BUILT-IN RESILIENCE: LEARNING FROM GRASSROOTS COPING STRATEGIES TO CLIMATE VARIABILITY

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Summary:

Significant lessons can be drawn from grassroots experiences of coping with existing environmental hazards to reduce vulnerability of the urban poor. Knowledge of existing coping capacities for disaster risk reduction can help to strengthen planning strategies for adaptation to climate change in cities. Primary data collected by the authors in Korail area - the largest informal settlement in Dhaka, Bangladesh - observes household and collective adaptation strategies for existing environmental hazards such as flooding and heat. Adaptation to climate variability from physical, economic and social perspectives at the community level can be scaled up to local government level through a pro-poor approach in land-use planning and the development of buildings and infrastructure that take climate change risks into account.

Key Words: adaptation plans, Bangladesh, built environment, coping strategies, grassroots, urban poor

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I. INTRODUCTION

It is now widely acknowledged that the effects of climate change will disproportionately increase the vulnerability of the urban poor in comparison to other groups of urban dwellers (Alam and Golam Rabani, 2007; McGranahan, Balk and Anderson, 2007; Pelling, 2003; Satterthwaite et al., 2007). While significant attention has been given to exploring and unpacking 'traditional' coping strategies for climate change in the rural context – with a focus on agricultural responses and livelihoods diversification, with few exceptions less work has gone to deepening our understanding of the ways urban poor are adapting to climate variability[1]. The central argument of this paper is that significant lessons can be drawn from examining how the urban poor are already coping with conditions of increased vulnerability by understanding how they respond to existing environmental hazards such as floods, heavy rains, landslides, heat and drought. Knowledge of these existing coping capacities for disaster risk reduction can help to strengthen planning strategies for adaptation to climate change in cities because they draw on existing grassroots governance mechanisms and support the knowledge systems of the urban poor.

The purpose of this paper is to contribute to our current understanding of local coping strategies by examining the coping mechanisms developed and adopted by the urban poor - and to discuss how these mechanisms can be mainstreamed into urban planning responses to climate change adaptation. The research focuses on local coping strategies that can be observed in the built environment such as, how people adapt their houses, living spaces, streets, open spaces and infrastructure to cope with existing environmental hazards.

Conceptually and methodologically, the research comes from the disaster management perspective, drawing on a background of vulnerability and resilience literature and published case studies about coping mechanisms in urban areas and/or coping mechanisms for the built environment. The paper also draws on primary data collected by the authors in Korail area - the largest informal settlement in Dhaka, Bangladesh - and observes household and collective adaptation strategies for existing environmental hazards such as flooding and heat. The origin of Korail dates back to the 1980s, and it is located in the low-lying flood prone area of the city. It provides fruitful ground to explore the existing 'built-in' resilience of a poor urban settlement which would normally be considered extremely vulnerable and at risk.

[1] Throughout the paper, we refer to 'climate variability' and 'climate change' as forms of climate stress that affect the vulnerability of the poor both in the short and long term. For instance, droughts and heat waves are highly likely to reduce access to water for productive and reproductive purposes imposing short term negative impacts born out of water scarcity such as higher water costs but also long term health problems. Similarly, flooding, heavy rainfalls and sea level rise are likely to impose short and long term losses of houses, infrastructure and productive assets leading to poor water supply, unsanitary conditions and the spread of diseases. Food security is also threatened by climate variability.

The paper is organized in three sections. The following section sets the background by establishing the relations between adaptations, disaster risk reduction and coping strategies for urban areas. The next section summarizes the existing coping strategies of the urban poor in Korail, using the findings of the survey data. It highlights how the urban poor effectively use physical, economic and social means of gaining access to safety, reduce their loss and facilitate their recovery. The third section discusses how local planning and governance mechanisms aimed at adaptation can support these existing coping strategies and provide recommendations to mainstream them into adaptation plans that can be scaled up at the city wide level.

II. LOCAL COPING MECHANISMS FOR ADAPTATION AND DISASTER RISK REDUCTION

1. Making the links between adaptation and disaster risk reduction

The integration of disaster risk reduction and climate change adaptation is narrowing, as these two fields come closer together in understanding that reducing socio-economic vulnerability to hazards or effects from climate change, amount to similar schools of thought (Schipper and Pelling, 2006; Tomalla et al., 2006). The two fields use subtly different language to describe similar activities. From the field of disasters, the term 'coping capacity', is concerned with the means by which 'people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster' (UNISDR, 2009). In the climate change field, the term 'adaptive capacity' is used, the Intergovernmental Panel on Climate Change (IPCC) assessments use the definition "The ability of a system to adjust to *climate change* (including *climate variability* and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. " (IPCC, 2007, p. 18). Satterthwaite et al. (2007) relates this definition to the urban scale, thus describing 'adaptive capacity' as the "inherent capacity of a system (e.g. a city government), population (e.g. low-income community in a city) or individual/household to undertake actions that can help avoid loss and speed recovery from any impact of climate change" (p.5) Thus, both 'coping capacity' (disasters) and 'adaptive capacity' (climate change) are determined by a community's or a system's abilities to take actions that will help them to withstand hazardous events.

2. Urban coping strategies

Coping strategies are often complex depend on the assumption that an event will follow a familiar pattern, and that actions that were taken before to cope are a reasonable guide for similar events (Wisner et al. 2004). They operate within different scales: individual (e.g. household), community (e.g. neighbourhood) or institutional (e.g. city-wide or beyond). Individual coping strategies, which operate at the level of the household unit entails cooperation on activities within the household, but not beyond. Coping strategies operate at the community level when members of a community work together to improve their resilience. This requires a certain level of organisation beyond the household and may involve community-based organisations, religious organisations or other organisations that operate as an organising entity within the community. Local governments or outside NGOs may operate institutional level coping strategies, however the urban poor generally have little power over these – rather their sphere of influence is at the individual or community level.

