

*Scientific Capacity Building for Climate Impact and Vulnerability Assessments (SCBCIA)*

# FINAL REPORT

**Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities (CA2009-01-SNIDVONGS)**



茨城大学  
Ibaraki University



EAST-WEST CENTER



## Making a Difference

Scientific Capacity Building &  
Enhancement for Sustainable  
Development in Developing Countries

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## OVERVIEW OF PROJECT WORK AND OUTCOMES

### Non-technical summary

This second 'Cities at Risk' workshop builds on the first held in 2009 in Bangkok, and specifically addressed the limited capacity to carry out risk and vulnerability assessments in coastal Asian cities. The workshop brought together over 40 participants including academics, urban planners/government representatives, and experts in disaster management.

The workshop clarified the current information/knowledge gaps and challenges, and identified future research opportunities for addressing climate change related risks and vulnerability assessments in Bangkok, Ho Chi Minh City, Jakarta, Manila and Mumbai. Key findings distilled from the workshop were grouped into three categories - 'assessment of climate change related risk', 'information/knowledge management', and 'governance'. Some 25 specific observations and recommendations for future research were identified.

Two major projects are anticipated to commence in 2011, thereby offering the opportunity to address the identified gaps in information/knowledge faced by the cities. These projects demonstrate how the cities at risk workshops are encouraging communication and generating collaboration in addressing the impact of climate change on cities in Asia and beyond.

### Objectives

This workshop addressed the limited capacity to carry out risk and vulnerability assessments in most coastal Asian cities. Workshop objectives included:

- a) helping develop capacity on the part of urban planners, managers, and researchers in climate change vulnerability assessment and application to urban development planning and governance;
- b) promoting locally-led vulnerability research in Asian coastal cities linked to user needs;
- c) helping develop partnerships between researchers, planners, and policy makers, and to develop communities of knowledge for vulnerability assessment in each participating city.

### Amount received and number years supported

The workshop was funded by the Asia-Pacific Network for Global Change Research (APN) and Ibaraki University, Japan. The total amount of funds received for this activity was 50,000 USD; this comprised an APN Grant of US \$45,000 for one year (15 Dec 2009 – 14 Dec 2010), and Ibaraki University provided co-sponsorship of 5,000 USD. The APN support was under the Scientific Capacity Building and Enhancement for Sustainable Development in Developing Countries Programme (CAPaBLE)/Scientific Capacity Building for Climate Impact and Vulnerability Assessment (SCBCIA).

### Activity undertaken

The workshop, held from 22-28 August 2010 in Nakhon Pathom, Thailand, brought together over 40 participants including academics, urban planners and officials, and experts in disaster management (Participants, Appendix 4). The workshop comprised presentations from City Teams, expert presentations, training sessions (including socio-economic vulnerability analysis, and GIS data preparation for estimating flood and inundation areas); and a field excursion to see at first hand the issues facing Samut Sakhon, a city and province located to the south of Bangkok that is at increasing risk from extreme flooding.

The workshop builds on the first 'Cities at Risk' workshop held 26-28 February 2009 in Bangkok (*Developing Adaptive Capacity for Climate Change in Asia's Coastal Mega Cities*<sup>1</sup>), and findings from

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1 First Cities at Risk Workshop report available at: <http://www.apn-gcr.org>

recent studies of Asian cities supported by the Asian Development Bank (ADB), World Bank, and Japan International Cooperation Agency (JICA). The first workshop aimed to become the catalyst to encourage a series of follow-on activities for developing adaptive capacities in coastal megacities of Asia, specifically calling for various future activities including training exercises, development of resource materials, and visioning for young scientists and practitioners, including a Cities at Risk II (CAR II) workshop within two years. Importantly, it also recommended a focus on integrated socio-economic vulnerability assessments rather than downscaling of impact assessments. This workshop (CAR II) aims to raise awareness and improve capacity to assess climate change related risk and vulnerability in five Asian coastal megacities – Bangkok, Ho Chi Minh City, Jakarta, Manila, and Mumbai.

The workshop was hosted and co-organised by the Southeast ASIA START Regional Centre (SEA START RC) of Chulalongkorn University and the East-West Centre, Hawaii.

## Results

The workshop clarified the current information/knowledge gaps and identified future research opportunities for addressing climate change related risks and vulnerability in Bangkok, HCMC, Jakarta, Manila and Mumbai. The City Reports (submitted prior to the workshop), City Report Presentations (Day 2), Research Proposal presentations (Day 5) and abstracts (submitted post-workshop) were used as core sources of information for distilling and organizing findings, in addition to the training sessions and discussions. Key information/knowledge gaps and proposed research identified by the cities were identified as follows:

### *Category 1: Assessment of climate change related risks (hazards and socio-economic vulnerabilities)*

1. Improve stakeholder perception of risk
  - acknowledging the vulnerability of the poor to the impact of climate change
2. Better define urban hazard factors
3. Assess the risk to water and food security, including
  - consumption, water quality, sanitation, waste management, agriculture, and aquatic systems
4. Address lack of baseline climate data, including
  - temperature, sea level, and social impact (see socio-economic vulnerabilities below)
5. Conduct health risk assessments, including
  - assessing link between climate change and health impacts
6. Recognize the importance of green space in moderating air temperature and flood prevention
7. Recognize the potential future impact of coastal erosion
8. Conduct socio-economic vulnerability assessments
  - addressing limited information on social aspects of vulnerability
  - integrating existing studies to better understand the current situation
  - refining/identifying measures of risk
  - developing measures of social vulnerability
  - mapping vulnerabilities
  - integrating exposure, places, sectors, activities, individuals, households, social groups, communities, livelihoods into assessments
  - understanding how urban and rural areas are linked by migration
  - assessing the vulnerability of marginal groups/informal sector

### *Category 2: Information/knowledge management*

9. Address provision of an information/knowledge management system, including
  - lack of a central information system, poor data collection and storage
  - an interdisciplinary approach to development is needed

10. Address limited availability of geographic information
11. Address integration of geographic information with socio-economic data
12. Address lack of GIS and mapping tools, and understanding of their application
13. Ensure access to information by stakeholders
14. Develop materials for information dissemination and target the most vulnerable communities
  - make better use of mass media
15. Expand capacity building activities, including
  - developing a course on urban development and climate change
  - integrating climate risk content into other courses (e.g., engineering)
  - deliver stakeholder workshops
16. Recognize limitations of existing early warning systems

### Category 3: Governance

17. Recognize the need for an institutional linking mechanism
18. Build capacity for city officials
19. Address lack of coordination between government agencies, NGOs, and the private sector
20. Assess the role of civil society groups in urban governance
21. Address deficiency of existing planning instruments in incorporating climate change risk and vulnerability
22. Address development and enforcement of land use regulations and building and sanitation codes
23. Address vulnerability of marginal groups, including
  - invisibility in plans/assessments
  - inadequate dissemination of information to the poor
24. Investigate potential of climate-induced migration of population
25. Address challenges to allocating funds for climate change related risks and vulnerabilities, including
  - availability and commitment
  - project-based and donor-driven support
  - raising of funds through fees paid by the local community
  - sustainability of initiatives

### **Relevance to APN's Science and Policy Agenda**

The second Cities at Risk workshop is in accordance with the aims and activities of the CAPaBLE programme, which addresses scientific capacity development for sustainable development, science-policy interfacing, awareness raising and dissemination activities<sup>2</sup>. Specifically, the workshop provided a forum to share experiences, lessons learned and information relevant to climate change risk assessments in Asian coastal megacities and the identification of potential future opportunities for research and regional cooperation.

### **Self evaluation**

The workshop proved very effective and productive for participants and organisers. Training sessions delivered by experts from Ibaraki University, United Nations University Institute for Environment and Human Security, and Pacific Disaster Center were particularly well received by participants who were actively involved with various practical and exercise activities. Key outputs of the meeting were the identification of potential future research opportunities and further development of city research networks.

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2 CAPaBLE activities: <http://www.apn-gcr.org/newAPN/activities/capable.htm>

Notably, two proposed projects addressing climate change risk and adaptation are anticipated to commence in the near future, offering the potential for further collaboration with workshop participants (see section below).

### **Potential for further work**

Two major projects are anticipated to commence in 2011, thereby offering the opportunity to address the above gaps in information/knowledge and challenges faced by the cities. These projects demonstrate how the Cities at Risk workshops, are promoting communication and collaboration in addressing the impact of climate change on cities in Asia and beyond. In summary, the two upcoming projects:

- APN funded project - *Enhancing adaptation to climate change by integrating climate risk into long-term development plans and disaster management.*
- project funded by International Development Research Centre (of Canada) and the Canadian Research Tri-Councils (Natural Sciences and Engineering, Social Sciences, Health Research) - *Coastal Cities at Risk (CCaR): Building Adaptive Capacity for Managing Climate Change in Coastal Megacities.*

### **Publications**

A paper presenting a synthesis of the findings from the workshop is under preparation. It will highlight issues of risk assessment, information/knowledge management, and governance and planning issues in relation to coastal Asian megacities.

### **Acknowledgments**

We would like to acknowledge our gratitude to workshop sponsors (Asia-Pacific Network for Global Change Research and Ibaraki University), co-organisers (Southeast Asia START Regional Centre of Chulalongkorn University, and East-West Center), collaborators and participants.

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### 1.0 Introduction

The workshop expands on the first 'Cities at Risk' workshop held 26-28 February 2009 in Bangkok (*Developing Adaptive Capacity for Climate Change in Asia's Coastal Mega Cities*<sup>1</sup>) and findings from recent studies of Asian cities supported by the ADB, World Bank, and JICA. The first workshop initiated a series of follow-on activities for developing adaptive capacities in coastal megacities of Asia, specifically calling for various future activities including training exercises, development of resource materials, and visioning for young scientists and practitioners, including a Cities at Risk II (CAR II) workshop within two years. A focus on integrated socio-economic vulnerability assessments rather than downscaling of impact assessments was also recommended. This workshop (CAR II) aims to raise awareness and improve capacity to assess climate change related risk and vulnerability in five Asian coastal megacities – Bangkok, Ho Chi Minh City, Jakarta, Manila, and Mumbai.

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1 First Cities at Risk Workshop report available at: <http://www.apn-gcr.org>

The workshop was funded by the Asia-Pacific Network for Global Change Research (APN) and Ibaraki University, Japan. The total amount of funds received for this activity was 50,000 USD. This comprised an APN Grant of US \$45,000 for one year (15 Dec 2009 – 14 Dec 2010), and Ibaraki University provided co-sponsorship of 5000 USD. The APN support was under the Scientific Capacity Building and Enhancement for Sustainable Development in Developing Countries Programme (CAPaBLE) focused activity on 'Scientific Capacity Building for Climate Impact and Vulnerability Assessment (SCBCIA)'.

The workshop was hosted by the Southeast ASIA START Regional Centre (SEA START RC) of Chulalongkorn University and co-organised with the East West Centre, Hawaii.

## **2.0 Methodology**

### **2.1 Pre-workshop activity: Preparation of City Reports**

Prior to the workshop, groups of researchers and urban planning practitioners representing each city at the workshop (hereafter referred to as 'City Teams') – Bangkok, Ho Chi Minh City (HCMC), Jakarta, Manila and Mumbai – were invited to prepare a 'City Report' on 'Climate Change Vulnerability Assessment and Urban Development Planning' for their home city. These reports represented a key source of information for better understanding current efforts in integrating climate risk and vulnerability into development and planning in each of the five cities and for better identifying future research and capacity building activities. The guidelines for preparing the City Reports (full details in Appendix 1) suggested a range topics to be addressed, as follows:

- Current perception of climate change related risk (such as *floods, water and food supply, land losses, air quality, heat stress, disease outbreaks, etc.*) and social/economic vulnerability (such as *poverty, investment, capital and opportunity losses, social conflicts and divides, genders, justice, etc.*) in your city, e.g., how do they perceive the differences and linkages between weather/climate risks and social/economic vulnerability?
  - Among general public
  - Among urban officials, city managers
- Have various climate risks to your city have been assessed and/or mapped, and if so do they take into account possible effects of current and future climate changes?
- Have social/economic vulnerability to climate related risks been assessed and/or mapped, how, by whom, details?
- Have the climate risks and vulnerability of city been communicated to the public, and how?
- Is there an existing urban GIS information base that may be used for climate risk and vulnerability assessment? What is included?
- Which agencies and institutions (e.g., government, non government, business, academic, civil society, etc.) in the city have roles in risk and vulnerability assessments, communicating such assessments to public and managing for information and knowledge about climate change? Their skill level and capacities needed?
- Is there an urban master plan? When was it completed? Does urban master plan take into account future risk to climate change?
- Have and how building codes, land use regulations, sanitation codes, etc. been enforced?
- Is there an early warning system? Evacuation or emergency response plans for various types of weather and climate related disasters? How effective are they?
- Level and effectiveness of public funding and commitment to respond to climate related risks and vulnerability?
- Governance and social justice issues, institutional, jurisdictional and social conflicts, etc. that may worsen climate related issues?



