherent conditions predispose them to further risks. Following this view point, the study categorizes distribution or progression of risk by social capital. The perception of community members to risks and their interaction with each other are considered important aspects to social capital because it influences their ability to cope. The societal structure, as well as the existing built up structures, are therefore important factors which can act as barriers that predispose them to future vulnerabilities. Based on this measurement, the progression of risk profiles of the case-study communities is a function of exposure, sensitivity, and coping capacity.

The 83 community profiles were analyzed from two aspects. Firstly, through area studies, the exposure and sensitivity to environmental changes were evaluated to measure the extent built-up structures can predispose communities to natural disaster risks. Additionally, the social structures of the communities are also laid out to determine the social capital of these communities. As vulnerability and resilience are interlinked in multi-dimensional facets, the study also incorporates the evaluation of income of the population.

5.1 Social capital as Vulnerability Profile

The study of community vulnerability and resilience is evaluated in consideration to aspects of exposure and sensitivity to environmental changes as mentioned above. In the following section, the social

constructs in relation to their interaction with the built environment are evaluated to gauge the social capital vulnerability of low and middle to high-income communities in Bangkok and its outlying districts.

5.1.1. Low-income communities

As a suburban area, people in Bang Kae District in Bangkok had to originally rely on public transportation to get to work. However, once there are floods, individuals are unable to travel to work or live their lives normally. The rate of assistance they have received is dependent on the distance to main roads into the community. In the Baan King squatter community, for example, the majority of households consists of two-storey houses, made of concrete and wood. They are detached homes, which has areas for a garage. Many are currently unoccupied. For transportation, only smaller vehicles can access the area. For the problem of flooding, the community has been largely impacted, and travelling to and from has been met with many difficulties. This makes getting food difficult. In some areas, survival kits are not well-received, and some homes are uninhabitable and families have evacuated to other areas. The crowded community of Pherm Srupin Bang Kae District has also been greatly affected by the flood. Houses which are built in lower-levels than the road is heavily affected, whereas people in houses that have been heightened are still able to live in the area. Community members are afraid to leave their homes since there had been cases of burglary and drug use. State assistance is slow.

As previously mentioned, people and communities are vulnerable not only due to the direct immediate impacts of the disaster or environmental effects, but their inherent conditions that predispose them to further risks. Indirect loss due to lack of income security is exemplified in community of Wat Inta-Bunjong. The impact of the flood on the community was not severe, as many of the houses were constructed on raised-grounds. However, traveling is inconvenient during the flooding, leading to many individuals taking time off work. Thus, the flooding situation causes concern on job security and income.

Some low income communities are not vulnerable due to natural risk but to a lack of land tenure security. An example is Wat Lad Bua Khao in Bang Kor Laem District, where the community is situated beside the water. Flooding is, however, caused by overflows in plumbing systems. Regarding the 2011 flood, the water that rose and flooded the community came from the drainage system. The flood situation wasn't as severe on the community because the flooding subsided quickly due to low water levels. Nevertheless, urban planners should be aware that the rate of development occurring in the area and the increase of large-scale condominium and high-rise constructions puts the communities in this area at high risk of natural disaster and forced relocation.

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>

The lack of social cohesion of low income community is another important factor that increases vulnerability. In Hong Yen community, the construction conditions of the community are run down, especially within the smaller lanes where wastewater and travel conditions are congested. Only motorcycles are able to pass through these lanes. The societal conditions of the community are a lack of cohesion among community members and inefficient communication between community leader and members. Hence, during the time of crisis, communities cannot cope with flood effectively and lacking ability to plan for future floods possibility. The problem within the community are also problems of drug use, which is very prevalent in the community. Regarding situations of flooding, the community has received quite an impact because the community is situated quite deep, making traveling to and from the community difficult during flooding. In particular for the elderly who have regular visits to the doctor. Several cases of insect infestations were reported by the community due to over grown and un-kept properties.

5.1.2 Communities with middle to high income

For higher income communities, perceptions of risk seems to be an important variable to social vulnerability. There are still concerns about the recurrence of floods and the high costs of restorations, thus many have sold their homes. Higher income residents living in housing estates fear of losses to their lives due to natural disasters as oppose to the perception of risk of low-income residents who fear of loss to their properties. As a result they are reluctant to evacuate or relocate during and after the time of crisis. In Housing Estate Chai Pruek, floods reached up to 1.20 meters over the span of 30-45 days. Every household have been impacted by the water that flooded the area due to the breakage of the Wat Pru Dam (the Tawee Watana Dam could no longer hold the water).The rapid flow of the water led to over flow of water from underground and drainage systems, causing the area to flood within 3–4 days. The residential community, Baan Chai Pruek, has a total of 706 households with approximately 600 households currently living (around three people per households).When the disaster occurred, the majority of the residents evacuated from the area with only 10 households who remained. Around 2% of households received damage from the front area of their homes, as the structure of the houses was built on higher levels thus only flooding the initial parts of the homes. Damages inside the house were also received as the properties were furnished with built-in features and cannot be moved during the floods. Many of the damages were received on the first floor.