Wisner et al. (2004) and Wamsler (2007) identify several different types of coping strategies, some of which correspond to strategies that the urban poor use:

- *Preventative strategies* – at the individual and small group level means people making choices so that they will not be affected by an event, such as avoiding dangerous places at certain times or choosing safe residential locations.
- *Impact minimising strategies* – These are strategies to minimise loss and to facilitate recovery in the event of a loss. This is generally referred to as 'mitigation' in disaster literature, but 'adaptation' in climate change literature. Very simply, this should imply improving access to a minimum level of food, shelter and physical security so that people will be less vulnerable in case a disaster or climatic event does happen.
- *Building up stores of food and saleable assets:* storing of food may be more common in rural areas, but urbanites living in a cash-based economy may use similar strategies such as keeping items of value that can be sold if needed.
- *Diversifying income sources*: In cities this may mean illegal or quasi-legal work, such as street-hawking, waste recycling, or even looting and pilfering in areas that have been affected by a disaster. Having more than one, or sometimes several, income earners in the family also allows for diversification. If families have contributed to savings groups, this can offer a form of income during hard times.
- *Development of social support networks*: This is the ability to call on the resources of others during difficult times. Networks can be within the household, between extended family members (living near or afar), within neighbourhoods, and with wider groups who have a shared identity (religious, geographic, commercial, etc.). Assistance can come in many forms – financial help, emotional support, shelter in time of need, or physical helping of any kind. These types of networks maybe less present in urban settings due to the erosion of traditional systems that govern social interactions. Also, transience is quite common in urban settings, so families may not have the opportunity to establish these important networks.

3. Grassroots coping strategies for the urban built environment

As detailed above, coping strategies can entail many different kinds of activities, including the use of social networks and economic diversification or savings. Many important coping strategies employed in cities consist of modifications to the physical and built environment. Wamsler (2007) refers to physical/technological risk reduction as 'the structural and non-structural improvements of dwellings and surroundings.' She also refers to environmental risk reduction, which is the use and removal of natural resources, including clean-up of the natural environment. Studies of coping strategies for the physical and built environment highlight several common features of urban populations under risk (Nchito, 2007; Satterthwaite et al., 2007):

- *The poor usually inhabit informal settlements in the most hazardous locations in the city, and thus are most at risk when a disaster or climatic event happens*. The poor often build on leftover land on floodplains alongside the river, or on unstable hills surrounding the city susceptible to land slides. They may live close to garbage dumps or toxic industries or end up inhabiting the areas most prone to strong ground motion in earthquakes. Informal settlements often lack basic infrastructure of paved roads or adequate drainage

and thus are more susceptible to flooding. Lack of open spaces and little green areas mean that informal settlements may suffer from higher temperatures.

- *Informal developments often aggravate flooding and heat*. Flooding frequency, magnitude and duration can become stronger, as informal developments on floodplains restrict water runoff. Lack of open spaces and clearance of natural vegetation create stronger urban heat island effect.
- *Relocation is not an option* that the urban poor will agree to take in times of a disaster or a climatic event, unless they absolutely must. People do not feel safe leaving behind their belongings and often cannot afford to be far away from income earning possibilities.

Coping strategies for the physical and built environment operate at different scales. The following activities are common (Wamsler, 2007; UNFCCC, 2004; Douglas et al. 2008):

- *Within the house*: raising furniture in the house, building furniture that is higher so that people can rest on it during the flood, blocking entryways so that water cannot come in, creating outlets so water can flow out easily, turning off electricity;
- *Modifications to the house structure*: installing rain gutters, replacing walls or supporting structures with flood-resistant materials, i.e. bricks or cement, using light coloured materials to reflect heat, using lateral reinforcing with wood or bamboo for earthquakes and hurricanes, nailing down roof materials.
- *Modifications around the house:* digging water channels, building dykes, laying sandbags.
- *Improvements at the neighbourhood level*: cleaning drains that service several houses, building retaining walls, putting plastic sheets on slopes.

Cooperation beyond the household—at the community or institutional level—is usually necessary for the neighbourhood level coping strategies. Investments in roads and pathways, drainage and sanitation systems, and improvements to open spaces can reduce the frequency and magnitude of disaster events but require collective action. Some of the most effective adaptation strategies maybe beyond the control of the local community and must be implemented at the institutional level. For example, tenure systems that allow the urban poor security of tenure means that people will invest in improvements to their houses.

As part of any adaptation plan, outside agencies must understand existing local coping strategies and build upon them (Huq and Ried, 2007). Davis (2004) outlines the need to build a detailed understanding of the scale and nature of the coping strategies of communities at risk and makes the point that these coping strategies need to be integral to disaster plans. Moser and Satterthwaite (2008) highlight the need to support initiatives that build resilience at household and community levels. To understand the adaptation strategies urban poor dwellers in informal settlement are currently using to cope with climatic-related events, this research turns to a study of Korail in Dhaka.

III. CASE STUDY: KORAIL, DHAKA

1. Vulnerability of Dhaka

Bangladesh in general is vulnerable to climate variability and climate change because of its geomorphologic location. The capital city Dhaka has experienced 9 major floods in the last 55 years among which the ones of 1988, 1998 and 2004 were severe due to overflowing of surrounding rivers. Flooding from excessive rainfall also cause severe problems in certain parts of the city, which are inundated for several days mainly due to drainage congestion and inadequate pumping facilities. In addition the city experiences 'heat island' problems where the temperature is a few degrees higher than the surrounding areas. These affect infrastructures including water systems, housing and settlements, transport networks, utilities and industry. The 3.4 million urban poor living in Dhaka with limited or no access to services and poor living conditions are considered highly vulnerable among all the city dwellers (CUS, 2005). In addition to physical impacts the vulnerability increases through unsecured livelihoods, increased health risks and constrained economic activities.

2. General description of Korail

The informal settlement in Korail, considered being the biggest slum in Dhaka, started to develop during late 80's on the vacant higher grounds. Eventually the settlement expanded encroaching the highly vulnerable water edges. At present Korail covers an area of approximate 90 acres with an estimated population of over 100,000 (CUS, 2005). The eastern and southern edge of the area is defined by the Gulshan-lake, a main water reservoir for the adjoining areas. Because of its location near the high-end residential and commercial (Gulshan, Banani and Mohakhali) areas of Dhaka it attracted low income people engaged mostly in service jobs like cleaners, household helpers, rickshaw pullers as well as worker of ready made garments industries.

