

Chapter 4

Urban Poverty, Climate Change and Health Risks for Slum Dwellers in Bangladesh

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Abstract The health and rights of populations living in urban slum settlements against the backdrop of increasing risks and disasters brought on by climate change is a key development issue of the twenty-first century. The impacts of natural hazards as a result of climate change are unevenly distributed globally and nationally, with populations in mega cities most vulnerable. Bangladesh remains riskiest on the global climate index and was recently ranked as one of the top countries most affected by extreme weather events according to recent news report. Dhaka has a high vulnerability of climate change as well as urban poverty. Slums settlements tend to be located in low lying land areas that are flood prone. A spatial mapping of approximately 7,600 households in 44 slum settlements was found to be within 50 m of a river and risked being flooded. In urban slums, it was found that when water started pouring in, some families built bamboo platforms and shifted their belongings on it. In some cases, families raised their beds by putting bricks under it to raise the level of the beds. In some cases, families shifted to the roofs of their homes, if the roofs were sturdier. The situation from urban poor is dismal due to the overcrowding and lack of access to basic services, such as water and sanitation. Consequences of these living conditions include stress due to crowding, insecurity due to lack of housing and land tenure. These conditions worsen during floods and disasters. The absence of clear and forward-looking policies on urbanization and urban slum settlements discourages long-term thinking and interventions to improve the long-term prospects of people who live in slum settlements.

Keywords Climate change • Health vulnerability • Poverty • Sanitation • Urbanization

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4.1 Introduction

The health and rights of populations living in urban slum settlements against the backdrop of increasing risks and disasters brought on by climate change is a key development issue of the twenty-first century. According to the Fourth Assessment of the Intergovernmental Panel on Climate Change (IPCC) in 2007, average global temperatures have increased by 0.74 °C in the last 100 years, and the sea level rise has increased in the last decade to 3.1 mm/year compared to 1.8 mm/year for previous years (IPCC 2007). The world is entering a historic urban transition and in the last half century, the world's urban population has increased nearly fourfold, from 732 million in 1950 to more than 3.2 billion in 2006. For the first time in history of the world, more people live in cities than in rural areas (Schlein and Kruger 2006). Africa now has 350 million urban dwellers, more than the population of Canada and the United States combined. Asia and Africa are expected to double their urban populations to roughly 3.4 billion by 2030 (WWI 2007). The “mega cities (more than 10 million population)” of the developing world with their rapid urbanization, increasing populations and growth in slum settlements can be at significant risk from extreme weather conditions, earthquakes, flashfloods, droughts, tsunamis, landslides, cyclones and other natural disasters (Megacities 1995).

Slums in poor cities are growing by 100,000 people per day—one person every second (CARE). Rural to urban migration, combined with natural population growth in urban areas, creates enormous, often unmet, demand for housing, services, transport, and work, creating shack and slum settlements mushrooming in cities all over the world (Friel et al. 2008). There are now at least 750 million people living in urban squatter settlements without adequate shelter or basic services and without legal title to their land. The numbers of people living in these settlements is expanding so rapidly that governments are unable to keep up with the necessary infrastructure development and services like water and sanitation are woefully inadequate. The lack of legal recognition means not the absence of basic services and often basic rights, resulting in health risks and vulnerabilities (Vlahov et al. 2007).

The impacts of natural hazards as a result of climate change are unevenly distributed globally and nationally, with populations in mega cities most vulnerable. By 2015 there will be 33 mega-cities with populations over 8 million; 28 in developing countries and 21 are in coastal locations (Kreimer et al. 2003). In this paper, we examine the interrelations between urban poverty, climate change and resulting risks and health vulnerabilities for poor urban slum populations in Dhaka, Bangladesh.

Dhaka, the capital city is projected to become the fourth largest city with 22 million population in the world by 2025, due to its rapid urban migration and growth in urban slum populations (Table 4.1: UN 2007; ICDDR and ACPR 2008). Dhaka has grown from a 2.2 million population in 1975, to 13.5 million in 2007. This fast-paced growth has resulted in widespread urban poverty—25 % of the urban population lives in urban settlements of which one-third is urban slums (UN 2007). A majority of the slum settlements tend to be located in low-lying, flood prone areas,

Table 4.1 Population trend of Bangladesh and Dhaka city, 1974–2025

Census year	1974	1981	1991	2001	2007	2011	2025
Bangladesh population size (million)	71.5	87.1	106.3	124.4	–	142.3	188.1 ^a
Average annual growth rate %	–	2.32	2.01	1.58	–	1.34	1.34
Dhaka Urban population size (million)	2.2				13.5		22.0
Average annual growth rate %					5.64 ^b		2.72 ^b

Sources: 2011 Population & Housing Census: Preliminary Results; World Urbanization Prospects: The 2007 Revision, p. 11

^aProjected population

^bAverage annual growth rates for the year 1975–2007 and 2007–2025 respectively

with poor drainage, limited formal garbage disposal and minimal access to safe water and sanitation and services, and face unimportance by the State. The conditions of high population density and poor sanitation exacerbate the spread of disease and other kinds of vulnerability particularly during disasters (Rashid 2000).

