Special Issue

“Urbanization & periurbanization: Challenges for water governance in south Asia”
Guest Editor

Dr. Vishal Narain
Public Policy and Governance at MDI, Management Development Institute, Gurgaon.

Dr. Vishal Narain is Associate Professor, Public Policy and Governance, MDI, Management Development Institute, Gurgaon. He holds a PhD from Wageningen University, the Netherlands. His academic interests are in the inter-disciplinary analyses of water policy and institutions, urbanization and rural-urban transformations, water rights and irrigation reform. His research has been published in several peer-reviewed journals like Water Policy, Water International, Environment and Urbanization and Mountain Research and Development.

Managing Editor

Sumit Vij
Public Administration and Policy Group, Wageningen University, The Netherlands

Chief Editor

Anjal Prakash
International Centre for Integrated Mountain Development, Nepal
The combination of increase in frequency and intensity of heavy rainfall events due to climate change, and increase in surface water run-off due to rapid urbanization is exacerbating the risk of flooding in many cities in the global South. The urban poor residing in informal settlements are particularly vulnerable to the damaging impacts of flooding as they lack access to basic urban services and infrastructure that increase coping capacity. The global discourse on disaster risk reduction and climate change adaptation has stressed the importance of integrating the perceptions and needs of communities at risk in policies to better address development deficits that contribute to vulnerabilities.

This paper critically examines how flooding risk reduction unfolds at the grassroots level through the cases of Navi Mumbai and Kalyan-Dombivali—satellite cities on Mumbai’s periphery—to highlight the barriers for pro-poor, community-based adaptation through decentralized disaster governance in peri-urban municipalities. We discuss the gaps between community and local government perceptions of the drivers of and solutions to flooding risks in informal settlements. We find that local governments are constrained in integrating community-based approaches and implementing pro-poor risk reduction policies due to a lack of knowledge on the localized impacts of flooding in vulnerable communities. There is also apathy towards poor communities in flood-prone, informal settlements because of their ‘illegal’ status. Weak technical and human resource capacities at institutional level also play a part. All this is compounded by the absence of regulatory structures that incentivize and enable collaboration across departments as well as with elected representatives for disaster governance.

A bulk of the world’s urban population lives in small and medium-sized cities with less than a million residents. This trend is expected to continue in the foreseeable future (UN DESA 2015). With their spatial concentration of population, built assets, and economic activities, the impacts of climate change such as heat stress, flooding due to extreme precipitation, drought, and water scarcity are particularly acute in urban areas. Within urban areas, especially in the global South, poor communities living in informal settlements (nearly 1 billion worldwide) are highly vulnerable to and disproportionately affected by climate change as they live in poor-quality housing in hazard-prone areas with inadequate or no access to basic services and infrastructure that help adapt to risks (e.g. Satterthwaite et al. 2007). Hence, reducing risks for the vulnerable, urban poor is crucial for effective adaptation to climate change in cities.

In India, many small and medium-sized cities are growing on the peripheries of megaregions such as Mumbai, Delhi, and Kolkata. This is due to a variety of reasons including the availability of cheaper land for development and a poorly regulated environment (e.g. Narain 2009). The urban poor in these smaller, peri-urban cities are vulnerable to the impacts of climate change due to a development deficit that has not kept pace with population growth, and a weak capacity for governance (Rumbach 2015).

There has been a growing body of scholarship on the impacts of climate change-related risks, vulnerability, and adaptation in Indian megacities (e.g. De Sherbinin, Schiller & Pulsipher 2007; Chatterjee 2010; Dasgupta et al. 2013). However, there has been little discussion on the drivers of risks, vulnerabilities, and adaptation strategies in small and medium-sized cities, or peri-urban municipalities. The work of the Asian Cities
Climate Change Resilience Network (ACCCRN) (Brown et al. 2012), Rumbach’s study (2014) on Salt Lake City—a Modernist new town in Kolkata’s periphery, and Narain et al. (2013) are some notable exceptions. At the policy level, the National and State Action Plans on Climate Change, and the Disaster Management Act address risks in urban areas. But these, too, do not take into account differences in risk vulnerabilities and capacities for disaster governance as a function of city size in prescribing risk reduction approaches, which previous studies have established as an important factor (Cross 2001; Rumbach 2015).

This paper aims to contribute to this small but growing literature on vulnerabilities and adaptation to the risks exacerbated by climate change in small and medium-sized cities located on the peripheries of megaregions. We study adaptation to the increasing risk of flooding in the municipalities of Navi Mumbai and Kalyan-Dombivali in the Mumbai Metropolitan Region. Specifically, we examine the drivers and impacts of flooding in vulnerable, poor communities, their coping strategies as well as the role of local governments in supporting community-based adaptation. We also discuss current municipal risk management measures to highlight the unique barriers that local governments in such medium-sized cities face in taking a pro-poor, community-based approach to disaster risk reduction.

Local governments and autonomous adaptation strategies in poor urban communities

Since the late 2000s, there has been an increasing body of work on the coping and autonomous adaptation strategies adopted by vulnerable, poor urban households in response to climate change-related risks such as flooding in the global South (Douglas et al. 2008; Adelekan 2010; Chatterjee 2010; Jabeen et al. 2010; Porio 2010). These coping strategies include preventive measures to avoid impacts such as structural modifications to one’s house and built environment, and / or impact-minimizing measures such as accumulating assets or diversifying one’s sources of income to help reduce losses and speed up recovery (Wisner et al. 2004; Jabeen et al. 2010).