Fig 1: Korail amidst the high income residential area of Dhaka

High density of population without proper services and location in vulnerable water edge impose threats from climate variability and climate change. Security of tenure is one of the major concerns for the area. Since two government organizations own most of the land, ownership of land acts as a threat of eviction. The insecurity has caused reluctance among service providing authorities to give legal access to city wide system although inhabitants pay higher prices for water and electricity to the illegal providers. Also the inhabitants living as long as even 20 years are unwilling to invest in improving the living condition. High density self help housing in the area developed without any government intervention. Different NGOs worked in the area to develop segmented drainage, sanitation, garbage disposal as well as non formal education and healthcare facilities. People of Korail experience climatic hazards almost every year from excessive rainfall, increased heat and flooding.

3. Methods

A small qualitative survey has been done among 35 households to identify their experiences of climatic variability, hazards and coping strategies. The households have been chosen randomly based on the criteria of location, condition of houses, ownership and period of tenancy. Among the 30 households finally documented, 14 lived near the water edges, highly susceptible to flooding while other 16 live on higher ground in high density area with or without drainage facilities. The housing condition varied between permanent to temporary character and the period of tenancy varied from less than 1 year to more than 5 years. The survey included interviewing at least 2 household members (male/ female) preferable in two different times. The survey questions have been designed in consultation with local inhabitants and academics with options of flexibility and additions by the respondents. The answers of the respondents were compiled and analyzed from the filled out answer form using the programmes Microsoft Office Access, Excel and SPSS. Notes, pictures and sketches provides important basis for the documentation.

4. Findings

4.1 Population

The 30 household comprises of total of 163 members. 36% of the survey population are within the age group of 15 to 30 working as principle earning members employed either as service providers or self employed related to services. Any climatic hazards reduce their earnings from less working hours and days. 17% aged between 35-45 earn from either renting out rooms or running household based small businesses. Renting out rooms becomes problematic during rainy seasons for water clogging and flooding. Population pyramid of the studied population shows almost 30% under the age of 10 years. This raises two major concerns for future: high dependency rate on the earning members will increasing the vulnerability of the children as well as their susceptibility to long term impacts of disaster resulting from climate variability and climate change. Also there is high rate of illiteracy and low formal educational qualifications. It limits their access to information increasing vulnerability.

4.2 Economic abilities

There is a wide variation among the earnings of individual as well as combined household. Although 19 out of the 30 households shows allocation from earning for individual being less the 1 USD (BDT 70) per day but 40% of the households have combined earning between BDT 5000-9000 indicating availability of livelihood opportunities. 20% household have income more than BDT 17000 per month which is quite high in comparison to the other informal settlements in Dhaka. 36% individuals earn up to BDT 3000 per month. Average working hours of the working individuals are 10.5 hours and 26 days per month. But there is very high economic dependency rate of 59.5% on the working earning members.

4.3 Tenancy and migration

Most of the households migrated to this area from other parts of the city because of the availability of vacant land, familiarity with the area and proximity to livelihood opportunities with an aspiration to move into comparatively permanent location. 90% households have some experience of eviction in past. The principle reason for migration from village was aspiration for better life and move with the family. Approximately 7% households identified river erosion and loss of livelihood as one of reasons for migration from the village. Most of the households moved near to their extended family or people from the same village or region.

4.4 Experience of disaster and climate change impacts

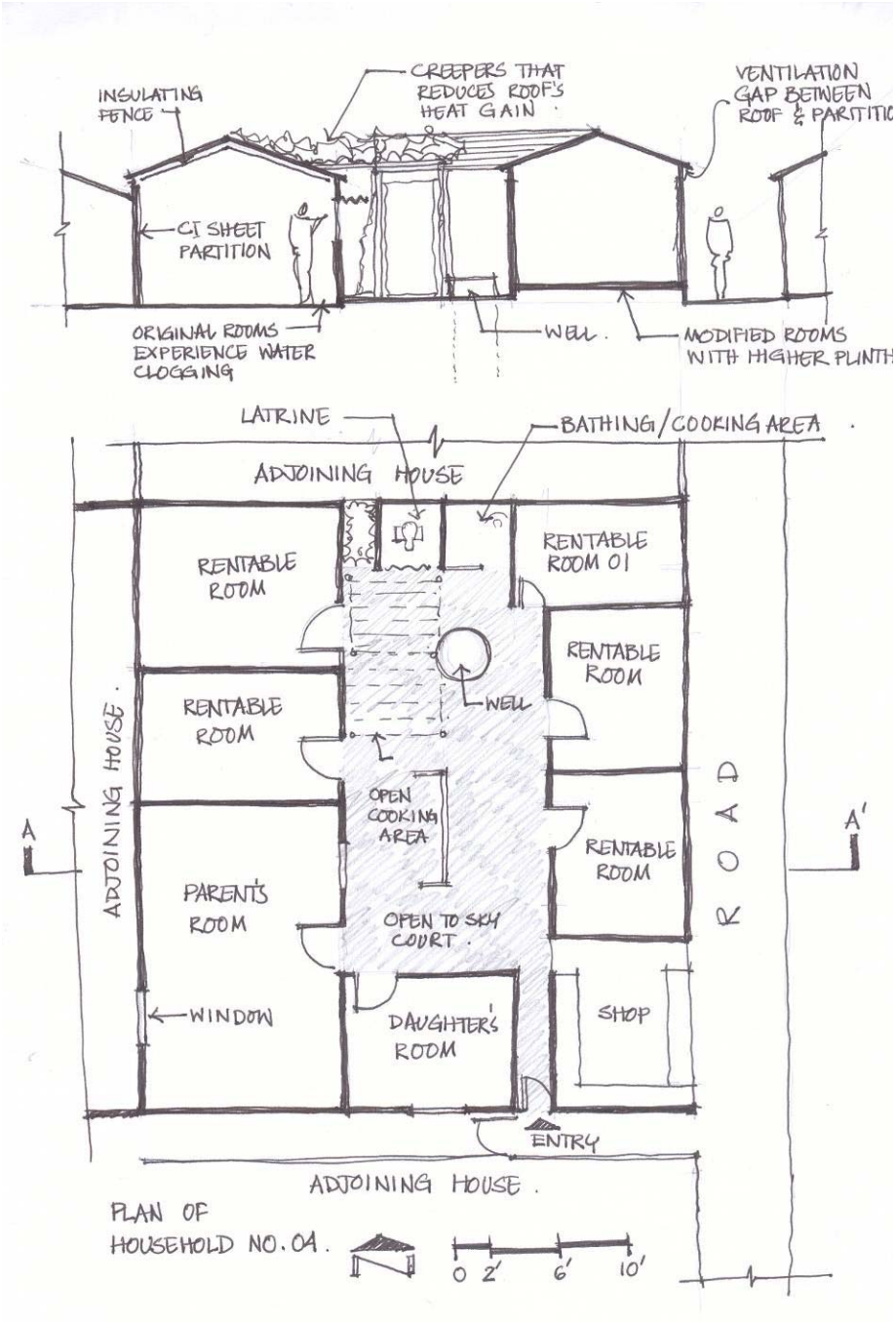
The facts of climate change are not evident phenomenon for the inhabitants of Korail. Rather they recognize the climate variability. They suffer from water clogging and flooding in regular monsoon as well as untimely rainfall. Also most of the older respondents felt there has been reduction in amount of rainfall from their childhood experiences. Increased heat is a major indicator of climate change and climate variability for most of the respondents. Heat increases the occurrence of diseases from water shortage like typhoid and diarrhoea that put pressure on the household earning from medical emergency.

