Second Flood Risk Management and Urban Resilience Workshop

MANAGING THE RISKS OF DISASTERS IN EAST ASIA AND THE PACIFIC

May 28 – 29, 2013
Seoul, Republic of Korea
WORKSHOP PROCEEDINGS

THE WORLD BANK

GFDRR
Global Facility for Disaster Reduction and Recovery

The International Bank for Reconstruction and Development
The World Bank Group 1818 H Street, NW Washington, DC 20433, USA
June 2013

Design: miki@ultradesigns.com

Photo by Thinkstock.com

Contents

List of Figures

List of Boxes

Acronyms and Abbreviations

BCP	business continuity planning
CCA	climate change adaptation
CDD	community-driven development
DMH	Department of Meteorology and Hydrology
DRM	disaster risk management
DRR	disaster risk reduction
DRRM	disaster risk reduction and management
EWS	early warning system
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	geographic information system
GIZ	German Society for International Cooperation
JICA	Japan International Cooperation Agency
KOICA	Korean International Cooperation Agency
LFEWS	Local Flood Early Warning System
LSM	Land Surface Model
NCEP	National Community Empowerment Program
NEDA	National Economic Development Authority
NEMA	National Emergency Management Agency
NGO	non-governmental organization
NOAH	Nationwide Operational Assessment of Hazards
OSM	OpenStreetMap

Acknowledgements

This report summarizes the presentations and discussions that took place as part of the Second Flood Risk Management and Urban Resilience Workshop in Seoul, Republic of Korea, in May 2013.

The workshop was organized by the Disaster Risk Management team of the East Asia and Pacific region of the World Bank, with support from the Global Facility for Disaster Reduction and Recovery (GFDRR) and the government of Korea. The team is grateful for their generous support.

The task team, led by Eiko Wataya, Dillip Bhanja, Demilour Ignacio, and Zuzana Stanton-Geddes, would like to thank Abhas Jha, Lester Dally, Prashant, and Shyam KC for their guidance and support.

The report was compiled by Eiko Wataya and Zuzana Stanton-Geddes, based on notes from Tasnuva Khan and M. H. Ullah and on inputs from Chusit Apirumanekul, Dillip Bhanja and Demilour Ignacio. Anne Himmelfarb edited the report. The graphic design was carried out by Miki Fernandez, Ultradesigns.

The graphics (figures and photographs) included in these proceedings are taken from the various workshop presentations in original format. For further reproduction, please contact indicated source.

Workshop proceedings and individual presentations are available through the GFDRR website: https://www.gfdrr.org/secondfloodriskevent.

Photo by Thinkstock.com

SUMMARY

Building on a workshop held in Jakarta, Indonesia, in 2012, policy makers from eight East Asian countries reunited on May 28–29, 2013, in Seoul, Republic of Korea, at the Second Flood Risk Management and Urban Resilience Workshop. The workshop was attended by over 70 policy makers from China, Indonesia, Korea, Lao People's Democratic Republic, Mongolia, the Philippines, Sri Lanka, and Vietnam, along with international experts from the field of urban flood risk management and representatives from partner and donor organizations. It successfully facilitated regional knowledge transfer and fostered a multistakeholder community of practice on urban flood risk management.

The two-day workshop, organized by the World Bank with support from the government of Korea through the National Emergency Management Agency (NEMA) and the Global Facility for Disaster Reduction and Recovery (GFDRR), was part of an ongoing collaboration to strengthen cooperation and facilitate international partnerships for disaster risk reduction (DRR) and climate change adaptation (CCA). The workshop was undertaken as part of a comprehensive joint program implementation of sub-regional projects in Asia, with the support of Korea and the World Bank/GFDRR. The program implementation is being carried out in 15 countries and includes three sub-regional projects, which focus on glacial lake outburst floods in the Himalayan region, typhoons in the Pacific, and flooding and building resilience in East Asia.

Through case studies and project examples, the workshop participants shared their experiences in balancing structural and non-structural measures designed to better manage existing and future flood risks facing fast-growing Asian cities. The focus was on information collection and sharing, community-based risk management approaches, and effective early warning systems (EWS). Each country drew on its own situation to offer views on and approaches to disaster prevention; each country was also able to learn from the others. Participants were especially interested in environmentally friendly methods that both cost relatively little and contribute to long-term flood prevention. They agreed that key factors in reducing risk are the involvement of local populations and sufficient funding; the latter is a particular issue for developing countries, which often lack a budget for disaster risk reduction.