However, various studies have since recognized and articulated that coping and adaptation measures at the household level are shaped by factors such as secure tenure (Roy, Hulme & Jahan 2013), access to financial capital in the form of wealth and income (Linnekamp et al. 2011), quality of housing and the built environment (Jabeen & Guy 2015), and access to human as well as social capital (Chatterjee 2010; Jabeen et al. 2010; Braun & Aßheuer 2011). Additionally, coping strategies are also shaped by perceptions of flooding risk, which depends on past experience of flooding incidents (Grothmann & Reuswigg 2006; Fatti & Patel 2013; Qin et al. 2015), and information from public authorities (Hung et al. 2007). Thus, the ability to perceive, and cope with or adapt to flooding risks is contingent upon access to assets, resources, and information, which are distributed at different scales beyond the household such as the neighbourhood or city scale. For example, income, education, and housing quality are household scale factors. Infrastructure and services such as drainage or waste disposal systems, and access to help are neighbourhood scale factors, whereas land use and early warning systems are usually city-scale factors that affect coping capacity and strategies (Romero-Lankao et al. 2014).

As a lot of risk-reducing resources are only accessible at the community or city scale, government or state institutions and civil society actors have a key role to play in helping poor households adapt. Additionally, in decentralized states, local governments are well-positioned to foster community-based adaptation, because they are in charge of providing and maintaining a majority of the infrastructure and basic services necessary for risk reduction at the local level. If institutional (particularly local government) adaptation measures are informed by a deep understanding of household and community-based coping strategies and needs, it ensures that the stresses and risks associated with climate change are considered in an integrated manner alongside other development issues that affect these households and communities, and contribute to their vulnerabilities (Archer et al. 2014). Such an integrated, community-based approach not only helps build diversity and flexibility into the local government’s adaptation

---

¹ According to the Intergovernmental Panel on Climate Change (IPCC), coping refers to ‘the use of available skills, resources, and opportunities to address, manage, and overcome adverse conditions, with the aim of achieving basic functioning of people, institutions, organizations, and systems in the short to medium term.’ Autonomous adaptation, also referred to as spontaneous adaptation is ‘adaptation in response to experienced climate and its effects, without planning explicitly or consciously focused on addressing climate change’ (IPCC 2014).
or risk reduction plans but also augments any lack of governance capacity in local governments (Archer et al. 2014; Wamsler & Brink 2014).

**Challenges faced by government institutions in implementing community-based risk reduction and adaptation**

Despite the benefits of an integrated approach to adaptation and risk reduction, supporting grassroots strategies, and taking into account vulnerable communities’ perceptions and needs requires a government with a pro-poor perspective (Jabeen et al. 2010). An increased understanding or knowledge of community-based strategies alone does not necessarily translate into integration of the adaptation responses by multiple actors at different scales. This is because government institutions’ decision-making is affected by various factors (Fatti & Patel 2013). Broadly speaking, these include factors that are endogenous to local governments as well as those that are exogenous, which depend on higher scales of government and the developmental context (Malalgoda et al. 2013).

Endogenous factors that affect the adoption and successful implementation of disaster risk reduction or adaptation measures include knowledge of risks, vulnerabilities, and impacts at the local scale (Measham et al. 2011; Malalgoda et al. 2013; Lehmann et al. 2015). It includes recognizing that there are multiple drivers of vulnerability beyond risk exposure (Lebel et al. 2011). Knowledge, in turn, is affected by certain actor-specific characteristics such as their risk perceptions, preferences for certain strategies, and past experiences of hazards and risk mitigation or adaptation (Fuchs et al. 2011; Lehmann et al. 2015; Pasquini et al. 2015). Specifically, in the case of the urban poor, perceiving them as ‘encroachers’ or ‘illegal’ prevents local governments from gathering their inputs in the planning process, or extending risk reducing infrastructure or services in flood-prone informal settlements (Mustafa 2005).

In addition to knowledge and perceptions, the institutional structure of local governments, especially opportunities for inter-departmental coordination on cross-cutting issues such as disaster risks and climate change, and enabling bureaucratic structures that promote participation and information exchange facilitate better risk governance (Romero-Lankao et al. 2013; Lehmann et al. 2015). Often, differences in disciplinary backgrounds, departmental silos, and rigidity in approaches (e.g. reactive or emergency management approach) with an unwillingness to learn and change prevent adoption of holistic, long-term risk reduction measures (Fuchs et al. 2011; Measham et al. 2011; Lehmann et al. 2015). Cases from Durban (South Africa), and Mexico City (Mexico) have shown that the presence of influential champions or political leaders, who are strong advocates for adopting adaptation measures, can offset some of these institutional silos or rigidities (Romero-Lankao et al. 2013).

Local governments are also unable to take proactive adaptation or risk mitigation measures due to a lack of financial, time and / or qualified human resources. The absence of stable leadership (administrative or political), and a high rate of turnover in staff make it difficult to achieve any continuity or coherence in adaptation planning (Malalgoda et al. 2013; Romero-Lankao et al. 2013; Lehmann et al. 2015; Pasquini et al. 2015). Exogenous factors such as the regulatory or legal frameworks for policy implementation, opportunities for collaboration with the city administration or with state actors at higher scales, as well as policy incentives also affect adaptation strategies by the local government (Measham et al. 2011; Malalgoda et al. 2013; Romero-Lankao et al. 2013; Lehmann et al. 2015). For example, in the Indian case, climate change adaptation has not yet been devolved below the subnational state governments. At present, disaster management plans are the only available policy structures for flooding risk reduction at the city or local scale.

In the Indian context, specifically in the case of disaster risk governance in small cities, Rumbach (2015) finds that decentralization of disaster management to the subnational state and local governments has failed to reduce risks because of lower capacity for governance in smaller cities as well as a lack of redundancy in core physical as well as social infrastructure. Smaller cities lack a robust civil society or research community that can complement local government’s efforts by generating knowledge and raising public awareness. Additionally, many of these newly formed or rapidly growing smaller cities lack the environmental experience and learning from past disasters that help shape adaptation strategies at the household or city scale.

