Disaster Risk Reduction
Towards Disaster Resilience in Kampong Cham, Cambodia

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Key Messages

- Floods pose the most significant threat to Kampong Cham, and it is anticipated that its impacts would be further exacerbated under projected climate scenarios
- Trans-boundary communication and early warning systems, especially with Chinese authorities, need to be established to reduce the impacts of floods in Kampong Cham
- Droughts are emerging as a climate threat in Kampong Cham; however, more detailed study is required and mitigative measures are to be explored
- Mapping exercises that cover hazards, socio-economic profiles, asset profiles and other key aspects need to be undertaken in Kampong Cham to support effective planning and implementation
- The city requires a climate-sensitive disaster management plan, that considers anticipated climate impacts and can draw on the assessments of loss and damage at the national and provincial level
- The Disaster Risk Reduction (DRR) plan for Kampong Cham, should integrate strategies on natural resource management, extensive training and awareness generation and appropriate flood resistant infrastructure planning.
- The recently adopted Disaster Management Law would provide an opportunity for Kampong Cham to implement its climate-sensitive DRR plan

City Introduction

Kampong Cham is the capital city of Kampong Cham Province in eastern Cambodia (refer Figure 1). It is the sixth largest city in Cambodia with a population of 118,242 people (2008 census). It is located on the Mekong River at a height of 52 feet above mean sea level. This city has a tropical climate. When compared with winter, the summers have much more rainfall.

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The average annual temperature in Kampong Cham is 27.7 °C and annual precipitation averages 1,722 mm. Kampong Cham has over 3,000 private enterprises that include cashew, starch and vegetable processing.

Approach

Data available from online national disaster loss and damage database (http://camdi.ncdm.gov.kh) was

Figure 1: Location of Kampong Cham in Cambodia

analysed. The database was established with UNDP support and is now maintained by the National Committee for Disaster Management (NCDM) of the Government of Cambodia. The data analysis aimed at correlating trends in loss and damage from disasters to the country and district levels to assess whether these could help prepare resilience strategies for cities. The database was used to identify the most impacted provinces and a prominent city within each was selected for further analysis. Impact on human life due to natural disasters was considered of prime concern while prioritizing the impacts and given the highest weightage, followed by the number of injured people, followed by the number of victims (a wider population that incurred varying range of losses) and finally the damage to and destruction of houses due to the disaster. Provinces were thus prioritized and two top ones selected. The capital city of each was taken up for detailed study. The steps followed are summarized in the figure below.