In direct impacts received by the residents, whom the majority of employees or business owners, where 98% had evacuated to outer area soft he city, down town, or temporary shelters. As a result many could not work for the duration of one month. For the 2% that remained in the area, they were unable to travel

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>

outside of the community. Up to 90% of the residents have an average income of 30,000– 50,000 baht a month and the remaining 10% are elderly or retirees who are no longer working. The three reasons for evacuation area follow:

- The social characteristic of the community show reliance amongst one another, and trust in the safety and security measures of the housing estate agency.
- Difficulty traveling in and out
- the water levels were forecasted to be quite high

For recovery and the coping mechanisms in the long run, the housing estate agency provides assistance with food, and safety measures in the community. Additionally, the residents cooperated with each other in the cleaning, and also received food donations from the Bangkok councilor and soldiers during the disaster. After the flood, officers and firemen also came to assist in the cleaning, drainage clearing, and restoration of the community. Waste management was also a concern after the disaster, therefore there was cooperation to clean up the community. During the flooding, waste management was difficult so the community residents helped move the waste higher ground to a bridge beside the housing estate. Some houses had also burnt their refuse, which is normally prohibited. The social characteristic of the Chai Pruek community is community reliance on each other, which had not changed before or after the flooding.

5.2 Vulnerability for Communities

Based on the two previous aspects, the vulnerability in relation to community/sector resilience are discussed to highlight the importance of multi-level risk adaptation measures. The severity of the floods can influence the individual or household coping mechanisms. The difference between low-income households to their more affluent counterparts is whether or not they can shoulder the ripple effects of the flood. The more it reduces a household's monetary resource, the less they are able to weather the direct and indirect impacts of the flood. For low-income households, the lack of savings may not be enough to support the weeks or months of unproductivity due to the inability to commute to work. Based on the survey results, up to 41 percent of participants had responded the lack of income savings, and 16 percent are in debt. The ripple effect of the months of unproductivity could impact low income household's inability to later afford health-care or children's tuition.

When respondents were asked their willingness to invest in property enforcements, three responses were prominent. Approximately 27.6% answered those they had no resources, or are relying on the government. 24.7% stated that the flood is "too strong" and too difficult to cope with. Others stated that

the severity of the flood will not happen again, or that they hoped to move elsewhere. However, the responses on their willingness to invest in flood insurances, both yes and no answers, scored similarly (around 33-34%). These responses highlight the notion that residents in flood-prone areas are aware of future risks, however their self-capability is scattered. This highlights the need to consider aspects of community confidences a type of community vulnerability.

As mentioned previously, several communities' association with one another has been found quite lacking. Based on findings from the case-study communities, some had low levels of interaction among fellow residents, a lack of communication from community leaders and residents, or the lack of cooperation among neighboring communities. According to Cutter et al. (2008), the community's vulnerability is interlinked to its resilience and adaptive capacity. If a community perceives itself as being unable to cope with the floods, or places the locus of control externally (e.g. relying on the government, or flood is too severe), then it could impact the community's ability to be adaptive or resilience to floods. This could then deepen the already existing pre-disaster vulnerabilities of the communities. Accordingly disaster management plans, without the consideration of the varying community's context, may not result in a truly efficient community disaster management.

Urban communities have their disparities as they function within its own context, based on its social structures and geographical defined spaced. A "one-size-fits-all" disaster mitigation strategy may not fully be applicable to all communities within the city. Therefore community-based disaster management (CBDM) may be an approach to promote "local ownership" in disaster management plans, and strengthen the communities' ability to cope and adapt to future disasters. The concept of local ownership is defined as *"empowering communities to collaborate in addressing the challenges they face. By implementing development strategies themselves, they're able to take control of their own destiny"* (Roopnarine, 2013). Allowing communities to "own" or be locally involved in programs can promote and encourage commitment, participation, and capacity development (Pouligny, 2009). As narratives from the community case-studies have illustrated issues of community cooperation, CBDM that promotes local ownership can improve the community's ability to cope and adapt to pre and post flood situations.

6. Conclusions and Recommendations

As the vulnerability profiles are different across different income, the resilience also varies. This implies the need to enhance knowledge and build capacity relevant to the population. Nevertheless, cross-sectoral cooperation is also important. As highlighted above, vulnerabilities and resilience is different among sectors and between sectors but the effects are interlinked. Therefore, disaster management planning and urban blueprints must incorporate these varying risks through participatory decision making

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

ICLEI does not accept any kind of liability for the current accuracy, correctness, completeness or quality of the information made available in this paper.

<http://resilient-cities.iclei.org/>

into planning processes, to lessen sector-specific vulnerabilities and mitigate across-sector impacts. Urban resilience is not merely technically engineered or based on economic factors, but must be holistic to integrate social factors and vulnerabilities of people, households and communities. In taking into consideration societal structures (e.g. the lack of cooperation) as a type of vulnerability, resilience and sustainability are also promoted there by enhancing disaster management measures.