Biesbroek et al. (2013) note that these institutional challenges are not particularly unique to the process of climate change adaptation or risk reduction, but some aspects of climate change do pose distinct decision-making challenges. Since the localized impacts of climate
change are both difficult to predict and spread over a longer time frame, local governments with constrained capacities tend to focus their limited resources on solving more immediate, pressing problems (Fuchs et al. 2011; Fatti & Patel 2013; Archer et al. 2014).

Finally, contextual factors such as local government’s relations with communities at risk, and the political context within these cities affect how disaster risk governance unfolds at the local level. Urban poor communities themselves are heterogeneous, which makes designing inclusive or participatory processes a big challenge for local governments with constrained capacities, and risks elite capture (Measham et al. 2011). Within the Indian urban context, too, studies have shown that the poor largely tend to mobilize through political structures rather than through civil society or administrative bodies (Harriss 2007). Therefore, in the absence of political support for adaptation planning, it becomes difficult for local governments to adopt pro-poor, community-based approaches to risk reduction.

With this overview of the different factors that affect coping at the household level, and the challenges that prevent local governments from integrating community-based adaptation we now turn to examine how the process of flooding risk reduction unfolds at the local level in the municipalities of Navi Mumbai and Kalyan-Dombivali.

The geographic context: Flooding risk in the Mumbai region

The Mumbai Metropolitan Region (MMR) is one of the world’s largest urban agglomerations with a population of about 20 million according to the 2011 Census. It consists of 22 municipalities, each governed by its own local government, according to the provisions of decentralization legislation, i.e. the 74th Amendment to the Indian Constitution. The entire region receives heavy rainfall of more than 2200 mm annually, between June and September, which makes it vulnerable to seasonal flooding. Mumbai experienced its worst floods in recorded history on 26 July 2005, when the city received over a third of the total seasonal rainfall in a single day. In addition to heavy rainfall, factors such as location at mean sea level, tidal inflows, and increase in surface runoff due to rapid urbanization, coupled with the low capacity of the existing drainage systems, contribute to flooding. With climate change, studies predict that the amount and intensity of rainfall are likely to increase (Rana et al. 2014).

Climatic conditions in the region have undergone a change in the past century. Bhagat et al. (2006) note a 50% increase in the average rainfall per day experienced in the city. Despite the great difficulty and uncertainty in projecting the impacts of climate change on future precipitation (and the risk of flooding) in the Mumbai region, research indicates that by 2080, the intensity of extreme rainfall is likely to increase for all return periods, particularly for shorter return periods (more frequent) events (Ranger et al. 2011). Through a statistical downscaling of Global Climate Models, Rana et al. (2014) find an increase in the average amount of rainfall from 20% to 40% in various projections for the present century. Overall, these studies suggest a heightened risk of flooding in the MMR in future if planned adaptation measures are not taken in advance.

Navi Mumbai (NM) and Kalyan-Dombivali (KD) are ‘million-plus’ cities located in the MMR (see Figure 1). NM was conceived as a planned satellite town in the early 1970s to decongest Mumbai, and distribute growth inland in new areas. On the other hand, KD was formed by combining the twin towns of Kalyan (an ancient port, now an important railway junction), and Dombivali (an industrial suburb) in 1983 (Baud et al. 2013). NM has a population of 1.11 million, and KD a population of 1.67 million (Census of India 2011). Both cities are growing at a faster rate compared to the city of Mumbai, with annual population growth rates of 4.6% and 1.1% respectively. Despite being a ‘planned’ city, nearly 19% of NM’s population lives in slums or informal settlements, while for KD the corresponding figure is 45%.

In addition to the regional impacts of climate change discussed earlier, both cities are vulnerable to flooding on account of their specific geographic conditions. Many parts of NM were reclaimed from mud flats, and therefore are below the mean sea level. To prevent flooding of these low-lying areas during heavy rains, the city planners designed a series of holding (retention) ponds following the ‘Dutch method’ to store the storm water during high tide, and later release it during low tide (Kulkarni et al. 2014). Despite these hard infrastructure measures, our research indicates that some households continue to experience flooding due to a host of reasons that we elaborate in a subsequent section.

KD is also located in a low-lying region adjacent to the estuaries of three rivers –Ulhas, Kalu, and Waldhuni– that form 60% of the boundaries of
the municipality. Due to this, the city is vulnerable to riverine floods as well as flooding due to runoff from surrounding municipalities in upstream areas. There are also tidal inflows from the Thane creek estuary that prevent the drainage of these rivers during high tide (Baud et al. 2013). Rapid population growth in creek and river bank areas without corresponding expansion in drainage infrastructure is exposing a greater population to flooding risks in both these cities.

**Methodology**

To understand the process of flooding risk governance through decentralized disaster management planning, and the challenges that local governments face in implementing risk reduction measures that integrate household and community-level coping strategies, we adopted a case study approach (Yin 2009) to study NM and KD. Additionally, we used Thane (another municipality as well as district headquarters within the MMR) as a secondary case to develop a more detailed, in-depth understanding of flooding risks and municipal risk reduction approaches in the two primary cases.

Given the limited geographic scope of our study, we do not intend to generalize flooding risk management across the variety of mid-sized Indian cities or peri-urban municipalities. However, the analytic generalization of the case study method allows us to compare our findings with previous studies that have examined the challenges faced by local governments in implementing pro-poor risk reduction strategies. It also allows us to extend the emerging literature on climate-related risks and adaptation through decentralized disaster governance in smaller Indian municipalities on urban peripheries.