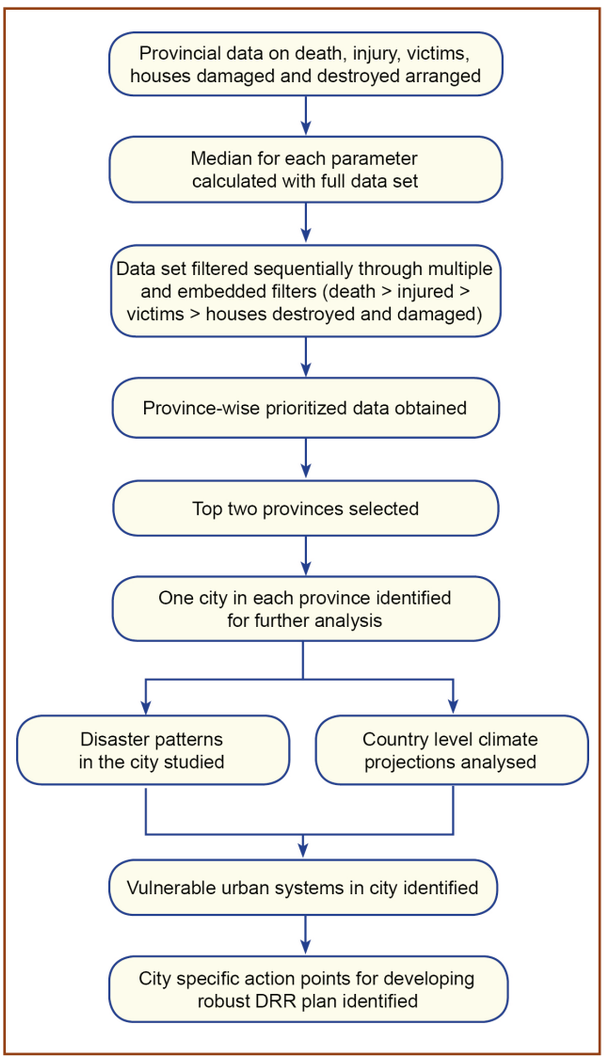

Figure 2: Detailed Methodology

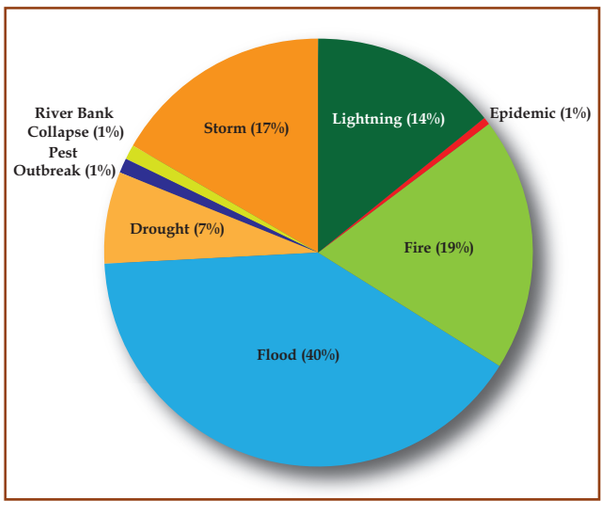

Figure 3: Frequency of Disasters at the country level in Cambodia

Correlating Disaster Patterns and Impacts

An analysis of the disaster patterns at the country level in Cambodia shows that floods are most prominent (40 percent), followed by fire, storm, lightning, and drought which have frequency of 19, 17, 9, and 7 percent respectively (refer Figure 3).

A similar analysis was undertaken at the provincial level and it was found that Kampong Cham province is affected by floods, fire, storm and lightning. Floods are the predominant disaster. Table 1 details the events, along with their relative frequency and percent impact in Kampong Cham province as compared to the frequency and impacts at the national level. This clearly shows a similarity in trend between the disaster patterns at the national and provincial levels.

A district-wise analysis within Kampong Cham province was also carried out. Flood and drought are the significant natural disasters (refer Figure 4 and 5). However, even though the highest number of events was not recorded from Krong Kampong Cham district, the city of Kampong Cham was selected for further analysis as it is the province capital and the most significant urban centre in the entire province. City level interactions[1] were also carried out, which revealed that flood, storm and lightning are the prominent disasters of which flood has the maximum

1 Meetings with Provincial Council for Disaster Management, Department of Environment, National Council for Disaster Management, National League for Communes and Ministry of Climate Change