Policy makers participating in the workshop had a chance to visit NEMA's Central Control Center and the Climate Change Adaptation and Disaster Risk Reduction Exhibition (CADRE 2013), where they learned about innovative and high-technology approaches to flood control and disaster prevention that could be adapted for their own countries. At the control center, they saw both how NEMA as an institution is organized and managed, and how training for disaster prevention can be conducted. The example of Korea, a country that underwent the development process very rapidly and is now an innovator in disaster prevention, was instructive.

According to evaluation forms, participants appreciated the workshop as a venue for facilitating South-South knowledge exchange and peer learning. They also saw it as an opportunity to build a common understanding on key issues related to preparedness, strengthen their technical knowledge, and improve their understanding of regional and country-specific issues. The participants agreed on a new pilot initiative to promote continuous knowledge exchange and to encourage ongoing discussions of issues raised at the workshop, via a virtual platform to be coordinated by international experts. They hope to stay connected to one another and to give updates on the progress of their initiatives—including instances of failure—so that countries can take necessary steps to prevent failures of their own. They also plan to explore opportunities to share disaster data with neighboring countries to aid them in forecasting and issuing early warnings.

OPENING AND WELCOME REMARKS

Lester Dally, Special Representative for Korea, World Bank

Photo: World Bank

- The World Bank has had a cooperative relationship with Korea for many years. Efforts are now being made to establish a World Bank office here, in part because Korea's expertise is so wide-ranging.
- This workshop is the second in a series held in the region; the last one, in Jakarta, was very successful. Experts are here from different parts of the world, including China, Indonesia, Lao PDR, Mongolia, the Philippines, Sri Lanka, and Vietnam, as well as Korea, to discuss and share knowledge about how to deal with flood risk management and urban resilience. High-level government experts on disaster risk management from Korea's NEMA are present, as are Vice President Jo and Dr. Jeong, the president of the Korean Society for Hazard Mitigation. We very much appreciate that Minister Singson from the Philippines is also here.
- It is well known that Asia is a disaster "hot spot"; annually, some 60 percent of all disasters occur in this region. Disasters not only erode countries' development initiatives, they also affect the lives and livelihoods of millions of people. There must therefore be a concerted and coordinated effort by departments and ministries in all sectors to make sure that ongoing development initiatives include disaster risk mitigation and management.
- The Korean government was recently forced to handle a flood in Seoul, and it is prepared to share with participants its knowledge and experience in disaster risk management (DRM). Korea uses world-class technology and advanced methods for reducing disaster risks, and there are obviously great benefits to sharing this knowledge, technology, and good practice with countries within as well as outside of the region through South-South cooperation.
- In this context, the World Bank has been working very closely with NEMA and relevant ministries and agencies to leverage this knowledge and technology. The World Bank has had a partnership with NEMA since 2011, and it is committed to moving this partnership forward and taking Korea as a model for disaster risk mitigation in the region.
- The World Bank is thankful to Mr. Jo for hosting and supporting this event. Korea is a country with a great deal of expertise in the area of DRM, and the workshop provides an important opportunity for countries to learn from Korea.

Jo Sung Wan, Vice Administrator, NEMA, Korea

Photo: World Bank

- Climate change presents countries with unprecedented challenges, as they cope with the serious threats brought about by inadequate infrastructure and planning, increased frequency of floods and typhoons, and rising sea levels. The August 2012 flooding that paralyzed cities in the Philippines and caused not only economic losses but loss of life is an example of the kind of events associated with climate change. Unfortunately, the intensity and frequency of floods are expected to increase because of climate change.

- NEMA was established in June 2004 as the first dedicated DRM government authority in Korea. As part of its mandate, NEMA is also responsible for assessing Korea's approach to flood prevention and response. It has designed an active and participatory response system based more on prevention and preparedness than on a traditional disaster response approach. This preemptive approach has reduced the loss of human life and property. By sharing its knowledge and experience, NEMA hopes to strengthen international cooperation in Asia and around the world to prevent catastrophic disaster impacts and to manage flood risks in a comprehensive way.