Primary data was collected from June to August 2015 during the monsoon season. We used mixed methods that included in-depth, semi-structured, open-ended interviews with key informants, on-site observations, and a survey of 130 households from seven low-income, informal settlements prone to flooding in the two municipalities (see Figure 1 for location of these settlements).

We held key informant interviews with twenty policy makers, municipal officials, elected representatives, planners, and state officials at different scales. These helped us understand the localities vulnerable to flooding, main causes and impacts of flooding, various measures being undertaken to mitigate floods, and provision of emergency relief through municipal disaster management planning. The interviews also touched on the various institutional and contextual challenges to implement risk reduction measures in general, and specifically those that were inclusive of the needs of vulnerable communities. In addition to the disaster management cells, interviewees at the municipal level were sampled from a range of departments related to flooding such as storm

Figure 1- Location of the informal settlements studied in Navi Mumbai and Kalyan-Dombivali in the Mumbai Metropolitan Region in India. MMR Map source: Mumbai Metropolitan Region Development Authority (MMRDA) website http://www.mmrda.maharashtra.gov.in/

² See Mukhija (2010) for an elaboration for the N of One plus Some approach to conducting a single case study, where he advocates using multiple secondary cases to augment a single case. In principle, we used the same method but our study differs since we used two case studies supported by a single secondary case.

³ We understand informal settlements as those where residents do not have tenure security. These could include but are not necessarily restricted to slums.
water drainage, water supply and sanitation, encroachment, solid waste management, fire and emergency services, and town planning. These informants were identified through a snowball sampling strategy by making visits to the city administration offices.

The informal settlements, where we conducted household surveys, were identified using a convenience sampling strategy following key informant interviews, on-site observations, and analysis of secondary data such as city development plans, and disaster management plans. Because we were interested in autonomous adaptation strategies adopted by the urban poor, the specific criteria that guided our sampling of settlements included high exposure to flooding risk, and higher concentration of low-income households in relatively poor housing and infrastructure conditions.

We selected the settlements of Ashok Nagar, Bhavani Nagar, Katemanavli, Atali, and Ahire gaon than  in KD, and parts of Ghansoli gaon than and Digha in NM. Of these, Atali, Ahire gaon than and Ghansoli gaon than have grown rapidly in creek areas in the last ten years due to a high demand for affordable housing in the region, and a less stringent regulatory environment controlled by local politician-landlords, who are natives of these former villages. In all these settlements, most people live in pucca houses, and work in the informal service sector as housemaids, drivers, security guards, or construction workers. They also pay property taxes to occupy land and access municipal services, but do not have tenure security. Residents of these settlements lack proper access roads, reliable water connections or supply, sewers, storm water drainage, or solid waste collection infrastructure. In many cases, storm water drains double up as sewers and garbage dumping channels, which increases the risk of illnesses whenever they flood. Unlike many parts of Mumbai city, there are no developmental NGOs operating in these areas to compensate for poor service delivery by local governments.

Within these settlements, we surveyed households to understand socio-economic characteristics, access to basic services, perceptions and experiences of flooding, autonomous adaptation responses, and perceived solutions to mitigate flooding risk. Households located in flood-prone areas of these settlements were sampled with a combination of simple random sampling using door-to-door asks and purposive sampling to include the perspectives of households belonging to different social groups within the settlement. The structured survey instrument consisted of a combination of closed and open-ended questions. Each survey lasted about 30 minutes on an average, and was conducted in either Marathi or Hindi using an Android-based survey platform called Open Data Kit. Household perceptions of the drivers of flooding, and neighbourhood development histories were triangulated with the help of at least two key informant interviews in each settlement.

**Findings**

**Household level impacts of flooding and autonomous adaptation**

Flooding is perceived as a major risk in informal settlements in NM and KD. Nearly 95% of the households we interviewed felt that they were affected by heavy rains and flooding. Although the deluge of 2005—which several older residents recalled vividly—was one of the most damaging events, we found that many residents have also experienced flooding in subsequent years as well during monsoons with relatively low rainfall. Around a quarter of the households in our sample reported that they were last affected by flooding in June 2015, shortly before we conducted surveys. This indicates that, in addition to heavy rainfall, several drivers contribute to flooding risk. These include the geographic location including its relative affordability, and the quality of physical environment including provision of basic services such as storm water drainage and solid waste management. Alterations in storm water courses, and increasing runoff as a result of newly constructed buildings in their vicinity were also perceived by communities as drivers of flooding.

Flooding has wide-ranging impacts in informal settlements in NM and KD. On an average, people reported that their houses were flooded to a maximum depth of 0.45 m during the last flooding incident that affected them, and that their houses were flooded for 18 hours at a time.

---

4 These are former villages within urban areas, governed by a different set of land use planning guidelines.

5 In our study, flooding refers to the inundation of people’s houses or immediate surroundings when water enters the structure from the ground up (Rumbach 2014). 90% of the households we interviewed said that the floor or the bathroom drain was the source of storm water entry in their house during heavy rainfall events.
Nearly 75% of surveyed households reported deterioration in drinking water quality during the rainy season, and nearly 50% felt that their toilet use was affected during flooding incidents. This has implications for neighbourhood and city scale planning of basic services and public health. When it rains heavily, there is flooding along access roads to public toilets in these informal settlements, or toilets get choked up due to backflow of sewage from the drains. Households that have a private toilet (65%) also reported flooding of toilets due to poor capacity of the sewerage system, and choking of drains due to improper garbage disposal.