## 2.2 Workshop structure

The workshop, held from 22-28 August 2010 in Nakhon Pathom, Thailand, brought together over 40 participants including academics, urban planners/government representatives, and experts in disaster management (Participants, Appendix 4). The workshop included presentations from City Teams, expert presentations, training sessions (including socio-economic vulnerability analysis, and GIS data preparation for estimating flood and inundation areas); and a field excursion to see at first hand the issues facing Samut Sakhon, a city and province located to the south of Bangkok that is at increasing risk from floods.

## 2.3 Approach to synthesis

In order to identify gaps in information/knowledge and future research/capacity building needs, pertinent information was extracted from the City Reports (submitted prior to the workshop), City Report Presentations (Day 2), Research Proposal presentations (Day 6) and abstracts (submitted post-workshop). City Teams were requested post-workshop to prepare one page abstracts based on the City Reports and presentations under three main categories - 'assessment of climate change related risks', 'information/knowledge management', and governance' (Appendix 2). Additional outputs from the training sessions and discussions are reported in the Results and Discussion section and/or Summary of Proceedings (Appendix 5).

Content from the above documents were initially distilled into two tables (Tables I and II, Appendix 3) to help clarify the key issues. Table I essentially captures a present day understanding of climate risk assessment and current adaptation efforts for each city, based on extracting pertinent elements from the City Report and City Report Presentations (Day 2). Table II clarifies future research topics and activities, and is compiled from the Research Proposal presentations (Day 6) and abstracts. While both tables categorize information into the three broad sections, as requested for drafting the abstract, they have been further refined in Table I in an attempt to allow a more detailed comparison between cities, plus an additional fourth category is added on 'knowledge status/research gaps'. All content in these tables and the *Results and Discussion* section is referenced back to the workshop documents and presentations.

Extracted information in Table I was compiled into the following four main categories where possible in order to better understand the capacity for assessing climate risk and its application to urban development planning and governance in the five megacities.

### *Category 1: Assessment of climate change related risks (hazards and socio-economic vulnerabilities)*

- Projections of extreme risk to cities
- Perception of risk
- Substantive reports (key references cited in Table I)
- Assessment of hazards (categorized by individual hazard where possible)
  - flooding
  - drought/salt water intrusion (impacting city water and food security)
  - heat stress
  - public health (disease)
  - coastal erosion
- Assessment of socio-economic vulnerability

### *Category 2: Information/knowledge management systems and communication*

- Urban GIS information systems, decision support systems, early warning systems\* (overlap with category 3 below), websites, metadatabases

- Communication – to all stakeholders (e.g., public, government officials)/capacity building

#### *Category 3: Governance and planning*

- Agencies responsible for adaptation efforts
- Current planning instruments
  - Extent of integrating adaptation measures?
- Disaster response plans/early warning system\*
- Provision/enforcement of land use regulations/building codes

#### *Category 4: Knowledge status/research gaps*

Extracted information in Table II is presented under the three original categories, with a fourth – 'proposed partners' – indicating possible future institutional research collaboration.

### **3.0 Results & Discussion**

#### **3.1 Category 1: Assessment of climate change related risks (hazards and socio-economic vulnerabilities)**

##### *3.1.1 Projections of extreme risk to cities*

All five cities represented at the workshop, Bangkok, Ho Chi Minh City (HCMC), Jakarta, Manila and Mumbai are at extreme risk from climate change. The possible scale of future disruption faced by city populations was clearly highlighted in the the City Reports. Projections of millions of people displaced by floods in Bangkok (UNEP Bangkok Assessment Report 2009; cited in Bangkok City Report, p12) or 12 per cent of the population in HCMC with 1m inundation (Carew-Reid 2007; cited in HCMC Report, p14), and massive infrastructure damage by extreme weather events (OECD study cited in Mumbai City Report, p15) were described.

... sea-level rises, cyclones and storm surges could have a devastating impact on a large urban centre like Mumbai, which falls into a low elevation coastal zone (LECZ) (Mumbai City Report, p16).

##### *3.1.2 Perception of risk*

The perception of risk by the various stakeholders in the five cities appears variable. It was identified as one of the 'critical gaps both at national and local level' (HCMC Report p13). Recent intense weather events are increasing awareness of the public to the threat posed by climate change (Manila City Report, Part3, p1), and while there appears to be a limited awareness in the Jakarta public, the issues are well known and discussed in the scientific community (Jakarta City Report, p11). Furthermore, big business developers in the northern coastal area of Jakarta already appear to have anticipated flood risk by building canals and drainage systems (Jakarta City Report, p15). The vulnerability of the poor to the effects of climate change is also recognized by the Jakarta city government (Jakarta City Report, p5), but elsewhere marginalized groups are not properly addressed in climate risk assessments (Bangkok City Report Presentation, s17). However, the Bangkok Team reported that following the 2009 pre-Copenhagen meeting in Bangkok 'some level of sensitisation to climate change and disasters has already been initiated in the mainstream media which built on the effects of the 2004 Boxing Day tsunami' (Bangkok Abstract).

With their extreme experiences of typhoons and floods in recent years like Typhoon Milenyo, Pepeng and Ondoy, the residents of Metro Manila have heightened sense of awareness of climate change related risks (Manila City Report, Part3, p6).

##### *3.1.3 Assessment of potential hazards*

Assessments of climate change related risk have predominantly focused on the physical impacts of

hazards, whereas information on social aspects of vulnerability remain limited. In addition to the City Report, City Report Presentation, and Research Proposals, key hazards and vulnerabilities were identified on Day 3 as part of the exercise session on socio-economic vulnerability assessment; outputs from the latter are summarized below in Tables 1 and 2 below.

### Flooding

Flooding can be a function of one or more factors, including absolute sea level rise, precipitation, storm surge and land subsidence, and has been assessed in a variety of studies. For instance, northern Jakarta is reported to be vulnerable to both sea level rise and flood water from its rivers (Jakarta City Report, p7) and outlying areas of Bangkok are subsiding (up to 30 mm annually) thereby exacerbating flooding (Bangkok City Report, p9). Dr Snidvongs also commented that a one meter sea level rise by the end of the century is projected for Bangkok, as reported in a World Bank report. Moreover, in addition to the physical hazards identified in Table 1, the impact of impervious surfaces and storm water runoff and inundation damage caused by man-made structures preventing drainage from floodplains after localized rainfall (Bangkok City Report, p9), demonstrates how urbanisation and development have increased the possible impact of flooding.

<b>Bangkok</b>	<b>HCMC</b>	<b>Jakarta</b>	<b>Manila</b>	<b>Mumbai</b>
Flooding	Flooding (duration and frequency) - diseases (water-related) - damage/asset loss	Flood	Extreme rainfall (severe flooding)	Flooding due to heavy precipitation
Coastal erosion	High tidal surge	Inundation	Intense typhoons (severe flooding)	Landslides
Land subsidence	Land subsidence	Landslide	Earthquakes	Sea level rise
Salt intrusion		Disease outbreak (dengue, diarrhea)	Subsidence/ landslides	Storm surges /cyclones
Excessive groundwater withdrawal		Pollution	Sea level rise	Earthquake
Storm surge		Twister	Storm surges	
Rise of temperature (heat island and heat wave)		Earthquake		

TABLE 1. HAZARDS AS IDENTIFIED BY CITY TEAMS DURING DAY 3 TRAINING SESSION.

Flooding has been assessed to various extents with vulnerable flood-prone areas identified (e.g., Manila City Report, p19; Jakarta City Report, p7; Bangkok City Report, p2), and sea level rise has been studied recently using satellite TOPEX measurements (HCMC Report Presentation, s12). However, gaps in baseline data such as rising sea water, air temperature, and social impacts were noted (Jakarta City Report, p21). Future proposed research includes studying the subsidence and stability of reclaimed land (Mumbai Research Proposal, s15; Mumbai Abstract), and more broadly defining urban hazard factors (Bangkok Research Proposal, s6).

### Drought/saltwater intrusion

City water supplies and food production were identified as other areas of concern. Drought (Mumbai City Report, p17), unreliable river flows (Bangkok City Report, p10), salt water intrusion (HCMC Report, p14), uncontrolled groundwater extraction (Jakarta City Report, p20), together with increasing populations and industry and contamination of supplies (Bangkok City Report, p9-10) all pose threats to the provision of adequate water services. According to Boer et al. (2007; cited in Jakarta City Report, p8), 'between 2010 and 2015 the country is predicted to experience a major clean water shortage, and this is expected to occur mainly in urban areas'. Decreases in crop productivity and aquatic ecosystems are expected in light of increased saltwater intrusion into the Mekong (HCMC Report, p14). The need to assess the risk to water and food security and their input into decision support systems for national planning and local governance was identified (Manila City Report, Part3, p5). Water is addressed in proposed research on urban infrastructure by the the Bangkok Team (Bangkok Research Proposal, s8), asking: 'What is the climate impact on fresh water quality? How does it impact on water consumption? Who is most affected?'

...due to the uncontrolled extraction of fresh groundwater, some freshwater in the north part of Jakarta are mixed with sea water making it unfit for drinking (Jakarta City Report, p20).

Baseline climate related data is lacking in some cities. Historical and projected temperatures and rainfall have been mapped in the Philippines (Manila City Report, Part3, p2). In contrast, studies on climate change were described as 'sorely lacking' in Jakarta together with a lack of available baseline data such as air temperature and sea water level (Jakarta City Report, p21). The need for more research on climate was mirrored by the Mumbai Team, proposing research to focus on intra-seasonal monsoon variability (Mumbai City Report, p24), and the Manila Team, advising that 'climate with the associated geophysical and ecological risk to food, water and energy security as well as health need to be assessed' (Manila City Report, Part3, p5).

### Heat stress

Projected increases in temperature were mentioned in all City Reports. Studies were cited that suggested rising maximum and minimum temperatures. It was commented that losing green space was influencing the heat island effect (Efendy, 2007; cited in Jakarta City Report, pp7-8). The importance of urban green space in moderating air temperature and the impact of automobile density was reported to be an important cause of the heat island effect (Jakarta City Report pp7-8). On Day 5, the issue of greens pace was also noted in measures for climate change adaptation by Jakarta (i.e., increasing green area, upper stream reforestation, and mangrove conservation) and by Bangkok (mangroves) (see Appendix 5).

... a 50% reduction in urban green space would bring air temperature to rise between 0.4 to 1.8C and automobile density is found to be the most important cause of urban heat island in Jakarta (Sobry Efendy, 2007; cited in Jakarta City Report, pp7-8).

### Disease

Vector-borne and water-borne diseases pose another climate related risk to communities. Increases in vector-borne diseases (dengue fever and malaria) were mentioned by several cities (Bangkok City Report, p5; HCMC Report, p14; Mumbai City Report, p16) and water-borne diseases (diarrhea, cholera, typhoid) by Mumbai (Mumbai City Report, p16). Public health was reported as a key concern in flooded areas (HCMC City Presentation, s24), and that 'pollution of river in addition to hygiene issues after floods should be seriously taken into consideration, especially for groups of the poor who

are living along the river channel and workers who are living in low standard residential areas' (HCMC Report, p27). Future information needs on health impacts was noted (Mumbai Abstract), and more specifically with regard to: 'establishing the link between climate variability and health impacts; assessing the vulnerability of the city to water-borne and vector-borne diseases; sensitizing city stakeholders including health professionals, public health administrators, municipal officials and citizens' groups to health risks of climate change' (Mumbai City Report, p24). The Manila Team likewise raised the need for future health risk assessment (Manila City Report, Part3, p5).

Another important climate risk for Indian cities, in particular Mumbai, is the onset of water-borne diseases (diarrhea, cholera and typhoid) and vector-borne diseases (malaria and dengue) (Mumbai City Report, p16)

### Coastal erosion

The importance of coastal erosion was highlighted by several cities including Bangkok, HCMC, and Mumbai. It was reported that more than 1 million people could be impacted by coastal erosion and land loss in the Mekong Delta by 2050 (IPCC 2007; cited in HCMC Report, p8), and that Bangkok was especially at risk (OECD 2007; cited in Bangkok City Report, p11).