OPENING AND WELCOME REMARKS

Prashant, Team Leader, Strategy and Partnerships, GFDRR/ World Bank

Photo: World Bank

- Both Mr. Dally and Mr. Jo Sung Wan already highlighted the urgency for holistic DRM in Asia, where 60 percent of the world's disasters occur. Globally, 75 percent of disasters are related to climate, and 75 percent of damages and loses are related to natural disasters. We unite here in seeking effective and proactive disaster and climate risk management.

- The Global Facility for Disaster Reduction and Recovery, managed by the World Bank, supports country governments through technical assistance and capacity building. Currently, GFDRR members include 43 countries and eight international organizations, including the United Nations International Strategy for Disaster Reduction (UNISDR). Most workshop participants here are partners of the World Bank.

- The World Bank's fruitful and mutually satisfying partnership with Korea began in 2010, when the Bank engaged with Korea in sponsoring a conference on DRM. Since then the World Bank has benefited enormously from Korea's cutting-edge technical expertise and knowledge, as well as its desire to share that expertise and knowledge with developing countries. In addition to engaging with NEMA, which is the World Bank's main counterpart for DRM in Korea, the World Bank has also engaged with the Korean International Cooperation Agency (KOICA), the Ministry of Strategy and Finance, and the Korea Meteorological Administration (KMA).

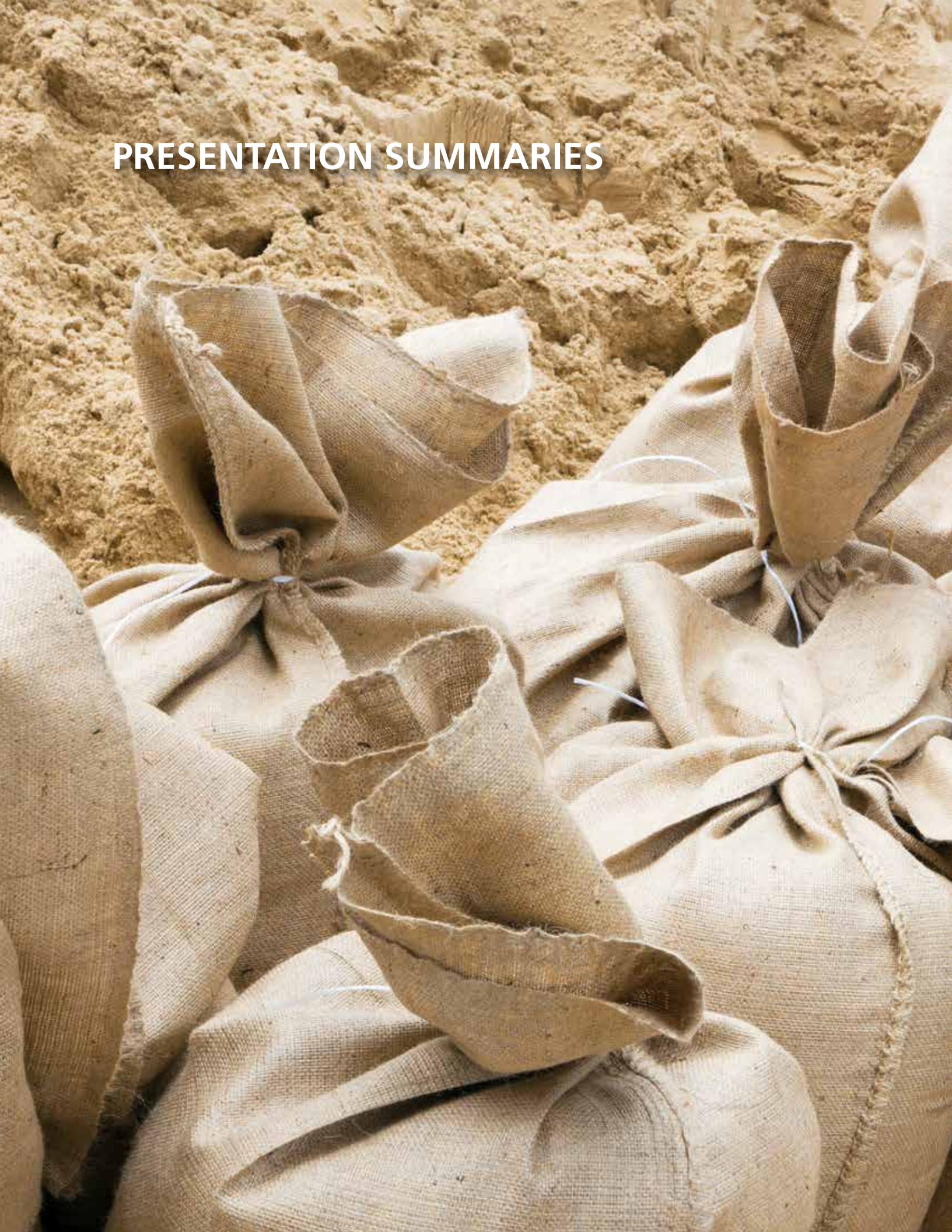
- The World Bank should make three things clear in its work with governments: First, DRM, including flood risk management, is about development and development planning, not about disasters. Second, flooding affects developing countries much more than it affects others. Third, most of the losses and damages caused by disasters are preventable; policies for risk reduction and for disaster prevention and preparedness can counter what we call "natural" disasters. These are the basic messages that will be delivered during this workshop, as participants describe technological, structural, and non-structural approaches to DRM, which lies at the heart of sustainable development planning.