5. Activities of people before, during and after the disaster

5.1. Physical coping strategies

As mentioned earlier from Wisner et al (2004) coping strategies for the urban poor can be preventive as well as impact minimizing. In Korail choosing safe location to avoid danger is not an option for most of the squatters, as option of building new rooms are now only possible through encroachment of water edges susceptible to flooding. Some of the renters move to higher lands by buying possessions from the older inhabitants. In that sense most of the households take few preventive actions before any disaster as a recognised measure of coping strategy. Most of impacts minimizing actions have become integral part of their regular practice generated from experiences. For instance, they make barriers at the door front (53.3%), increase the furniture height (43.3%), make higher plinth (30%) and arrange higher storage facilities (30%). Only 5 out of the 30 household informed to change to weather resistant building materials before the rainy season and store food and water before predicted flooding. Some of the household took initiatives to work with NGOs working in the area to construct drainage facilities connected to the lake.

The families living in higher grounds away from the water edge construct minimum 5 inches barriers at the door to safeguard the rooms from water clogging from regular rainfall where



. *Fig 2: Typical house arrangements Source: Author*

drainage facilities are unavailable. Maximum households increase height of the furniture at least 6 to 9 inches (2 or 3 bricks) depending on the location. In Korail most of the rooms are arranged in courtyard type pattern, adjoining rooms facing a narrow passage like shaded courtyard Typically one household occupy a single room where as better off households use two rooms. To reduce the heat in the rooms made out of CI Sheet creepers are grown in the courtyards to cover the roofs. Also most of the household use some form of false ceiling materials or canopy made out of cloths. This is a popular practice in rural areas that has been brought forward in urban shelters.

The households living near the water edge usually built on stilts. The platform for the floors is made higher considering the flood level. These silt houses have better ventilation and experience reduced heat comparing to the houses inland. The wooden planks in the floor are preferred as they face fewer problems from water clogging as soon as the water resides after heavy rainfall. The stilts have the flexibility to increase height depending on the water level every time they rebuild. The techniques used in the joints between partitions with roof and floor enhance ventilation as shown in Fig 3. Also the stilt houses have the options of incremental expansion and repairing affected from any disaster.