#### *3.1.4 Assessment of socio-economic vulnerabilities*

Understanding socio-economic vulnerabilities to climate change was recognized as a critical knowledge gap by all City Teams. For instance, existing vulnerability assessments 'focused mainly on the physical or the climatic aspects of vulnerability and little attention is given to non-climate factors that exacerbate an individual or household's vulnerability' (Bangkok Abstract). Similarly, the Jakarta Team reported that 'risks related to the impact of climate impact on people have experienced much less attention ... studies [on] coping strategies and adaptation to these disasters are few and far between' (Jakarta Abstract). The need to address the research gap was reiterated by the HCMC Team, calling for a 'comprehensive research study on climate change vulnerability of the city ... to understand which future strategies and adaptation measures need to be built up for sustainable urban development', and specifically mentioning a 'socio-economic assessment of riverine communities in HCMC ... as a primer for assessing the vulnerability of these communities to climate change in HCMC' (HCMC Abstract). In Indonesia, 'officially, assessment and mapping on social/economic vulnerability has not been done', with most assessments focusing on vulnerability to conflict or economic issues (Jakarta City Report, p9). However, the National Bureau of Statistics has been examining the development of a social vulnerability index (Jakarta City Report, p9). A summary of vulnerabilities, including socio-economic, was additionally identified by City Teams during the Day 3 training session (see Table 2 below of participant outputs).

The most vulnerable section is the slum dwellers and squatter communities that comprise more than half of the total residents. Therefore, it is critical for the city to assess the vulnerabilities and devise adaptation and mitigation mechanism to cope with future climate risks (Mumbai Abstract).

<b>Bangkok</b>	<ul style="list-style-type: none"> <li>• Discussion focused on healthcare</li> </ul>
<b>HCMC</b>	<ul style="list-style-type: none"> <li>• Infrastructure (transport/road, drainage, water supply, public facilities)</li> <li>• Production (agricultural practices, industry, aquaculture, services (tourism, trading))</li> <li>• Health (outbreak diseases, infectious disease)</li> <li>• Social impacts</li> </ul>

<b>Jakarta</b>	<ul style="list-style-type: none"> <li>• Poverty</li> <li>• Elderly</li> <li>• Weak governance (capacity building, corruption, limited information)</li> <li>• Low level land</li> <li>• Lack of enforcement</li> <li>• Lack of budget</li> <li>• Lack of awareness</li> </ul>
<b>Manila</b>	<ul style="list-style-type: none"> <li>• High incidence of poor people living in hazard-prone areas</li> <li>• High population density (exposure)</li> <li>• High number of poor people without access to basic services</li> <li>• Sub-standard buildings and infrastructure due to weak implementation of regulations</li> <li>• Haphazard zoning / land use plans and implementation</li> </ul>
<b>Mumbai</b>	<ul style="list-style-type: none"> <li>• Physical (reclamation, low lying, congestion, poor drainage)</li> <li>• Economic and social (high population density, informal sector, land use pattern, access to resources, poverty)</li> </ul>

TABLE 2. VULNERABILITIES AS IDENTIFIED BY CITY TEAMS DURING DAY 3 TRAINING SESSION

All city teams proposed conducting socio-economic vulnerability assessments to address current shortcomings in knowledge. More specifically, issues to be addressed included:

- Integrating existing studies to better understand the current situation (Bangkok Research Proposal, s13; Manila City Report, Part3, p5),
- Refining/identifying measures of risk (Manila Research Proposal, s3; Mumbai Research Proposal s13),
- Developing measures of social vulnerability, such as macro and micro social vulnerability indicators (SoVI) (Jakarta Research Proposal, s9), climate disaster resilience index (Bangkok Research Proposal, s13), and a quantifiable profile of socio-economic vulnerabilities (HCMC Research Proposal, s21).
- Mapping vulnerabilities (HCMC Research Proposal, s21; Jakarta Abstract; Mumbai Research Proposal, s14). Mapping of socio-economic vulnerabilities was proposed for visualizing climate risk. To date, limited and uncoordinated assessment/mapping has been reported (Manila City Report Presentation, s35; HCHC Abstract). The Jakarta Team highlighted that there is 'an urgent need to combine physical as well as socio-economic data to construct vulnerability mapping that can provide a holistic assessment of climate change impact' (Jakarta Abstract). Furthermore, the collection of remotely sensed LIDAR data is planned by the Department of Spatial Planning, and this could be used for climate risk and vulnerability analysis (Jakarta City Report Presentation, s11). Expected results from developing an adaptation plan for Jakarta, includes a multi-hazard risk map and ranking (Jakarta Research Proposal, s17). Similarly, HCNC calls for the creation of

... what seems to be lacking in the BMR is the identification of the vulnerable groups so that a more proactive and differentiated intervention can be crafted (Bangkok Abstract).

risk maps of vulnerable communities in Thu Doc and Can Gio areas of HCMC (HCMC Research Proposal, s21). The use of ArcGIS was suggested for mapping (Jakarta Presentation).

- Integrating exposure, places, sectors, activities, individuals, households, social groups, communities, livelihoods into assessments (Bangkok City Report, p5)
- Learning how urban and rural areas are linked by migration and the threshold at which migration due to climate-induced change is triggered (Bangkok City Report, p7)
- Assessing the vulnerability of marginal groups/informal sector (Bangkok Research Proposal, s11-12; Mumbai Abstract). The Bangkok Team proposed the following research objectives -
  - a) to identify the major CC hazards facing vulnerable groups;
  - b) to link the future well being of vulnerable groups to impacts of climate change and extreme weather events;
  - c) to link planned adaptation strategies with existing autonomous adaptation strategies.
- The cultural aspect should be expressed in future research (issue raised during the HCMC presentation).
- Use available household data (e.g., SUSENAS / PODES / SAKERNAS / 2010 Population census data (comment from Jakarta Team during Jakarta Presentation)
- Need to consider the dynamic nature of vulnerability (comment by Dr. Virji during the Jakarta Presentation)

### **3.2 Category 2: Information/knowledge management**

Category 2 focuses on the development of information/knowledge management systems for sharing data and information (e.g., through creation of urban GIS databases, decision support tools, early warning systems), and their access and content dissemination to stakeholders. The aim of an information/knowledge management system is to facilitate access to relevant data and information for stakeholders, for example, by centralizing storage in a single location.

#### Information/knowledge management systems

Development and implementation of information/knowledge management systems appears limited across all cities. The HCMC Team reported that there was 'no unified information centre and poor data collection and storage' (HCMC Report, p30). Furthermore, there was 'a lack of GIS or mapping tools for climate risk and vulnerability assessment' (HCMC Abstract). Likewise, the Mumbai Team highlighted the need 'to compile information regarding different climate-related risks' and 'assess how and where different models & tools can be applied to look at changes in hazards, exposure & vulnerability' (Mumbai Abstract). The Bangkok Team reported that while GIS and maps on various coastal risks and hazards are available from government departments, ministries and international development organisations in Bangkok, to date the only climate change specific mapping for Bangkok was conducted by Panya Consultants (2009) (Bangkok Abstract); data/maps in meteorology,

hydrology, land subsidence, erosion, hazard, and coastal change are currently held in four different government departments (Bangkok City Report Presentation, s5).

Jakarta has limited geographic information located at provincial and national agencies, which is used for urban planning but not integrated with socio-economic data (Jakarta City Report, p12). Furthermore, 'the lack of available data also makes it difficult to conduct any meaningful assessment of the climactic conditions in Jakarta, such as long time series data on rainfall, baseline data on tides, the daily measurement of temperatures, etc.' (Jakarta City Report, p12). The Manila Team reported that 'aside from thematic layers from the Manila Observatory ... there is also the Metro Manila Earthquake Impact Reduction Study (MMEIRS) in the form of a GIS, which may contain related information on exposure and vulnerability (Manila City Report, Part3, p2). The latter is also reported to be accessible to local government units (Manila City Report, Part3, p2).

### Access and dissemination of information

In addition to limited information resources, stakeholder access and communication were also identified as issues of concern. The HCMC Team noted that 'in the area of disaster management especially climate change impacts such as food, salt water intrusions, drought, it is very difficult to access information and despite public debates demanding more transparency there has been little progress' (HCMC City Report, p30). They further reported that 'important information is only available through informal channels' and there are 'few mechanisms for citizens to access all useful information of water management, flood prevention, and pollution control (HCMC City Report, p30). This was similarly articulated by the Manila Team, who saw developing an information system and its access as a main issue to address (Manila City Report Presentation, s42), noting the 'dire need to develop materials for information dissemination in the popular media' (Manila Abstract). The importance of effectively communicating research to government and targeting information to the most vulnerable communities were issues raised by the Jakarta Team. The latter group reported:

An interdisciplinary approach is needed to create an information and knowledge base to help identify, develop and implement effective responses to reduce vulnerability and enhance adaptive capacity (Patwardhan et al. 2009; cited in Mumbai City Report, p21).

the public have been informed on the climate risks and vulnerability through the mass media and seminars. The main problem is that the method of delivery as well as the target audience has not been properly addressed. As an example, campaign on the impact of climate change has not been done on those vulnerable to the risks such as the poor and other groups. The main climate risk campaign is still limited to the high government circles and academics (Jakarta Abstract).

Concerns about existing early warning systems were expressed. For example, 'Metro Manila's flood warning system (Effective Flood Control Operation System or EFCOS) under MMDA has not been utilized effectively as seen during Typhoon Ondoy (Ketsana)' (Manila Abstract). An early warning system has also been implemented in Jakarta, but according to the Jakarta Team, it has been designed for flooding caused by heavy rainfall rather than sea level rise (Jakarta City Report, p17). However, as noted by the Jakarta Team 'these efforts are more of reactive measures rather than proactive measures to tackle the problem of climate change' (Jakarta City Report, p20).

At the city level, the Bangkok 5-year Action Plan for Climate Change identifies communication among different sectors. This strategy could lay ground for the integrated framework (Bangkok City Report, p1).

The above limitations regarding systems, access and dissemination of information were reflected in



proposed future research. The Manila Team proposed 'information architecture and infrastructure for integrated risk analysis' as one approach for their research, and more specifically development of dynamic risk assessment and decision-support framework/tools (Manila Research Proposal, s10, 5). The Jakarta Team's Research Proposal addressed raising awareness of the public on the vulnerability to climate change (Proposal I)(s9), and in their third proposal described developing a comprehensive course on 'Urban Development and Climate Change' (s33). Likewise, the Manila Research Proposal included risk and vulnerability communication and education, and integration into curricula (s10). Stakeholder workshops were proposed by the Mumbai Team to help in 'creating a mechanism for integrating post event recovery strategy with long-term development plans leading to reduction in vulnerability and enhancement of adaptive capacity of the cities at risk' (s19). Dr. Virji described as 'critically important' the development of a risk management course incorporating climate. The Mumbai Team noted that there are a number of disaster management and climate change programmes, but they are driven by those with engineering backgrounds, hence the usual focus on infrastructure fixes, so there is a need to look at science curricula in engineering courses.

Topics in the Jakarta Team's proposed course on 'Urban Development and Climate Change': urbanization and urban development in developing countries; coastal cities and small island development; climate change; sea level rise, land subsidence, flooding, inundation, heat, storm surge; vulnerability, risks and socioeconomic implications; prediction and mapping; data and information; mitigation and adaptation, land use and spatial planning, disaster management, infrastructure development; and governance (Jakarta Research Proposal, s33)

### **3.3 Category 3: Governance and planning**

The section addresses a range of governance-related matters including: institutional coordination/linkage; the role of civil society groups; deficiencies in existing city plans; land use regulations, building and sanitation codes; vulnerability of marginal groups; and challenges to funding.

The need for an institutional linking mechanism for climate risk related planning was highlighted. The latter was raised in meetings in Bangkok by some agencies including the Bangkok Metropolitan Administration (Bangkok City Report, p1). In Jakarta, there is no single organisation that manages issues related to climate change risk, and 'it appears that most government agencies, NGOs, and the private sector conduct their own activities to cope with climate change without coordinating with each other' (Jakarta City Report, p13). The Jakarta City Team also commented that compared to the national level, city level officials have less understanding of climate change adaptation issues. Similarly in HCMC, it was commented that there was no single responsible metropolitan administration, and cooperation among government agencies and stakeholders is unsatisfactory (HCMC Presentation). The Mumbai Team identified two research areas to address this issue including: 'identifying and defining specific roles of public and private stakeholders in adaptation', and 'capacity building in institutions to strengthen adaptation decision-making' (Mumbai City Report, p23). The role of civil society groups in urban governance was raised in the presentation by the Bangkok Team. The latter specifically asked (Research Proposal, s8) - 'how civil-society groups play a role in adapting to uncertainties? What are factors influencing their success?