Sangman Jeong, President, Korean Society of Hazard Mitigation

Photo: World Bank

- The Korean Society of Hazard Mitigation, which is one of the key actors on DRM in Korea, commends the World Bank and NEMA for organizing this event dedicated to this very important issue.
- Disasters are a common concern, and we must prepare to ensure quick response and recovery in the aftermath of a disaster. Preparing for disasters, countries must ensure links with their national development plans, and those of the region.
- Abnormal weather patterns are increasing and are capable of causing previously unimaginable destruction. The damages and economic losses caused by disasters constitute a major obstacle for development at the global level, not just for specific countries affected by disasters. It is undisputable that DRM plays a vital role in poverty alleviation and efforts to promote sustainable growth.
- NEMA's approach to DRM emphasizes ex ante management and resilient recovery. Preventive management helps to create a safer, more disaster-resilient environment. Sharing of knowledge and information technology is crucial for helping countries to devise an effective DRM agenda. International experts attending this conference can help us improve our national DRM and demonstrate new and innovative ways of dealing with disasters.

PRESENTATION SUMMARIES



Session I

Balancing Structural and Non-structural Measures in Flood Risk Management: An Overview

Moderator: **Dr. Chusit Apirumanekul, Asian Disaster Preparedness Center, Thailand**

Speakers:

Mr. Kees Bons, Flood Risk Management Specialist, Deltares, Indonesia

Dr. Ho Long Phi, Center of Water Management and Climate Change, Ho Chi Minh City, Vietnam

Dr. Hitoshi Baba, Senior Advisor, Japan International Cooperation Agency

Key Points

- Urban flooding risks can be addressed through a combination of structural and non-structural adaptation measures. These measures have to take into account socioeconomic and environmental factors along with hazard exposure and vulnerability.
- Every flood risk scenario is different, and there is no single flood risk management blueprint. Acknowledging local conditions, every country has to consider multiple scenarios to ensure effective DRM and CCA.
- Conventional or engineered approaches may not be flexible enough to cope with climate and disaster uncertainty. Non-engineered solutions can prove cost-effective with benefits for community livelihoods and sustainable resource management. In their interventions, policy makers can focus on strengthening four key capacities: threshold capacity, coping capacity, recovery capacity, and adaptive capacity of systems and communities.
- While it is challenging, it is important for countries and the international development community to prioritize risk reduction and incorporate it into planning processes. Involvement of the private sector, academia, and civil society in risk reduction can greatly contribute to effective DRM and CCA.
- A shift from a deterministic to a probabilistic approach to estimating flood risk is needed, given that sudden flooding may occur in areas that had no history of flooding.
- Given residual risk of flooding, emergency management, disaster forecasting and early warning systems, are needed to decrease disaster impacts and ensure quick disaster response and reconstruction.

1. Comparing Structural and Non-structural Measures

Mr. Kees Bons, Flood Risk Management Specialist, Deltares

Photo: World Bank

The causes of urban flooding vary. Unplanned or badly planned urban expansion, in both developing and developed countries, contributes to flooding, as do neglect of water management (ineffective operation and maintenance of flood defenses, pumping stations, and drains) and loss of natural flood defenses (for example, mangroves). Cities are now facing the consequences of this mismanagement, which are being exacerbated by climate change.