Therefore, the long-term and sustainable planning of the city is crucial in reducing the risks derived from climate change and poor urban development. Capacity building of residents near the coastal area is also necessary to ensure their ability to cope and adapt to the effects of environmental changes. Sustainable development plans, and a provincial government can incorporate risk mitigation measures. This will facilitate the communities along the coastal edge with the ability to live among the existent risks in a better and more sustainable way.

References:

- Adger, W.N. (2006). Vulnerability. *Global Environmental Change*, 16(3), 268-281.
- Bankoff, G. (2001). Rendering the World Unsafe: "Vulnerability" as Western Discourse. *Disaster*. 25(1). 19-35.
- Cutter, Susan L., Boruff, Bryan J., and Shirley, W. Lynn. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*. 84(2). 242-261.
- Cutter, Susan L, Barnes, Lindsey, Berry, Melissa, Burton, Christopher, Evans, Elijah, Tate, Eric, & Webb, Jennifer. (2008). A place-based model for understanding community resilience to natural disasters. *Global environmental change*, 18(4), 598-606.
- Framework, H. (2005). Hyogo framework for action 2005–2015: Building the resilience of nations and communities to disasters. In *World Conference on Disaster Reduction, January* (pp. 18-22).
- Gale, P., Drew, T., Phipps, L. P., David, G., & Wooldridge, M. (2009). The effect of climate change on the occurrence and prevalence of livestock diseases in Great Britain: a review. *Journal of Applied Microbiology*, 106(5), 1409-1423. doi:10.1111/j.1365-2672.2008.04036.x
- Ingirige, M. J. B., & Amaratunga, R. D. G. (2013). Minimising flood risk accumulation through effective Private and public sector engagement. *UNISDR Global Assessment Report*.
- ISDR (2005). Hyogo Framework for Action 2005-2015: Building the Resilience of nations and Communities to Disasters. World Conference on Disaster Reduction. 18-22 January 2005, Kobe, Hyogo, Japan.
- Johnson, C., Adelekan, I., Arefian, F., Boshier, L., Jabeen, H., Kataria, S., Marome, W.A. and Zerjav, B., 2012. Private Sector Investment Decisions in Building and Construction: Increasing, Managing and

- Transferring Risks. Geneva, Switzerland: UNISDR.
- Marome, W.(with A. Patandwarhan, A. Patankar and E. Porio) (2013) Impacts of Extreme Weather Events and Implications for Adaptation Planning for Coastal Cities in APN Science Bulletin (3): 16-75.
- Nicholls, R.J., Hanson, S., Herweijer, C., Patmore, N., Hallegatte, S., CorfeeMorlot, J. Chateau, J. and Muir-Wood, R. (2008). Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes. OECD Environment Working Papers No. 1.
- Poesen, J.W.A., &Hooke, J.M. (1997).Erosion, flooding and channel management in Mediterranean Pouligny, B. (2009).Supporting local ownership in humanitarian action. *GPPi Policy Paper*,1. Environments of southern Europe. *Progress in Physical Geography*, 21(2), 157-199. doi: 10.1177/030913339702100201
- Schmidt, Charles W. (2000). Lessons from the flood: will Floyd change livestock farming? *Environmental Health Perspectives*, 108(2), A74.
- Schröder, Thomas J, Hiemstra, Tjisse,Vink, JosPM,& vander Zee, Sjoerd EATM.(2005). Modeling of the solid-solution partitioning of heavy metals and arsenic in embanked flood plain soils of the rivers Rhine andMeuse. *Environmentalscience&technology*, 39(18),7176-7184.
- Wedawatta, G., Ingirige, B.and Proverbs, D.(2012), Impacts of flooding on SMEs and their relevance to Chartered Surveyors, Final Report of the DEFENCES project, London: RICS

The author:

Assistant Professor Dr.

Wijitbusaba (Ann), Marome

Lecturer

Department of Urban Environmental Planning and Development, Faculty of Architecture and Planning,
Thammasat University, Thailand

Email: wijitbusaba@ap.tu.ac.th

www.ap.tu.ac.th

Bio:

Dr. Marome earned her PhD in Planning from Development Planning Unit at University College London. She currently teaches at the Faculty of Architecture and Planning of Thammasat University in Thailand in which, through her researches, she takes urban development planning approach to the understanding of climate change adaptation and urban resilience. She is a Bangkok team leader for the Coastal Cities at Risk (CCaR), an international research funded by Canada's IDRC, the Social Sciences and Humanities Research Council, the Canadian Institute of Health Research, and the Natural Sciences and Engineering Research Council. She is also one of the authors for UNISDR's Global Assessment Report 2013 and The First Thailand Assessment Report on Climate Change.

Conference organizers: ICLEI – Local Governments for Sustainability

In cooperation with the City of Bonn and the World Mayors Council on Climate Change

*ICLEI does not accept any kind of liability for the current accuracy, correctness,
completeness or quality of the information made available in this paper.*

<http://resilient-cities.iclei.org/>