The Plans only solves the current issues of urban development (land use, public works and infrastructure) and are not integrated with the scenarios of climate change and the prediction of sea level rise (HCMC Presentation, s21; 'Plans' refers to the Regional and Master Plans)

There are no particular agencies or institution in Jakarta which oversees account risk and vulnerability assessments, managing climate change knowledge, or disseminating the climate related information to the general public (Jakarta City Report, p13).

What are their challenges?'

Existing planning instruments are deficient with regard to incorporating climate change risk and vulnerability. For instance, it was reported that the Metro Manila Development Authority (MMDA) had created several master/development plans, with the most recent integrated into the National Medium-Term Development Plan, but that 'these plans have not systematically incorporated climate change risks and the socio-economic vulnerability of the metropolis to climate changes' (Manila Abstract). Similarly, the Bangkok 5-year Action Plan for Climate Change incorporated strategies concerning development and disaster preparedness, but 'according to the preliminary reviews, the plan paid little discourse on vulnerability reduction' (Bangkok City Report, p1). Regarding the Greater Mumbai Disaster Management Action Plan (DMAP), 'no specific attention is given to adaptation strategies which may be more important in the short to medium-term to deal with the climate risks of flooding, storms and cyclones' (Mumbai City Report, p17). Understanding the gaps in existing urban plans at different scales was identified by Bangkok as an issue requiring future inspection (Research Proposal, s7), and in their second research proposal, the Jakarta Team proposed developing an 'Adaptation Plan for Climate Change' for their city (Research Proposal, s17). In order to mainstream adaptation into planning, the Mumbai Team proposed two research activities - 'identifying contexts such as disaster management or infrastructure development activities for mainstreaming adaptation into current planning and policies', and 'carrying out policy oriented studies to understand where such integration is possible.'

Integrating climate risk into land use regulations and building and sanitation codes was another key governance issue raised in the workshop. Zoning regulations are currently being drafted by the Jakarta Government, for which the Jakarta Team noted the opportunity for integrating climate risk assessment into the regulations (Jakarta City Report, p16). However, big business developers in the northern coastal area of Jakarta already appear to have anticipated flood risk by building canals and drainage systems (Jakarta City Report, p15). The Manila Team reported that 'it cannot be determined whether these are adequate or whether these have been enforced', further adding that a 'JICA study projected a high number of casualties if a strong intensity earthquake hit Metro Manila because of poor regulation and enforcing of building related laws and codes as well as in the compliance of requirements for business permits' (Manila City Report, Part3, pp3-4). The challenge of enforcement was echoed by the the Jakarta Team (Jakarta Abstract), noting that 'the real problems are enforcing these regulations on the public', where 'most effort has only been partly successful'. One of the expected outcomes from proposed research by the HCMC Team is to develop building codes for low-lying areas (HCMC Research Proposal, s21); the importance of which is evident with respect to proposed new developments on flood-prone land (HCMC City Report, p27).

In general, LGUs are unable to enforce laws and ordinances (Manila City Report, Part3, p4; 'LGUs' refers to Local Government Units)

Addressing the vulnerability of marginal groups was identified as another critical issue. Slums are not included on Mumbai's developmental plans, and the Mumbai Team reported that this 'deliberately induced invisibility of slums pushes its dwellers to multiple forms of displacements' (Mumbai City Report, p10). According to the Bangkok Team, 'marginalized groups and informality are currently viewed by the general public as non-climate issue, and hence not only ignored by city planning but also perceived as a non-climate factor for risk assessment, that could also exacerbate sector and community vulnerability' (Bangkok City Report Presentation, s17). Inadequate dissemination of information to the poor was criticized by the Jakarta Team, reporting that a 'campaign on the impact of climate change has not been done on those vulnerable to the risks such as the poor and other groups', with the main climate risk campaign 'still limited to the high government circles and academics' (Jakarta Abstract). Issues addressing marginal groups were considered in research

activities proposed by Bangkok (Bangkok Research Proposal, s11-12), and Mumbai (Mumbai Abstract; Mumbai Research Proposal, s13); for more details see above section on assessment of socio-economic vulnerabilities.

Climate-induced migration of population was raised by the Bangkok and Mumbai Teams. The former expressed the need to understand how urban and rural areas are linked by migration and the threshold at which migration due to climate impact is triggered (Bangkok City Report, p7). For example, migration may be in response to falling agriculture production, closed factories, industry relocation, and interruption to the transport network. The latter commented that migrations from surrounding areas into the city might be triggered by drought becoming more frequent (Mumbai City Report, p17).

Allocating and disbursing funds and sustainability of initiatives were other challenges discussed. The Jakarta Team reported that there 'is currently no information on public funding and commitment on climate change', though according to the Jakarta City Government Medium Term Development Plan (2007-2012) 'some sort of funding must be available and there should also be commitment' (Jakarta City Report, p17). The problem of funding being largely project-based and donor-driven was also noted (Manila Abstract), and is further complicated in Manila as the National Disaster Coordinating Council (NDCC) does not have control of its own regular budget to disburse (Manila City Report, Part3, p5). In HCMC, research into climate risks and impacts has been supported by domestic and international organisations (HCMC Report, p20), and the city is permitted to raise funds for flood and storm prevention through fees paid by the local community (HCMC Report, p28). In Thailand, the parliament is currently considering how to institutionalize and fund climate change adaptation activities (Bangkok Abstract). The need to better integrate projects into ongoing programmes and initiatives was also commented by the Mumbai Team.

Public funding and commitment to respond to climate related risks and vulnerability has been mostly project-based and donor-driven. Thus, sustainability and progress of these initiatives are a major concern for most stakeholders (Manila Abstract)

#### 4.0 Conclusions

The workshop identified current information/knowledge gaps and future research opportunities for addressing climate change related risks and vulnerability in Bangkok, HCMC, Jakarta, Manila and Mumbai. As previously noted, the City Reports (submitted prior to the workshop), City Report Presentations (Day 2), Research Proposal presentations (Day 5) and abstracts (submitted post-workshop) were used as core sources of information for distilling and organizing findings, in addition to the training sessions and discussions. Key information/knowledge gaps and proposed research identified by the cities are summarized as follows:

##### *Category 1: Assessment of climate change related risks (hazards and socio-economic vulnerabilities)*

1. Improve stakeholder perception of risk
  - acknowledging the vulnerability of the poor to the impact of climate change
2. Better define urban hazard factors
3. Assess the risk to water and food security, including
  - consumption, water quality, sanitation, waste management, agriculture, aquatic systems
4. Address lack of baseline climate data, including
  - temperature, sea level, and social impact (see item 8 below on socio-economic vulnerabilities)
5. Conduct health risk assessments, including
  - assessing link between climate change and health impacts

6. Recognize the importance of green space in moderating air temperature and flood prevention
7. Recognize the potential future impact of coastal erosion
8. Conduct socio-economic vulnerability assessments
  - addressing limited information on social aspects of vulnerability
  - integrating existing studies to better understand the current situation
  - refining/identifying measures of risk
  - developing measures of social vulnerability
  - mapping vulnerabilities
  - integrating exposure, places, sectors, activities, individuals, households, social groups, communities, livelihoods into assessments
  - understanding how urban and rural areas are linked by migration
  - assessing the vulnerability of marginal groups/informal sector

#### Category 2: Information/knowledge management

9. Address provision of an information/knowledge management system, including
  - lack of a central information system, poor data collection and storage
  - an interdisciplinary approach to development is needed
10. Address limited availability of geographic information
11. Address integration of geographic information with socio-economic data
12. Address lack of GIS and mapping tools, and understanding of their application
13. Ensure access to information by stakeholders
14. Develop materials for information dissemination and target the most vulnerable communities
  - make better use of mass media
15. Expand capacity building activities, including
  - developing a course on urban development and climate change
  - integrating climate risk content into other courses (e.g., engineering)
  - stakeholder workshops
16. Recognize limitations of existing early warning systems

#### Category 3: Governance

17. Address the need for an institutional linking mechanism
18. Address the lack of coordination between government agencies, NGOs, and the private sector
19. Build capacity for city officials
20. Assess the role of civil society groups in urban governance
21. Address deficiencies in existing planning instruments in incorporating climate change risk and vulnerability
22. Address development and enforcement of land use regulations and building and sanitation codes
23. Address vulnerability of marginal groups, including
  - invisibility in plans/assessments
  - inadequate dissemination of information to the poor
24. Investigate potential for climate-induced migration of population
25. Address challenges to allocating funds for climate change related risks and vulnerabilities, including
  - availability and commitment
  - project-based and donor-driven support
  - raising of funds through fees paid by the local community
  - sustainability of initiatives

## 5.0 Future Directions

### 5.1 Research networks

Potential future city research networks were identified by HCMC, Jakarta and Mumbai in their Research Proposals (see Table II, Appendix 3), and the Bangkok Team referred to the need to build an institutional community towards the research. Furthermore, an upcoming Research Conference (CAR II) is planned for Taipei in 2011 (Dr. Roland Fuchs, Day 1 Opening session).

### 5.2 Proposed projects

Two major projects are anticipated to commence in 2011, thereby offering the opportunity to address the above gaps in information/knowledge and challenges faced by the cities. These projects demonstrate how the Cities at Risk workshops, the first of which was held in February 2009, are promoting communication and collaboration in addressing the impact of climate change on cities in Asia and beyond.

1. An APN funded project titled - *Enhancing adaptation to climate change by integrating climate risk into long-term development plans and disaster management*. The study will include a comparative analysis of Bangkok, Manila and Mumbai in order to identify policy implications for managing risk, adaptation strategies, and development planning. More details on the study are included in the Mumbai abstract (Appendix 2).
2. A project funded by International Development Research Centre (of Canada) and the Canadian Research Tri-Councils (Natural Sciences and Engineering, Social Sciences, Health Research) - *Coastal Cities at Risk (CCaR): Building Adaptive Capacity for Managing Climate Change in Coastal Megacities*. The overall objective is to 'develop the knowledge base and enhance the capacity of megacities to successfully adapt to and when necessary cope with risks posed by the effects of climate change, including sea level rise, in the context of urban growth and development' (Gordon Bean, Presentation Day 6). The cities of Bangkok, Lagos, Manila and Vancouver were selected for the study, with workshops involving other cities, including HCMC, Mumbai and Jakarta. Approval for the five-year project is anticipated in January 2011, becoming operational in April 2011.

## References

### 1. City Reports (collated in Appendix 6)

#### *Bangkok City Report*

Hutanuwatr K (2010) A Preliminary Review on Frameworks for Thai Climate Risk and Approaches in Social/ Economic Vulnerability Assessment in Bangkok.

Yila JO (2010) Gender Perspective on Climate Change Risk and Vulnerability.

Salamanca A (2010) Climate Change and Migration.

Marome WA, Suwanarit A, Tiampayothorn R, Chenvidyakarn T (2010) Urban Development Perspective on Climate Change Risk and Vulnerability: Landscape Urbanism, Landuse Plan and Informality Economy and Settlement.

### *HCMC Report*

Vo Le Phu, Le Anh Duc, Dang Van Khoa, Lam Vu Thanh Noi (2010) Climate Change Vulnerability Assessment and Urban Development Planning in Ho Chi Minh City, Vietnam.

### *Jakarta City Report*

Surbakti IM, Idroes IC, Simarmata HA, Firman T (2010) Jakarta City Report. Information related to Climate Change in Jakarta City.

### *Manila City Report*

Porio E, Loyzaga AY, Vicente C, Perez R, Narisma G, Olaguer D, Muto M, Cartagena R (2010) Climate Change Related Risks and Adaptation Potential in Metro Manila.

### *Mumbai City Report*

Patankar A, Patwardhan A, Andharia J, Lakhani V (2010) Mumbai City Report.

## **2. City Report Presentations (collated in Appendix 7)**

## **3. City Research Proposals (collated in Appendix 8)**

## Appendix 1: City Report Guidelines

### International Workshop

#### Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities

Rose Garden Sampran Riverside, Nakorn Pathom, Thailand,

22-28 August 2010

The City Report is critical for participants, mentors, and resource persons of the workshop to discuss the knowledge status and research gaps of each participating city. It will also be the important justification for research activities that each city team will propose for financial support from international research networks on urban development and climate change over years to come.