In Bangladesh, discussions and research on climate change and its impact on cities and urban poor populations remain a new area of research and little is known. While these statistics are useful to indicate the importance of climate change, local policymakers require more concrete information at the local level, such as, indicators to measure the impact of various natural hazards, disaster risk management and the public health risks associated with changes in temperature and precipitation and incidences of asthma, malaria and other waterborne diseases, and other social and economic impacts due to flooding and lack of proper drainage and sanitation facilities. Presently all of the major urban centers of the country have slum and squatter settlements, with the largest concentrations being in Dhaka with 4,966, followed by Chittagong 1,814, Khulna 520, Sylhet 756 and Rajshahi 641 slums and the rest are scattered throughout the country (Islam et al. 2006). In comparison to rural areas of the country, documentation on the lives of urban poor populations has been less rigorous and scanty. Viewed as “illegal settlers” by the government; there has been an overall neglect and exclusion of urban slum populations from long-term baseline studies, with few in-depth documentation of their needs, health and status. Drawing on the literature available, the paper will provide an insight into the growth of urban settlements, the resulting risks of climate change faced by urban slum populations who cope with floods and other kinds of disruptions, given their marginal status. It hoped that the paper will contribute to any steps government and agencies can take to reduce risks and thereby develop better planning to mitigate the effects of climate change on urban slum populations (Megacities 1995).

The chapter is structured into three main sections; the first section deals with climate change and the situation in Bangladesh; the second section describes the growth of urban slum settlements and their marginalized status, and the final section draws on secondary data to share stories of urban families who suffer from increasing flood risks due to climate change.

4.2 Climate Change

There are extreme climate changes occurring in Asia with temperatures rising and heat waves recorded in China, Russia, Mongolia, Korea, Japan, India and South East Asia. There have been increased and erratic rainfall induced frequent floods in Bangladesh, India, China and South East Asia. Cyclones and typhoons have affected Bangladesh, India, Philippines, Japan and China. Sea level rise and increased salinity are occurring in Bangladesh, India, Maldives, Sri Lanka, Indonesia and South East Asia. Droughts have affected South Asia including India and Bangladesh, as well as China and Mongolia. It is reported that the number of recorded disasters doubled globally from approximately 200 to over 400 per year in the past two decades, with nine out of 10 disasters now viewed as climate related (Mallick 2008).

The environmental and health outcomes of climate change impact unequally across regions and populations. In 2000, climate change accrued to that point causing a conservative estimate of 150,000 deaths. Although the poorest one billion people account for around 3 % of the world's total carbon footprint, the deaths were almost entirely confined to the world's poorest populations (Mallick 2008). The irony is that the vast majority of the people at risk have contributed almost nothing to the ongoing warming of the climate (Ali 1999).

Extensive climate changes may alter and threaten the living conditions of much of the world, with a sudden increase of large-scale migration because of climate induced human displacement. These may lead to greater competition for the earth's resources (land, water, agriculture, food, forest, biodiversity) particularly in the developing countries. Such changes place heavy burdens on the world's poor countries and most vulnerable communities (Mallick 2008).

In a series of articles published in *Environment and Urbanization*, the vulnerability of cities in relation to climate change is analyzed. It is predicted that the sea-level rise will create additional flooding risks for the 600 million people living in low-elevation coastal zones (Fig. 4.1). A high proportion of the urban population in low- and middle-income countries live within the Low-Elevation Coastal Zone (LECZ): the continuous area along the coast that is less than 10 m above sea level. Bangladesh is one of the nations with a large urban population in the LECZ.

Simulations by University of Middlesex, UK, suggest that South Asia will be massively affected, with up to 55 million people affected by flooding, if there is no change in their present levels of CO₂ emissions and atmospheric warming (Streatfield and Karar 2008 and no. 9). Higher temperatures will increase the risk of direct heat effects (heat stroke and reduced work ability due to heat). Urban air pollution will be exacerbated. This is truly an issue with major inequity consequences not only for health but for economic and social equity as well (Oxfam 2007). Among the consequences of a hotter climate, heat waves are an obvious concern. Poor people living in cities unable to afford air-conditioning as a means to reduce the health risks, while air-conditioning is in itself a contributor to the heat island effect and climate change. High temperatures will also jeopardize people's ability to carry out heavy

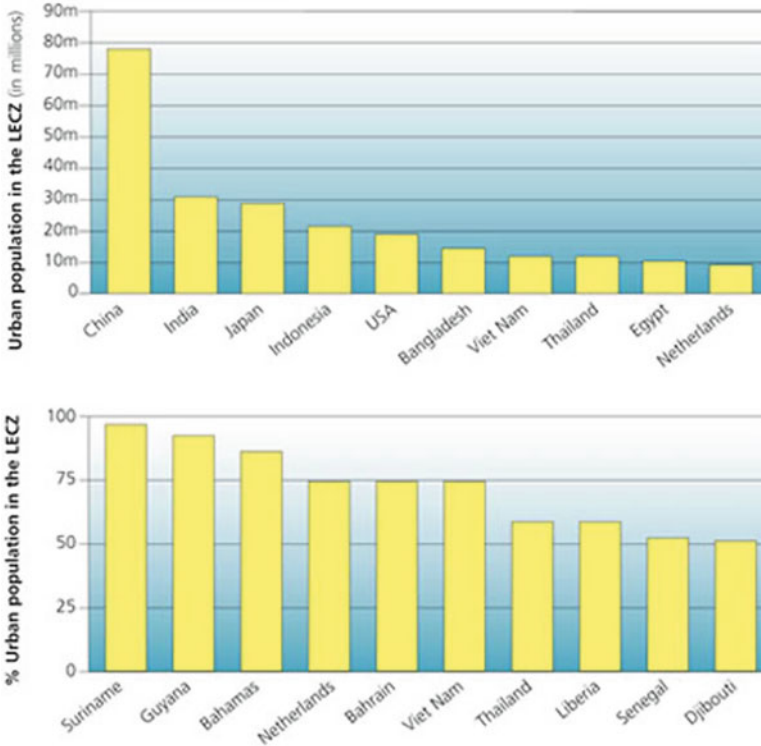


Fig. 4.1 People at risk in urban coastal zones. Nations with the largest urban populations in the LECZ. Nations with the highest proportion of their urban populations in the LECZ. *Source:* Satterthwaite et al. (2007)

