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CITIES AND CLIMATE CHANGE
Initial Lessons from UN-HABITAT

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IMPACT OF CLIMATE CHANGE ON CITIES

Cities with high concentrations of people and buildings will be more adversely affected by climate change in the future. In many countries, cities are located in coastal areas, beside rivers, on steep slopes and other risk-prone areas. In addition, infrastructure such as roads, water networks, transmission lines, schools and hospitals that support the necessary services for urban populations, are vulnerable to extreme climatic events such as floods, storms or landslides.

Cities located in coastal areas of the tropics are particularly vulnerable to cyclones and there has been an increase in the number and intensity of these in the past three decades. The Fourth IPCC Assessment Report[1] predicts a continued increase in the future, which will pose even greater risks to coastal settlements. In addition, salt water intrusion will limit the availability of fresh water in coastal areas and jeopardize food security as once-fertile land becomes barren due to high salt content.

Inland cities may also be vulnerable. Those located along rivers where more precipitation is expected may be affected by flooding. Conversely, areas where climate change is expected to result in reduced precipitation, human settlements may find themselves affected by drought, reduced water tables and food scarcity.

In cities around the world, particularly in developing countries, the poor often live in informal settlements, located in risk-prone areas, characterised by poor housing, inadequate water, sanitation, waste disposal and other services. These marginalised and underserved populations, which are generally increasing, are extremely vulnerable to climate change as a result of their limited resources which hamper their ability to respond to changing conditions.

Cities can respond to climate change by adapting to the consequences or mitigating the effects of climate change. They can employ various urban management strategies to adapt to the impacts of climate. For example, planning and land use controls can prevent people from building in risk zones; revised building codes can improve the resilience of building structures and infrastructure such as roads and bridges can be designed to be climate-proof.

Cities can also help to mitigate climate change by reducing the emission of greenhouse gases. Examples of how this could be achieved include development of rapid transport systems and reduction of the use of single-occupancy vehicles; waste methane gas capture; ensuring the energy efficiency of buildings, and planning and designing more compact cities.

1 Fourth Assessment Report, IPCC, 2007. www.ipcc.ch/.

THE CITIES IN CLIMATE CHANGE INITIATIVE

UN-HABITAT is supporting cities in developing countries to address climate change. A component of the Sustainable Urban Development Network (SUD-Net), the Cities in Climate Change Initiative (CCCI), builds on UN-HABITAT's long experience in sustainable urban development, specifically through the Sustainable Cities Programme and Localizing Agenda 21 Programme.

The initiative is developing, adapting and making available methodologies that provide city managers and practitioners with guidelines on how to cope best with climate change. The initiative has a strong focus on poverty reduction strategies. In particular, it seeks to support the development of pro-poor and innovative approaches for the implementation of climate change policies and strategies.

The Cities and Climate Change Initiative has four key objectives: (1) to promote active climate change collaboration between local governments and their associations; (2) to enhance policy dialogue so that climate change is firmly established on the agenda; (3) to support local governments in making climate-sensitive changes; and (4) to foster awareness, education, and capacity-building strategies that support the implementation of climate change strategies.

CCCI emphasizes practical initiatives and governance issues for municipalities and their citizens. To achieve its objectives, climate change networks at the global, regional, national and city levels are supported. The networks include national governments, local government associations, non-governmental bodies, universities, the private sector, and UN organizations. They help to enhance awareness of climate change issues and the dissemination of knowledge among key actors. CCCI also supports education, capacity building and the localization and implementation of national adaptation and mitigation strategies. In particular, CCCI works with local authorities to strengthen their capacities to integrate climate change concerns in local and city-wide planning and budgeting for cost-effective policy responses.

Implementation of the CCCI started with the selection of four pilot cities: Esmeraldas in Ecuador, Kampala in Uganda, Maputo in Mozambique and Sorsogon City in the Philippines.

The cities began by carrying out an assessment of their vulnerabilities to climate change. This included an analysis of the existing institutional framework to address climate change and an analysis of the stakeholders currently involved in addressing climate change.