Suggested topics to be included in the City Report are

- Current perception of climate change related risk (such as *floods, water and food supply, land losses, air quality, heat stress, disease outbreaks, etc.*) and social/economic vulnerability (such as *poverty, investment, capital and opportunity losses, social conflicts and divides, genders, justice, etc.*) in your city, e.g., how do they perceive on the differences and linkages between weather/climate risks and social/economic vulnerability?
  - among general public
  - among urban officials, city managers
- Have various climate risks to your city been assessed and/or mapped, and if so do they take into account possible effects of current and future climate changes?
- Have social/economic vulnerability to climate related risks been assessed and/or mapped, how, by whom, details?
- Have climate risks and vulnerability of the city been communicated to the public, and how?
- Is there an existing urban GIS information base that may be used for climate risk and vulnerability assessment? What is included?
- Which agencies and institutions (e.g., government, non government, business, academic, civil society, etc.) in the city have roles in risk and vulnerability assessments, communicating such assessments to the public and managing information and knowledge about climate change? Their skill level and capacities needed?
- Is there an urban master plan? When was it completed? Does the urban master plan take into account future risk to climate change?
- Have and how building codes, land use regulations, sanitation codes, etc. been enforced?
- Is there an early warning system? Evacuation or emergency response plans for various types of weather and climate related disasters? How effective are they?
- Level and effectiveness of public funding and commitment to respond to climate related risks and vulnerability?
- Governance and social justice issues, institutional, jurisdictional and social conflicts, etc. that may worsen climate related issues?

## Instructions

1. One report will be submitted by each city team and every member of the team is expected to contribute.
2. These topics are only for suggestions, each city team may identify or add other topics that they feel relevant to climate and development issues in their city.
3. We do not expect an intensive technical review of each topic but rather a general overview of the status, gaps and opportunity that may be further developed in to a research framework for each city team to carry out.
4. The total length of each city report is about 20-25 A4 pages.
5. Please identify clearly on who, among the team members, contribute to which parts of the report so that further questions/comments can be appropriately directed to that person.
6. Please submit the first draft of city report by *August 8<sup>th</sup> 2010* in electronic form to [pasita@start.or.th](mailto:pasita@start.or.th)



## Appendix 2: Abstracts submitted by City Teams

### 1. Bangkok City Report Abstract

A number of assessments have identified the coastal areas of the Bangkok Metropolitan Region (BMR) as vulnerable to the risks resulting from or associated with climate change and extreme weather events. These risks include sea-level rise, coastal erosion and flooding. These assessments were carried out under the auspices of various government ministries and bilateral and multilateral development agencies. To an extent, the climate change related vulnerabilities of the BMR are also covered in the national assessments for the whole Kingdom. As a result of these assessments, issues related to climate change were heavily discussed in the Thailand 11th National Economic and Social Development planning and various action plans were formulated to mitigate the root causes of climate change such as the Bangkok Metropolitan Administration's Global Warming Action Plan and efforts are underway to plan for adaptation to the impacts of climate induced variability and the increasing frequency of extreme weather events. Thailand's Parliament is also now debating on how to institutionalise and fund climate change adaptation activities and infrastructure.

The conduct of a pre-Copenhagen meeting in Bangkok in 2009 has substantially raised awareness on climate change. The media has covered this event and several locally based initiatives have sprung up as a result to deal with future disasters. Thus, some level of sensitisation to climate change and disasters has already been initiated in the mainstream media which built on the effects of the 2004 Boxing Day tsunami which hit Southern Thailand with devastating impact. But whether the level of awareness crystallise by these events sufficiently leads to concrete action is another thing.

GIS and maps on various coastal risks and hazards are also available with various government departments and ministries in Thailand and international development organisations based in Bangkok. The only climate change specific mapping to date for Bangkok is carried out by Panya Consultants with funding from the World Bank.

Despite all these assessments, what seems to be lacking in the BMR is the identification of the vulnerable groups so that a more proactive and differentiated intervention can be crafted. Furthermore, it appears that most assessments of the BMR's vulnerability used mapping, ranking and quantifiable indicators which tend to treat vulnerability as attributes, in other words as objects, rather than understanding the underlying social, economic, political and geographical processes underpinning climate change vulnerabilities because these approaches lack the process dimension, relied heavily on available database, limited by rigidity and subjectivity in indicator selection and weightings, and insensitivity to context-based vulnerability. Also, existing vulnerability assessments focused mainly on the physical or the climatic aspects of vulnerability and little attention is given to non-climate factors that exacerbate an individual or household's vulnerability. Finally, the scale and interdependence of climate risks and vulnerabilities with other social and economic factors are not given adequate attention in existing assessments. Places and communities which are likely to be affected by climate change and extreme weather events are treated as undifferentiated and independent.

In terms of governance, existing compartmentalised, rigid and politicised bureaucratic structure is likely to hamper effective implementation of measures to adapt to climate change and extreme weather events. For instance, the efficiency and effectiveness of existing jurisdictional and authority structure of the Bangkok Metropolitan Authority and the provinces in the BMR, represented by the Ministry of Interior, will be called into question whether this is the best way to provide for and implement a coherent and sensible climate change adaptation plan.

## 2. Ho Chi Minh City Report Abstract

Ho Chi Minh City (HCMC) is a biggest city and the largest economical, cultural and scientific center in Vietnam. Though the city accounts for 0.6% of Vietnam's total area and 8.3% of the country's total population, it has witnessed a remarkable economic growth, evidenced by GDP growth rate with more than 10% since 2000. The city faces many serious issues due to rapid development: congestion, inadequate infrastructure and housing, sprawling and uncontrolled expansion. In addition, recent environmental changes resulting from emerging global climate change continue to threaten the city. Sustainable development of the economy and urban expansion of HCMC will be significantly affected by long term consequences of climate change and environment-related factors.

A recent World Bank report showed that Vietnam is one of the top five countries affected by climate change, effects which include rising sea-level, temperature fluctuation and extreme weather phenomena. The report showed that a projected 1-meter rise in sea level would affect about 5 percent of Vietnam's land area, 11 percent of the population, 7 percent of agriculture and reduce the country's GDP by 10 percent. More importantly, HCMC is one of the top 10 southern provinces in Vietnam that will be drastically affected by a 1 meter rise in sea level. As the largest urban area in the Mekong Delta, HCMC will be inundated with 43% of its total area, and more than 660,000 people (about 12% of the City's population) will face displacement.

In-order to report city's risk to climatic threats many papers and research projects explore the current climate of the city and forecast the climatic hazards such as severe storms, storm surges, and tidal flooding. Studies show with only 40%–45% of HCMC's land at 0-1 m elevation, 15%–20% at 1–2 m elevation, and a even smaller percentile land above 4m elevation. HCMC is most vulnerable to a rise in sea level. Despite such crucial studies, there remained a lack of GIS or mapping tools for climate risk and vulnerability assessment.

In 2008, the national government responded with the National Target Program (NTP). NTP utilizes a framework generated by the Ministry of Natural Resources and Environment (MoNRE) which includes key policies for responding to climate change in the country. Accordingly, the HCMC municipality has established the Department of Natural Resources and Environment (DoNRE) as the agency responsible for studying and advising the city government to conduct activities in climate change adaptation. An Action Implementation Strategy has been recently issued on seeking prevention and mitigation measures for the city by 2020.

Unfortunately, these measures are difficult to implement within terms of the MoNRE policies. The most important issue comes from the collaboration of the urban planning sector with other sectors. Urban development of HCMC is anchored at two major plans: the Regional Plan and Master Plan which were recently approved by the government in May 2008 and Jan 2010 respectively. However, these plans have not been integrated with the predicted rise in sea level that is clearly indicated by climate change scenarios of MoNRE. They only address the current issues of urban development (land use, public works and infrastructure) that serve population growth. Climate change policy is limited to the national and city level, hereby preventing the implementation of climate change policy at the community level.

A comprehensive research study on climate change vulnerability of the city is necessary to understand which future strategies and adaptation measures need to be built up for sustainable urban development. Therefore, a socio-economic assessment of riverine communities in HCMC is proposed as a primer for assessing the vulnerability of these communities to climate change in HCMC. Two riverside communities in HCMC, Hiep Binh Chanh ward - Thu Duc district (inner urban area) and Can Gio district (coastal urban district), will be examined for the magnitude of impact of

climate change on social and economic aspects daily life. According to Vietnam National climate change scenarios, these areas will be the most vulnerable and are most at risk to a rise in sea level and coastal flooding.

### **3. Jakarta City Report Abstract**

The city of Jakarta is one of the most vulnerable cities to climate change impact. There is a general perception on the dangers of natural disasters, such as flooding, disease outbreaks, rising sea water. Whether or not they agree that climate change is occurring and increasing the frequency of these disasters is still unclear. Officials as well as the academic circle also agree on the impact of these disasters. Mitigation programs and the setting up of disasters centers among others are proof enough that there recognition that disasters are occurring more and more. The only problem is whether the cause of these disasters is man-made or due to climate change is still debated among officials and academics.

Various climate risks, mainly regarding flood in Jakarta have been assessed. However, these assessments are limited to the physical aspect of climate change impact. Risks related to the impact of climate impact on people have experienced much less attention. There are studies on the effect of flood and rising sea water. However, studies coping strategies and adaptation to these disasters are few and far between. Limited efforts are also being done to assess and map these socio-economic impacts of climate change.

The public have been informed on the climate risks and vulnerability through the mass media and seminars. The main problem is that the method of delivery as well as the target audience has not been properly addressed. As an example, campaign on the impact of climate change has not been done on those vulnerable to the risks such as the poor and other groups. The main climate risk campaign is still limited to the high government circles and academics.

The current GIS maps on Jakarta climate risk assessment do have spatial data for the physical aspect of vulnerability. The maps have not been integrated with the socio-economic aspects of vulnerability. Thus, there is an urgent need to combine physical as well as socio-economic data to construct vulnerability mapping that can provide a holistic assessment of climate change impact.

The local government has not been unaware of the implications o climate change. There are various local government bodies which are responsible for disaster management in Jakarta. There is an urban master plan that takes into account disaster scenarios such as flood and rising sea water. There are also mitigation programs as well as regulations and building codes in place. However, the real problems are enforcing these regulations on the public. Most effort has only been partly successful.

### **4. Manila City Report Abstract<sup>1</sup>**

Perception of Climate Change Related Risks. In a recent national survey<sup>2</sup>, majority of Filipinos (52 percent) had a wide knowledge of climate change, especially the big changes in climate during the past three years (62 percent). After recent climate extreme experiences like Typhoon Ondoy (Ketsana), Metro Manila residents now have a heightened sense of awareness of climate change related risks. While aware of its severe consequences on their lives, they have not been systematically oriented/educated nor have their capabilities been systematically built to respond or

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<sup>1</sup> This abstract was prepared by Emma Porio, Celine May Vicente and Antonia Y. Loyzaga with inputs from Ronald Cartagena and Megumi Muto

<sup>2</sup> Pulse Asia 2010 Survey on Climate Change.

adapt to these risks and hazards. In like manner, government agency officials and barangay officials coordinating disaster responses are very ill-equipped to respond to these hazards and risks as demonstrated during Typhoons Ondoy in September 2009.

But among city officials and managers, this high awareness/knowledge has not been translated to concrete assessments and mapping/inventory of risks and its links to social-economic vulnerability. At most, these risks have been incorporated, albeit unevenly, through poverty assessments, social services inventory for vulnerable populations, and disaster management plans of local government units. Meanwhile, uncoordinated assessments of climate change related risks (including GIS databases) have been done by research institutes (e.g., Manila Observatory), universities (University of the Philippines), government agencies (e.g., PAG-ASA or the Philippine Atmospheric Geophysical and Astronomical Services Administration, Department of Environment and Natural Resources, Metro Manila Development Authority) and a few local government units (Makati City, Marikina City) in partnership with some overseas development agencies (ODA). There has been no systematic climate-related risk assessment and mapping done but since Metro Manila consists of 17 municipalities and cities which are interconnected by the same rivers, watersheds and drainage ways, a Metro-wide risk assessment and mitigation/adaptation plan is badly needed. Meanwhile, the 2010 National Climate Change Framework need to be operationalized at city/local/provincial levels.

Information/Knowledge Management. Metro Manila Development Authority has drawn several master/development plans, with the most recent incorporated to the National Medium- Term Development Plan (2010-2014). But these plans have not systematically incorporated climate change risks and the socio-economic vulnerability of the metropolis to climate changes. PAGASA is the government agency designated to provide hazard warnings (sometimes inaccurate) which are relayed to LGUs and schools. Metro Manila's flood warning system (Effective Flood Control Operation System or EFCOS) under MMDA has not been utilized effectively as seen during Typhoon Ondoy (Ketsana). Most LGUs have disaster response teams for emergency situations but often these cannot cope when the need rises during typhoons and extreme rainfall bringing floods.

There have been some limited attempts to communicate climate risks and vulnerability to the public through radio/TV programs (e.g. Climate Change Challenge, Kalikasan-Kaunlaran). There is a dire need to develop materials for information dissemination in the popular media.

Public funding and commitment to respond to climate related risks and vulnerability has been mostly project-based and donor-driven. Thus, sustainability and progress of these initiatives are a major concern for most stakeholders.