work, which indirectly has negative effects on their income (Kjellstrom 2000; Hogstedt et al. 2007).

Bangladesh remains riskiest on the global climate index and was recently ranked as one of the top countries most affected by extreme weather events according to recent news report. The country was placed at the top of the position with a death toll of 4,729 in 2007 due to the natural calamities with an additional absolute loss of property worth more than \$10 billion dollars (Germanwatch 2008). Bangladesh has faced extreme hazards with recent severe floods: 1988, 1998; 2004; and 2007; cyclones and tidal surges in 1991, 1998, 2000, 2004, 2007 (Table 4.2); and salinity and water logging in coastal zones and drought, heat stress and erratic and untimely rainfall (Mallick 2008).

The country is one of the most densely populated in the world and there is a high dependency on natural resources for subsistence, making Bangladeshis particularly vulnerable to climate shifts. Increased storm intensity could potentially worsen seasonal flooding that occurs in many parts of the country, while persistent drought is predicted in the North-West and rising sea levels may threaten low-lying coastal areas in the South if interventions are not forthcoming. These impacts may be exacerbated by demographic and social factors.

Table 4.2 Flood affected areas in major floods since the 60s (area of Bangladesh: 1,48,393 km²)

Year of flooding	Flood-affected area (km ²)	% of total area
1954	36,780	24.8
1955	38,850	26.2
1974	52,520	35.4
1987	57,270	38.6
1988	77,700	52.4
1998 ^a	1,00,000	67.4

^aSource: GOB web site as of 26 September 1998 (<http://www.bangladeshonline.com/gob/flood98>)



Fig. 4.2 Korail Slum at Mohakhali of Dhaka City in Bangladesh (photo credit: Kim Streatfield)

In Bangladesh river erosion is believed to swallow nearly 25,000 acres (10,000 ha) each year, leaving some 60,000 people homeless. It is predicted to consume 3,575 km² by 2025. The Brahmaputra and Jamuna rivers alone are said to have contributed to one million rural inhabitants being driven into poverty, and forced to relocate, with the trend in recent decades of moving to cities in search of work (Streatfield and Karar 2008). It is predicted that over 35 millions will be climate refugees in Bangladesh by 2050 with increased rural-to-urban migration to cities, if flooding and drought make rural livelihoods less tenable.

Dhaka city remains extremely vulnerable. It is located between four flood-prone rivers in the most densely packed nation in Asia, and lies between the Himalaya mountain range and a body of water that not only generates violent cyclones and the occasional tsunami, but also moves further inland every year, washing away farmland, contaminating drinking water, submerging fertile deltas, and displacing villagers as it approaches. As a consequence, rural villagers migrate to Dhaka. It is estimated 300,000–400,000 migrants, mostly poor, arrive to the city annually (World Bank 2006) making Dhaka one of the world's largest megacities and also one of the most unplanned urban centres (Fig. 4.2).



Fig. 4.3 A small slum in Dhaka city as it sits precariously on the edge of a lake, and in contrast are some expensive apartment complexes (photo credit: Alayne Adams)

It is reported that the melting of glaciers and snow in the Himalayas, along with increasing rainfall attributable to climate change, will lead to more flooding in Bangladesh in general, especially in cities located near the coast and in the delta region, including Dhaka. Researchers studying the impact of climate change on Dhaka predict that the city will be affected primarily in two major ways: flooding and drainage congestion and heat stress. The elevation in Dhaka ranges between 2 and 13 m above sea level, which means that even a slight rise in sea level is likely to engulf large parts of the city. Moreover, high urban growth rates and high urban densities have already made Dhaka more susceptible to human-induced environmental disasters (UN Habitat 2009).

On arrival to Dhaka many rural migrants are unable to afford proper housing and turn to live slum settlements, on empty government or private land in congested crowded settlements, and remain vulnerable to sudden eviction by the government (Fig. 4.3). Viewed as “illegal residents” urban slum settlements are generally excluded from public sector resources, severely limiting residents’ access to formal education, health care services and water and sanitation. Bangladesh does not have a comprehensive policy on urban slums. Implicit in the lack of urban policy in the country is the assumption that slum settlements are a transitory and passing phenomenon, something that can be remedied by programs for the rural poor to stem migration. This assumption has resulted in the denial of special programs for the urban poor and with the rate of urbanization increasing rapidly (Rashid 2009).