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PILOT CITY CASE STUDIES

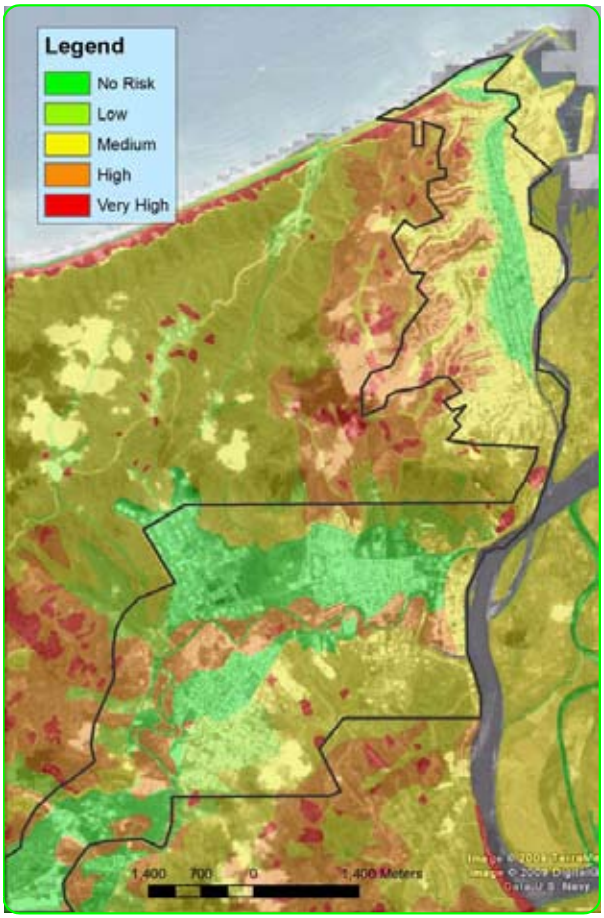
ESMERALDAS, ECUADOR

Before 1975, the city of Esmeraldas developed along the hillsides of the original settlement, occupying the flood zones of the Teaone and Esmeraldas Rivers and the Piedad and de Prado Islands.

The hillsides surrounding Esmeraldas are unstable, with the most recent emergencies occurring during the torrential rains of El Niño in 1998. After this, the risks facing the new settlements were primarily related to floods.

In many ways Esmeraldas is a typical medium-sized Ecuadorian city. Its social and economic indicators are comparable to other cities of similar size. The population estimate for Esmeraldas Canton for 2010 is 188,694, 66 per cent living in an urban situation. This is up from 162,225 in 2001, an increase of 16 per cent in nine years. As in many Latin American cities, urban growth is mainly associated with illegal occupation of land around the consolidated city. The local government increasingly has, therefore, been incorporating areas within the city limits that face a high risk of natural disaster. By 2007, almost 60 per cent of the population lived in areas with medium to high risk of floods or landslides. An estimated 66 per cent had medium to high exposure to climate-related risks.

The likely impacts of climate change vary depending on the climate transition path guiding the analysis



Flood and landslide risk for the City of Esmeraldas. Source: Esmeraldas City Planning Department

process. Current relatively high risk levels of landslides and floods, linked to climate patterns, make Esmeraldas one of the most endangered cities in Ecuador. The variability and uncertainties associated with the climate change projections for the Esmeraldas River Basin are consistent with those observed for Ecuador as a whole. The CCCI team identified and analysed five models and nine emission scenarios for the area. These consistently project increases in temperatures of approximately 2°C to 3°C for the Basin. For the coastal region in and around Esmeraldas, however, precipitation projections vary from +30% to +50%, to -30% to -50% (mm/day). There are several small, isolated watersheds in this area that would be affected severely by either extreme.

Under climate change scenarios predicting a path towards hotter and more humid climates, Esmeraldas would face even greater and more frequent disasters, requiring more complex planning and management scenarios. Increased precipitation would certainly cause additional loss of life and property. In this respect, one of the key challenges is how to better control the ongoing expansion of informal settlements along the flood zones.

Under scenarios predicting hotter and drier climates, Esmeraldas could experience lower risks of flooding, and lower stress on their water delivery systems. But stakeholders consider water shortages and price increases a major concern. In both climate transition paths energy demands are expected to increase drastically, not only because of higher temperatures and larger populations, but also increased consumption levels.

In this context, adaptation to climate change in and around the city requires a complex set of actions, including a combination of land use controls, infrastructure modifications, shifts in patterns of energy usage, capacity building, and improved governance. According to stakeholder assessments, adaptations to climate change in Esmeraldas would consist of infrastructural adjustments, such as the constructions of upstream water storage and flood control systems, and levees to protect flood-prone neighbourhoods. It would also involve the consolidation of the existing drinking water and sewerage systems and network expansion into new settlement areas. New institutional tools such as zoning plans are needed to improve governance and urban management. Finally, measures to diversify the economy would also reduce vulnerability by facilitating the consolidation of marginal urban areas.