### **5. Mumbai City Report Abstract**

Mumbai is one of the largest megacities in the world and is home to more than 13.4 million people. It is the financial capital of India with a large commercial and trading base. The city plays host to a number of industries, multinational companies and important financial institutions. It is also an important international sea port on the western coast and strategic from defense perspective. Mumbai has a large coastline, which has been reclaimed for development purposes. The geographical location of the city and its physical, economic and social characteristics make the city more vulnerable to the threats posed by climate risks, such as, sea level rises, storms, floods and coastal erosion. The most vulnerable section is the slum dwellers and squatter communities that comprise more than half of the total residents. Therefore, it is critical for the city to assess the vulnerabilities and devise adaptation and mitigation mechanism to cope with future climate risks.

Studies carried out over the past decade indicate that Mumbai is likely to be highly vulnerable to climate change with majority of its population living on the flood prone and reclaimed land.

Estimates suggest that the average annual temperatures in the city would increase by 1.75°C and 1.25°C respectively in the A2 (business as usual) and B2 (sustainability) scenario. Mumbai is also predicted to have an average annual decrease in precipitation of 2% and an increase of 2% for the A2 and B2 scenario respectively. The most damaging scenario for the city is the predicted sea-level rise of 50cm by 2050. Further, the city is ranked 2nd in terms of population exposure to future climate conditions by 2080. The city is also expected to have a high exposure to coastal flood risk in the 2070s. However, exposure will not necessarily translate into impact if effective adaptation and risk management strategies are in place. However, for a city like Mumbai with far lower standards of adaptation and risk management or flood defenses, the impacts of extreme weather events are likely to be large in future with huge costs.

In the aftermath of the unprecedented Mumbai floods of July 2005, Government of India enacted the Disaster Management Act. In Maharashtra, the state government accordingly prepared the Greater Mumbai Disaster Management Action Plan (DMAP) in 2007. Under this plan, the risks and vulnerabilities associated with floods, earthquakes, landslides, cyclones, etc., have been identified. The Plan envisages specific relief and mitigation measures in terms of infrastructure improvement, contingency plan and changes in land-use policies and planning. The Plan identifies important stakeholders, such as, various departments of the local authority, MCGM, engaged in storm water drainage systems, early warning systems and public health, police and fire brigade, NGOs and communities.

There are, however, a number of research gaps and challenges that need to be addressed for Mumbai in immediate future in order to reduce climate vulnerabilities and build city resilience. These can broadly be classified into three categories: Information, Assessment and Knowledge. There is a need to compile information regarding different climate-related risks. We further need to assess how and where different models & tools can be applied to look at changes in hazards, exposure & vulnerability. We also need to build on the fundamental knowledge about topics where there is inadequate understanding, e.g., health impacts of climate change, intra-seasonal variability in the monsoon, studies of subsidence and stability of reclaimed lands, etc. Further, the city administration and other stakeholders need specific strategies and an integrated approach to build resilience of the city to climate risks.

The proposed APN funded project titled 'Enhancing adaptation to climate change by integrating climate risk into long-term development plans and disaster management' will evaluate the immediate to medium-term post-disaster recovery and response scenario in the aftermath of flooding caused by heavy intensity precipitation in three Asian cities – Mumbai, Bangkok and Manila. In each of the three target cities, this exercise will include analysis of secondary data pertaining to the flooding events, the resultant physical, economic, environmental and social impacts, the response measures undertaken and their benefits for climate change adaptation. The comparative analysis of the three cities will bring out the policy implications for risk management, adaptation strategies, city resilience and development planning in the long run. The project further seeks to integrate post event recovery strategy with investment and development plans through stakeholder workshops that would lead to long term reduction in vulnerability and enhancement of adaptive capacity. The methodology evolved to document and analyze the impacts of flooding events and the resultant analysis will be shared with the policy makers and other stakeholders including the scientific and research community through the in-country consultation and information dissemination workshops held in the three cities to enable them to draw relevant lessons.

**Appendix 3: Tables summarizing key content extracted from City Reports, City Report Presentations, and Research Proposal Presentations**

**Two tables summarizing the current status of information/knowledge and future research proposals on climate change related risk assessments and application to urban development planning and governance in five Asian megacities**

**Table I:** Current status of information/knowledge on climate change related risk assessments and application to urban development planning and governance in five Asian megacities

**Table II:** Proposed research on climate change related risk assessments and application to urban development planning and governance in five Asian megacities

Content presented in the tables was extracted from the City Reports, City Report Presentations (Day2) (**Table I**) and the Research Proposal Presentations (Day 6) (**Table II**).

[see PDF files on enclosed CD]

## Appendix 4: Participants list

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Bangkok 10

Ho Chi Minh 4

Jakarta 4

Manila 5

Mumbai 3

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Dr. Christina Finch	Maui Hawaii	Senior Risk Assessment Analyst /Pacific Disaster Center	Email: <a href="mailto:cfinch@pdc.org">cfinch@pdc.org</a>	Socioeconomic vulnerability assessment
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Dr. Joern Birkmann	Bonn	Head/ Vulnerability Assessment, Risk Management & Adaptive Planning Section	Email: <a href="mailto:birkmann@ehs.unu.edu">birkmann@ehs.unu.edu</a>	Integrating risk and vulnerability assessment with spatial planning

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## Appendix 5: Workshop Program and Summary of Proceedings

### 5.1 Workshop Programme

**Day 1: Sunday 22 August 2010**

**Suvarnabhumi International Airport**

**Rose Garden Riverside**

08.00 – 18.00	Arrival Registration
19.00 – 21.00	Reception dinner

**Day 2: Monday 23 August 2010**

**Rose Garden Riverside**

09.00 – 09.40	<b>Opening Session</b> Workshop in the context of a longer term collaborative research activity <i>Dr. Anond Snidvongs, SEA-START Regional Center</i> <i>Dr. Roland Fuchs, East-West Center</i>
09.40 – 10.00	Tea and coffee break
10.00 – 12.10	<b>City team introduction and city report presentation</b> (15 minutes for presentation and 10 minutes for discussion) <ul style="list-style-type: none"> <li>• Bangkok</li> <li>• Ho Chi Minh</li> <li>• Jakarta</li> <li>• Manila</li> <li>• Mumbai</li> </ul>
12.10 – 13.30	Lunch
13.30 – 14.40	<b>Visioning and participatory process as a tool for developing stakeholder partnerships and strategies to deal with multiple stresses</b> [this presentation moved to Friday 27 August at 330pm] <i>Dr. Hassan Virji, International START Secretariat</i>
14.40 – 15.00	Tea and Coffee Break
15.00 – 16.00	<b>Estimation of future flood and inundation risks due to climate change at downstream regions of major rivers in Japan</b> <i>Dr. Hiromune Yokoki, Ibaraki University</i>
16.00 – 16.30	<b>Data preparation and process for estimating flood and inundation areas</b> <i>Dr. Yuji Kuwahara, Ibaraki University</i>

**Day 3: Tuesday 24 August 2010**

**Rose Garden Riverside**

08.30 – 09.00	Review of Day 2
09.00 – 10.30	<b>Risk Assessment of river flood on GIS (Practice)</b> (continued from 23 August) <i>Dr. Hiromune Yokoki, Ibaraki University</i> <i>Dr. Yuji Kuwahara, Ibaraki University</i>
10.30 – 10.50	Tea and coffee break

10.50 – 11.50	<b>Methodology to link GIS flood maps and socio-economic data: case of Metro Manila</b> <i>Dr. Megumi Muto, Research Fellow, JICA Research Institute,</i> <i>Dr. Tran Thi Viet Nga, Hanoi University of Civil Engineering</i>
11.50 – 13.00	Lunch
13.00 – 16.00	<b>Socioeconomic vulnerability assessment</b> Overview of disaster risk reduction terminology Demonstration examples of risk assessment (American Samoa, Marikina City) Focus on characteristics of vulnerability Audience participation/discussion breaks for applicability in host cities <i>Dr. Christina Finch, Pacific Disaster Center</i> <i>Dr. Stanley Goosby, Pacific Disaster Center</i> * Tea and coffee break is arranged where appropriate
16.00 – 17.00	<b>Brief summary of climate change vulnerability and adaptation of Samut Sakhon Municipal Area : Case study for field trip</b> <i>Dr. Anond Snidvongs, SEA-START Regional Center</i>

#### Day 4: Wednesday 25 August 2010

##### Fieldtrip Samut Sakhon

09.00 – 10.00	Depart Rose Garden Riverside
10.00 – 12.00	<b><u>Sight Seeing # 1</u></b> Khok Kham, Muang District, Samut Sakhon Province Visit to Eastern Mahachai Coastline Natural Resources Conservation Center and related areas
12.00 – 13.30	Lunch
13.30 – 15.00	<b><u>Sight Seeing # 2</u></b> Visit to Mahachai municipal area
15.00 – 17.00	<b><u>Sight Seeing # 3</u></b> Tha Chalom, Muang District, Samut Sakhon Province A case study of people-based involvement in coping with flooding <i>Mr. Samran Klinard, Chairman of People-based Participation</i>
17.00	Back to Rose Garden Riverside

#### Day 5: Thursday 26 August 2010

##### Rose Garden Riverside

08.30 – 09.00	Review of Day 3
09.00 – 12.00	<b>Socioeconomic vulnerability assessment</b> (continued from 24 August) <ul style="list-style-type: none"> <li>• GIS and demographic data; place-based research</li> <li>• Overview of methodology for the Social Vulnerability Index (SoVI)</li> <li>• Demonstration of SoVI examples and analysis (US County and Hurricane Katrina)</li> <li>• Audience participation/discussion breaks for applicability in host cities</li> </ul>



	<p><i>Dr. Christina Finch, Pacific Disaster Center</i>  <i>Dr. Stanley Goosby, Pacific Disaster Center</i>  * Tea and coffee break is arranged where appropriate</p>
12.00 – 13.00	Lunch
13.00 – 14.00	<p><b>Vulnerability as the entry point to link disaster risk reduction and climate change adaptation for adaptive urban governance (Part I)</b>  <i>Dr. Joern Birkmann, United Nations University Institute for Environment and Human Security</i></p>
14.00 – 14.20	Tea and coffee break
14.20 – 16.20	<p><b>Vulnerability as the entry point to link disaster risk reduction and climate change adaptation for adaptive urban governance (Part II: Exercise and development of a questionnaire and criteria for adaptive urban governance)</b>  <i>Dr. Joern Birkmann, United Nations University Institute for Environment and Human Security</i></p>

#### Day 6: Friday 27 August 2010

##### Rose Garden Riverside

08.30 – 09.00	Review of Day 5
	<p><b>APN recent global change research and capacity building activities in the Asia-Pacific region</b>  <i>Ms Perlyn Pulhin, Asia-Pacific Network for Global Change Research (APN)</i></p>
09.00 – 12.00	<p><b>Presentation: City team work plans for future research</b>  (40 minutes for presentation and 10 minutes for discussion)</p> <ul style="list-style-type: none"> <li>• Mumbai</li> <li>• Jakarta</li> <li>• Ho Chi Minh</li> </ul> <p>* Tea and coffee break is arranged where appropriate</p>
12.00 – 13.00	Lunch
13.00 – 14.40	<p><b>Presentation: City team work plans for future research (continued)</b></p> <ul style="list-style-type: none"> <li>• Manila</li> <li>• Bangkok</li> </ul>
14.40 -15.00	Tea and coffee break
15.00 – 16.00	<p><b>Closing Session</b>  <i>Dr. Anond Snidvongs, SEA-START Regional Center</i>  <i>Dr. Roland Fuchs, East-West Center</i></p>
19.00 – 21.00	Farewell dinner

#### Day 7: Saturday 28 August 2010

##### Rose Garden Riverside

##### Suvarnabhumi International Airport

09.00 – 18.00	Departure
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## 5.2 Summary of Proceedings

### Day 2

The workshop was opened by Dr. Anond Snidvongs (Southeast Asia START Regional Centre) and Dr. Roland Fuchs (East-West Centre) introducing the workshop in the context of longer-term collaborative research activities.

Dr. Fuchs delivered a presentation on the background to the Cities at Risk Initiative. The latter highlighted coastal vulnerabilities in light of global change; the Keeling Curve; social and environmental disruption from global warming; projected global temperature increases by 2100; dangerous warming consequences; strategic retreat; sinking deltas; and impact zones using Vietnam as a case study. Social vulnerability assessments were discussed, including 'what if' scenarios; assessing and monitoring social and spatial inequalities in impacts and recovery; and vulnerability of Asian coastal cities. The Cities at Risk project objective is to 'help develop capacity of Asian coastal cities to better cope with risks posed by the combined effects of sea level rise, climate change, and urban growth and development.' Key recommendations from the first Cities at Risk workshop, included:

- 1) move from conventional downscaling impact assessments to integrative socio-economic vulnerability assessments;
- 2) prioritize need for training urban planners in climate change risk and vulnerability assessment;
- 3) create urban "communities of knowledge" involving researchers, planners and urban officials.