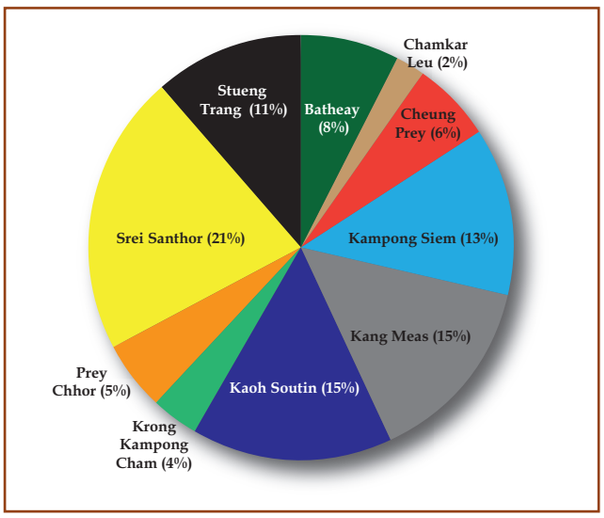

Figure 4: Frequency of Floods within Districts under Kampong Cham Province

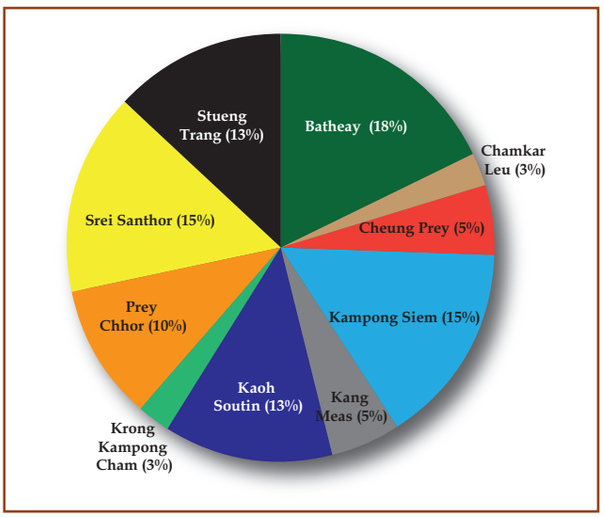

Figure 5: Frequency of Drought within Districts under Kampong Cham Province

impact. Figure 6 details the areas in the province that were affected due to the flood in 2013. Increased rains in China lead to additional volumes of water flowing in Mekong river, which leads to floods in Kampong Cham (owing to it being situated right on the banks of the river). The city has witnessed floods on a regular basis, the most recent one being in the year 2014. Apart from the loss of human lives, livestock loss and damage to houses, the flood in 2013 had resulted in breaching of the banks of the Mekong, leading to flooding in many of the high elevation areas as well. In addition, drought is gradually becoming a major disaster in Kampong Cham and there has been one in 2015. Though there has been no loss of human life due to drought, Kampong Cham faced water shortage issues, especially for the agricultural fields. Figure 7 summarises the impacts of natural disasters in Kampong Cham in 2014 and 2015.

The multi-level analysis of past disaster patterns indicate that floods are presently the major natural disaster at the national, provincial and city level. Therefore, resilience building strategies for flood proofing at the national and provincial level can also inform and guide the necessary city level strategies.

Looking at Disasters through the Lens of Climate Change

The analysis of past patterns of disasters was then reviewed through the lens of anticipated climate change impacts. In the absence of downscaled climate impacts for Kampong Cham city, the country level projections for Cambodia were reviewed (refer World Bank Group, 2011). It was found that the following impacts would be expected:

- An increase in the mean annual temperature by 0.7-2.7°C by the 2060s and 1.4 -4.3°C by the 2090s,
- Though there is not a clear picture for precipitation change, due to large model uncertainties, increases in rainfall are projected during the monsoon (May- August)

Additionally, review of existing literature as well as direct interactions with city level representatives were undertaken to capture the perceptions on climate change impacts at the city level. It was found that Kampong Cham has been experiencing a rise in temperature and an amplified frequency of high intensity rainfall along with a decrease in the total

Table 1 : Events and their Relative Frequency and Impacts

Province	Event	Relative Frequency	Percent Impact			
			Deaths	Injured	Houses Damaged	Victims
Kampong Cham	Flood	5.96	66.66	88.13	46.07	86.04
	Fire	9.77	0.35	0.78	8.96	0.634
	Storm	14.43	2.08	5.64	53.79	0.974
	Lightning	10.98	30.90	5.45	0	0.01