Almost 80% of households reported that they take various autonomous adaptation measures in anticipation of flooding to avoid or minimize impacts based on past experiences. These measures can be classified as preparedness measures to mitigate the flooding risk through infrastructural improvements or maintenance at the settlement scale, or actions to minimize the intensity of heavy rainfall and flooding through structural modifications to one’s house in case it is not possible to mitigate the risk (See Figure 2 for the most common autonomous adaptation measures). These structural modifications include elevating the plinth above previously recorded flooding levels, creating small cement or brick bunds around doorways to prevent rainwater from entering the houses, or covering the house with tarpaulin sheets every monsoon (See Figures 3 and 4).

However, most households (48%) take loss and damage minimizing measures such as storing valuables at a safe height or in a safe area, placing furniture on bricks or stones to prevent damage due to water, buying and stocking less food grains during the monsoon season, and/or saving money for recovery in case of a particularly damaging incident similar to the floods on 26 July 2005. Most of these measures are undertaken in an individualistic, piecemeal fashion at the household level. Households do not receive any support from local governments for physical upgradation. Previous studies of coping and autonomous adaptation to flooding risks in informal settlements in other urban areas of the global South have noted similar autonomous adaptation strategies at the household level.

In addition to autonomous adaptation taken before the monsoon, several people take steps to cope with flooding when it occurs. They do so by preparing to remove water from their houses, or taking shelter in nearby elevated areas or their relatives’ houses. However, we also found that a large number of people (nearly 50%) simply do nothing, and wait for the floodwater to recede, due to a lack of awareness and/or coping capacity, or the non-availability of shelter close to their house. This is because most households we interviewed were low-income, and had low access to financial capital to make physical improvements to their house. Besides, a lack of tenure security prevented them from making any long-term investment in the upgradation of their houses and surroundings. Only about 55% of the households we interviewed received information or early warnings on flooding, and related precautionary measures in advance.

Due to a lack of physical and financial capital at the household level, people are heavily dependent on local state actors and their social capital to increase their coping capacity during floods. Social capital refers to additional resources that a household can access at the time of disasters using their social networks, and relationships developed on trust, reliability,
reciprocity, and shared norms (Braun & Aßheuer 2011). 61% of our respondents reported that they received some form of help during floods. Help was mainly in the form of relief measures such as food, drinking water, clothes, mattresses, and food supplies, or provision of shelter. Elected representatives at the local level (ward councillors) called nagarsevaks were counted as the biggest sources of help (by 69% of those who received help). Other sources of help that came up in our discussions were friends, neighbours, or relatives (14%), followed by community-based or local religious organizations (17%). Since social capital is weak in most newly developing urban areas, and as friends and neighbours tend to be affected too at the time of flooding, we find that there is a higher dependency on state actors (cf. Chatterjee, 2010 for the role of social capital in disaster recovery in older slums in Mumbai). As elected representatives and local politicians are also the main providers or brokers of housing and basic services in these informal settlements, they play an important role in shaping the coping capacities of vulnerable households.

Household and community perceptions of long-term solutions to mitigate flooding risk

Given the limited nature of early warning systems or public outreach measures, household and community perceptions of flooding risks are largely based on their past experiences of flooding events. We found that residents in older informal settlements such as Ashok Nagar, Bhavani Nagar, and Katemanavli in KD had a higher awareness of flooding risks in their neighbourhood as compared to those in more recently formed informal settlements in NM. Likewise, residents with past experiences were well aware of the multiple drivers of flooding in their neighbourhoods. In turn, they perceived a

Linnekamp et al. (2008) also find low social capital, and the absence of collective action among urban dwellers in Georgetown, Guyana.
A wide range of long-term solutions at the neighbourhood or city scale to mitigate flooding risks or reduce its impacts. It is, therefore, important to engage them in flooding risk governance in these areas.

People’s conditional willingness to relocate suggests further, that they live in these risky and deficient conditions because of a lack of affordable housing options in safer areas. Nearly two thirds of the households we interviewed were willing to consider relocating, provided the new location was equally affordable, and offered similar conveniences such as easy access to schools, transportation nodes and places of work. Familial and community ties, and locked investments in homeownership were the reasons for unwillingness to relocate. Although relocation holds the promise of safety, it is currently not a viable solution for reducing flooding risks, unless local governments develop the capacity to regulate land use and make provisions for affordable housing development for the poor in a participatory manner.

When questioned about their perceived solutions to reduce flooding risks, many people were unwilling to voice their views because of a lack of faith in the local government’s commitment or ability to deliver these solutions in their informal settlements. However, a majority expressed that improvements to the existing storm water drainage system and solid waste collection services, periodic cleaning of gutters, and building embankments along rivers or major drains would greatly reduce the flooding risk (See Figure 5). Other flooding mitigation measures perceived by these communities at risk include the installation of improved early warning systems, financial support from the government to upgrade their houses or to elevate the entire neighbourhood, land use regulation to prevent development along rivers and storm water drains, and building better access roads to facilitate recovery at the time of flooding. The ability to provide and maintain most of these ‘hard’ infrastructural or ‘soft’ regulatory solutions clearly lies beyond the household or community level, and requires active intervention from the local government.

**Municipal approaches to flooding risk reduction through disaster management plans**

In the last decade, both NM and KD have implemented city-level disaster management plans in adherence to the decentralization requirements of the National Disaster Management Act of 2005, with provisions for responding to flooding –perceived as one of the biggest environmental risks in the region. Our analysis of these municipal disaster management plans (hereafter DMPs) reveals that the two cities have recognized several low-lying areas within each ward that are vulnerable to flooding-risk on account of their location and topography, higher concentration of population in slums or informal settlements, and (to a far less extent) poor access to infrastructure such as transportation, water, sanitation, healthcare, and storm water drainage.

