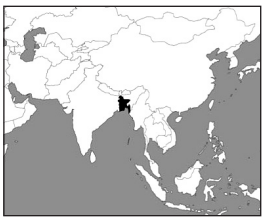

The challenges of local environmental problems facing the urban poor in Chittagong, Bangladesh: a scale-sensitive analysis

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Acknowledgement: The research was funded by the universities of Hull and Chittagong and by the Sir Philip Reckitt Educational Trust. This paper was presented at the International Conference on Climate Change and Urban Poverty – Infrastructures of Development, held at the BRAC Centre Auditorium, Dhaka, Bangladesh, on 28 January 2009 and jointly organized by the Brooks Poverty Institute, Manchester University and BRAC University.

ABSTRACT This paper explores local environmental problems at both the household and neighbourhood levels in Chittagong, based on a broad spectrum household survey. The survey shows that households in poor areas are very exposed to localized environmental problems and thus necessarily develop a wide range of coping strategies around the living space. Yet poorer households are less likely to express their concerns about neighbourhood environmental issues, despite experiencing many problems at this level. This paper investigates the interface between household and neighbourhood environmental problems.

KEYWORDS environmental problems / household problems / local environment / neighbourhood problems / urban poor

I. INTRODUCTION

This paper examines the ways in which environmental problems at the household and neighbourhood levels are perceived and responses are structured in the poorest neighbourhoods in Chittagong, Bangladesh. It is widely recognized that the dominant urban environmental problems in developing cities are localized, immediate and health threatening, thus posing serious threats to the poorest urban residents and to their livelihoods.(1) Households in higher-income areas are generally better positioned not only in terms of dealing with household scale problems but also with neighbourhood level problems. The opposite holds true for the urban poor living in low-income neighbourhoods, where neighbourhood level conditions can compound problems found at the household level.(2) Local problems are further compounded where the homes of the poor are poorly served with essential infrastructure and services, most notably but not exclusively in informal settlements.

Chittagong has an estimated population of 4.1 million and covers an area of 177 square kilometres.(3) It is located in the southeastern coastal region of Bangladesh, one of the most cyclone-prone coastal regions in South Asia, which puts it at risk from various natural environmental hazards, particularly storm surges and flooding,(4) The city also experiences other regular human-induced and natural hazards such as flash floods, landslides and earthquakes, and there is frequent interplay, such as when, in June 2007, landslides prompted by heavy rain and illegal "hill-cutting" killed 126 people, mostly slum dwellers living on steep hillside sites.(5)

Vol 22(2): 561–578. DOI: 10.1177/0956247810377560 www.sagepublications.com

Here, the citywide environmental problems are not least due to its poor urban governance and non-existence of an appropriate environmental management system. Citizens face different types of city regional environmental burdens, notably air pollution, noise pollution, traffic congestion and surface water pollution.

There is also important interplay between household level problems and neighbourhood problems; this study explores the issue, arguing that the experience of, and response to, environmental problems is both scale specific and scale dependent. Scale in this context refers to the need to differentiate between those environmental problems and responses that are distributed widely throughout an urban area and those that are specific to a district, neighbourhood or even a household spatial unit within the city. The following sections examine residents' perceptions of the most severe environmental problems facing them at the household level and the coping strategies that these necessitate, followed by a similar analysis at the neighbourhood level.

II. STUDY AREA AND METHODOLOGY

Chittagong is located in the southeast of Bangladesh on the fringes of the Bay of Bengal. It is encircled to the east by the Karnaphuli River, which opens up into the Bay of Bengal, which itself provides the southern boundary, and is surrounded by Hathazari Upazila (sub-district) to the north. Due in part to its location, Chittagong has become the biggest port city and the commercial centre of Bangladesh,[6] and comprises 41 administrative units known as wards (Figure 1). Chittagong was once well known for its pleasant environment and biodiversity, which helped it develop into a well-known tourist city. But in recent times its population has grown rapidly, a growth that has not been accompanied by a similar expansion in essential urban infrastructure facilities and services, thus leading to substantial infrastructure shortfalls.[7] For instance, the public housing contribution in Chittagong is fairly insignificant, as in other major cities in Bangladesh, and the private and informal sectors supply more than 90 per cent of urban housing.[8] Due to the lack of institutional control and monitoring, housing and residential processes follow an unplanned and irregular approach across the city. On the other hand, the urban administration and management system in Chittagong, which is centrally managed and mostly dependent on government grants, is performing inadequately in providing municipal services. Citizens are frequently dissatisfied with the quality of service facilities provided by different urban authorities, and report acute shortages of water and power, sanitation problems, mismanagement of the garbage disposal system, lack of access to medical and healthcare facilities and inadequate roads and drainage infrastructure.[9] Residents in slums and squatter settlements, where more than one-third of the city's population lives, are worst affected in terms of quality and access to services and facilities.[10] This paper focuses on these poorer neighbourhoods, attempting to identify the mix of household and neighbourhood environmental problems that they face and some of the coping strategies adopted by those who live there.

This paper extends recent research that revealed how households in lower-income residential areas (mainly slums and squatter settlements)

1. McGranahan, G and J Songsore (1994), "Wealth, health and the urban household", *Environment* Vol 36, No 6, pages 4–11; also McGranahan, G, P Jacobi, J Songsore, C Surjadi and M Kjellen (2001), *The Citizens at Risk: From Urban Sanitation to Sustainable Cities,* Earthscan, London, 240 pages; Hardoy, J E, D Mitlin and D Satterthwaite (2001), *Environmental Problems in an Urbanizing World,* Earthscan Publications Ltd., London, UK, and Sterling VA, USA, 448 pages; and McGranahan, G (2007), "Urban transitions and the spatial displacement of environmental burdens", in P J Marcotullio and G McGranahan (editors), *Scaling Urban environmental Challenges: From Local to Global and Back,* Earthscan with UNU–IAS and IIED, UK, pages 18–44.

2. Montgomery, M R, R Stren, B Cohen and H E Reed (editors) (2004), *Cities Transformed: Demographic Change and its Implications in the Developing World,* Earthscan Publications Ltd., London, UK, and Sterling VA, USA; also Montgomery, M R and P C Hewett (2004), "Urban poverty and health in developing countries: household and neighbourhood effects", accessed 3 August 2007 at http://web.mit.edu.

3. Centre for Urban Studies (CUS), National Institute of Population Research and Training (NIPORT) and MEASURE Evaluation (2006), *Slums of Urban Bangladesh: Mapping and Census 2005*, Dhaka, Bangladesh, and Chapel Hill, USA, page 18.