Slums settlements tend to be located in low lying land areas that are flood prone. A spatial mapping of approximately 7,600 households in 44 slum settlements was found to be within 50 m of a river and risked being flooded (Islam et al. 2006; World Bank 2006). Of the 9,048 slum settlements mapped by Islam et al., only 10 % had sufficient drainage to avoid water-logging during heavy rains (2006). The mapping also found that the problems associated with flooding are aggravated by poor quality housing and overcrowding. It was found that more than one-third of Dhaka's urban population lived in housing where almost all the structures were too weak to withstand large-scale environmental disasters. Although Bangladesh has among the highest population densities in the world (at 1,415 persons per km²), the population density in slums is roughly 200 times greater and given that nearly all slums are mainly single-storey structures, this figure is shocking. Approximately 80 % of the slum population in Dhaka lives in dense slum clusters of between 500 and 1,500 persons per acre with more than 90 % of slum dwellers sharing a single room with three or more people (Islam et al. 2006).

In terms of employment the urban poor remain excluded mainstream job opportunities. They are mostly engaged in low paid, labor intensive work in the informal sector as they lack specific skills and unable to gain entry into the more competitive formal sectors of urban employment. A survey conducted in 2006 in Dhaka of 500 households in slum settlements found that 29 % of males pulled rickshaws (three wheeled bicycle taxis) in the city. Most rickshaw pullers tend to be illiterate and have no formal employment training. Another 23 % were involved in street peddling and petty trading (e.g. selling fruit/vegetables, towels, cheap merchandise, etc). The poor also worked in other occupations like construction work (6 %), driving and transport (5 %), garments and factory work (5 %) and domestic help (8 %). A much smaller portion had access to some education and worked in low grade government and semi-government institutions. Usually, the available low-skilled jobs are temporary; leaving the urban poor particularly vulnerable to fluctuations in the economy, and loss of work was one of the most devastating shocks they can face. In a survey of 500 households it was found that 35 % of people had been underemployed at least once during the survey year (Hossain 2006).

In terms of access to basic services, a review of the situation on health services for urban poor people who live in slum settlements found that only 7.3 % of slum settlements in Dhaka city have access to a public health clinic and only 26 % have a government school (World Bank 2006). The mapping of slums in the country found 70 % of slum settlements had no access to safe latrines. In nearly all slum settlements latrines were shared by a number of households, in half latrines were shared by at least 6 families (30 or more persons) (Islam et al. 2006). Another study reported out of 1,925 slum settlements identified, only 43 were within 100 m of a public toilet. One of the largest slum settlement, *Korail basti* in Banani, Dhaka city with more than 12,000 households did not have a single public toilet or health clinic (World Bank 2006). Problems of poor sanitation and drainage are endemic, and of the 9,048 slum settlements surveyed, 26.5 % had experienced full flooding during the rainy season (Islam et al. 2006).

A recent study indicates that slum settlements are growing at over 7 % per annum, implying a doubling time of less than a decade. The inevitable consequence of this situation will be urbanization on a scale which risks overwhelming the capacity of the urban authorities to provide housing, water and sanitation, healthcare, education, and other essential services to incoming migrants. Urban dwellers lack land to grow food, and are dependent on markets, but without an income, they cannot buy food. They also lack infrastructural support and resources and family support networks which they might have in a rural situation (Rashid 2005).

Streatfield and Karar review of studies on challenges of urbanization suggests that Bangladesh is close to the limits of availability of agricultural land and productivity (Streatfield and Karar 2008), at least in the short-term and with future rapid urban growth water is likely to be a limiting factor. While the recommended allowance of water is around 200 l/day per person (for all purposes), many slum-dwellers manage with less than 10 l/day. With the Dhaka population increasing by over 300,000 persons each year, theoretically needing six million additional liter per day, the numbers limited to this inadequate amount or less, will undoubtedly increase. The health implications are clear, where populations are growing, water is becoming increasingly scarce and sanitation is poor and not improving, water-borne diseases are very likely to become a serious problem again. In addition, air-borne diseases, such as influenza, pneumonia, and TB, all of which tends to be compounded by climate change (Streatfield and Karar 2008).

4.3 Slum Dwellers at Increased Health Risk in Bangladesh

Climate change increases both frequency and intensity of natural disasters. The negative consequences of climate change are likely to be felt especially by the urban poor who live in flood-prone and water-logged areas and remain neglected from government interventions. A rapid assessment on the impact of floods in 1998 by BRAC found that flooding was a major problem in a number of the slum settlements in Dhaka city, leaving thousands of families socially, economically and physically vulnerable and adversely affected. Climate changes are not only a destructive effective to slum dwellers, but also for the general population as whole. Recently Haque et al. (2012) had conducted a cross-sectional study among 450 senior household members (male/female ratio: 112.3) in two villages—one from the northern part (Rajshahi district) and other from the southern part (Khulna district) of Bangladesh. This study had reported that more than seven types of immediate problems from changes in heat and cold were due to changing of heat and cold were mentioned by respondents (Table 4.3), such as health and hygiene, production loss, working hour losses, poor crop growth and yield, over irrigation and increased illness incidence. Moreover, this study had also confirmed the most frequently reoccurred cold/cough/fever, dysentery, headaches, diarrhea, skin diseases, burning sensation, conjunctivitis, jaundice, blisters, asthma, pox, weight loss and pneumonia in relation to extreme and/or irregular patterns of heat, cold and rainfall. Similar data are missing in urban areas where the extreme cold and heat is highly prevalent.