In making decisions on appropriate urban flood risk management, policy makers can benefit from the guidance provided by the World Bank report *Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century* (box 1). One of the key messages is that integrated flood risk management relies on a combination of structural adaptation measures and non-structural adaptation measures. Structural or "hard" measures involve construction of permanent facilities (such as dikes) to reduce the risk of damage, while non-structural or "soft" measures involve changes in stakeholders' behavior, usually through capacity building, active learning, and engagement between stakeholders. While structural measures often require national/federal funding, non-structural measures often rely on local and community investments.

To reduce flood vulnerability, policy makers can focus on strengthening four key capacities: *threshold capacity, coping capacity, recovery capacity, and adaptive capacity*.[1] Threshold capacity deals primarily with water-robust infrastructure, enlarged seasonal storage, floor levels, etc. Coping capacity is about drainage systems, wet proofing of vulnerable buildings, and use of paving and grassing materials. Recovery capacity focuses on redundant pumping capacity, cleaning and drying times, and water supply capacity in extremely dry periods. Adaptive capacity deals with temporary infrastructure, adaptive management, water-based spatial planning, and water and urban planning policies.

A traditional approach relies on engineered solutions to strengthen threshold capacity. This approach neglects non-structural measures and can increase vulnerability to other hazards (e.g., pluvial flooding, land subsidence, drought, heat, etc.). It also shows poor effectiveness in extreme conditions and limited adaptability to changing conditions. Moreover, engineered solutions can be expensive, can transfer risk downstream, often have undesirable side effects on the natural and built environment, and when they fail, they often fail dramatically. Structural measures are effective only if people are risk aware, prepared, and trained; if land use and construction are regulated; and if governments keep relevant legislation and rules for preparedness up to date. Non-engineered measures are better equipped to meet the goal of adaptive management and to reflect changing climate or built conditions. They can for example seek to improve contingency planning, legislation, risk insurance, and financing, as well as raise public awareness of disaster and climate risks.

To select an appropriate mix of measures, policy makers should first complete a vulnerability analysis and then select a strategy for reducing vulnerability. At that point they can select appropriate measures. Stakeholders need to be included in the negotiations about selecting appropriate measures. Factors that need to be considered include type of flooding (fluvial, pluvial, coastal, groundwater), the country's stage of development and (spatial) planning, local culture and government structures, community/individual concerns and benefits, etc. This process can help in selecting the most effective mix of measures and can strengthen all capacities—threshold, coping, recovery, and adaptive—needed to manage flood risks.

[1] As described by Rutger de Graaf, Nick van de Giesen, and Frans van de Ven, "Alternative Water Management Options to Reduce Vulnerability for Climate Change in the Netherlands," Natural Hazards 51, no.3 (December 2009): 407–22.

BOX 1. Twelve Key Principles for Integrated Urban Flood Risk Management

1. Every flood risk scenario is different: there is no flood management blueprint.
2. Designs for flood management must be able to cope with a changing and uncertain future.
3. Rapid urbanization requires the integration of flood risk management into regular urban planning and governance.
4. An integrated strategy requires the use of both structural and non-structural measures and good metrics for "getting the balance right."
5. Heavily engineered structural measures can transfer risk upstream and downstream.
6. It is impossible to entirely eliminate the risk from flooding.
7. Many flood management measures have multiple co-benefits over and above their flood management role.
8. It is important to consider the wider social and ecological consequences of flood management spending.
9. Clarity of responsibility for constructing and running flood risk programs is critical.
10. Implementing flood risk management measures requires multistakeholder cooperation.
11. Continuous communication to raise awareness and reinforce preparedness is necessary.
12. Plan to recover quickly after flooding and use the recovery to build capacity.

Source: Abhas K. Jha, Robin Bloch, and Jessica Lamond, *Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century* (Washington, DC: World Bank, 2012), 46–49.

2. A Balanced Approach for Urban Flood Management: Ho Chi Minh City Case Study

Dr. Ho Long Phi, Center of Water Management and Climate Change, Ho Chi Minh City, Vietnam

Photo: World Bank

The most difficult aspect of managing urban flooding is dealing with uncertainties. Uncertainties, created by urbanization, land use, sea-level rise, subsidence trends, upstream flows, rainfall, policy changes, and other factors, are increasing every year. As a result, flood prediction becomes increasingly difficult.