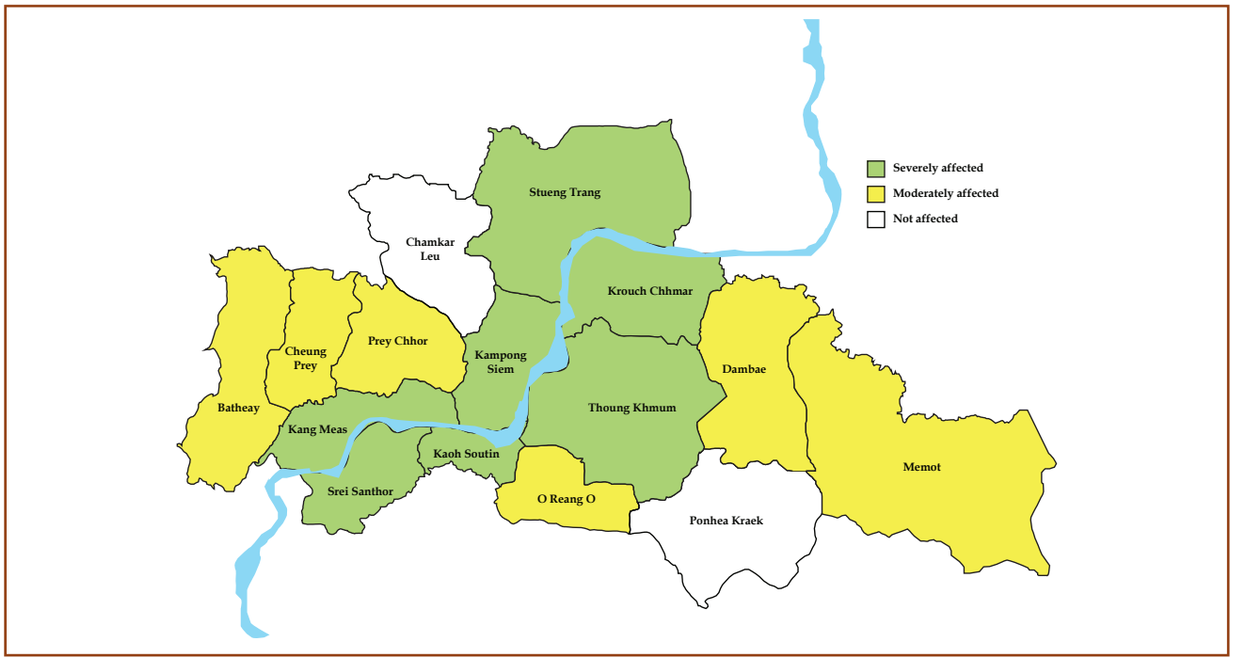

Figure 6: Map showing areas affected by flooding in 2013 in Kampong Cham Province