Future activities of the Cities at Risk project were identified, including: 'locally generated research in context of international projects; research conference (CAR II Taipei 2011); publications, including policy papers.' It was noted that there were about 3000 papers on urban adaptation, and is a growing area of interest. Dr. Fuchs emphasized that through this initiative, participants have the opportunity to make a real difference to people's lives.

Dr. Snidvongs discussed the link between science and policy making, and how the workshop is a contribution to the Cities at Risk project, with APN the major sponsor of the workshop, plus the important contribution from Ibaraki University. Pre-workshop activities were also described including the establishment of City Teams; Dhaka and Shanghai teams were unable to attend on this occasion. It was noted that the City Reports are for sharing among the Cities at Risk network, and the important outcome of workshop will be a roadmap or workplan over 3, 4 or 5 years of what each team plans to accomplish.

Dr. Hassan Virji (Director, International START Secretariat) discussed future research opportunities including the IDRC/Canadian Research Council proposal, noting that there were 12 proposals and that six will be selected. The study will focus on four cities - Bangkok, Manila, Lagos, and Vancouver.

The remaining sessions of the day focused on City Team presentations of their City Reports (refer to the section 3 in this report for outputs from the City Team presentations), and commencement of the GIS session by Dr. Hiromune Yokoki (Ibaraki University). Dr. Yokoki's presentation (*Estimation of future flood and inundation risks due to climate change at downstream regions of major rivers in Japan*) was divided into two parts, the first describing flood and inundation simulation, covering the concept and method, examples (Chikugo river), and indexes of risk; and the second giving examples of hazard maps. It was noted in the discussion that all households in Japan receive copies of hazard maps.

The presentation by Dr. Hassan Virji on *Visioning and participatory process: Developing stakeholder partnerships and strategies* was moved to Day 6 at 330pm.

### Day 3

Day 3 continued with the GIS theme that commenced the previous afternoon, with the practical session - *Data preparation and process for estimating flood and inundation areas*. Each City Team worked separately on their own workstation using ESRI ArcGIS, led through the practical session by Dr. Yuji Kuwahara from Ibaraki University. The aim of the session was for the participants to gain an insight into the technical aspects of estimating flood and inundation areas using GIS. The process comprised four major steps including sourcing data (pre-downloaded for participants), pre-processing of input data, flood simulation, and overlaying data. Useful sources of data included: GTOPO30 – digital elevation data – 1km resolution; ASTER GDEM – 30m resolution; SRTM 90m Digital Elevation data; GLCF; www.maproom – roads, boundary data – but 20 years old; iscgm.org – to download elevation, land use, vegetation, boundary, elevation – 1km resolution.

The next step of linking flood maps to socio-economic data was presented by Dr. Megumi Muto, Research Fellow, JICA Research Institute (*JICA-WB-ADB Joint Study: Climate Risks and Adaptation in Asian Coastal Mega-Cities (The Case of Metro Manila)*), and Dr. Tran Thi Viet Nga, Hanoi University of Civil Engineering (*Infected Risk Assessment with Exposure to Pathogens in the Flood Water Case of City of Manila*). The conclusions and future directions of work summarized from Dr. Muto's presentation:

costs of damage will be substantial in Asian coastal megacities; urban plans and flood protection infrastructure need to take climate risks into consideration; need to address other non-climate factors such as improved management of canals and drains; and the potential cross-fertilization with disaster risk reduction community.

The way forward for future research was noted by Dr. Tran as requiring comprehensive investigations into human behavior during flooding episodes, inundation water quality, and the natural and socio-economic status of the area.

In the afternoon, the workshop moved into the topic of social vulnerability assessment, with presentations from Dr. Stanley Goosby and Dr. Christina Finch from the Pacific Disaster Center. The session provided an overview of disaster risk reduction terminology, demonstration examples of risk assessment, characteristics of vulnerability, and with opportunities for participants to address issues to their home cities. Participant outputs from the training session components on city hazards and vulnerabilities are presented in Tables 1 and 2 as follows.

Bangkok	HCMC	Jakarta	Manila	Mumbai
Flooding	Flooding (duration and frequency) - diseases (water-related) - damage/asset loss	Flood	Extreme rainfall (severe flooding)	Flooding due to heavy precipitation
Coastal erosion	High tidal surge	Inundation	Intense typhoons (severe flooding)	Landslides

Bangkok	HCMC	Jakarta	Manila	Mumbai
Land subsidence	Land subsidence	Landslide	Earthquakes	Sea level rise
Salt intrusion		Disease outbreak (dengue, diarrhea)	Subsidence/ landslides	Storm surges /cyclones
Excessive groundwater withdrawal		Pollution	Sea level rise	Earthquake
Storm surge		Twister	Storm surges	
Rise of temperature (heat island and heat wave)		Earthquake		

TABLE 1. HAZARDS AS IDENTIFIED BY CITY TEAMS DURING DAY 3 TRAINING SESSION.

<b>Bangkok</b>	<ul style="list-style-type: none"> <li>• Discussion focused on healthcare</li> </ul>
<b>HCMC</b>	<ul style="list-style-type: none"> <li>• Infrastructure (transport/road, drainage, water supply, public facilities)</li> <li>• Production (agricultural practices, industry, aquaculture, services (tourism, trading))</li> <li>• Health (outbreak diseases, infectious disease)</li> <li>• Social impacts</li> </ul>
<b>Jakarta</b>	<ul style="list-style-type: none"> <li>• Poverty</li> <li>• Elderly</li> <li>• Weak governance (capacity building, corruption, limited information)</li> <li>• Low level land</li> <li>• Lack of enforcement</li> <li>• Lack of budget</li> <li>• Lack of awareness</li> </ul>
<b>Manila</b>	<ul style="list-style-type: none"> <li>• High incidence of poor people living in hazard-prone areas</li> <li>• High population density (exposure)</li> <li>• High number of poor people without access to basic services</li> <li>• Sub-standard buildings and infrastructure due to weak implementation of regulations</li> <li>• Haphazard zoning / land use plans and implementation</li> </ul>
<b>Mumbai</b>	<ul style="list-style-type: none"> <li>• Physical (reclamation, low lying, congestion, poor drainage)</li> <li>• Economic and social (high population density, informal sector, land use pattern, access to resources, poverty)</li> </ul>

TABLE 2. VULNERABILITIES AS IDENTIFIED BY CITY TEAMS DURING DAY 3 TRAINING SESSION

## Day 4

A field trip to Samut Sakhon Province was organised for Day 4, to see at first hand issues faced by the local communities to potential future climate risks. In the morning, participants visited the Marine and Coastal Resources Research Center (under the Department of Marine and Coastal Resources), where an extensive area of mangroves has been planted for coastal protection (see photos below), and in the afternoon Tha Chalom, Muang District, to understand the impact of flooding on the local urban population. Dr. Snidvongs led the field trip, providing an account of vulnerability and adaptation for the Samut Sakhon area and giving participants the opportunity to meet with community leaders at each site: Mr. Vorapol Doundlomchan from the the Khok-Kham community (Photo 2), and Mr. Sumran Klinard, the previous Tha Chalom community leader (Photo 6, next page).



PHOTO 1: MARINE AND COASTAL RESOURCES RESEARCH CENTER (SAMUT SAKHON)



PHOTO 2: DR. ANOND SNIDVONGS AND MR. VORAPOL DOUNDLOMCHAN FROM THE THE KHOK-KHAM COMMUNITY



PHOTO 3: MANGROVE COASTAL PROTECTION AT THE MARINE AND COASTAL RESOURCES RESEARCH CENTRE (SAMUT SAKHON)



PHOTO 4: LOCAL COMMUNITY AREA REGULARLY IMPACTED BY FLOODING (SAMUT SAKHON)



PHOTO 5: MR. VORAPOL DOUNDLOMCHAN TALKING TO THE WORKSHOP PARTICIPANTS



PHOTO 6: DR. ANOND SNIDVONGS AND MR. SUMRAN KLINARD (THE PREVIOUS THA CHALOM COMMUNITY LEADER)

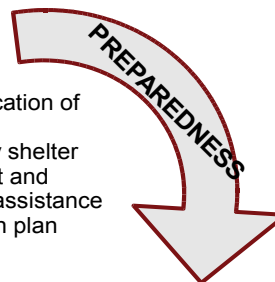
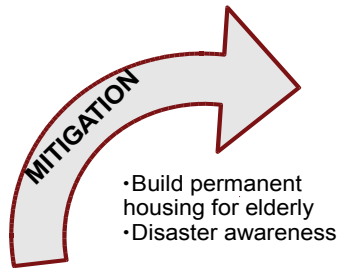
## Day 5

Day 5 continued with the social vulnerability assessment led by Dr. Goosby and Dr. Finch, focusing on GIS and demographic data, an overview of the Social Vulnerability Index (SoVI), demonstration of SoVI examples, and with opportunities for audience participation. During this session, emergency management cycles were drafted by the City Teams as illustrated below.

Emergency management cycles

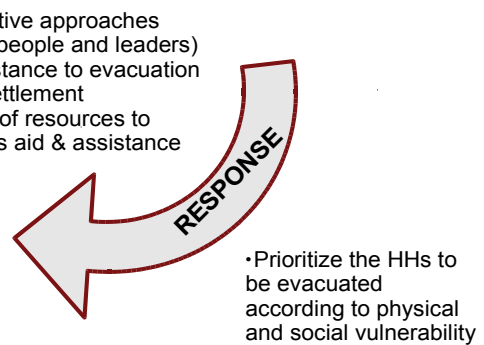
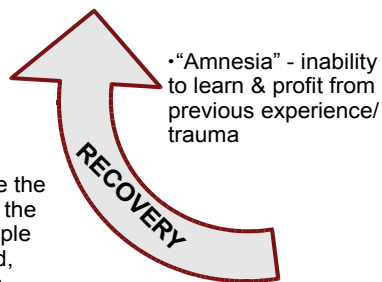
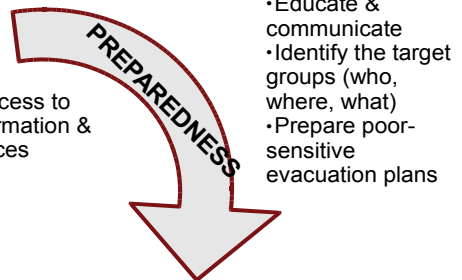
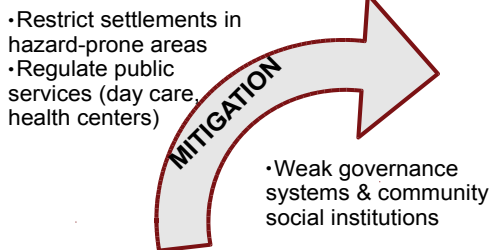
**JAKARTA TEAM**

**AGE (ELDERLY)**

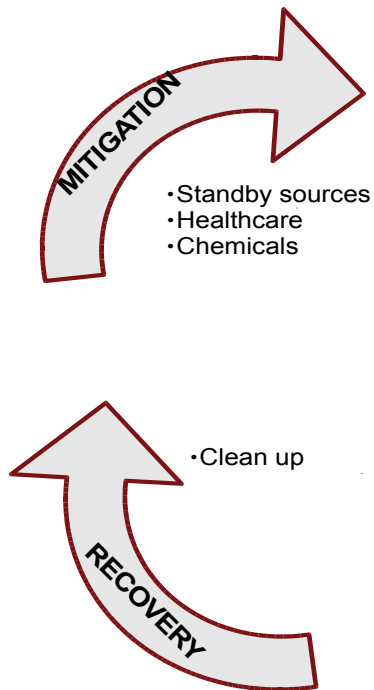


**MANILA TEAM**

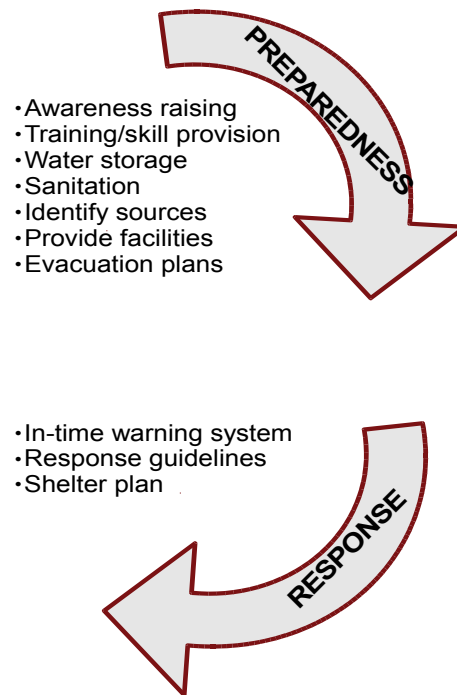
**POVERTY**



## HCMC TEAM



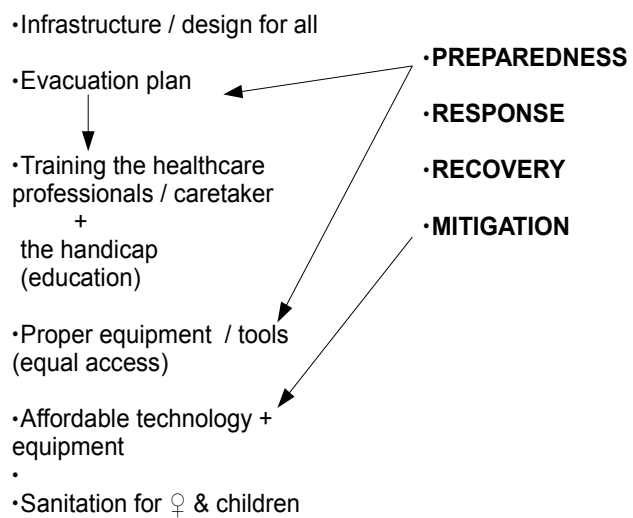
## EDUCATION - FLOODING



## BANGKOK TEAM

- Handicap
- ♀ health
- Intellectual disability (information access)
- Access to healthcare
- Specialised recovery plan
- Re-construction (design for all)
- Job security + income
- Increase capacity of social institution (temples, schools)