4. Paul, A and M M Rahman (2006), "Cyclone mitigation perspectives in the islands of Bangladesh: a case study of Sandwip and Hatia islands", *Coastal Management* Vol 34, pages 199–215.

5. Quddusi, Kazi (2007), "Chittagong on the precipice", *The Daily Star* Vol 5, No 1080, 15 June.

6. Bangladesh Bureau of Statistics (BBS) (2001), *Urban Area Report of Bangladesh 1991, Volume 1,* Ministry of Planning, Government of Bangladesh, Dhaka.

were more susceptible to home and neighbourhood environmental problems compared to those households located in the higher- and middle-income residential areas of Chittagong.[11] The empirical research involved primary fieldwork using quantitative research methods, as outlined below.

III. BROAD SPECTRUM HOUSEHOLD SURVEY

a. Selection of household income pattern for lower-income residential areas

A recent study of slums in urban Bangladesh revealed that 97 per cent of households in the slums and squatter settlements of Chittagong had

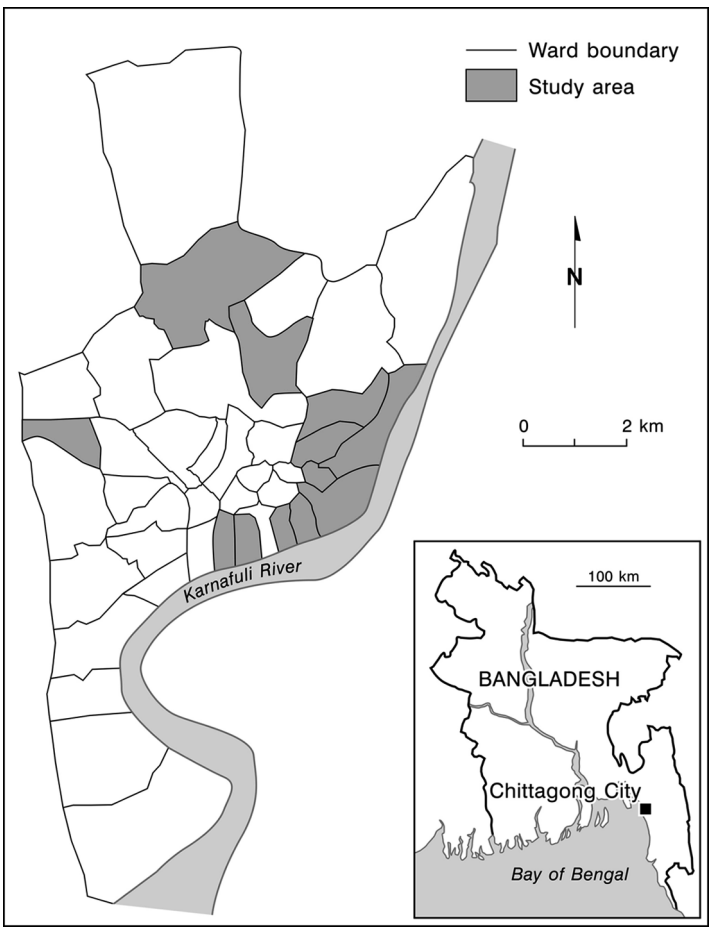

FIGURE 1
Wards with lower-income residential areas, Chittagong

SOURCE: Adapted from base map from Chittagong City Corporation (2008).

7. Taker, M A (1997), "City report: Chittagong City Corporation", submitted to the second study course on specific fields of urban policy conducted by the Asian Urban Centre of Kobe, Japan, 28 September–12 October, accessed 15 December 2006 at www.auick.org.

8. Rahman, M M and A S M Mahbub-Un-Nabi (2002), "Governmental-managed and non-governmental-managed water supply and sanitation facilities for urban poor: planning strategies for future development", in F M Ahmed, S A Tanveer and A B M Badruzzaman (editors), *Bangladesh Environment 2002*, *Volume 2*, Bangladesh Poribesh Andolon (BAPA), Dhaka, pages 619–641.

9. Rahman, M M, A M Dewan and M S Islam (2001), "Degradation of urban environment: a case study of citizens' perception in Chittagong city", *Oriental Geographer* Vol 45, No 1, pages 36–52.

10. Ashraf, M A (1995), *Slums in Chittagong City: Strategy for Improvement,* Report prepared for the Task Force for Slum Improvement, Healthy Project Chittagong, WHO, Geneva; also Hasna, M K (1995), "Street hydrant project in Chittagong low-income settlement", *Environment and Urbanization* Vol 7, No 2, October, pages 207–218; Burton, S (1999), "Evaluation of healthy city project: stakeholder analysis of two projects in Bangladesh", *Environment and Urbanization* Vol 11, No 1, April, pages 41–52; and see reference 3.

11. Rahman, M M (2008), "Urban environmental problems in Bangladesh: a case study of Chittagong city", unpublished PhD thesis, Department of Geography, University of Hull, UK, downloadable from http://edocs.hull.ac.uk/muradora/objectView.action?pid=hull:1617. This wider study of 300 households compared high-income, middle-income and low-income neighbourhoods in more detail. In this paper, the focus is on the 90 households in

monthly incomes ranging between TK 2,000 and TK 5,000.[12] This survey thus selected as low-income groups those with monthly household incomes up to TK 5,000 (approximately UK£42), a figure that was held to represent the urban poverty line.[13]

b. Selection of lower-income areas

For this study, the survey focused on typical low-income settlements from within those city wards generally held to be most clearly characterized as low income. The Centre for Urban Studies (CUS) slum survey found that 35.4 per cent of Chittagong residents lived in slums and squatter settlements, identifying 1,814 slum clusters scattered over the whole city. The CUS survey estimated the number of lower-income people living in each ward, revealing that in three wards more than 80 per cent of residents, and in a further two wards more than 65 per cent of residents, lived in slums and squatter settlements. In helping to select low-income wards and the low-income neighbourhoods within them, all 41 elected ward commissioners were interviewed using a short, semi-structured questionnaire. In total, 111 lower-income neighbourhoods were identified through the ward commissioners' survey and then triangulated against the CUS survey findings.