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KAMPALA, UGANDA

Climate change is influencing re-alignment of global and country policies towards adaptation and mitigation[2]. The effects of climate change are now felt with Africa as the most vulnerable region[3]. This is due to many problems including the fact that the continent is urbanising faster than any region globally, exposing inland and coastal cities to risks. Cities are both contributors to and vulnerable to climate change, but the effects of climate change are exacerbating the already grim environmental, social and economic challenges, heightening the risk to the urban poor[4]. Vulnerabilities are manifest in several areas including housing, energy, food security, water resources, health, transport infrastructure, environmental services and economic productivity.

Applying a multi-faceted methodological approach, findings show that the impacts of climate change are increasing. In Uganda, there has been recorded variation in average temperatures that correlates with an estimated increase of 1.5 ºC in the next 20 years and by up to 4.3ºC by the 2080's, although recent scientific studies indicate the globe could warm by 4ºC by 2050. Significant observed changes in rainfall patterns and temperature continue to pose vulnerabilities to urban areas in Uganda. The most significant impact to Kampala is flooding due to increased rainfall. Increase in runoff has made flooding the most serious threat to life, livelihoods, urban system and economy. On the other hand changes in temperature regimes have affected urban livelihoods and food security.

Kampala is the capital and main city of Uganda, with 39.6 per cent of the national urban population. Located along the shores of Lake Victoria - a region with evidence of increased precipitation - the challenge of surface run-off, coupled with fragile drainage systems has increased vulnerability of infrastructure, housing, social services and livelihoods. For example, between December 2006 and February 2007 there was serious damage to housing, schools and disruption of livelihoods from excessive rainfall. Since the urban sectors of the city are affected variably[5], sector-specific vulnerability analysis provides better clues on mitigation and adaptation measures.

Energy is an important sector with heavy reliance on biomass energy for domestic and institutional use. About 75 per cent of Kampala's population use wood fuel (an estimated 535 metric tons annually by 2007[6]). This is coupled with an increase in motorised transportation and consumption of petroleum products leading to greenhouse gas emissions. Although the contribution of Uganda to CO2 emissions is low, adapting urban transportation for energy efficiency is important. Another sector associated with energy is housing which not only protects inhabitants from climate change impacts, but

2 Prasad, N., F. Ranghieri, et al. (2009). Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters. Washington, THE WORLD BANK.

3 UN-Habitat and ECA (2008). The State of African Cities A framework for addressing urban challenges in Africa. Nairobi, United Nations Human Settlement Programme: 206.

4 Ibid

5 Nyakaana, J. B., H. Sengendo, et al. (2004). Urban Development, Population and the Environment in Uganda: The Case of Kampala City and its Environs. Kampala.

6 Mukwaya, P. I., H. Sengendo, et al. (2007). Energy Options in Uganda. The Commonwealth People's Forum. Kampala.

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also contributes to emissions from buildings. Low or neutral energy housing is needed and a housing code that is energy-efficient is being developed under the CCCI.

Urban water is also vulnerable to climate change. Safe urban water supply reaches only 67 per cent of the population in Kampala, the largest sector excluded being the urban poor. Climate change impacts around Lake Victoria have led to a decrease in the water levels and affected supply for the past two-and-a-half years. The linkage between solid waste management, energy and flooding has increased the vulnerability of the population to health hazards. Infectious diseases, especially water-related and air-borne, are prevalent in many neighbourhoods, while disease outbreaks occurred in 1997, 1999, 2004, 2006 and 2008 due to the increased floods[7]. The ecosystem of the city region is also under threat with wetland destruction, biodiversity loss and soil erosion, augmented by clearance of vegetation and ecosystem services decline. Ecosystem conservation and management remains an important component for climate change adaptation and mitigation. A gender perspective has encouraged the initiative to analyse the effects of climate change on different gender groups and develop strategies that address the needs of women and children.

SUD-Net CCCI has initiated awareness campaigns which will be followed by development of tools to enable stakeholders to develop climate change plans.

7 KCC and BTC (2008). Baseline Survey for the Kampala Integrated Environmental Management Project, Bwaise III. Kampala, Kampala City Council & Belgian Technical Cooperation: 81.

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Drawing on the National Adaptation Programme of Action and the Initial Climate Communication tool, the CCCI is amplifying the role of urban areas in climate change adaptation and mitigation[8]. A platform to enable engagement of stakeholders is envisaged to highlight vulnerability for policy action. Various demonstration projects including city greening, alternative energy briquette utilisation, clean wood fuel use, climate-proofing of infrastructure and energy efficient urban transport systems are underway.