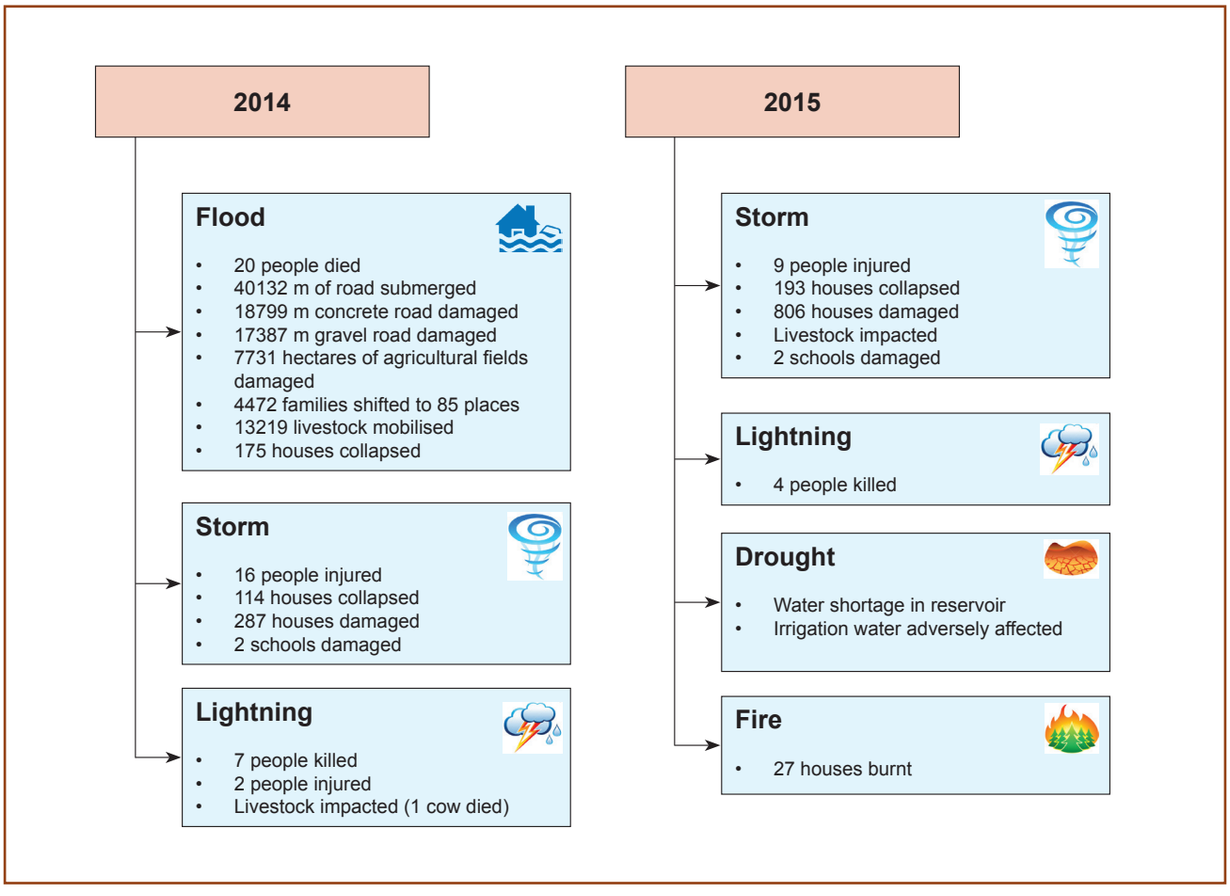

Figure 7: Impact of Natural Disasters in Kampong Cham in 2014 and 2015

number of rainy days. These trends are aligned with the national level projections.

Considering that floods are currently the natural disaster with the maximum impact in Kampong Cham, and that climate projections and local perceptions highlight a scenario of wetter monsoons, there is a high probability of increased incidences of floods with greater adverse impacts in the city.

Urban systems are comprised of the processes by which life in a city is organized and operated. An analysis of the urban systems in Kampong Cham shows that 5 systems (water supply, sanitation, food supply, health and transport) have been affected by floods and are thus vulnerable in scenarios of increased precipitation (refer Table 2) and have been affected by floods earlier as well. In addition, the city is also experiencing drier spells in the non-monsoon months and can expect increased drier conditions, that could lead to drought or drought-like situations. Urban systems are vulnerable to the same as well and an analysis of the impact of the same is provided in Table 2. The most vulnerable people in the city are the urban poor who have limited access to resources and facilities.

Way Forward

The city of Kampong Cham has initiated some steps to build city resilience to disasters. Efforts have been initiated to identify rice varieties which can adapt to the climate change. In 2014, the governor of Kampong Cham province issued directives to all communes to renovate the gravel/ sand roads with concrete roads. A special fund has been provided by the governor in 2015, to help address the issue of river bank collapse during floods, and the banks of river Mekong are being concretized for the same. In addition, the river bank height is also being increased with this wall by 32 metres to prevent flooding. However, on an average, less than one percent of the total budget of Kampong Cham province is spent for disaster risk reduction initiatives presently. A law on disaster management has been passed by the Government of Cambodia on 30th June 2015. The city now hopes to be able to get some assured funds for undertaking activities aimed at disaster risk reduction.