Pulling these sources together, it was possible to classify 12 wards as "lower-income wards" (Figure 1), and within each of these, between two and seven representative lower-income neighbourhoods were identified. The result was a list of 45 lower-income neighbourhoods from within the 12 lower-income wards.

c. Respondent selection, sample technique and sample size

The household head was normally taken as the respondent. In urban societies in Bangladesh, most high- and middle-income families are headed by males. However, Hasna noted that in the low-income areas in Chittagong, female-headed households outnumbered male-headed ones.[14] The women of lower-income families are involved mainly in activities such as garment manufacturing, water vending, household work and day labouring. As these women are also income earners, they are in some ways more empowered within their households than the women of middle- or high-income families in urban societies. Thus it was deemed important to include the views of both women and men in the survey, while respecting the cultural practices of different households. In practice, this meant that in the absence of the household head within a male-headed household, the principal homemaker, generally a woman, was taken as respondent, and vice versa. When both were present, they were given the choice as to who would be the respondent. The response rate was high, almost 100 per cent. A simple random sampling technique was chosen for the household questionnaire and a total of 90 questionnaires were successfully administered.

IV. RESPONDENTS' CHARACTERISTICS

A higher percentage of men (57.8 per cent) than women participated in the survey. It was observed that when both the male and female

low-income neighbourhoods. Citywide survey data from all 300 households is provided for comparative purposes in Tables 2 and 3.

12. See reference 3. The Taka (TK) is the monetary unit of Bangladesh. During the field visit to Chittagong, January–June 2006, UK£ 1 = approximately TK 120.

13. See reference 3.

14. See reference 10, Hasna (1995).

household heads were present, the male was most likely to respond. Nearly 68 per cent of respondents fell within the 30–59 year-old age group. More than one-quarter of respondents had never attended school and almost one-third of those who had had not completed their primary education. The respondents' occupations suggest that households from lower-income neighbourhoods are positioned in a weak economic situation, typified by involvement in the informal service sectors, insecure petty businesses or marginal forms of self-employment. The unemployment rate was also high.

Reflecting our interest in the interplay of household and neighbourhood level conditions, the decision was taken to select all households on a random basis, regardless of wealth. So while most of the respondents came from poorer households, reflecting the choice of low-income neighbourhoods, some middle-income households (19 per cent, earning TK 5,000–20,000 a month) and a few higher-income households (two per cent, earning more than TK 20,000 a month) were also captured by the survey. Almost two-thirds of respondents were renters and one-third were owners. Respondents who were renters reported that rents accounted for 20–50 per cent of their monthly household income. The CUS slum survey found that about one-third of slums in Chittagong were located on government land,[15] meaning that residents of such slums commonly faced eviction.[16]

15. See reference 3.

16. DFID (2004), "Rural and urban development case study – Bangladesh", Oxford Policy Management, accessed 7 September 2007 at www.passlivelihoods.org.uk; also see reference 3.

V. DOMINANT HOUSEHOLD ENVIRONMENTAL PROBLEMS

The analysis here focuses on identifying the major household environmental issues in low-income areas based on all respondents' answers (Table 1), and identifying how, wherever possible, the households developed coping strategies to deal with these problems (Tables 2 and 3). Table 1 provides a ranking of the main problems identified by interviewees, with comparative figures provided on a citywide basis. This reveals some differences in the ranking of problems, but a general pattern emerges showing that those in low-income neighbourhoods were generally more likely to record problems than the city average.

a. Water shortage

There is a general shortage of piped water in all residential areas in Chittagong, so it was not surprising that water supply shortages emerged as a very serious and frequent problem in the surveyed lower-income residential areas. Amin argues that at present, the water supplied by the Chittagong Water Supply and Sewerage Authority (CWASA) only meets about 33 per cent of the city residents' demand,[17] and it is those in the low-income neighbourhoods who disproportionately bear the consequent costs and inconvenience of accessing alternative sources of water. More than 80 per cent of the surveyed residents regarded this as a "serious or very serious problem",[18] with 70 per cent of these householders regarding water shortage as a very frequent problem, indicating the importance of water supply shutdowns (Table 2).

Not having access to in-house water sources[19] means that the poor face the daily problem of obtaining potable and cooking water. Nearly

17. Amin, M O (2006), "Status of water and sanitation services in Chittagong Water Supply and Sewerage Authority, Bangladesh", Paper presented at the Capacity-building Workshop on Partnerships for Improving the Performance of Water Utilities in Asia and the Pacific Region, organized by UNDESA and UNESCAP, 25–27 July, UNCC, Bangkok.

TABLE 1
Dominant household environmental problems identified by householders in lower-income neighbourhoods in Chittagong and in the city overall

Household problem	*Rank	Lower-income neighbourhoods (n=90) (%)	Rank	City average (n=300) (%)
Water shortage	1	84.4	2	78.1
Electricity crisis	2	82.8	1	85.3
Mosquito menace	3	46.7	3	43.2
Poor ventilation	4	30.0	4	24.3
Overcrowding and indoor air pollution	5	25.0	9	7.5
Poor sanitation, damp housing and insect menace	6	11.0	11	3.3

SOURCE: Rahman, M M (2008), "Urban environmental problems in Bangladesh: a case study of Chittagong city", unpublished PhD thesis, Department of Geography, University of Hull, UK, downloadable from http://edocs.hull.ac.uk/muradora/objectView.action?pid=hull:1617.

NOTE: *Householders were asked to rank the most serious environmental issues they faced at household level and the relative seriousness of each. The data here reflect the percentage of householders who considered a particular issue as being problematic for them. City average data are provided here simply for contrast, and careful interpretation is needed. For example, households in higher-income areas and to some extent in middle-income areas are more likely to have water and electricity connections to the household or to have alternative sources (deep wells or generators). So self-recording of priority problems in the poorer neighbourhoods often relates to poor connection to piped water, whereas in better-serviced areas the issue may be one of water cut-offs. For a detailed comparative analysis, see Rahman, M M (2008) "Urban environmental problems in Bangladesh: a case study of Chittagong city", unpublished PhD thesis, Department of Geography, University of Hull, UK, downloadable from http://edocs.hull.ac.uk/muradora/objectView.action?pid=hull:1617.

two-thirds of households in lower-income neighbourhoods collect drinking water[20] from private shallow hand tubewells. However, getting water from hand tubewells during the summer is very difficult because of lower groundwater levels. The survey found that more than two-thirds of households do not boil, or purify by any other means, their collected water before drinking, indicating that they are either not aware of water contamination or are unable to afford water from uncontaminated sources.