## HEALTHCARE (physical, mental disability)





In the afternoon of Day 5, Dr. Joern Birkmann, from the United Nations University Institute for Environment and Human Security, gave a presentation on *Vulnerability assessment as the entry point to link disaster risk reduction and climate change adaptation for adaptive urban governance*, which included examples from the north (London) and south (Vietnam). The challenges for adaptive urban governance were summarized as the scale-dimension, normative-dimension, knowledge-dimension, and access-dimension. Subsequently, group work was assigned to participants to develop a questionnaire and criteria for adaptive urban governance. The detailed outputs from the City Teams are summarized as follows.

### **Ho Chi Minh City Team**

#### *1. Adaptation goals*

Developing feasible strategies and adaptive capacity for minimizing CC impacts.

#### *2. Measures*

- a) Define visions and objectives for adapting with CC
- b) Identify major risks/vulnerability
- c) Classify/categorize structural and non-structural measures of adaptation strategy.
- d) Enhance HMR and governance system (decision-making process)

#### *3. Evaluate*

- a) Adaptation strategies
  - multi-sector policies
  - multi-sector cooperation
  - participatory approach
- b) Adaptation measures
  - feasibility of eco-socio
  - technical feasibility
  - effective reductions in damages/vulnerability

#### *4. Questionnaire / criteria*

- accountability
- transparency
- decentralize
- effectiveness
- participatory approach system

### **Jakarta**

Questionnaire

Goals:

1. To reduce flooding areas
2. To reduce victims

Measures

- 1.1 Flood canals
- 1.2 Polder (embankment)
- 1.3 Dykes + sea wall
- 1.4 Mangrove conservation
- 1.5 Public education (i.e., waste disposal)
- 1.6 Upper stream reforestation
- 1.7 Increasing green area

- 2.1 Early warning system
- 2.2 Evacuation plan
- 2.3 Improvement of public awareness (CSO, NGO)(i.e., learning center)
- 2.4 Preparing rescue equipment
- 2.5 Zoning regulation enforcement
- 2.6 Building code enforcement

Key performance indicators

- 1. Decreased flooding areas gradually
- 2. Reduced number of victims significantly

Q1.1 Size of flood canals?

Area of coverage?

Operation and maintenance?

Q1.2 Number and location of polder?

Area of coverage?

O & M

Q1.3 Who are target group?

Methods of education?

### **Manila**

Target: Decision-makers in MMDA and LGUs

MMDA: Metro-Manila Development Authority

LGU: Local Government Units

- 1. What are the major hazards/extreme events that you experience?  
Climate/weather-related (e.g., extreme rainfall)  
Geophysical (e.g., floods)
- 2. What are your adaptation goals
- 3. What have been the impacts of adaptation strategies to the cities (e.g., flood management in Kamanava)
- 4. What are the challenges and barriers to adaptation in the respective cities (e.g., institutional, political, economic, social, cultural)?
- 5. What are the existing and accessible data baselines/benchmarks for decision-making and monitoring?
- 6. What is the decision-support system?

### **Mumbai**

*Questions for local government/admins:*

- 1. Is Mumbai vulnerable to regular extreme weather events of flooding due to heavy precipitation and how frequent would such events potentially be/ occur (readiness/ awareness)
- 2. If yes, has vulnerability / risk mapping been done for the city?
- 3. Are the potential vulnerabilities/risks articulated in an action plan?
- 4. What are the potential physical/social/eco vulnerabilities?
- 5. Are these communicated to the local admin depts?
- 6. Who is responsible for undertaking rescue/recovery operations?
- 7. Have the roles of different stakeholders been closely identified? If so, what are their roles?
- 8. What are the coping/adaptation strategies proposed/implemented by the local administration
- 9. Are these strategies regularly reviewed and does any feedback mechanism exist for evaluation/ revision?

10. How are stakeholders, particularly NGOs, community organisations and common people involved in formulation / revision of adaptation strategies.
11. Are the strategies focused on the city alone or due consideration is given to the urban, peri-urban areas surrounding the city?
12. Is there any exchange of information or participation of the local authorities in surrounding areas to formulate mitigation/adaptation strategies.
13. Is adaptation mainstreamed into development plan for the city? What is the time horizon of such a plan?
14. How are the strategies or the development plan inclusive of such strategies dealing with the most vulnerable/marginalized communities (slum dwellers/squatter communities).

*Questions to the community:*

1. What is your perception of vulnerabilities to weather events?
2. Which vulnerabilities can you identify in terms of physical location, built environment, livelihoods and health?
3. How have you coped in the past?
4. Outline your coping/adaptation strategies (local knowledge)
5. How would you perceive your relationship with local admin/elected representative?
6. Have you received timely help in the past? (rescue, relief, rehabilitation and developmental support)
7. What are the major vulnerabilities (eco and social) faced by your community which affect your coping strengths?
8. What kind of support (monetary/non-monetary) do you expect from your local administration to help you cope better?

**Bangkok**

FLOODING (→ SLR – Coastal community)

Protect:

1. Lives
2. Infrastructure
3. Livelihood
4. Cultural identity

Measures:		
Policy	Physical	Social
Evacuation and recovery plan Building codes Land use planning Early warning system	Dykes Canals Mangroves Sand saudades Sea walls Retentions Drainage system	Public awareness Relocation Re-settlement Strengthen community institutions

*How to measure?*

Define risks

Measure the impacts of the measures?

## Day 6

Day 6 commenced with the presentation by Ms Perlyn Pulhin, from the Asia-Pacific Network for Global Change Research (APN), describing APN's global change research and capacity building activities in the Asia-Pacific region. An account of APN's history, membership, and major activities (ARCP, CAPaBLE, Science-policy linkages) were given. Types of activities eligible for ARCP funding includes new research addressing key knowledge gaps, synthesis/analysis of existing research, and generation of policy products (e.g., climate models, impact assessments). CAPaBLE funding supports activities addressing capacity development, scientific policy, raising awareness, and dissemination activities. APN supported projects under the *Scientific Capacity Building for Impact and Vulnerability Assessments* programme includes the initiative supporting this workshop - *Cities at Risk - Developing Adaptive Capacity for Climate Change in Asia's Coastal Mega Cities* .

Subsequently, City Teams gave presentations on their plans for future research. Key outputs from this section are presented in section 3 and Table II in Appendix 3.

In the afternoon, a presentation on *Visioning and participatory process* was given by Dr. Hassan Virji. Sustainable adaptation and the Bangkok visioning exercise were discussed, highlighting outcomes including a 'mobilized and active civil society process in Bangkok led by the Bangkok Forum' and 11 city representatives (from Manila, Hanoi and Bangkok) trained as knowledge facilitators. The IDRC/Research Council (Canada) proposal was also discussed, identifying key issues including investigating CC drivers and development context; action research effort; resilience focus; and the three track approach – visioning-development, resilience framework, and strategic partnering context.

The latter proposal was further elaborated by Dr. Gordon McBean (Director/ Policy Studies, Institute for Catastrophic Loss Reduction, Departments of Geography and Political Science, Social Sciences Centre, University of Western Ontario). The proposed project - *Coastal Cities at Risk (CCaR): Building Adaptive Capacity for Managing Climate Change in Coastal Megacities* - is a five year project with the overall objective 'to develop the knowledge base and enhance the capacity of mega-cities to successfully adapt to and when necessary cope with risks posed by the effects of climate change, including sea level rise, in the context of urban growth and development.' Four cities were selected for the study - Bangkok, Lagos, Manila and Vancouver – with opportunities for other cities to participate at workshops. Key research themes include: 'characterization of vulnerability and risk; characterization of hazards; understanding decision making; city system dynamics risk simulator; response strategies leading to knowledge-based actions; knowledge transfer and capacity building.' The decision on project approval will be made in January 2011, with April 2011 the likely start date.

### **Closing Session**

Dr. Snidvongs and Dr. Fuchs thanked the participants, presenters, sponsors and staff for making this such a successful workshop. Dr. Fuchs reiterated how the participants of the Cities at Risk programme could really make a difference with regard to improving the management of climate change impact, highlighting the limited work in this urban field and future research opportunities such as the substantial project supported by the IDRC/Canadian Research Tri-Councils.



Participants of Cities at Risk Workshop, Nakhon Pathom, 22-28 August 2010

## Appendix 6: City Reports

[see PDF files on enclosed CD]

### **Bangkok City Report**

Hutanuwatr K (2010) A Preliminary Review on Frameworks for Thai Climate Risk and Approaches in Social/ Economic Vulnerability Assessment in Bangkok.

Yila JO (2010) Gender Perspective on Climate Change Risk and Vulnerability.

Salamanca A (2010) Climate Change and Migration.

Marome WA, Suwanarit A, Tiampayothorn R, Chenvidyakarn T (2010) Urban Development Perspective on Climate Change Risk and Vulnerability: Landscape Urbanism, Landuse Plan and Informality Economy and Settlement.

### **HCMC Report**

Vo Le Phu, Le Anh Duc, Dang Van Khoa, Lam Vu Thanh Noi (2010) Climate Change Vulnerability Assessment and Urban Development Planning in Ho Chi Minh City, Vietnam.

### **Jakarta City Team**

Surbakti IM, Idroes IC, Simarmata HA, Firman T (2010) Jakarta City Report. Information related to Climate Change in Jakarta City.

### **Manila City Report**

Porio E, Loyzaga AY, Vicente C, Perez R, Narisma G, Olaguer D, Muto M, Cartagena R (2010) Climate Change Related Risks and Adaptation Potential in Metro Manila.

### **Mumbai City Report**

Patankar A, Patwardhan A, Andharia J, Lakhani V (2010) Mumbai City Report.

## **Appendix 7: City Report Presentations**

**[see PDF files on enclosed CD]**

## **Appendix 8: City Research Proposal Presentations**

**[see PDF files on enclosed CD]**



### **Appendix 9: Funding sources outside the APN**

Contribution from Ibaraki University:	5,000 USD
Funding from APN:	45,000 USD
<u>Total support:</u>	<u>50,000 USD</u>

## Appendix 10: Glossary of Terms

- ADB:** Asian Development Bank
- APN:** Asia-Pacific Network for Global Change Research
- BMA:** Bangkok Metropolitan Administration
- BMR:** Bangkok Metropolitan Region
- CAPaBLE:** Scientific Capacity Building and Enhancement for Sustainable Development in Developing Countries programme (APN)
- CAR II:** Cities at Risk workshop II
- CC:** Climate Change
- EWC:** East West Center
- GIS:** Geographic Information System
- HCMC:** Ho Chi Minh City
- IPCC:** Intergovernmental Panel on Climate Change
- JICA:** Japan International Cooperation Agency
- LGUs:** Local Government Units (Manila)
- LIDAR:** Light Detection and Ranging
- MMDA:** Metro-Manila Development Authority
- NDCC:** National Disaster Coordinating Council (Philippines)
- OECD:** Organisation for Economic Co-operation and Development
- SEA START RC:** Southeast Asia START Regional Center
- SLR:** Sea level rise
- START:** global change SysTem for Analysis, Research and Training