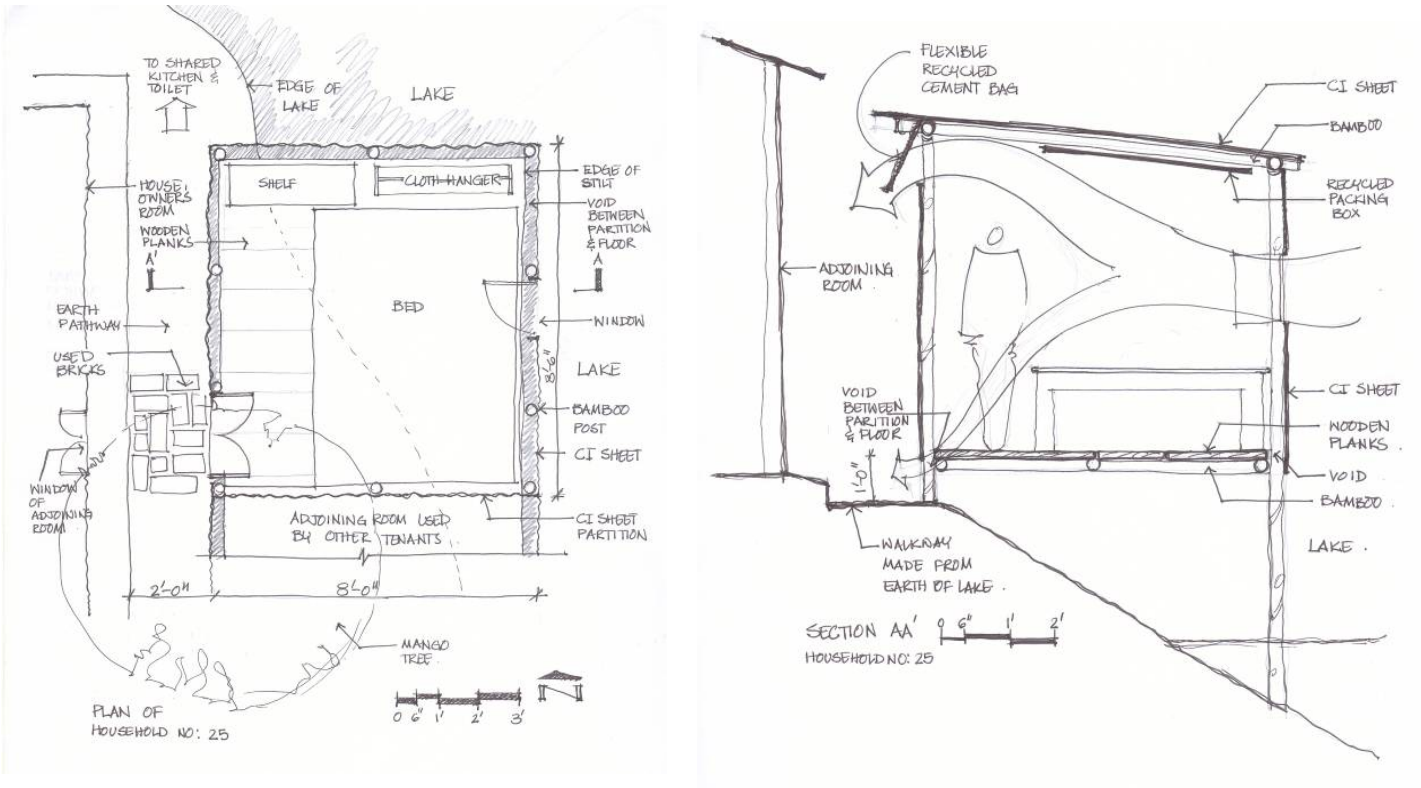


Fig 3: House 1 on water edge Source: Author

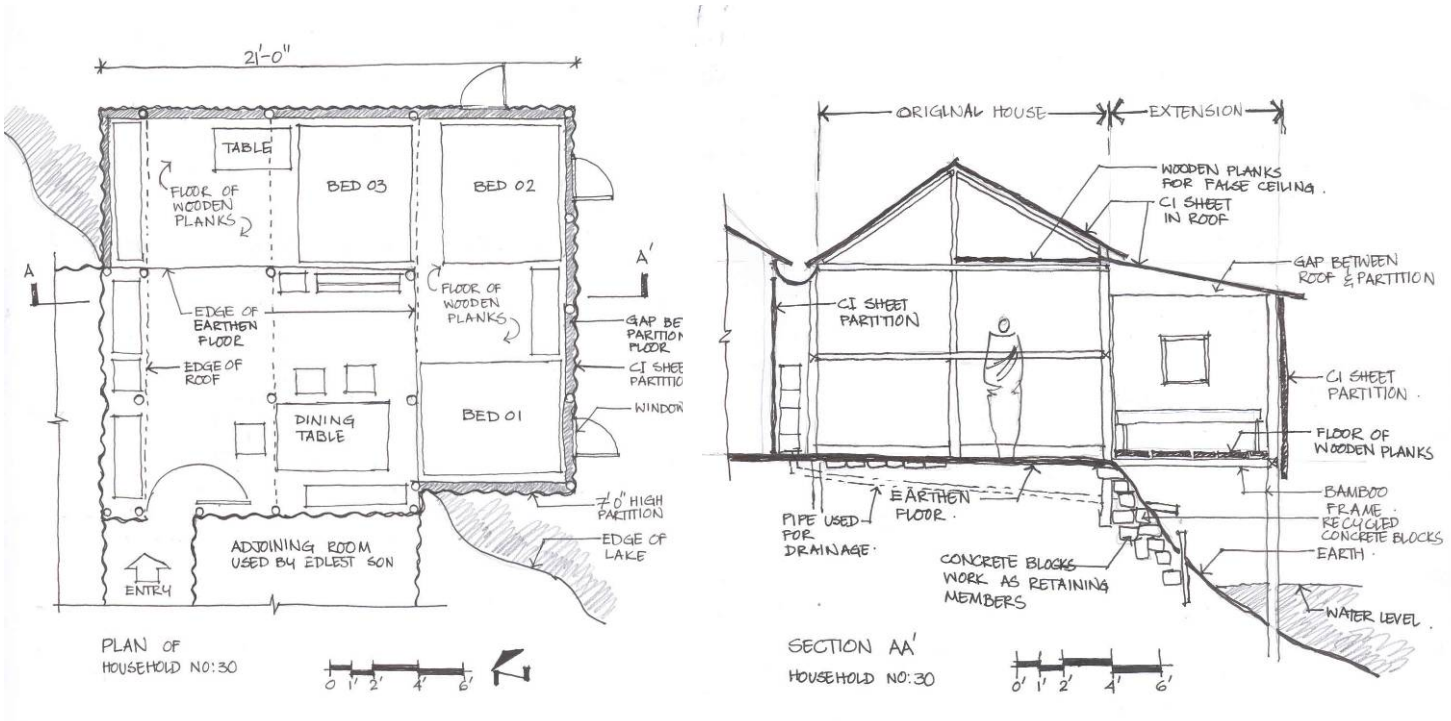


Fig 4: House 2 on water edge Source: Author

In Korail during any disaster moving to safer areas is not a preferred options as moving means losing the assets, social and livelihood network and chances of losing right to live. This can be argued as emotionally oriented strategies of adaptation. During flooding or water clogging the most practiced option is to sleep on furniture above flood level and use movable cooker for food preparation. 14 out of the 30 households shared services of the unaffected neighbours. Some temporary measures were also taken like making higher barriers at the doors, making outlets at the house for easy flow of water, develop alternate means of access, build higher stilts inside the rooms, and community initiatives to clean drainage and move most effected families to safer spaces within the neighbourhood. 30% of the households suffered from food shortage during the pervious flooding and elongated water clogging. Only 16% shared food with neighbours while 27% borrowed money from their savings and others to tackle hardship.

To cope with the increased heat most of the households (70%) increase their power usage and buy additional electrical equipments during summer. Generally closely space structures create shaded courtyards that are used as open space for ventilation and hold outdoor household activities during frequent power shortage. Also the use of different insulating materials reduces the heat from CI sheet roofing and partitions. People use various kinds of recycled materials like paper, styrofoam, packing boxes, cement bags bamboo mats and old clothes for insulation.

After any disaster like flooding and water clogging 18 out of the 30 households rebuild their structures in someway from changing building material, increasing plinth level, changing materials for plinths to changing structural, roofing and walling materials. 30% households took loans and got help from the household members or neighbours for the purpose. There is a common practice among the households to save not only money but also building material through out the year for rebuilding after any future disaster. Only less than 4% preferred to move to new locations after the last disaster as they are mostly renters.

5.2. Economic strategies

Savings is seen as a main coping strategy for most of the households. 50% household saves regularly with savings groups or NGO with an intention that they can take loan from their savings during and after any disaster. Usually the savings groups are formed within extended families, neighbourhoods and wider groups who have shared geographical identity. They create a social and livelihood network through savings. The amount saved varies between BDT 200 – 2800 per month forming 3-17% of total household income. Usually these households have more than one earning members or source in diversified professions.