Table 4.3 Perceived problems due to climate changes in rural two villages (i.e. extreme heat and cold, n=450)

Perceived problems due to extreme climate variability	Heat		Cold		Consequences of the problems
	Yes (%)	No (%)	Yes (%)	No (%)	
Perceived problems due to heat					
Problems with drinking water	70.7	29.3			Health and hygiene
Can't cultivate the crops in due time	75.8	4.7			Production loss
Growths of crops has decreased	78.2	2.2			Production loss
yield of crops has decreased	77.1	3.1			Production loss
Can't go outside of house due to extreme heat	87.3	9.3			working hour loss
Have to work hard for irrigation	80.8	1.1			Extra work
Diseases/health problems/sickness has increased	96.2	3.1			Health problem
Perceived problems due to heat					
Boro (summer paddy) can't be cultivated timely			68.9	3.1	Food shortage
Boro (summer paddy) seedbed can't be shown			70.9	0.9	Production loss, food shortage
Potato cultivation is hampered			16.2	49.3	Food production loss
Betel leaf field is hampered			63.6	1.6	Cash crop loss
Robi (winter crops) crops can't be cultivated			47.1	26.2	Cash crop loss
Potato cultivation is hampered because of dense fog			60.7	2.7	Cash crop loss
Flowering /blooming is delayed			47.1	16.5	Cash & food loss
Color of the crops has faded			45.1	17.5	Cash loss
Mango inflorescence is hampered due to heavy fog			46.0	16.8	Cash & food loss

Source: Haque et al. (2012)

Water and Sanitation

Water availability is mainly dependent on the climate change, and the surface water availability depends on the timing and volume of rainfall. Inadequate access to improved water and sanitation has long been recognized as the resultants of the current burden of disease, particularly for the high rates of infant mortality in deprived urban areas (Kovats and Akhtar 2008). Socio-economic status at household level, particularly for the urban poor, is the root cause for the lack of access to improved water. However, cities in both high- and low-income countries have experienced failures in supply due to extreme drought events. It is also known that access to water within cities is not equally distributed, and any reductions in supply are likely to have a greater impact on pro-poor populations.

Floodwaters in slums can mix with raw sewage and breed water-borne diseases, such as diarrhoea, typhoid and scabies. Water supplies also become contaminated

during floods, as pipes in slum areas are likely to be damaged or to leak. In a number of urban areas where the few available tube wells were submerged by flood waters, people collected water from schools, mosques or other places where the water sources were not inundated. Some boiled water or used alum/tablet (accessed from non governmental organizations) for purifying water. Some in the *Katasoor Beribadh* area of Dhaka city stated that they had to buy water “... we also buy water from the owner of the deep tubewell....sometimes depending on the person it costs us Tk 10, 20 or 30.” The women had to go on boat across to the main road to access water, “... we have to walk to where the supply line is and then stand for a long time, and then we get our water. But it is free.” Not everyone, however, could afford to buy water or wait in long queues, and basically resorted to drinking whatever dirty water was available. The common declaration was, “What to do, Apa?”

Many of the families swam to the nearest tube-well or available water source to access water for the households. One woman said, “Everyday my youngest daughter swam to the tubewell with a dekchi (cooking pot) and waited in the chest-deep water for a long time. After a great struggle she managed to collect one dekchi of water which I used for the whole day.” This one pot of water was a precious asset for them and they had to use it very carefully for all their activities—cooking, washing and drinking.

Sanitation posed a serious problem, especially for women and young female adolescents. As men were generally more mobile, they went by rafts or boats to a distant area for defecation. The men also used trees and even rafts for this purpose. However, for women the situation was much more difficult and they spoke of shame and insecurity. Many of the women waited till dusk to defecate “...we go to attend nature’s call early in the morning or very late in the evening...this is ‘shorom’ (shameful) for us...you are a woman, you know what it is like.” Some used to defecate inside the house in polythene bags and others used to defecate deep in the floodwater while bathing. Sometimes, they could not find bushes to defecate because these were inundated. Poor urban women voiced their shame and embarrassment and often said, “what to do now...we put our thing (feces) in polythene packets or kagoj (paper) and throw it into the water...we don’t have a choice but we feel very badly about this...” A few girls explained that they were so embarrassed to go to the toilet in public that they would wait till late at night when no one could see. One young girl explained her situation, “I just held it in- I would try not to go unless I really had to! What I would do is not eat at all sometimes or eat less so that I would not have to go to the toilet at all... then when I just couldn’t anymore, I would and stand in the jol (water) and do it there. So much shame this is - To be out there in the open like this and do this - I felt so bad about it!”

In the less flooded slums, some of the residents devised a system of “hanging latrines”—precarious bamboo platforms raised a few feet above the ground, or water, and screened with rags with sewage and filth building around the vicinity. It was observed that the sanitation in public shelters were filthy as children defecated everywhere. Infants crawled and played in the faeces and dirt, mostly unattended, risking their health. Although the authority at the shelter got some bleaching powder to clean the latrines, the limited stock meant that the conditions were extremely unhygienic.

In some of the urban areas makeshift latrines were made on water bodies with bamboo poles and old clothes, especially for women. A few mentioned the indignity they faced as they were forced to take baths in front of the *para* (neighborhood) men and outsiders "...all of us bathe together, we take turn for having a bath by the side of the road... 'kee ar korbo' (what else to do)." Women also spoke of drinking less water and eating less food so that they would urinate and defecate less frequently. In desperation, one marooned woman in the urban slum lamented "...we cannot eat properly, we cannot bathe properly and we cannot leave the house to (use toilet)... what to do?"