Some households (10 per cent) use the CWASA-provided communal standpoints at no charge. Generally, one standpoint serves about 20–30 families but the household survey found that one tap might serve as many as 50 families. Residents can normally get water three times a day from a standpoint; however, during the hot dry summer, at times they might only receive water once a day, which might be at midnight. This creates severe problems and takes up considerable time because collectors have to join a long queue. When this happens, residents may wait to collect water from midnight until morning. Most lower-income family water collectors are female, being either the principal homemaker or their daughter(s).

A few households depend heavily on vendors for drinking water. Ullah found that the price ratio between private vendors and the public service is 30:1 in Chittagong, which is somewhat higher than in Dhaka.[21] As a result, households in poor neighbourhoods are not highly dependent upon

18. Thirty-five per cent of the 60 householders surveyed in high-income areas in the wider study felt that water shortage was a very serious problem for them, compared to 54.4 per cent of those in the lower-income areas. See reference 11, page 112.

19. Forty-three point two per cent of households in lower-income neighbourhoods reported that they did not have an in-house water connection, thus causing water shortage, compared to only 1.7 per cent in higher-income households. See reference 11, page 113.

20. Some 83.3 per cent of higher-income neighbourhood respondents and 42.7 per cent of middle-income neighbourhood respondents were dependent mainly on piped water as a source of drinking water. See reference 11, page 115.

TABLE 2
Perceived seriousness, frequency and coping strategies related to water shortage in lower-income areas in Chittagong and in the city overall

Appraisal	Scale	Lower-income neighbourhoods (n=90) (%)	City average (n=300) (%)
Perceived seriousness	Very serious	54.4	46.0
	Serious	27.8	25.0
	To some extent serious	2.2	6.5
	Not serious	–	0.6
	No response	*15.6*	*21.9*
	Total	**100.0**	**100.0**
Problem frequency	Very frequent	68.9	61.2
	Frequent	13.3	9.9
	To some extent frequent	2.2	5.9
	Infrequent	–	1.1
	***Total**	**100.0**	**100.0**
Primary coping strategies	Use shallow hand tubewell	45.3	24.6
	Collect water from another neighbourhood	6.7	3.8
	Use pond water	6.7	3.3
	Do nothing or adjust to the problem	6.7	4.0
	Use deep tubewell	5.6	15.7
	Collect water from neighbour's house	5.6	4.5
	Buy water from vendor	5.6	3.2
	Use standpoint water	2.2	1.8
	Store water in reservoir	–	12.8
	Buy extra water from WASA	–	4.4
	***Total**	**100.0**	**100.0**

SOURCE: Rahman, M M (2008), "Urban environmental problems in Bangladesh: a case study of Chittagong city", unpublished PhD thesis, Department of Geography, University of Hull, UK, downloadable from http://edocs.hull.ac.uk/muradora/objectView.action?pid=hull:1617. Household Survey 2006

NOTE: *The total percentage has been arrived at by adding the "no response" figure (in italics) above.

vendors' water, instead depending on other sources, such as collecting water from another neighbourhood or from a neighbour's house, when water is unavailable from their hand tubewells. Coping measures against water shortages can also include using contaminated and polluted water whose quality is not guaranteed.[22]

b. Electricity crisis

Electricity is the principal source of energy for lighting homes in Chittagong. Despite tremendous deficiencies at the household level, all respondents from lower-income neighbourhoods reported that they had "access to electricity connection". However, almost 98 per cent of respondents claimed that they were not receiving a regular electricity supply from the Power Development Board (PDB). The electricity crisis is seen as both a very serious and a frequent household problem by those living in the poorest areas (Table 3). Some of the highest "electricity

21. Ullah, H (2006), "Lots of mini-WASAs in Chittagong city" (in Bengali), *The Daily Prothom Alo*, accessed 21 August 2006 at www.prothom-alo.com, pages 1–2.

22. See also Surjadi, C (1988), "Health of the urban poor in Indonesia", Urban Health Problem Study Group Paper No 29, Atma Jaya Research Centre, Jakarta; also see reference 1.

cut-off"[23] levels (more than five times a day) were recorded in the lower-income areas. The average minimum duration of each measured cut-off was typically half an hour; however, more than two-thirds of respondents claimed it could take more than an hour to get power restored. Many poor dwellers also claimed that the power crisis (cut-off times and duration) was greater at night, when electricity was most needed.

The main consequences of the electricity crisis cited by respondents were disturbances to children's studies followed by overheated homes and increased household expense. In general, the electricity crisis hampers most household activities and daily routines. It causes cooking problems, especially in the slums and squatter settlements where electricity is used as fuel.

Lower-income people in Chittagong are largely accustomed to using traditional as well as cheaper sources of "alternative crisis-coping equipment"[24] such as candles or kerosene lamps, or a combination of the two. However, the amount of money spent on buying candles or kerosene lamps was never less than an average of TK100 per month. More than half the respondents claimed they faced problems using candles and kerosene for home lighting, such as indoor air pollution, suffocation and sometimes fires.

23. The highest incidence of electricity cut-offs was recorded in the middle- (68.7 per cent) and lower-income (62.2 per cent) areas, compared to 48.3 per cent in the higher-income residential areas. See reference 11, page 105.

24. Households in upper-income residential areas in Chittagong can cope better with an electricity crisis as they can use modern, as well as more expensive, electrical equipment such as chargers, instant power supply (IPS) and generators. See reference 11, pages 109–110.

TABLE 3
Perceived seriousness, frequency and coping strategies related to electricity crisis in lower-income areas in Chittagong and in the city overall

Appraisal	Scale	Lower-income neighbourhoods (n=90) (%)	City average (n=300) (%)
Perceived seriousness	Very serious	46.7	52.0
	Serious	31.1	25.4
	To some extent serious	4.4	6.5
	Not serious	–	1.1
	No response	*17.8*	*15.0*
	Total	**100.0**	**100.0**
Problem frequency	Very frequent	76.7	76.2
	Frequent	4.4	4.8
	To some extent frequent	1.1	4.0
	***Total**	**100.0**	**100.0**
Primary coping strategies	Use both candles and kerosene	31.1	16.0
	Use candles	20.0	14.0
	Use kerosene	16.7	7.1
	Do nothing or adjust to the problem	10.0	3.2
	Use instant power supply (IPS)	2.2	12.2
	Use charger	1.1	21.4
	Use generator	1.1	3.6
	Use both charger and candles	–	7.5
	***Total**	**100.0**	**100.0**

SOURCE: Rahman, M M (2008), "Urban environmental problems in Bangladesh: a case study of Chittagong city", unpublished PhD thesis, Department of Geography, University of Hull, UK, downloadable from http://edocs.hull.ac.uk/muradora/objectView.action?pid=hull:1617.