5.3. Social networks and safety-nets

The inhabitants of Korail have a very strong social network. It has a strong community based activities which prevented eviction in number of instances. Typically the area developed by people migrating from the same area who tend to stay near (56.6%). A major population migrated from southern districts often inundated by flooding and mid land areas with less livelihood opportunities. 23 out of 30 households have some relatives or friends living in the city and 14 of them felt they can seek assistance in the event of any emergency. Service sector employment in private sector requires keeping professional and livelihood networks. More than 46% household acknowledged having acquaintance with any professional group. Because of the

courtyard living with shared services there is a strong bonding among different households. Also the households who are renting the rooms act as guardians for the tenants. People tend to be self sufficient with sharing attitude with neighbours.

Findings from areas like Korail raise concerns about the future of urban planning in the face of rapid urbanization in Bangladesh, on how to reorient and reduce effects of climate change and variability for the urban poor. As Dodman & Satterthwaite (2008) state urban authorities can have a number of specific roles in reducing climate change vulnerability by introducing zoning and planning controls to help provide appropriate and safe locations for low-income households while reducing exposure to the risks of flooding, slope failure and other disasters. The presence of a strong local government with capacity to develop framework for future investments; land use management and possibility to incorporate climate change adaptation measures is a prerequisite for such activities. However in Bangladesh, although few urban centres have such plans, in most case they are 'outdated, unenforced, or unenforceable'. The following section unfolds the local government's possible contributions to mainstreaming adaptation plans.

IV. SUPPORTING LOCAL COPING STRATEGIES THROUGH ADAPTATION PLANNING

1. How can local planning and governance mechanisms support existing coping strategies

Local governments are better placed than any other government structure to deal with the effects of local climate events from a pro-poor perspective. However, adaptation to climate change is a relatively new issue for local government staff and this means that more often than not they engage with it through spontaneous responses triggered by urgent climate events usually interpreted as 'natural disasters'. By contrast to these spontaneous efforts, planned adaptation involves "a set of conscious policy and financial decisions made before signs of climate impacts become apparent or just after the first changes take place" (Deri and Alam, 2008). Ideally, spontaneous and planned adaptation should be articulated to enable the local government to develop integrated and systematic approach to climate change.

Whilst it is useful to bear in mind the distinction between 'spontaneous' and 'planned' adaptation, the former approach should not be underestimated or overlooked, as it constitutes the typical 'learning-by-doing' mechanism by which local governments can make good use of indigenous knowledge systems built up from the historical experience of urban dwellers and passed over from one generation to another one. These play a crucial role in contextualising the adaptation process, generating community-wide ownership and commitment. Planned adaptation allows local governments to draw on scientific knowledge to map and predict climate risks.

There are a number of ways in which the two aforementioned approaches can be effectively articulated. The first step towards the development of robust local adaptation plans is for local governments to effectively engage in pro-poor adaptation to climate change in urban areas, promoting democratic and accountable local governance structures that actively challenge anti-poor attitudes among government bodies and engage key stakeholders from the private and civil society spheres to raise awareness, ensure the exchange and integration of various knowledge and skills, identify needs and priorities, evaluate scenarios and build collectively negotiated

strategies. Local adaptation plans can be meaningless unless community organisations of the poor are systematically engaged and their short and long term autonomous responses to climate change are understood, valued and supported.

The recent Bangladesh Climate Change Strategy and Action Plan 2008 reiterate Government of Bangladesh's vision to eradicate poverty and achieve economic and social well-being for all the people through a pro-poor approach prioritising adaptation and disaster risk reduction. The strategy and action plan are focusing on six sectors of development. Among others these include comprehensive disaster management, infrastructure, research and knowledge management as well as capacity building and institutional strengthening. This can be an opportunity for future activities. Unfortunately most of the detailed programmes focused on rural areas and failed to address other than improving urban drainage under the infrastructure development whereas urban poor also lack food security and social protection or should be part of the comprehensive disaster risk management from the impacts of climate change.

A second area where local governments can play a crucial role in adaptation is by ensuring that land-use planning and the development of buildings and infrastructure take account of climate change risks. This poses several challenges as it requires planning and regulatory frameworks that do not only prevent further developments in high-risk areas and support mitigation efforts but also reduce the vulnerability of the urban poor and of collective infrastructure without imposing additional costs on the poor or obstructing their right to the city. Furthermore, infrastructure adaptation in the context of the developing world is compounded by the very large deficits suffered in urban areas and the poor quality and lack of maintenance of existing infrastructure. This implies that local adaptation to climate change cannot be divorced from a wider development perspective which at the same time focuses on tackling risk through lifeline infrastructure in areas where such risk has historically accumulated whilst planning to reduce disaster risk in future urban development.

The case of Korail, vividly illustrates the reality of most informal settlements in the context of low and middle income countries, where a large percentage of the urban population lives, contributing more than their fair share to the development of socially, culturally and economically vibrant cities. Yet, their contribution is not only ignored but in many cases actively resisted, with local governments typically denying the provision of basic infrastructure to informal settlers and imposing additional threats through widespread forced evictions. Potential improvements by local dwellers to the area’s infrastructure are often deterred by the insecurity of land tenure and the threat of eviction. The merits of securing land tenure in informal areas have been largely discussed elsewhere but cannot be emphasised enough. In the case of Korail, most of the land belongs to the state and there is therefore considerable room for a comprehensive land regularisation programme.

Community-managed saving groups constitute a widespread mechanism employed by the urban poor and their federations to spread risk, increase their capacity to embark in affordable housing and the provision of infrastructure and services and ultimately enhance their resilience to climate-change related risks (D’Cruz and Satterthwaite, 2005). Local governments can support such saving schemes by backing their development into larger networks of savers – therefore helping to further spread their risks – and engaging in the co-production of housing, services and

infrastructure, whilst ensuring that such developments are climate-risk sensitive. The saving patterns among the inhabitants of Korail exemplify an opportunity of such nature.

Another area where local governments can play an active role is in the development of collective disaster risk transfer instruments to provide insurance coverage for low income groups. In the last decade, there has been increasing interest on the notion of 'risk transfer' instruments (such as policy insurance), and their linkage with reconstruction and disasters mitigation programmes. However, there is still considerable room for development and innovation, particularly in relation to local/municipal approaches that effectively target the urban poor, who are typically unable to access the insurance market. The Bangladesh National Adaptation Programme of Action (NAPA) includes the consideration of micro-insurance for the poor using institutions involved in micro lending such as the Grameen Bank (Satterthwaite et al, 2007).