Management plans in both NM and KD have implemented city-level disaster management plans in adherence to the decentralization requirements of the National Disaster Management Act of 2005, with provisions for responding to flooding –perceived as one of the biggest environmental risks in the region. Our analysis of these municipal disaster management plans (hereafter DMPs) reveals that the two cities have recognized several low-lying areas within each ward that are vulnerable to flooding-risk on account of their location and topography, higher concentration of population in slums or informal settlements, and (to a far less extent) poor access to infrastructure such as transportation, water, sanitation, healthcare, and storm water drainage.

The NM DMP specifically outlines long-term flooding risk mitigation measures such as infrastructural improvements to the storm water drainage system, and improving transportation access to dense areas at risk for rescue and relief. Other measures include earmarking rehabilitation of settlements in sites prone to flooding and landslide risk in land use plans, and raising community awareness through early warning systems in partnership with NGOs and emergency services. Town planners, on the other hand, outlined various flooding risk reduction measures such as prevention of development in coastal regulation zones through land use planning, and reducing flooding by encouraging developers to plant trees, adopt permeable paving, and harvest rainwater to cut down surface water runoff.

Short-term preparedness measures in both plans pertain to the desilting of gutters, cleaning of storm water drains and nallahs (major drains that are either natural or built), and clearance of debris in partnership with other line agencies such as the railways and highways department. They also include stockpiling of equipment necessary for disaster response, relief and recovery; raising community awareness through...
the distribution of pamphlets and warning notices; training of municipal staff from various departments at all levels to respond during rescue efforts; and assigning vigilance duties during the monsoon months.

These measures were always emphasized by officials in interviews, and they often provided detailed updates on the status on ‘nallah saaf-safai’ (cleaning and maintenance of drains) in their jurisdictions to emphasize disaster preparedness. They also showed us their wireless communication and hotline devices in the disaster management control rooms that were installed to receive and process complaints during disasters. At the ward level, too, we were often directed to speak to officials in the solid waste management departments, because they were in-charge of sub-contracting drainage maintenance to ensure that the water courses were free of any garbage or ‘choke-ups’ that could cause water-logging or flooding during heavy rainfall. As Rumbach (2015) rightly notes, DMP documents are essentially disaster response plans that contain copious details on the relief supplies and equipment in store, contact details of emergency personnel in each ward, a list of location of shelters, and standard operating procedures in case of emergencies.

Despite outlining various holistic ‘hard’ and ‘soft’ long-term mitigation measures on paper (KD to a less degree), these DMPs fall short on implementation. They adopt a narrow, short-term emergency or crisis management approach that fails to reduce risks for the vulnerable, urban poor. In the next section, we examine why these implementation gaps arise as a result of differences between the local government’s perceptions and knowledge of the impacts of flooding risks and the needs of vulnerable communities, and a failure on part of the municipalities to engage with the public. Other barriers that prevent pro-poor risk governance include a lack of technical, human resource and financial capacities at the local level, and weak institutional and regulatory frameworks that provide no incentives for implementing pro-poor disaster governance.

**Knowledge, capacity, and institutional barriers and opportunities in flooding risk governance**

Our interviews with officials reveal that they do not perceive flooding, let alone climate change-induced variations in precipitation as a major risk. This is evident from their responses to questions on long-term mitigation measures: ‘Flooding is not a big risk, not as much as it is in Mumbai’ (Interview with official, July 2015).¹¹ In their view, unlike Mumbai which is located along the Arabian Sea, NM and KD abut a khadi (creek). So, these localities were not at risk of tsunamis or cyclones or sea-level rise—which they viewed as the main climate change-related risks. Another official felt that: ‘[Flooding] occurs only for a matter of few hours, at which time, we send our staff with pumps to clear the water-logging, provide food or tea to people whose houses get water logged. There are some disruptions but nothing serious... no loss of lives’.¹²

In NM, officials elaborated on the carrying capacity of the ‘planned’ storm water drainage system and holding ponds to highlight that heavy rainfall could not inconvenience the city for more than a few hours at a time. Further, officials in both municipalities strongly felt that flooding was only possible when heavy rainfall coincided with high tide as on 26 July 2005, which constricted the capacity of the existing storm water drainage system. As far as climate change was concerned, it was largely perceived as a distant threat that did not require any interventions in the short-term.

Planners and officials do not view flooding as a major threat because of lack of information and awareness on its localized but significant impacts in informal settlements (also see Wajih & Chopde 2014). This is partly due to a lack of technical data on local climate change projections or maintenance of databases on extreme weather-related complaints. It is also due to insufficient and incomplete data on key development indicators about the city such as slum population, and coverage of basic services like water, sanitation, and solid waste collection (all handled by different departments) that are linked to reducing vulnerabilities and increasing adaptive capacity. Their current measures are not grounded in evidence from vulnerable communities, as people report that they have never been consulted in the plan-making process. Even where hazard-risk vulnerability assessments have been carried out—often through donor or state funding—there are no systems in place to update these assessments continuously, based on the occurrence of rainfall events, neighbourhood-level improvements and planning, rapid population growth and urban

¹¹ (Interview with official, July 2015)
¹² (Interview with official, June 2015)
measure their impact on risk reduction at the district and community level with funding to build capacity through simulation exercises at the Disaster Management Unit has taken some steps towards these levels. The Government of Maharashtra is working on development indicators at the neighbourhood or local level, capacity-building measures and ways to address them through development planning. This can include interventions such as training staff in the use of GIS-based decision-making tools that aggregate multiple risks and scenarios. They can help in planning for flood events and higher order disasters. The readiness of these floodplain groups can be improved with such planning and collaboration with NGOs and the local state. This can make them more responsive to early warning systems, and promote collective action for community-based adaptation, thereby increase the community’s adaptive capacity. Current strategies to raise awareness in informal communities at risk through pamphlets and booklets are ineffective, because they are not accessible to a majority of residents who have low levels of educational attainment. Local governments have to employ alternatives such as TV, radio, social media, SMS-alerts, and outreach in schools.