Risk is a hazard-dependent spatial-temporal function that can be expressed as follows:

$$risk = hazard\ probability * exposure * vulnerability$$

Within this formula, exposure uncertainties arise from urbanization, hazard uncertainties arise from both climatic and non-climatic causes, and vulnerability uncertainties arise from social policy and economic development. In practical terms, this means for example that a history of low risk does not rule out high risk in the future. We also need to recognize that higher levels of protection against flooding can actually increase the risk of flooding in the future: when people have a perception of safety, they may be overconfident and less prepared for a sudden disaster. This is why risk accumulation and transfer of risk should be taken into account in the cost-benefit analysis of potential measures.

A conventional approach to managing flood risk, one focusing on structural interventions, may not be flexible enough to cope with climatic and non-climatic

variations. A "balanced intervention" approach, which deals in a timely and harmonized way with all aspects of flood risk—hazard, exposure, and vulnerability—is preferable. Such an approach requires a needs analysis that takes economic and social risks into account, as well as an analysis of technical, financial, and human capacity. These analyses help to determine an appropriate strategy that integrates resilience, adaptation, and protection measures.

The level of operational and maintenance capacity, both technical and financial, determines intervention scale and level of sophistication of the protective measures. Where social capacity levels are low, more prevention is needed, as it requires less governance and coordination effort compared to other measures. Exposure reduction and control can be achieved through urban spatial and water management policies. Vulnerability reduction can be achieved by improving the housing stock and conducting emergency response planning, as well as by other means. Ho Chi Minh City's existing flood protection plan is very similar to the Bangkok protection plan; both focus on hazard control through structural measures. Currently, this plan is being revised to ensure better balance. Focusing on specific areas, the revised plan encourages adaptation measures by reducing exposure of existing highly urbanized areas.

Developing countries tend to opt for protective (structural) measures focusing on hazard control. These countries would do better to adopt a flood management approach that seeks to reduce hazard, exposure, and vulnerability in a comprehensive and coordinated manner.

3. Comprehensive Flood Risk Management Strategy: Methodology and Technology to make Resilient Urban Development

Dr. Hitoshi Baba, Senior Advisor, Japan International Cooperation Agency

Photo: World Bank

The number of reported flood events is increasing. In the last 10 years, severe floods have resulted in loss of life and economic damage in Bangladesh, Brazil, China, Ethiopia, India, Indonesia, Lao PDR, Latin America, Mongolia, Myanmar, Pakistan, the Philippines, the United Kingdom, the United States, and other countries.

Five priority actions contribute to effective flood risk management. First, DRR needs to be a national and local priority with a strong institutional basis for implementation. Second, disaster risks need to be identified, assessed, and monitored, and early warning systems need to be enhanced. Third, a culture of safety and resilience at all levels must be built using knowledge, innovation, and education. Fourth, underlying risk factors need to be reduced. Finally, disaster preparedness needs to be strengthened for effective response at all levels.

The Global Platform for Disaster Risk Reduction (GPDRR), which took place in Geneva in May 2013, called on countries to develop uniform standards for hazard risk assessments, especially for critical infrastructure. It also invited the private sector to integrate disaster risk consideration in its business practices and urged collaboration between the public and private sector in managing risk. A summary of action items from the GPDRR meeting are listed in box 2.

The important (and difficult) task is ensuring that individuals and decision makers, including the development community, make risk reduction a priority. We need to understand and be able to assess flood risk and impacts. We need to have a methodology for estimating damages and carrying out DRR cost-benefit analysis. Finally, we need to be able to incorporate lessons from recent disasters into development policy, strategy, and planning.

Japan's ability to learn from past floods is instructive. When the country underwent extensive development and reconstruction after World War II, the area surrounding the river in Kitakyushu was rebuilt

BOX 2. Global Platform for Disaster Risk Reduction Action Items

- **Targeting the root causes of risk:** price fluctuations, unemployment, violence, conflict, health burden
- **Connecting mutually reinforcing agendas:** sustainable development, environment, climate change impact, economic and social development
- **Assessing risk:** global economic losses, small local events
- **Leading at the local level:** municipalities, schools, hospitals
- **Engaging communities:** women, youth, persons with disabilities
- **Recognizing the private sector as actor and partner:** economic growth, resilient business and investment
- **Strengthening integrated risk governance:** communities and local governments
- **Strengthening scientific and technical support:** analysis, knowledge, data, tools, methodology

Source: Adapted from "Chair's Summary," Global Platform for Disaster Risk Reduction, Fourth Session, Geneva, May 19 – 23, 2013, http://www.preventionweb.net/files/33306_finalchairssummaryoffourthsessionof.pdf.

to make the area resilient to flooding. Japan has invested in building various structures to reduce flood impacts, through multipurpose rainwater storage facilities (figure 1), dams, underground flood tunnels, and others.