UN-HABITAT, under the SUD-Net, is supporting a Local Urban Knowledge Arenas platform through which climate change information at city and national level will be exchanged.

8 ISABIRYE, P. (2009). Climate Change Impacts and Adaptation Strategies: Opportunities for Reduced Impacts. UAIA. Kampala.

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MAPUTO, MOZAMBIQUE

Maputo, the capital of Mozambique, is highly vulnerable to the impacts of climate change as it is situated on the Indian Ocean and is the most densely populated urban area in the country. According to the 2007 census (INE, 2008)[9] the population of the city is about 1.1 million. But the combined metropolitan area of Maputo-Matola-Marracuene has an estimated population of between 2.5 and 3 million. Maputo, like other African cities, is experiencing rapid population growth (1.2 per cent) causing an increasing demand for housing and infrastructure (UNFCCC, 2006)[10], especially in the peri-urban slum areas. Consequently, there is a risk of severe impact on urban poor, which will increase as a result of their incapacity to improve their circumstances or move to safer areas.

A preliminary assessment of climate change impacts in the urban areas of Maputo identified the following vulnerable areas:

- Coastal zones and ecosystems
- Human settlements and infrastructure
- Health, food security and waste management
- Transportation system
- Wetlands and urban agriculture

The main climate-related hazards with destructive consequences are floods, droughts, rising sea level and storms (cyclones).

The predicted sea-level rise related to global warming would result in flooding of the lowest areas of Maputo, which are the most populated and where slum dwellers are concentrated. This prediction is also supported by the Mozambique National Adaptation Plan of Action to Climate Change. The National Institute for Disaster Management recently produced a study on the impacts of climate change in Mozambique showing that in the next 20-30 years most of the coastal area of Maputo, including its harbour and other important infrastructures, will be affected by sea-level rise if no adaptation measures are adopted, resulting in severe economic and social repercussions[11].

The assessment also identifies the main steps to be followed for setting up a climate change adaptation strategy for Maputo city, namely:

- Actively involving key stakeholders from the public sector, private sector and academia, civil society and development partners in the process of raising awareness about the impacts of climate change at all levels.
- Establishing an appropriate institutional arrangement between the city and the central government through the Ministry of Coordination

9 INE – National Statistics Institute: http://www.ine.gov.mz/censo2007

10 UNFCCC - United Nations Framework Convention on Climate Change (2006). Background paper on: Impacts, vulnerability and adaptation to climate change in Africa. African Waorkshop on Adaptation Implementation of Decision 1/CP.10 of the UNFCCC Convention. Accra, Ghana, 21 - 23 September.

11 INGC. 2009. Main report: INGC Climate Change Report: Study on the impact of climate change on disaster risk in Mozambique. [Asante, K., Brito, R., Brundrit, G., Epstein, P., Fernandes, A., Marques, M.R., Mavume, A Metzger, M., Patt, A., Queface, A., Sanchez del Valle, R., Tadross, M., Brito, R. (eds.)]. INGC, Mozambique.

of Environmental Affairs, the National Institute for Disasters Management, among others, to ensure proper management and implementation capacity of the climate change issues;

- Ensuring the creation of a Natural Disasters Risk Reduction and/or Climate Change Unit at local level.
- Preparing a more in-depth assessment of the impacts of climate change in Maputo, in order to determine the required adaptation and/or mitigation measures to be implemented.
- Developing methods and tools for the analysis of climate change effects in order to facilitate the financial planning and decision-making and preparation of a Climate Change Adaptation and Mitigation Plan, which identifies priority interventions to be implemented in the short, medium and long term.
- Creating synergy and coordination mechanisms with new initiatives or ongoing projects, to jointly identify potential sources of funding to ensure continuity of operations.

A CCCI-inception workshop was held in Maputo in May, 2009, with a large stakeholder attendance, including Ministry for Coordination of Environmental Affairs, National Institute of Meteorology, Maputo Municipal Council, representatives from academia, private sector, civil society, NGO's and development partners.An important outcome was a proposal for a communication mechanism to ensure the participatory and inclusive process of all stakeholders, leaving the ownership of projects in the hands of the municipal authorities.