NOTE: *The total percentage has been arrived at by adding the "no response" figure (in italics) above.

c. Mosquito menace

In Bangladesh, as in much of the tropical world, mosquitoes represent a major public health problem. In all the poor residential areas surveyed, the respondents who highlighted mosquito menace as a problem claimed it was very frequent at the household level. One-third of the surveyed households in the lower-income neighbourhoods claimed that the problem was very serious.

Residents want to eradicate mosquitoes from their households by any means, since dengue[25] has emerged recently as a major health threat and has taken many lives in Chittagong. From June to December 2000, the total number of dengue patients recorded was 771, with 15 deaths.[26] Residents of lower-income neighbourhoods are largely dependent on less expensive smoke coils to eradicate mosquitoes. An interesting outcome of the survey is that residents of the surveyed areas don't habitually use mosquito nets as an alternative coping strategy although they are more environmentally friendly. Thus poverty is a major impediment to the purchase of mosquito nets in the poor areas of Chittagong, as it is elsewhere.[27]

d. Poor ventilation

Appropriate ventilation might keep a house free from indoor pollution. Nearly one-third of lower-income households claimed that poor ventilation was a serious as well as very frequent problem for them.

In the large cities of Bangladesh, including Chittagong, an average five-member family in a slum or squatter settlement lives in just one room.[28] This kind of housing is built with no provision for through ventilation nor are there any windows, and there is only one door, as entrance. The main effect of poor ventilation is a hot room with no movement of air. There is also a lack of natural light inside, which means that residents are dependent on artificial lighting, with all the attendant costs.

e. Overcrowding and indoor air pollution

Overcrowding is a common problem for most households in slums and squatter settlements in Bangladesh,[29] but was found to be particularly severe in households in lower-income neighbourhoods in Chittagong. Several studies show that many infectious, airborne, viral and bacterial diseases are associated with overcrowding, as are fire hazards and other accidents.[30]

Almost 18 per cent of respondents reported that they had no access to natural gas for cooking but, rather, had to choose other options such as wood, jute, paper and other biomass fuels. Poverty pulls such households down the energy ladder,[31] which results in more exposure to indoor air pollution. Only a few respondents (six per cent) claimed that they were suffering from indoor air pollution, which may of course reflect low educational levels and ignorance about the health effects of indoor air pollution. The survey revealed that many of the households, particularly in slums and squatter settlements, use biomass fuel for cooking, burn coils to eradicate mosquitoes, and smoke inside the house. Smoke from

25. Dengue is a flu-like viral disease spread by the bite of infected mosquitoes. Dengue haemorrhagic fever is a severe, often fatal, complication of dengue. See www.dhpe.org, accessed 14 December 2007.

26. Yunus, E B, A M Bangali, M A H Mahmood, M M Rahman, A R Chowdhury and K R Talukder (2001), "Dengue outbreak 2000 in Bangladesh: from speculation to reality and exercises", *Dengue Bulletin* Vol 25, pages 15–20.

27. Onwujekwe, O, K Hanson and J Fox-Rushby (2004), "Inequalities in purchase of mosquito nets and willingness to pay for insecticide-treated nets in Nigeria: challenges for malaria control interventions", *Malaria Journal* Vol 3, No 6, pages 1–8.

28. Islam, N, M N Huda, F Narayan and P B Rana (1997), *Addressing the Urban Poverty Agenda in Bangladesh: Critical Issues and 1995 Survey Findings*, published for the Asian Development Bank, University Press Limited, Dhaka; also see reference 3.

29. See reference 28, Islam et al. (1997); also see reference 1, Hardoy et al. (2001); and see reference 3.

30. See also Stephens, C (1995), "The urban environment, poverty and health in developing countries", *Health Policy and Planning* Vol 10, No 2, pages 109–121; and see reference 1, Hardoy et al. (2001).

31. See reference 1, Hardoy et al. (2001), page 73. Higher-income households generally choose fuels that generate less indoor air pollution (such as kerosene), much less indoor air

these sources remains within the typical unventilated dwelling, which results in those householders who spend a large amount of time indoors being major victims of indoor air pollution.[32]

f. Sanitation problems, damp housing and insect menace

Households in lower-income neighbourhoods are seriously affected by Chittagong's poor quality sanitation infrastructure. In the absence of an integrated sewerage system, the most suitable sanitation system is the household septic tank, used mostly in upper- and middle-income residential areas (Figure 2). However, many residents who use this system do not know where the wastewater finally ends up. Temporary sanitation systems such as pit or bucket latrines (sanitary toilets) are common in the slums and squatter settlements, where residents often use unsanitary open and communal toilets. As many as 10–20 families can share a single communal toilet, and these are overloaded virtually all the time because of their frequent use and being out of order due to a lack of cleaning and maintenance.[33] The pit/bucket latrines and open toilets are built mostly outside the main house and there is no water source inside the toilets for maintaining hygiene. Some households (5.6 per cent) reported that they did not use any sanitation system, which means that they either defecate in the open or rely on using other people's toilets.[34] The wastewater with faecal material from unsanitary toilets generally discharges into drains, ponds, ditches, canals and other low-lying areas, which are never cleaned.

Kutcha housing,[35] which is usually built on mud-based plinths, is regarded as damp housing, especially when it is close to ditches, ponds,

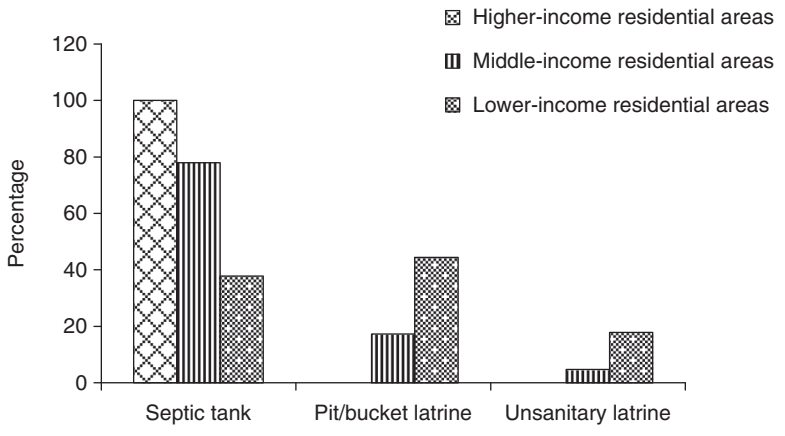

FIGURE 2
Sanitation facilities used by households in different types of residential area in Chittagong

SOURCE: Rahman, M M (2008), "Urban environmental problems in Bangladesh: a case study of Chittagong city", unpublished PhD thesis, Department of Geography, University of Hull, UK, downloadable from http://edocs.hull.ac.uk/muradora/objectView.action?pid=hull:1617.

pollution (such as natural gas) or virtually no indoor pollution (electricity).