Health Hazard Risk

Impacts of climate change on human health is newly emerged as the greatest concern which is happened due to changes in freshwater resources, food supplies and increases in extreme weather events such as floods and droughts (Table 4.4: Kovats and Akhtar 2008).

During the floods, it was observed that the water often rose above the tops of the stilts supporting some homes, flooding the floors and tiny alleyways with dead vermin, human faeces and other refuse. Disease was especially rife during this time. Fevers, diarrhoea, dysentery, scabies and tuberculosis often combine with malnourishment to impact on the weakest and most vulnerable among the very young and elderly. In the flooded slum areas visited, people were found to be increasingly suffering from respiratory infections, skin diseases and diarrhoea. Fungal infection on the skin of the legs due to prolonged submersion in dirty water was commonly observed. In addition to this, most of the respondents complained about developing sores on their feet and various skin diseases from walking in the filthy water.

People in the interviews complained of fevers and high temperatures. "Apa, my mother-in-law is so sick, because of all this dirty water." Another woman said, "My son is very sick, for the last few days he has dysentery and is very sick..." One two-month old child already died of diarrhoea in a public shelter (where families were taking refuge from the floods), while many children and adults were reported to be suffering from various illnesses (Karim et al. 1999). Most of the families struggling with loss of homes, dirty flood waters and lack of sanitation, had very little money or opportunity of seeking treatment for their ailments. Some of the slum women admitted quietly to taking their sick children to the local "huzur" (religious leader) or a "fakirani" (female faith healer). A woman complained of the lack of support services available for her children and her family, "...my son is so sick from 'amasha' (dysentery)...but there is no one around...where do we go?" Slum residents complained that few community health workers, if at all, either from government or NGOs came to visit and give medicine. Usually slum residents took treatment from nearby pharmacies or from general practitioners. But all the pharmacies were under water and the chambers of the private practitioners were also closed. The situation was worse for pregnant women; and two had already given birth (at the time of

Table 4.4 Summary of known effect of weather and climate on health

Health outcome	Known effects of weather
Heat stress	<ul style="list-style-type: none"> • Deaths from cardio-respiratory diseases increase with high and low temperatures • Heat-related illness and death due to heat waves
Air pollution-related mortality and morbidity	<ul style="list-style-type: none"> • Weather affects air pollutant concentrations • Weather affects distribution, seasonality and production of aeroallergens
Health impacts of weather disasters	<ul style="list-style-type: none"> • Floods, landslides and windstorms cause direct effects (deaths and injuries) and indirect effects (infectious diseases, loss of food supplies, long-term psychological morbidity)
Mosquito-borne diseases, tick-borne diseases (e.g. malaria, dengue)	<ul style="list-style-type: none"> • Higher temperatures reduce the development time of pathogens in vectors and increase potential transmission to humans • Vector species require specific climate conditions (temperature, humidity) to be sufficiently abundant to maintain transmission
Water-/food-borne diseases	<ul style="list-style-type: none"> • Survival of important bacterial pathogens is related to temperature • Extreme rainfall can affect the transport of disease organisms into the water supply. Outbreaks of water-borne diseases have been associated with contamination caused by heavy rainfall and flooding, associated with inadequate sanitation. • Increases in drought conditions may affect water availability and water quality (chemical and microbiological load) due to extreme low flows.

survey) and moved to their relative's homes. Another two women were living at a shelter and were on the verge of delivering but there were no facilities to assist the pregnant women in case of emergencies. The pregnant women were in a difficult situation in the shelter with restricted mobility, little privacy, and living in extremely congested and unhygienic conditions. Many families spoke of the helplessness of waiting desperately for support and the uncertainty of their situation.

4.4 Shelter and Insecurity

People in urban slums hung on to their own homes as long as possible until the water level compelled them to abandon their belongings. In urban slums, it was found that when water started pouring in, some families built bamboo platforms and shifted their belongings on it. In some cases, families raised their beds by putting bricks under it to raise the level of the beds. In some cases, families shifted to the roofs of their homes, if the roofs were sturdier. When everything was inundated, families reluctantly took shelter in nearby schools, or empty under-construction buildings (in urban area) or on nearby embankments or culverts. Where these were not available, they moved to take shelter by the side of the highways in makeshift shelters made with plastic sheets on bamboo frames. A woman said, "...my house is submerged, we sleep on the pucca rasta (main road)...what to do if there is

nowhere else to go...?” The most devastating loss for the poor was the irreparable damage done to their homes. For the urban poor, security is having a roof over their heads. The women and men repeatedly cried over the loss of their homes. A group of men remarked “we have lost everything. Without our homes we have nothing and now our houses are gone, broken and destroyed...” Their sense of despair and utter helplessness at their present situation was overwhelming.

An important concern was the high incidence of theft occurring when families left their belongings and sought temporary shelter elsewhere. A woman narrated, “when we went for shelter, our fans and other items such as clothing and utensils were all stolen. Pieces of our tin roof was taken.” One woman exclaimed, “Apa, what are we going to do, sort out our utensils and belongings or buy food? All we have is our home and now we have nothing, no tin, no home, everything is flooded!” Some remained awake in the night to guard against thieves. One man said, “I remained awake almost every night. There was darkness all around as there was no electricity. We used to hear rumors about looting in different parts of the city. I therefore kept watch on all the directions throughout the night. I only slept when I could not stay awake anymore.” (Zaman 1999).