An improved understanding of climate risks, especially from floods, and the preparation of a City Resilience Strategy with implementable actions is the need of the hour in Kampong Cham in order to address issues related to flood management and mitigation, vulnerability reduction and improvement of preparedness and adaptation. Kampong Cham city is located on the banks of Mekong river and floods here are also caused due to increased precipitation in

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Table 2: Fragile Urban Systems in Kampong Cham

Urban Systems Impacted by Past Events	Current Status	Climate Change Scenario: Increased Precipitation	Climate Change Scenario: Increased Temperatures & Decreased Precipitation
		Potential Impacts	Potential Impacts
Water Supply	Only 50 percent of the city has access to piped water supply.	Increased flooding situations can lead to contamination of potable water, especially in the sub-urban areas and for people residing along river bank.	Increased stress on the existing water supply system. Increased extraction of untreated river water from river for drinking purposes can lead to increased incidences of water borne diseases.
Sanitation: Solid Waste and Waste Water Management	Only 60 percent coverage of the existing infrastructure for garbage collection and landfill on the verge of reaching its full capacity.	Heightened unhygienic conditions and health hazards due to increased incidences of water borne diseases.	Drier conditions can lead to increased incidences of fire in the landfill.
Food Supply	There is dependence on surrounding sub-urban area for agricultural supplies and food security.	Flooding and water logging can lead to crop loss due to submerge of agricultural fields and also affect access to the city leading to decrease in food supply to the city.	Drought can lead to decline in agricultural productivity and decrease in food supply to the city.
Health	Increasing incidences of vector-borne diseases like malaria	Water logging/flooding which will increase chances of water/vector-borne communicable diseases	Increasing temperatures could cause greater incidences of heat stress
Transport	Majority of the roads, particularly in sub-urban areas are not made of concrete.	Flooding situation leading to washing away of the non-concrete roads, resulting in loss of connectivity/access.	Reduced reliance on modes non-motorised transport due increased temperatures potentially leading to higher emissions

Table 3: Towards Disaster Resilience

City Specific Action Points					
	Urban Systems				
	Water Supply	**Sanitation**	**Food Supply**	**Health**	**Transport**
Infrastructural Measures	• Improvement in the piped water supply infrastructure to ensure 100 percent city coverage • Installation of rain water harvesting systems	• Improvement in garbage collection infrastructure to cater to entire city • Development of sanitary landfill • Scouting possibilities with neighbouring cities for development of common landfill site	• Improved storage facilities (cold storage) in the city using renewable energy • Allocating land for urban agriculture	Improved health facilities in the city	Construction of roads with permeable material and concrete.
Social Empowerment	Capacity building of city officials and community members in water conservation, rain water harvesting, water purification	Capacity building of city officials and community members in waste segregation	Capacity building of city officials and community members in roof top gardens; vertical farming, urban farming	Capacity building of city officials and community members on importance of hygiene and measures to maintain the same Capacity building to deal with heat stress and flooding situation	Capacity building of city officials and community members on importance of public transport and non motorised transport
Strengthening disaster preparedness and response	• Developing hazard maps, socio-economic profile maps • Usage of GIS based planning tools • Access to climate projection data at provincial and city levels • Development of early warning system in coordination with Chinese authorities to address floods • Intensification of research on development of climate resilient crop varieties				
Risk reduction through continuous assessment and monitoring **Blue: data already being collected by city** **Red: data collection required by city**	• Per capita water supplied (lpcd) • Quality of water: total number of tests passed/total number of tests conducted	• Percent waste water treated • Efficiency of solid waste collection (%) • Scientific solid waste disposal (%) • Extent of recovery (% treated /recycled)	• Food shortage duration (Nil; 0-2 days; 3-5 days; more than 5 days)	• Mortality (numbers) • Morbidity (numbers)	• Length of roads destroyed (km) • Duration of access lost (hrs) • Incidence of waterlogging and flooding (numbers)

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China, which brings in additional volumes of water into the river. Thus, apart from coordination with the national and provincial initiatives, the city also needs to develop an early warning system in coordination with Chinese authorities in order to address floods.

In addition, the city also needs to focus on drought resilience. Mandatory rain water harvesting is an essential step for the same. Development of crop varieties resilient to climate change is the need of the hour in the primarily agrarian Kampong Cham province.

Steps which the city needs to take to build a robust DRR plan are summarised in Table 3.

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