32. Songsore, J and G McGranahan (1993), "Environment, wealth and health: towards an analysis of intra-urban differentials within the greater Accra metropolitan area, Ghana", *Environment and Urbanization* Vol 5, No 2, October, pages 10–34; also see reference 1, Hardoy et al. (2001); and see reference 1, McGranahan et al. (2001).

33. See reference 8; also Rahman, M M and S Ahmed (2004), "Myths and realities of sanitation facilities for the urban poor in Dhaka city, Bangladesh", *Oriental Geographer* Vol 48, No 2, pages 47–60.

34. See reference 1, Hardoy et al. (2001).

35. *Kutcha* houses are temporary structures. In urban areas of Bangladesh these are typically made of materials such as bamboo, sacking, plastic and corrugated iron sheets.

canals, coastal belts and low-lying areas, and its inhabitants are likely to suffer from health problems related to damp housing conditions. Although respondents did not highlight many major health impacts, they noted that the damp damaged their household goods and increased the insect menace. Household damp typically increases when there is in-house water stagnation during the monsoon. A small number of respondents also noted problems of insect infestation, although the true picture may be more severe as residents in poor neighbourhoods are used to their poor living environment and may not see the link between insects, the spread of germs from nearby open toilets and drains, and health problems such as diarrhoea. The connections between household and neighbourhood problems are not always visible to the naked eye, or obvious to those with poor educational standards or a limited understanding of environmental hazards.

VI. DOMINANT NEIGHBOURHOOD ENVIRONMENTAL PROBLEMS

A review of environmental problems in cities noted four major urban neighbourhood environmental problems that are typically found in Asia, Africa and Latin America. These are: dangerous sites; no collection of household garbage; disease vectors; and inadequate provision for drainage and other forms of infrastructure.[36] The major neighbourhood environmental problems identified in the lower-income neighbourhoods of Chittagong were broadly similar, but with some differences in emphasis. Table 4 provides a ranking of the main neighbourhood level environmental problems identified by householders both in low-income neighbourhoods and for the city more generally, revealing a closer alignment between the two than was the case for household level problems.

36. See reference 1, Hardoy et al. (2001).

a. Poor cleaning and maintenance services

Poor cleaning and maintenance of neighbourhood roads and drains by the Chittagong City Corporation (CCC) was ranked as the most widespread major problem for householders in the lower-income residential areas. Some 40 per cent of surveyed households claimed it was a serious problem, with many noting that it was a "very frequent" problem. By contrast, it was generally felt that there was better provision of cleaning and maintenance services in the planned higher-income residential areas.

Some households in poor neighbourhoods continued to leave waste on the roads and in drains rather than use sometimes distant waste collection points. Nonetheless, most respondents claimed that either irregular or no garbage collection and cleaning by the CCC were the main reasons for dirty neighbourhood environments. With only a small workforce (1,840) engaged in cleaning, sweeping and waste collection, it was widely felt that the CCC did not provide adequate cleaning services in low-income neighbourhoods, although service is better on the main roads and in some commercial and residential areas.[37]

37. Chittagong City Corporation (CCC) (2004), *Solid Waste Management*, accessed 15 December 2006 at www.bdix.net.

Householders in the survey typically argued that cleaning and maintenance was a major duty of the CCC. However, a significant number of slum households (22,890) did not pay any holding tax for 2005–2006,[38] so they had little formal claim to these services. Those who

didn't pay tax either lived mainly on illegal land or could not afford to pay. Few coping mechanisms were noted, with households getting used to their situation, and there was little evidence of communities coming together to deal with their problems. In general, householders regarded the problems as best addressed by the CCC.

b. Narrow access roads

Narrow access roads emerged as a serious problem for residents of lower-income neighbourhoods in Chittagong. Almost all of the respondents who said that narrow access roads were a problem claimed that it was their "everyday crisis".

The household survey found that in the older parts of Chittagong, where mostly lower- and lower middle-income neighbourhoods are located, access roads are narrower than in the newly developed areas. This is a legacy of the colonial times, and the circulation of vehicles is a serious problem. Having too few roads at the neighbourhood level creates pressure on the few existing roads, and many of the households in lower-income neighbourhoods (80 per cent) claimed that there were not enough access roads for the movement of vehicles. As many as 12 per cent of households in these areas in Chittagong are on land sites where access by motor vehicle is difficult or impossible, and most of these sites are located in slums and squatter settlements. Again, few coping mechanisms emerged, as residents simply learned to live with the problem and walked, rather than rely on other forms of transportation. In some areas, the narrowness of the access roads forces pedestrians to stand aside when vehicles are passing. The ambulance and fire services cannot enter most of these neighbourhoods, thus exacerbating the existing health and fire risks at household level that were noted earlier.

38. Chittagong City Corporation (CCC) (2005), *Budget 2005–2006,* Chittagong City Corporation; also Chittagong Development Authority (CDA) (1999), *Chittagong Metropolitan Master Plan (1995–2015), Urban Development Plan,* Chittagong Development Authority, *Bangladesh Gazette*, Dhaka.

TABLE 4
Dominant neighbourhood environmental problems identified by householders in lower-income areas in Chittagong and in the city overall

Neighbourhood problem	*Rank	Lower-income neighbourhoods (n=90) (%)	Rank	City average (n=300) (%)
Poor cleaning and maintenance services	1	40.0	4	30.6
Narrow access roads	2	35.6	3	33.2
Drainage congestion	3	34.4	1	41.3
Noise pollution	4	33.3	2	36.0
Inadequate garbage collection	5	13.3	5	17.8

SOURCE: Rahman, M M (2008), "Urban environmental problems in Bangladesh: a case study of Chittagong city", unpublished PhD thesis, Department of Geography, University of Hull, UK, downloadable from http://edocs.hull.ac.uk/muradora/objectView.action?pid=hull:1617.