2. How can grassroots coping strategies be mainstreamed into adaptation plans and scaled up at the city-wide level

We started this paper by arguing that pro-poor adaptation to climate variability in cities demands a better understanding of the poor's adaptive capacity and of their autonomous coping strategies. This is because the urban poor are affected by the 'double vulnerability' of climate change and poverty, which means that they are disproportionately affected both in terms of their exposure to climate related risks and in terms of the limited resources at their disposal to response to such risks. Thus, support to local adaptation must pay attention to the differentiated impacts of and responses to climate change among different groups in society. However, there is a series of issues to take into account in order to mainstream this consideration into municipal adaptation plans in an effective and equitable way.

First, large uncertainties persist about the knowledge of observed short and long term climate effects in urban areas and in particular of how local specific conditions shape the vulnerability of the poor. Therefore, it is important to generate sustainable local means to identify and monitor climate change related impacts and to integrate risk management principles and mechanisms of knowledge production sharing into municipal adaptation policies and plans. In the process, the urban poor should be considered both as the producers and consumers of such information, addressing the striking gap in climate risk relevant information by and for the urban poor.

Second, a fundamental problem resides on the fact that external support agencies are rarely set up to understand and support local governments and local community adaptation plans. Thus there is a mismatch between the areas where increased local capacity and competence in climate adaptation is urgently needed and the flow of development cooperation resources supporting of adaptation. Bangladesh receives a significant volume of overseas development assistance (ODA) to support development activities, amounting to 1, 739 USD million during the 1998-2000 period (Agrawala and Ahmed, 2005). Out of this, it is estimated that the share of activities potentially affected by climate change risk - comprising climate-affected projects dealing with water supply and sanitation, renewable energy and hydropower, urban and rural development, food security and infectious diseases among other categories – has been as high as half a billion per year; whilst ODA committed to activities potentially affected by climate risk is considerable higher than that committed to specific projects for climate change adaptation (Ibid).

The above discussion highlights that consideration of climate change related risks could play a central role in financing both general development goals and adaptation responses and reinforces the need to mainstream climate risk in the overall flows of development aid as a cross-cutting concern. However, this measure alone would not be enough for external funding flows to effectively support local adaptation plans. The problem requires a deep rethinking of the aid architecture to open a two-way direct dialogue between international development agencies and urban authorities and dwellers, pretty much along the lines of decentralised cooperation programmes and the creation of social funds for community adaptation.

Third, as suggested by the previous discussion, adaptation plans cannot be developed in isolation from other development strategies. Bangladesh Poverty Reduction Strategy Paper (PRSP) gives limit consideration to the impact of climate change on how to plan vulnerability reduction strategies. The lack of consideration of the specific impact that climate change will have on the urban poor both in PRSP and international ODA is a product of the macro-perspective often adopted in addressing the links between development, poverty and increased vulnerability due to climate change effects. Thus, the task ahead is not only to incorporate the consideration of climate change impacts to urban programmes and activities but also a consideration of climate change vulnerability to any development intervention. Eriksen et al (2007) argue that sustainable adaptation measures should be seen as those at the intersection of poverty reduction and vulnerability reduction measures.

Fourth, as highlighted in the introduction, coping with climate change risks is not a new situation for the urban poor and much can be learnt from their slowly matured autonomous responses in order to build local adaptation policies and plans on the evidence-base of grassroots experience. Section III described the coping strategies developed by the poor in Korail, Dhaka. These range from physical adaptive practices in individual dwellings, through collective efforts to construct and maintain drainage facilities to the use of local social capital, for instance by sharing food and cooking facilities or moving to less affected building in the neighbourhood during flooding or water clogging. About 50 percent of the households interviewed participate in saving schemes with the intention of taking a loan from their savings during hardship times. Furthermore, some of the strategies, such as the use of roof canopies or vegetation to reduce heat exposure were identified as regular practices imported from the rural areas where many of Korail's current dwellers come from. The physical and social strategies adopted are mutually reinforcing as shown in the widely use of courtyards which not only provide shaded open space for ventilation but also for outdoor inter-household activities that strengthen solidarity bonds among neighbours. As noted by Wisner *et al*. (2004) and discussed in section II, grassroots coping strategies may comprise preventive, impact-minimizing or post-event coping actions, all aimed at reducing vulnerability through various mechanisms of technology use, social organization, economic relationships and cultural arrangements.

Fifth, city plan adaptation strategies require coordination across government agencies and utility providers and a combination of 'structural' and 'nonstructural' approaches. The former term is often used in reference to "engineering interventions such as river channel modifications, embankments, reservoirs and barrages designed to control the flow of rivers and abate or control the spread of flooding" whilst nonstructural approaches "typically refer to measures designed not to prevent floods but to reduce the short- and long-term impacts of the hazard….[including]

formal flood warning systems and evacuation programmes, land use controls on flood-prone sites, building regulations to prevent incursion of floodwaters and insurance schemes" (Few, 2003:47). Over the time, the latter approaches began to pay more attention to community and household hazard coping strategies like the ones examined in this paper under Section III.

At present a number of structural measures adopted by the Ministry of Environment and Forests, the Dhaka Water Supply and Sewage Authority and the Bangladesh Water Development Board are underway in Dhaka to to improve environmental quality, manage floods and improve the drainage system. The severe destruction that took place in the 1989 floods prompted the adoption of the so-called 'crash programme', aimed at developing a comprehensive flood protection system both on the western and eastern parts of Dhaka city. The first phase of the Dhaka Integrated Flood Protection Project in the western part of the city has been completed and effectively protected half of the city from complete inundation in the floods in 1998 and 2004. Non-structural measures include the banning of polythene bags which has allegedly reduced the regular clogging of the city drainage system (Alam and Golam Rabbani, 2007). Improvements to the city surface drainage system are still under way but progress has been delayed by the encroachment of many canals and canal banks by influential actors within local politics.

Last but not least, local adaptation plans cannot be promoted in isolation from effective mitigation responses. Although the national and local contribution to global greenhouse emissions is negligible, both are increasing. The energy sector in Bangladesh contributes more than 60 per cent of the total annual greenhouse gases emitted in the country and 25–30 per cent of the emissions from the transport sector come from Dhaka city (Alam and Golam Rabbani, 2007). Beyond a number of measures adopted by the local authorities to improve ambient air quality and reduce greenhouse gas emissions – such as the introduction of compressed natural gas in the transport sector – there is still plenty of room to reduce electricity consumption at household and industrial levels and to introduce changes in the transport sector.