About 30 to 40 years ago, Japan recognized that national coordination was needed to ensure application of technical standards and to make flood control measures obligatory. The original scheme was fragmented, with separate laws applying to rivers, flood protection, sewerage service, and city planning. Under the new scheme, a single law applies to specified urban river basins. Enacted in 2003, the law addresses the spatial distribution of measures that cross over the conventional laws, obligatory installation of flood control facilities, reporting of actions and operations, administrative agreement among local public organizations, and cost-sharing rules.

Urban flood management should follow the key principles articulated by the World Bank in *Cities and Flooding* (see box 1). The Japan International Cooperation Agency (JICA) also recommends the following steps for DRR: First, understand the risk as it relates to development planning and establish a standard methodology for assessing risk. Second, understand the impact of a disaster, including the cost of damages. Third, draft structural and non-structural adaptation measures and use a probabilistic approach to formulate a strategy for resilient urban development. Fourth, implement and manage the measures, and finally monitor and evaluate them.

A number of steps need to be taken for flood hazard identification. Any geographic information system (GIS) or printed map should include identified flood hazards. Municipal governments should be notified of flood hazards by relevant national, state, or provincial governments; if a risk area lies across multiple municipalities, the municipal governments concerned may need to jointly conduct flood hazard identification and mapping in a wider area. In addition to information on risk areas and intensities, hazard maps could also include evacuation sites and emergency routes.

To estimate flood risk, JICA uses the following factors: hazard, vulnerability, probability of hazard, value of the elements at risk (exposure), and damage of the elements at risk. In estimating flood risk, a shift is needed from a deterministic to a probabilistic approach. The deterministic approach, which uses a target protection level for a given hazard in order to determine protection and mitigation measures, can be dangerous in the face of uncertainty.

Figure 1 Multipurpose Rainwater Storage Facility

Source: © Dr. Hitoshi Baba, Japan International Cooperation Agency. Used with permission.

The probabilistic approach, which uses multiple scenarios based on probabilistic hazard projection to determine the hazard level, makes it possible to minimize damages and losses by combining appropriate structural and non-structural measures and building in redundancy.

Because disasters affect the global economy, JICA recommends using business continuity planning (BCP) for a specific area, under which critical resources are shared based on regional, interregional, or supply-chain cooperation to ensure redundancy for enterprises, industries, or sectors. The aim of BCP is to ensure critical resource management for businesses in the affected area and—by fostering redundant resource management (backup)—to serve as part of regional DRR plans.

The rapid growth of urban agglomerations is increasing the risk of flood. Stakeholders need to have a common understanding of the risk of flood, which must be based on a probabilistic assessment. They also need to enhance capacity for flood risk management. Given the increasing vulnerability of industrial agglomerations and increasing global economic damages due to disasters, area-specific BCP should be adopted as part of comprehensive DRM.

Summary of Discussion

The discussion focused on the importance of risk awareness, different approaches to risk assessment, stakeholder engagement, and land subsidence.

- **Addressing the importance of risk awareness,** Dr. Phi said that governments seeking to protect people from dramatic disaster impacts have to ensure that people are aware of the existing and future climatic and non-climatic risks, since overconfidence about safety discourages adaptation and can lead to accumulation of people and assets in hazardous areas. Agreeing with Dr. Phi, Mr. Bons suggested that not taking a measure is itself a kind of measure—and a kind of gambling. If a government declares that it cannot afford adaptive measures, then it is assuming a high risk for the population.