With regard to the need to implement immediate and demonstrative adaptation/mitigation actions in priority areas of Maputo, the threatened mangroves surrounding the Costa do Sol neighbourhood were identified as a good pilot project. The aim of these interventions is to provide clear and physical limits of the mangrove area and make the recently approved master plan legally binding, including special provisions for the protection of endangered species.

Maputo ©UN-HABITAT/B.Oballa

Points of Marginal Avenue susceptible to be impacted by the erosion process linked to the sea level rise effect
Source: Climate Change Impacts in Urban Areas of Mozambique: A Pilot Initiative in Maputo City. Preliminary Assessment and Proposed Implementation Strategy, Paulo da Conceição Junior, 2009, p 15, Unpublished.

SORSOGON, PHILIPPINES

Sorsogon City is flanked by the ocean on two sides. It has a land area of 313 sq. kilometres with a population of 151,454 (2007), growing at a rate of 1.78 per cent annually. Its economy is based mainly on agriculture, fishing, trade and services.

In August 2008, the city launched a climate change initiative, championed by the mayor. Before then the popular perception was that climate change was a global and national issue requiring limited action from the local government. A series of briefings was held to enhance basic understanding of climate change and the important role of local government. This resulted in a commitment from decision makers to develop the city's climate-change profile and define local actions.

Various stakeholders worked together with local government to conduct a vulnerability and adaptation assessment. Using climate change projections and risk assessments from national agencies and private research institutions, as well as its own recorded observations, the city government analyzed its local vulnerability and assessed impacts. These were augmented by local residents' accounts of their personal experiences of how typhoons and storm surges over the past decade had become stronger and more destructive. These records and personal accounts were recorded through community risk mapping as evidence of climate change impacts. Local people graphically described the changes in the reach of tidal flooding and identified the areas gradually lost due to sea level rise and erosion. The exercise promoted ownership of the assessment process and encouraged the people to work together with local government to find practical solutions.

In 2006 the city was hit by two super-typhoons, which caused widespread devastation, affecting a total of 27,101 families and destroying 10,070 houses. The first typhoon, in just five hours, caused infrastructure damage estimated at USD 4.3million. The city is also projected to experience prolonged monsoon rains, causing rainfall exceeding 2,800 to 3,500 mm per year.

The vulnerability and adaptation assessment revealed that the city's geographical location make it sensitive to climate changes in extreme situations, such as tropical cyclones, storm surges, and heavy rainfall. It is also affected by other circumstances, such as increased temperature, increased precipitation and sea level rise. With sea level rise projected to accelerate, the built-up areas near the coast are the most vulnerable because they have the highest concentration of people, especially informal settlers, living in inadequate structures. These areas are also the hub of economic activities (accounting for 60 per cent of the local economy) and the location of basic infrastructure such as water, electricity and basic service facilities. Around 36.6 per cent of the total population or 55,452 people are vulnerable to flooding. A total of 35,621 people from nine coastal villages are threatened by sea level rise and storm surge, 22,000 of who are women.

Knowing these climate change vulnerabilities, the city government is now engaging local communities and the private sector in climate change adaptation planning. Using tools from UN-HABITAT's Sustainable Cities Programme, the local government conducted multi-sector consultations that resulted in the identification of four priority "quick-win" responses to increase people's resilience to climate change. These were: i) improving settlements and basic infrastructure,