NOTE: *Ranking of the dominant neighbourhood environmental problems was arrived at based on percentages. Each household was asked to name and rank up to five neighbourhood environmental problems; highest percentage indicates rank 1 (perceived severity).

c. Drainage congestion

Most of the lower-income households who said drainage congestion was a problem claimed it was very frequent in their neighbourhoods. Drainage congestion occurs in drains or canals when rain or wastewater does not discharge properly from the source to the end points. Besides natural canals, the CCC has constructed roadside and area-based drains as the main drainage network for the city. Thus, drains in neighbourhoods play an important role in carrying household wastewater (not sewer water) and rain and stormwater to the main drainage network. During the monsoon season, a few hours of heavy rainfall can cause severe waterlogging in many parts of the city as a result of drainage congestion, and households in lower-income settlements that are located in low-lying flood plains and foothills face regular in-house water stagnation. Rainwater can also remain for long periods because of a lack of drainage infrastructure, congestion of existing drains and canals, and illegal encroachments. The household survey found that more than 60 per cent of households in the poor areas suffered from drainage congestion during the rainy season in 2005.

In some poor areas, there is no proper drainage infrastructure; in others, existing drains are not cleaned regularly, an important problem since, in the absence of adequate garbage collection, household garbage is sometimes deposited in the neighbourhood drains. Inadequate investment in drainage infrastructure has contributed to an increased incidence of flooding during the monsoon, followed by disease epidemics. Prolonged congestion and associated local flooding hinders ease of movement, and respondents also noted that it caused bad odours in their houses. The misery is compounded when dirty water floods the roads and enters people's homes, and residents face in-house water stagnation. The household survey revealed that water typically stays for 2–3 days; however, at times this can extend to more than a week, in which case residents take shelter on their *chaki*.[39] Residents largely lived with and worked around the problems, most feeling that there was nothing they could do. However, a small number noted that community-based cleaning-up activities took place.

39. A *chaki* is a piece of wooden furniture, often with four legs, which is used for sleeping.

d. Noise pollution

Noise pollution at neighbourhood level proved to be a serious problem for many living in the poorer areas of Chittagong. Although one-third of the surveyed households claimed that outdoor activities produced a lot of noise, they did not feel that they were seriously affected by this exposure to noise pollution. Once again, this raises questions of whether many people are aware of the consequences of long-term exposure to noise pollution.

Proximity and high density living conditions contribute to noise pollution, and major causes of the problem were identified as road traffic, railroads, construction, industry, noise in buildings and noisy consumer products such as music systems. Due to economic reasons, most residents have limited prospects of moving to quieter areas and feel helpless about protecting themselves from outdoor noise. Those who create the noise are also sufferers but, again, they may not be aware of the negative impacts of noise pollution. The major effect of neighbourhood noise pollution,

as perceived by residents in poor areas, is sleep disturbance, while others noted that noise disturbs their children's studies, and some that their hearing had suffered.

e. Inadequate garbage collection

House-to-house garbage collection by the city authority is uncommon in Chittagong. More than two-thirds of the surveyed households in lower-income neighbourhoods identified inadequate or no garbage collection as a major neighbourhood level problem.[40] It is important to note that residents of Chittagong generally dispose of household garbage in the CCC-provided "open dustbins",[41] which are often set up along the various neighbourhoods' main access roads. The CCC disposes of the garbage from these bins at the city's main dumping grounds. However, no schedule is maintained, either by the CCC to collect or by the households to dispose of waste, creating a general health problem for local residents.

Irregular or no collection of garbage from the dustbins is the main cause of littering around lower-income neighbourhoods. The CCC has provided some 569 open dustbins across the city, but only 65 are made of concrete.[42] A total of 49 waste vans collect garbage from these bins once daily, although a vast majority of households (60 per cent) in lower-income neighbourhoods said that they were underserved.

Residents in lower-income neighbourhoods are regularly exposed to both bad odours and an unhealthy local environment as a consequence of irregular or no garbage collection services. The household survey found that 39 per cent of respondents are inadequately served, and many do not hesitate to dump their garbage in convenient open spaces, roads, drains and ponds. This kind of open dumping has caused infestations of mosquitoes, flies and other insects, also waste on the roads and drainage congestion.

Residents may also, or instead, temporarily store garbage inside their homes, mostly in open containers and plastic bags. It is important to note that despite a ban on the production, sale or use of any type of plastic bag in Bangladesh, a number of households (13.3 per cent) in the lower-income neighbourhoods use plastic bags for "storing household garbage".[43]

The use of plastic does not have a long history in Bangladesh. Locally made plastic shopping bags were introduced in Dhaka in 1982, but within a year had spread throughout the country.[44] An anti-plastic campaign gained momentum in 1989, when results from a study by the Environment and Social Development Organization (ESDO), an environmental NGO, found that the widespread use of plastic bags was hazardous to the environment, and also revealed that one of the main causes of the prolonged flooding in Dhaka in 1988 was plastic bags causing drainage congestion. The campaign gained popular support as people became aware of the various environmental problems caused by plastic bags. As a consequence, the government of Bangladesh decided to impose a ban on the production and sale of all types of plastic bag in Dhaka from 1 January 2002. A nationwide ban was imposed subsequently on 1 March 2002.

However, the fact remains that many types of plastic bag are still widely available, anywhere from a neighbourhood grocery shop to a large shopping centre. This could be the result of a lack of public awareness of

40. As a comparison, 1.7 per cent of households in high-income areas, 21.4 per cent in middle-income areas and 41.1 per cent in low-income areas reported no garbage collection. See reference 11, page 155.

41. Open dustbins often produce bad odours and encourage insects, birds, mammals and other disease-causing pathogens, and represent a poor neighbourhood aesthetic and environmental quality.

42. See reference 37.

43. It was found that nearly eight per cent and 13 per cent of households in higher- and middle-income neighbourhoods, respectively, used plastic bags for storing household garbage. See reference 11, page 157.

44. Shahriar, H (1998), "Polythene and plastic use in Bangladesh", in G Philip (editor), *Bangladesh Environment: Facing the 21st Century*, Society for Environment and Human Development (SEHD), Dhaka, pages 226–229.

environmental issues and weak law enforcement.[45] But the consequences are serious for the local environment; for instance, plastic bags continue to block drains and underground sewerage systems as they are not easily biodegradable and decomposable.[46]

When asked, those in the poorest neighbourhoods made clear a general preference for regular house-to-house garbage collection, which they believe is the general responsibility of the CCC. There is an interesting contrast with the experience in other parts of the city. In the absence of regular house-to-house garbage collection by the CCC, residents of higher-income residential areas set up community-based organizations (CBOs) that collect waste daily from their households in return for payment. The CBOs typically employ an open van puller to collect garbage, and the collected waste is then placed in nearby dustbins provided by the CCC.