Several flood studies documenting people displaced by the floods found that slum dwellers do not re-locate too far from their original residing place. They prefer to remain nearby, in the hope that the area will remain undamaged. Many families also worried about theft and loss of hard earned goods in their homes, such as tins or electrical goods such as fans and utensils (Rashid 1999). As one man said, “when we went to relief camp our fans and other household items such as clothing and utensils were all stolen...you see that woman – pieces of her tin roof was taken away.” A woman sadly said, “I stay awake all night to guard our household materials now that our house is under water; the children sleep next to me (on a polythene old torn sheet on the roadside) and I try to get some sleep but it is difficult to sit and watch and also sleep but these are my only belongings.”

Sexual harassment and lack of privacy were important concerns for young women and their families who had moved to public shelters for refuge during the floods. In a number of interviews, families reported the harassment of their daughters and women by thugs and local goons in the shelters but were unable to do much as many of them had become separated from their networks of support and had little control over their new surroundings. One flood shelter in a school of Dhaka city near Sobhanbagh area had young women and their families from the neighboring slums seeking shelter and protection from the floods. There were reports of some “outsiders” who in collision with some miscreants from within the shelter attempted to sexually harass young women. Due to limited space, the slum dwellers irrespective of gender and age had to sleep near one another, leaving young girls and single young women (without male guardians) vulnerable especially after dark. Many parents and guardians shared their anxieties, “Our daughters or daughters-in-law stay awake in fear of harassment. We cannot sleep either.”

Women and young girls spoke of having their modesty compromised as they had to use common latrine facilities, bathe and sleep in full view of male strangers. For the girls living in shelters, the particular concerns were to live with strangers,

especially men and to be at risk of exposing parts of their body. A young girl living in a relief camp shared her distress regarding her new living arrangements: “Can you imagine the *lajja* (shame) for us girls? We had to stay in this in room and have to change our clothes, eat, sleep and do everything there for more than two months! When I was sleeping I would think to myself - how am I sleeping?” For young girls who were menstruating, the lack of privacy made it difficult for them to wash their cloth and dry it. Two younger women mentioned the problems with washing their menstrual cloths, “where will we wash it and dry it...there is no space to dry the cloths or to wash in clean water...” A young woman explained, “I didn’t feel good having it [periods] during this time because I felt *lajja* (shame) in front of all these men. It is already difficult to wash and because there is dirty water everywhere one cannot even bathe properly and the cloth does not even dry quickly. The blood is dirty blood and I just felt very unclean and dirty all the time!” The feeling of dirtiness was also expressed by some other girls. In addition to not being able to bathe properly, some of the girls explained that they had difficulty finding space and time to wash their menstrual rag without being seen by others. Due to the floods, there was limited space and most people were confined to cramped surroundings.

4.5 No Income and Asset Loss

During any disaster situation, work and wages become scarcer for the urban poor. Even though, a various types of incurred asset losses were also happened due to the flood of 1998 in the rural areas as well as urban areas (Table 4.5). The opportunities for alternative income were very limited during the floods of 1998. The prices of basic food items had multiplied, with severe stress imposed on the poor who were dependent on daily wages for survival. Many of the women shared, “*Apa*, now a *mishti kumra* (pumpkin) costs 12 taka or more, and 20 taka in some places. Before we could buy *mishti kumra* for 4 or 5 taka...now how can we buy and how can we sell?” Most of the urban poor are unskilled, and involved in the informal sector. A majority tend to work in uncertain jobs as wage laborers and daily laborers. Thus, during the flood such jobs are most likely to be affected and threatened.

All of the women and men complained of the lack of available work, “My husband cannot ride a rickshaw, it costs 30 taka daily to rent but where will he go with it...there is floods everywhere...so there is no income for us.” Another woman said, “My husband has been sleeping for two days, he has no work because now he makes only 20 taka a day riding a baby taxi.” A slum resident commented, “Well my *mateer kaj* (earth cutting) is completely finished. There is no work for me anymore.” Another man said, “I used to drive the truck from here to collect sand and/or bricks and take it to *Gulshan* and *Baridhara*. I earned 150 to 200 taka a day...now I have no job and I am unemployed.”

A mother and daughter, both of whom would break bricks for a living, were unable to do any work. The daughter said, “We usually go and work in *Sobhanbagh* but now it is all flooded and we cannot earn any money.” Another woman, who was

Table 4.5 Distribution of households reported to have incurred asset losses due to floods of 1998

	% of households incurred loss	
	Rural (n=3,505)	Urban (n=628)
Homestead	87	45
Furniture ^a	44	71
Utensils ^a	30	43
Poultry ^a	58	31
Livestock (cow/goat)	11	2
Fish (from inundation of ponds)	9	–
Trees (nurseries and small trees)	36	–
Suruchi (restaurant)	3.1	–
Supannya (grocery)	3.0	–
Baby Taxi/Tempo	–	1
Rickshaw/Rickshaw van	–	10
Shop	–	9
Small trade (mobile)	–	25

^aFrom a smaller sample of 1,226 BRAC respondents in rural area and 178 BRAC respondents from urban area (Ahmed and Ahmed 1999)

still able to break bricks [although her place was slowly getting flooded], said that she was relying on the three takas she made per *tukri* (basket) to survive. A few women claimed that since their houses were completely submerged by the floodwater, the rent in the nearby bastis had risen, “Apa what will we do, pay rent of Tk 900 or try and eat food to live?” Others stated, “We cannot pay 200 taka rent and also eat, and with no income what are we going to do?”