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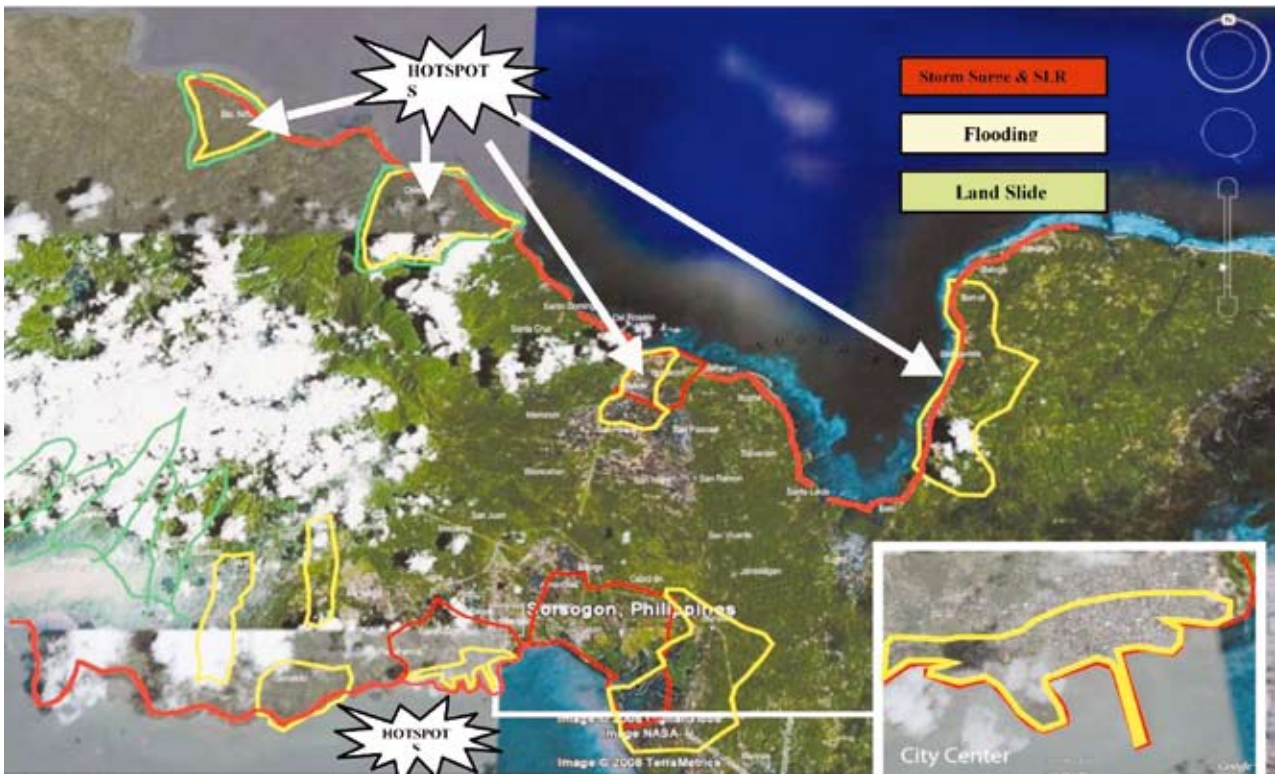
ii) enhancing livelihoods, iii) developing climate and disaster risk management systems, and iv) improving environmental management and climate change mitigation actions. Working groups composed of representatives from peoples organizations, NGOs, private sector and the Local Government Unit were organized to develop the action agenda and ensure its implementation.

So far the following lessons have been learned:

- There is a need to promote awareness on climate change among the general public and stakeholders through various media and community activities. This would broaden/establish partnerships among the private, public, academia, civil society, and neighbourhood associations for convergence of efforts on adaptation and mitigation.
- The city government's capacity must be developed to make it more responsive and increase its resilience to climate change impacts. A framework must be developed to help and guide the city in integrating climate change considerations in the land use and development plans. A stronger link with national climate change programs is critical especially in enhancing building code and land use planning parameters.
- The city needs to learn from good practices by other cities. It should also share its own experience in engaging various stakeholders in defining a collective climate change action.
- It is crucial for the business sector to play a vital role in providing green building technology development and in promoting risk-resilient communities through the use of appropriate and innovative technologies in housing and infrastructure development.

These lessons have become major considerations as the city works on mainstreaming risk management into its local governance processes and implementing climate change adaptation actions.



Identified City Hotspots due to combined risks from Storm Surge, Sea Level Rise, Flooding and Land Slide
Source: Sorsogon City Climate Change Vulnerability and Adaptation Assessment, 2008, p 17. Unpublished.

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WAY FORWARD

The reports from the pilot cities show an increased awareness and understanding of climate change. Local authorities have been sensitized to their role and to the need for a participatory approach in addressing climate change. The cities have held workshops at which all stakeholders were invited to participate in the formulation of actions and strategies to address the challenges. Some of the cities acknowledged the lack of information on climate change and expressed the need for further assessments to help them identify appropriate strategies.

In all the cities, specific issues were identified that highlight the need to strengthen governance systems to deal with climate change. In this regard, linkages between local government, national government, community groups and the private sector need to be strengthened. All these actors have an important role to play to make cities more resilient in the face of climate change.

Since the start of the CCCI, an additional five cities in Africa have joined the initiative. They are: Bobo-Dioulasso, Burkina Faso; Kigali, Rwanda; Mombasa, Kenya; Saint Louis, Senegal; and Walvis Bay, Namibia. These cities are at different stages in preparing their vulnerability assessments.

Preparations are also underway for cities in nine Asian countries to join the initiative. Further, select cities in Small Island Developing States in the Pacific and in the Caribbean are being targeted for a further expansion of the initiative.

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