The lack of knowledge on local vulnerabilities at the municipal level is often due to poor human resource and technical capacity. Disaster management departments in these medium-sized cities often consist of 2-3 persons. They are largely driven by one or two ‘champion’ administrators, who tend to be the only people with technical knowledge on vulnerability assessment, mitigation, and the process of recovery. However, these administrators do not necessarily oversee departments such as solid waste management or drainage, which are linked to flooding risk reduction and mitigation. These departments operate on their own budgets, timelines, and developmental mandates, which partly causes disaster governance to translate into short-term preparedness and emergency management. The positions of disaster management officers are currently contractual or part-time because of which it is hard to attract and retain technical capacities. Given the ‘specialist’ nature of the job, generalists in the city administration are unwilling (and sometimes unable) to commit their time and skills to it. There are presently no incentive structures in place to motivate city staff to take on these roles.

Within the city administration, there is almost no acknowledgment of the informal urban development processes that produce vulnerabilities in the first place. Disasters are viewed as a result of ‘encroachments by slum dwellers [due to rapid urbanization and population increase] in the 9-15 m strip of mandatory open spaces along nallahs’, and of the fact that ‘people are willing to put up with this inconvenience [flooding] for a few days during the year’. Officials also noted that a major cause of water logging and flooding was garbage disposal in nallahs by these ‘encroachers’. The criminalization of slum dwellers and flooding-affected persons as ‘encroachers’ as well as considering them the cause rather than the victims of flooding was common in many of our conversations on vulnerability of the poor. Ironically though, our research reveals that several of these ‘encroachers’ have citizenship claims to the city in the form of property tax receipts, and water and electricity bills. This reveals how crony capitalism acting in partnership with the local state (politician-landlords as well as lower level regulatory officials) has a role to play in increasing vulnerabilities by allowing the formation and maintenance of these informal settlements in the first place.

As far as flooding risk reduction is concerned, DMPs do not propose any long-term mitigation measures in these ‘illegal’ settlements to avoid legitimizing them (Chatterjee 2010). To close these knowledge gaps at the local government level, capacity-building measures will have to move beyond their traditional focus on rescue and relief operations to raise awareness on the multiple drivers of flooding risk and ways to address them through development planning. This can include interventions such as training staff in the use of GIS-based decision-making tools that aggregate multiple risks and development indicators at the neighbourhood or ward levels. The Government of Maharashtra Disaster Management Unit has taken some steps to build capacity through simulation exercises at the district and community level with funding support from UNDP. However, it is too early to measure their impact on risk reduction at the local level. In addition to raising awareness within the city administration, it is important for municipalities to engage communities in flooding risk governance by gathering their perspectives, and raising awareness through education and outreach on early warning systems and proper waste disposal. This is especially important in marginalized communities in medium-sized cities such as NM and KD that lack a robust civil society and NGOs that can supplement the local government’s outreach measures, promote collective action for community-based adaptation, thereby increase the community’s adaptive capacity. Current strategies to raise awareness in informal communities at risk through pamphlets and booklets are ineffective, because they are not accessible to a majority of residents who have low levels of educational attainment. Local governments have to employ alternatives such as TV, radio, social media, SMS-alerts, and outreach in schools.

The positions of disaster management officers are currently contractual or part-time because of which it is hard to attract and retain technical capacities. Given the ‘specialist’ nature of the job, generalists in the city administration are unwilling (and sometimes unable) to commit their time and skills to it. There are presently no incentive structures in place to motivate city staff to take on these roles.

---

¹³ We avoid mentioning the designation or affiliation of our interviewees to maintain confidentiality.
¹⁴ See Mustafa (2005) and Ranganathan (2015) for a detailed account of how these lower middle class communities in informal settlements become victims of crony capitalism rather than the perpetrators of land grabbing (and flooding) in floodplains in Rawalpindi and wetlands in peri-urban Bangalore respectively.
¹⁵ Within our sample, less than 40% of household heads had attained secondary education or higher, and nearly 18% were illiterate.
to participate in training exercises or mainstream risk reduction concerns in their respective planning activities. However, the relatively small-size of administration in these cities offers an opportunity to initiate inter-departmental dialogues and plans for an integrated flooding risk reduction.

The subnational state, which is the highest disaster management authority at the State level, can create incentives such as promotions, recognition, and allowances for staff across various departments. This way they can take an active interest in mainstreaming risk reduction concerns in their functions, and work across departmental silos. Although the state disaster management authority provides comprehensive guidelines for preparation of district DMPs, there are neither separate guidelines for preparing city-level DMPs nor any penalties for failure to implement proposed measures. This can be encouraged through funding streams or grants tied to the implementation of specific risk reduction measures that, in turn, are tied to vulnerability reduction in informal settlements. Similarly, because urban development is a State subject, the subnational state can facilitate long-term risk reduction through urban development policies. Thus, State-level policies should focus on directing cities to build and retain human resources, deploy financial resources for building localized knowledge on risks, undertake long-term mitigation through hard and soft measures, and mainstream risk reduction in regular development activities.