Some women complained that they were unable to continue their income earning activities such as selling vegetables, sugarcane, and clothes because prices had risen and they were unable to buy or to sell. A woman who was repaying an NGO loan stated, “We cannot even sell sarees anymore, where is the money to repay?” Most women complained that they were having difficulties repaying loans owed, and resorted to borrowing from different people (loan sharks and relatives) to repay these loans. Thus, the consequence was further debt problems for the women and their families. It has been argued that the loss of one set of resources for the poor seriously affects the functioning of others, and disasters can send such families or particular members into a downward spiral, “intensifying their burdens and decreasing the prospect of recovery” (Wood 1998).

Men and women also spoke of cutting down food intake and worrying about their next meals. In some household visits, families shared that they had gone without food for a day and were managing on basic bread (*chappatis*) as they had limited income and options during this difficult period.

4.6 Adaptation Practices

Adaptation to climate change requires local knowledge, local competence and local capacity within local governments. It needs households and community organizations with the knowledge and capacity to act (Satterthwaite et al. 2007). Local governments have the also willingness to work with lower-income groups, particularly who are living at urban slums settings. In the next few decades it will not be a problem at all for most developed and well-organized cities with good-governance system, the adaptation method like structural adjustments practices would possibly be an effective alternative way (or good disaster preparedness) of protecting the risks from climate change. One example for structural adjustments practices was portrayed in a study after the Mumbai floods in 2005 (Chatterjee 2007). The poor household resort to elevating a board to secure some of the important and expensive items of the household (Fig. 4.4). Widening and covering of drains were also applied in some neighborhoods where local groups collectively cleaned, widened and covered drains in the settlement before monsoons.



Fig. 4.4 Structural adjustments by slum dwellers during Mumbai floods 2005, India (photo credit: Monalisa Chatterjee in 2007 during data collection period)

Currently, there is a large deficiency in regarding to address the successful adaptation technique or adaptation capacity to avoid serious or potential catastrophic impacts in the world. In most of the cases the local government is unwilling to ensure provision for infrastructure and for disaster risk reduction and disaster preparedness, even though they are used to refuse to work with the inhabitants who have the illegal settlements. For this reason a large section of urban population turns into the vulnerable condition to any increases of the intensity of natural storms, floods or heat waves, and to increased risk of a disease, constraints on water supplies or increases in food prices. These environmental disasters could be easily solvable for those cities – which have wealthier with better-governed systems (Satterthwaite et al. 2007).

Most national governments and international agencies have had little success in supporting successful local development in urban centres. They need to learn how to be far more effective in this and in supporting good local governance if they are to succeed in building adaptive capacity. In Bangladesh short courses on climate change and health for public health professionals are offered by several Public Health Institutions including James P Grant School of Public Health, BRAC University, Independent University of Bangladesh, North South University.

There are clear and obvious linkages between adaptation to climate change and most other areas of development and environmental management. However, currently no data base on existing activities on climate change is present in Bangladesh. An inventory check list of the climate change and related activities such as courses, research, interventions should be developed. Based on that information a network should be developed that could be engaged in prioritizing and facilitating relevant tasks.

4.7 Conclusions

These calamities, which greatly affected urban slum areas, provide a wealth of information and experience from which lessons can be culled to improve how we respond to future disasters. Slum populations may suffer disproportionately during a disaster as they remain generally marginalized and socially and economically excluded from basic services and support from the State. The situation from urban poor is dismal due to the overcrowding and lack of access to basic services, such as water and sanitation. Consequences of these living conditions include stress due to crowding, insecurity due to lack of housing and land tenure. These conditions worsen during floods and disasters. Slum populations require specialized medical attention during the relief phase, and could have specific concerns during the recovery phase, e.g. their ability to access appropriate health care services, etc. Experts generally agree that apart from taking active steps to reduce the possibility of global climate change itself, cities can take steps to prevent the harmful aspects of natural disasters by improving planning, putting in effective infrastructure adjustments, support

networks after the events, long term recovery and networks of loss redistribution, and establishing all relevant steps for disaster preparedness. While, technical solutions are possible, but these solutions must also take into consideration unresolved development and structural inequalities, such as the city's growing slum population, which has doubled in the last decade, and which shows no signs of abating.

In supporting the millennium development goals governments globally have recognized the importance of addressing the rights of people who live in slum settlements. However in Bangladesh and in many countries around the world, while the people who live in slum settlements are an integral part of the city, their right to live safely in the city is not recognized or protected.

The absence of clear and forward-looking policies on urbanization and urban slum settlements discourages long term thinking and interventions to improve the long-term prospects of people who live in slum settlements. Dhaka is the world's fastest growing mega city; Bangladesh is predicted to be a megalopolis in three to four decades. In time this rapid increase in population density will be exacerbated by global warming. A sea level rise of 1.5 m will submerge 15 % of the country's landmass, further contributing to Bangladesh's exceptional population density and to the challenges associated with ensuring that the basic rights of the population are met. This future scenario emphasizes the urgency of developing strategies now to facilitate the management of the extreme population density that is predicted to characterize Bangladesh in 50–100 years.

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