V. CONCLUSION

Adaptive capacity and coping strategies can no longer be considered as different activities in policy and action level in countries like Bangladesh. In context of limited abilities of the government where actions should be taken to increase the community's as well as institutional abilities to help withstand hazardous events, the grass root experiences, especially in built environment, can form an effective knowledge-base to plan for future. For example government of Bangladesh is promoting public private partnership to provide housing for the urban poor. Bangladesh National Building Code (BNBC) defines minimum standard housing development for the low income people in urban areas. These codes however didn't take into account the climatic risks the urban poor faces living in vulnerable areas. The grassroots experiences can help redefine urban development codes for urban areas.

Urban poor communities come together from their survival intuitions creating strong bonding in individual and community level. Preventive or impact minimizing strategies may not be the best options to adapt to climate variability but others like diversifying income sources or development of social support networks can eventually create pressure to change on local government's institutional level to make it as integral part of development plans where options are to be there

to build resilience through the process. For that local governments need to effectively articulate between ‘spontaneous’ and ‘planned’ adaptation. This can be done in different level like from supporting saving schemes by backing their development into larger networks of savers to ensuring land-use planning and development of buildings and infrastructure take account of climate change risks and addressing security of tenure issues. These require coordination across government agencies, utility providers and funding agencies and a combination of ‘structural’ and ‘non-structural’ approaches.

Bibliography

Agrawala, S. and Ahmed, A. U. (2005) *Bridge over troubled waters: Linking climate change and development*. Organisation for Economic Co-operation and Development (OECD) OECD Publishing, Paris

Alam, M. and Golam Rabbani, M. D. (2007). "Vulnerabilities and responses to climate change for Dhaka." *Environment and Urbanization*, 19(1), 81-97

Allen, A. in collaboration with Hofmann, P. and Griffiths, H. (2007) "Report on Rural - Urban Linkages for Poverty Reduction" in *State of the World's Cities Report 2008: Creating Harmonious Cities.* United Nations Human Settlements Program (UN-Habitat) Earthscan, London

CUS et al (2005) *Slums of Urban Bangladesh: Mapping and Census*, CUS, Dhaka.

D'Cruz, C. and Satterthwaite, D. (2005) *Building holes, changing official approaches: the work of urban poor federations and their contributions to meeting the Millennium Development Goals in urban areas*. Poverty Reduction in Urban Areas Series, Working paper 16, IIED, London

Davis, I., (2004) "Progress in analysis of social vulnerability and capacity" in Bankoff, G., Freks, G. and Hilhorst, D., eds. *Mapping vulnerability: disasters, development and people*. London: Earthscan, p. 128-144

Deri, A. and Alam, M. (2008) "Local governments and climate change." *Commonwealth Secretariat Discussion Paper*, *Number 2*, October, London

Dodman, D. and Satterthwaite, D (2008) "Institutional capacity, climate change adaptation and the urban poor," *IDS Bulletin*, 39(4), Institute of Development Studies

Douglas, I. et al. (2007). "Unjust waters: climate change, flooding and the urban poor in Africa." *Environment and Urbanization*, 20(1), 187–205

Eriksen, S.E.H., Klein, R.J.T., Ulsrud, K, Næss, L.O. and O'Brien, K. (2007) *Climate change adaptation and poverty reduction: key interactions and critical measures.* Report prepared for the Norwegian Agency for Development Cooperation (Norad). GECHS Report. http://www.norad.no/items/10502/38/5649817983/GECHS%20Report%202007-1.pdf (Accessed March 9, 2009)

Few, R. (2003). "Flooding, vulnerability and coping strategies: local responses to a global threat." *Progress in Development Studies* 3(1), 43–58

Huq, S. and Reid, H., (2007) "A vital approach to the threat climate change poses to the poor: community-based adaptation," *IIED Briefing*. International Institute for Environment and Development (IIED), London

IPCC, 2007: *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland.

McGranahan, G., Balk, D. and Anderson, B. (2007). "The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones." *Environment And Urbanization*, 19(1), 17-37

Moser, C. and Satterthwaite, D. (2008). "Towards pro-poor adaptation to climate change in the urban centre of low- and middle-income countries." *Human Settlements Discussion Paper Series: Climate Change and Cities 3,* International Institute for Environment and Development (IIED), London

Nchito, W. S. (2007). "Flood risk in unplanned settlements in Lusaka." *Environment and Urbanization*, 19(2), 539–551

Pelling, M. (2003), *The Vulnerability of Cities: Natural Disasters and Social Resilience*, Earthscan, London

Satterthwaite, D, Huq, S, Reid, H, Pelling, M and Romero Lankao, P (2007). "Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-Income Nations," *Human Settlements Discussion Paper Series: Climate Change and Cities 1*, International Institute for Environment and Development (IIED), London

Schipper, L. and Pelling, M. (2006). "Disaster risk, climate change and international development: scope for, and challenges to, integration." *Disasters: The Journal of Disaster Studies, Policy and Management*, 30(1), 19-38

Tomalla, F. et al. (2006). "Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation." *Disasters: The Journal of Disaster Studies, Policy and Management*, 30(1), 39-48.

United Nations Framework Convention on Climate Change – UNFCCC, 2004. *Database on local coping strategies*. <http://maindb.unfccc.int/public/adaptation/ > (15 April 2009)

United Nations International Strategy for Disaster Risk Reduction – UN/ISDR, 2009. *UNISDR terminology on disaster risk reduction*. Geneva: UN/ISDR.
<http://www.unisdr.org/eng/terminology/terminology-2009-eng.html> (26 January 2009)

Wamsler, C. (2007). "Bridging the gaps: stakeholder-based strategies for risk reduction and financing for the urban poor." *Environment and Urbanization*, 19(1), 115–142

Warner, K. and Bouwer, L. (2005) **"**Financing weather and climate risks" Report from Workshop 3. In: *2nd International Work Conference on Climate Change and Disaster Risk Reduction*. The Hague, 21-24 June, 17-25

Wisner, B., et al., 2004. *At risk: Natural Hazards, People's Vulnerability and Disasters*. 2nd ed. Routledge, London