Our research within communities at risk also reveals that they often (almost always) mobilize through political channels—nagarsevaks and other elected representatives—to initiate developmental changes in their neighbourhoods, and to seek assistance in case of disaster events. Elected representatives also have access to special funds through which they undertake infrastructural improvements in their constituencies. Within the settlements we surveyed, these often included ‘visible’ improvements such as paving alleys, laying roads, installing streetlights, or improving the solid waste collection system, –not necessarily building or maintaining storm water or drainage infrastructure. Unfortunately, current disaster management plans only involve the city administration and line agencies, and outline roles for NGOs. They do not include capacity-building measures or active roles for elected representatives at ward levels to encourage them to consider flooding risks in their infrastructural improvements. This disconnect between the political and the administrative arms of the local government in flooding risk governance needs to be bridged by engaging elected representatives in early warning systems, infrastructure development, and public outreach.

Conclusion

Our study shows that there are multiple drivers of flooding risk in informal settlements in the peri-urban municipalities of NM and KD. One of the main drivers is the lack of affordable housing options at the city and regional level, which in turn forces the urban poor to live in poor quality housing in flood-prone areas along creeks and riverbanks, and/or in poorly serviced gaothans (former villages) that have less stringent development regulations. Other causes include increasing runoff due to new developments in the vicinity of these settlements, poor quality or non-existent drainage infrastructure, and improper waste disposal that chokes up the existing drainage systems. There is also some evidence to show that climate change will likely exacerbate flooding risk in the absence of adaptation planning.

Our findings show that poor households in these informal settlements are affected by moderate rainfall events too, due to their low coping capacity. In response to flooding events, households take a number of preparedness and impact-minimizing, autonomous adaptation measures. However, they are unable to take collective action to provide and maintain risk-reducing infrastructure or services at the community scale due to weak financial and social capital. Similar to other small and medium-sized cities, these peri-urban municipalities have few NGOs or civil society organizations operating in informal settlements, which can raise awareness on flooding risks or provide support for rescue and relief at the time of flooding (Rumbach 2015). Thus, the onus of risk reduction through long-term mitigation largely falls on local governments, elected representatives, and other state actors.

At present, municipal flooding risk reduction measures in NM and KD largely focus on short-term preparedness measures such as the maintenance of drains, and planning for response, relief and recovery in case flooding occurs rather than in preventing the disaster through long-term mitigation planning. However, these short-term preparedness measures rarely extend to poor communities in flood-prone, informal settlements. Public
awareness and outreach are limited in these settlements, while vulnerable communities are also not engaged in disaster governance for various reasons.

Local government actors lack knowledge on the magnitude and localized impacts of flooding in vulnerable communities. This is mainly because there is little research on the impacts of rapid urbanization on the ecologies of these peri-urban, small municipalities as well as on emerging risks due to climate change (Rumbach 2015). They also fail to acknowledge that rapid urbanization, and the shortage of affordable housing drives people to settle in informal settlements in flood-prone areas. They view the residents of these informal settlements as ‘illegal encroachers’ who are the cause rather than the victims of flooding. Because of this negative perception, they do not seek community input in disaster management planning nor do they extend risk reducing infrastructure to them.

A relatively small-sized city administration has to tackle many pressing development concerns. So, there is little technical and human resource capacity within these municipalities to undertake detailed vulnerability assessments through community participation or long-term risk mitigation planning. As shown by the experience of vulnerable communities, flooding risk can be greatly reduced through the provision of effective sewerage and storm water drainage, solid waste and debris disposal, and land use regulation to curb excessive surface water runoff. To promote inter-departmental collaboration and mainstreaming of risk reduction in day-to-day planning, awareness needs to be raised through training and capacity-building at the local government level.

In addition, elected representatives need to be actively involved in disaster governance as they provide or mediate access to housing and services in informal settlements, and help vulnerable communities during flooding incidents. This involvement is especially necessary in small city and peri-urban contexts that lack developmental NGOs or an active civil society that can facilitate community participation. Therefore, regulatory and institutional structures for decentralized disaster management need to be revised by the subnational state to encourage and incentivize inter-departmental collaboration; the mainstreaming of risk reduction concerns in regular developmental planning; and the participation of elected representatives in disaster governance.

In recent years, there have been increasing calls to mainstream climate change adaptation into existing disaster risk reduction policy structures, since both approaches focus on reducing risks for vulnerable groups, as also for the efficient use of human and financial resources (e.g. Schipper & Pelling 2006; Schipper 2009). Our study of flooding risk reduction through decentralized disaster management in peri-urban municipalities reveals that there are several knowledge and capacity gaps, and rigid regulatory structures that constrain local governments from taking a risk-reduction approach that focuses on vulnerable communities. These barriers are not unique to peri-urban municipalities, and have previously been observed in the literature on barriers to adaptation in other small and medium-sized cities in the Indian context. Overcoming these gaps in knowledge on the drivers of risks, vulnerabilities, and adaptation solutions through capacity-building and regulatory reform will pave the way for mainstreaming climate change adaptation concerns in future through existing disaster risk governance structures at the local level.

Acknowledgements

We would like to thank Canada’s International Development Research Centre (IDRC) for a Research Award that funded the study. The views expressed herein do not necessarily represent those of IDRC or its Board of Governors. We also thank the participants of the 6th Annual Climate Conference at the Tata Institute of Social Sciences, Mumbai, for their feedback on some of the ideas expressed in this paper. Jayshree Sankpal and Kailas Sathe from the University of Mumbai provided excellent research assistance in the field. Any errors remain our own.

References


Baud, I.; Pfeffer, K.; van Dijk, T.; Mishra, N.; Richter, C.; Bon, B.; Sridhara, N.; Pancholi, V.S. &


Lebel, L.; Manuta, J.B. & Garden, P. 2011. Institutional traps and vulnerability to changes in climate and flood regimes in Thailand. Regional