45. Chowdhury, A U (2004), *Modern Chittagong and CDA* (in Bengali), Balaka, Chittagong; also Jacobi, P, M Kjellen and Y Castro (1998), *Household Environmental Problems in São Paulo: Perceptions and Solutions from Centre to Periphery,* Urban Environment Series Report No 5, Stockholm Environment Institute with SIDA.

46. Ahmed, S and M M Rahman (2001), "Problems and prospects of informal plastic recycling industries in Dhaka city", *Development Review* Vol 13, No 1 and 2, pages 118–134.

VII. CONCLUSIONS: ISSUES AND PRIORITIES

Findings from the survey reveal that the lower-income areas of Chittagong experience a large number of household and neighbourhood environmental problems, many of them felt with greater severity and more regularity than in other parts of the city. However, the coping strategies that householders in these areas adopt to deal with their daily crises may, in turn, hold health risks, for instance when householders turn to water sources whose quality is not guaranteed.[47] One of the most striking findings of the survey is that while households in the poorest neighbourhoods had developed coping strategies for dealing with their household environment, few felt sufficiently empowered to find solutions to their neighbourhood problems. Instead, a general resignation to their situation seemed to prevail, as many householders understandably argued that they were not in a position to address problems of this scale individually, or even in conjunction with their neighbours. Rather, the most common response on being asked who should resolve a neighbourhood problem was the city council or utility provider.

47. See reference 1, Songsore and McGranahan (1994); also see reference 1, Hardoy et al. (2001).

When governments cannot fulfil citizens' needs, many actors at all levels advocate community action or NGO involvement as an alternative solution. However, in Chittagong's low-income neighbourhoods, examples of community or NGO action to improve neighbourhood environmental conditions were rare, hindered by low income and other factors. Instead, it was in higher-income neighbourhoods that CBOs could sometimes be found tackling the service provision deficit. This contrasting experience exposes one of the fault lines of community-led approaches to addressing neighbourhood environmental problems, namely that it is the richer areas that have the social capital and financial resources necessary to develop and sustain more effective high quality alternative provisioning strategies. There are consequent dangers in relying on an uneven patchwork of community-led initiatives, in effect consolidating rather than diminishing inequalities between areas, as well-serviced areas continue to attract like-minded residents while poorer areas continue to be underserviced. It is also worth emphasizing that there are many aspects of a good home or neighbourhood environment that cannot be addressed by CBOs or NGOs without government involvement – for instance, the power crisis, the poor quality housing and above all the lack of citywide infrastructure (roads, piped water supplies, sewers and drainage systems).

Not surprisingly then, residents in the lower-income neighbourhoods identified one of the major factors in the incidence and persistence of neighbourhood problems as the poor service performance of the public authorities. The majority demanded government action to improve service conditions, reflecting their limited financial power.[48] The systemic and continuing reality of management failure causes residents to devise alternative coping strategies to mitigate immediate household problems, in ways that sometimes may be both illegal and environmentally unfriendly, and ultimately deleterious to the health of those involved and their neighbours. Neighbourhood problems are usually accepted with resignation and worked around, with limited evidence of successful coping strategies emerging.

48. See reference 45, Jacobi et al. (1998).

This paper focuses on the argument that those living in lower-income neighbourhoods in Chittagong face more serious local environmental problems than middle- and upper-income neighbourhoods. However, this does not mean that middle- and higher-income residents in Chittagong can avoid all local environmental problems. To take the most common examples, the city government and utility providers are so ineffective that they cannot ensure regular piped water supplies, sewer connections, a regular electricity supply, household or neighbourhood garbage collection and drainage to predominantly middle- and upper-income neighbourhoods. Thirty-five per cent of households in high-income areas felt that water shortage was a very serious problem. When there are such inadequacies in the capacity of city governments and water and power utilities, even rich households are limited in their ability to pay their way out of some serious local environmental problems.

This said, there are more opportunities for high-income households to invest in methods that address at least partly some of their local environmental problems (e.g. coping with the lack of sewers by constructing septic tanks; coping with the lack of city government-provided garbage collection by paying for private collection services; coping with irregular piped water supplies by drawing water from deep tubewells and having large storage tanks; coping with electricity blackouts by having generators; coping with a lack of police services by paying for private security guards; paying for spraying the neighbourhood against mosquitoes and for cleaning drains; and paying servants to contribute to the above). By contrast, for the poorer neighbourhoods, financial constraints mean that the alternative coping mechanisms that are available to them are much more limited and, indeed, as previously noted, some actions such as dumping garbage in drains may actually exacerbate the problems faced either in the longer run or at the neighbourhood level.

Although this study has attempted to examine environmental problems at different scales, household and neighbourhood environmental problems are sometimes inseparable. Indeed, they are often mutually constitutive; for instance, the mosquito menace is influenced by neighbourhood drainage congestion. There is a two-way process at work here, since household garbage that is not disposed of properly may be deposited in the neighbourhood drains, affecting drainage congestion and, in turn, heightening the risk of insect infestation, including mosquitoes. The main problem, however, is not so much the behaviour of the householders as the fact that poor provision of services and inadequate maintenance leaves them with few alternatives. However, public policy does not necessarily recognize the interrelationships between household and neighbourhood

environmental problems in cities such as Chittagong. Instead, citywide policy responses overlook finer-grained geographies of environmental risk, especially among poor people and their living spaces.

Poorly developed environmental infrastructure is a particular problem for lower-income neighbourhoods in Chittagong, with the lack of organized infrastructure provision for poor households and neighbourhoods impeding the solving of health-related issues. This situation reflects the exclusion and deprivation of the urban poor, who in turn suffer from the most pervasive environmental health problems as a result of the underprovision of infrastructure at the household level. Likewise, poor neighbourhoods also experience low investment in infrastructure and services.

What this paper highlights is the diversity of coping strategies that the poor must necessarily develop in order to survive both their "day-to-day" environmental crises and more extreme events. Arguably, however, these coping strategies are as much about coping with poor management and governance as they are to do with dealing with environmental hazards, with the poor more vulnerable because government systems seem to work less well for them at both household and neighbourhood levels.

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