- **Discussing approaches to risk assessment**, Dr. Phi stressed the importance of combining policies for reducing hazard exposure with a probabilistic approach. For reducing risk, technical and financial capacity is important, but the social elements are equally important, and we should prioritize the reduction of exposure and vulnerability. Mr. Bons highlighted that relying on probability to prioritize interventions should not prevent us from investing in disaster preparedness. Residual risk always remains, and low-probability, high-impact events can not only harm people but also affect the national, regional, and global economy. Mr. Sonnasinh stressed the importance of cost-benefit analysis in selecting structural and non-structural measures. Dr. Baba stated that planning in the Netherlands and Japan is very similar. Originally Japan adopted a methodology based on a single scenario. However, nowadays Japan is looking at multiple scenarios, similar to what is being done in the Netherlands.

- **Discussing stakeholder roles and access to risk information,** Mr. Bhanja noted that during the 2011 Bangkok floods, stakeholders were largely absent while the disaster was occurring. He considers it very important for all stakeholders to be present during a disaster in order to coordinate the response. Dr. Baba agreed and added that those in the private sector may not always be very aware of the existing flood risks and would benefit from risk information. He described the Japanese experience of flooding in the 1970s and 1980s, when local governments applied a variety of technologies for controlling floods and also solicited ideas from citizens. The local governments tried to protect land use, while the central government established laws to govern urban planning and set standards that applied to all stakeholders, including individual homeowners. Nowadays, individuals or organizations seeking to develop an area have to discuss flood management measures with the local government, which requires the construction process to follow relevant guidelines and standards.

- **Discussing the issue of subsidence**, Mr. Neussner made the point that when groundwater extraction causes subsidence (as for example in Jakarta or Bangkok), it is easier to address the issue from a technical perspective than to address the social and economic factors contributing to the issue. Mr. Bons noted that Japan has had success in overcoming subsidence problems in urban areas. In Osaka, for example, groundwater extraction is prohibited and the prohibition is enforced. Dr. Baba added that it is quite difficult to ensure that groundwater extraction does not cause subsidence problems. He suggested that extraction be controlled rather than waiting for possible harmful results. In Tokyo, for instance, the local government decided to control groundwater extraction.

Session II

Challenges for Making Flood Risk Data Widely Accessible to Stakeholders

Moderator: ***Dr. Chusit Apirumanekul, Asian Disaster Preparedness Center, Thailand***

Speakers:

Mr. Ery Basworo, Managing Head, Jakarta Disaster Management Office, Indonesia

Mr. Edi Junaedi Harahap, Head of Information and Controlling Division, Jakarta Disaster Management Office, Indonesia

Dr. Tae Sung Cheong, National Disaster Management Institute/National Emergency Management Agency, Korea

Key Points

- While it is impossible to entirely eliminate the risk from flooding, the right metrics, realistic simulations, sound risk data, and visualization tools (such as flood hazard maps) can increase understanding of existing and future risks.
- Flooding is an ongoing problem in Jakarta, but both the central government and local governments have taken steps to address it, including widening of three main rivers and strengthening the flood early warning system.
- Participatory or community-based mapping is being used to support contingency planning in Indonesia. The collected information can also aid in development planning, damage and loss assessment, and post-disaster planning.
- Participatory mapping is an effective mechanism for engaging communities, incorporating local knowledge into the process of risk mapping, increasing accuracy of maps (especially through the collection of vulnerability and exposure information), and raising public risk awareness. Open-source technology facilitates participatory mapping and allows collected risk information to be accessible for further use.
- Data sharing is very important in flood risk management as it allows different stakeholders to access risk information and to actively participate in individual or collective risk management interventions.

1. The Flooding City of Jakarta

Mr. Ery Basworo, Managing Head, Jakarta Disaster Management Office, Indonesia

Photo: World Bank

Jakarta is a delta city that has had problems with flooding since the 17th century. A master plan for flood prevention was first implemented in 1854.

Flooding in Jakarta has multiple causes. As of 2010, more than 58 percent of the city's area was below mean sea level, making it prone to flooding from upstream and high tides. The city, spread over 651 km^2, is traversed by 13 rivers with a catchment area of 850 km^2. Their flow capacity has been decreased by sediment and settlements; some sections of the Ciliwung River, for example, are less than 30 m wide but require a minimum width of 50 m in order to properly drain the discharge of 500 m^3/s. Another factor in flooding is changes in land use as a result of rapid population growth. The increase in built-up areas has affected the rate of water runoff. Finally, land subsidence has been affecting Jakarta; in north Jakarta 4 m of subsidence occurred between 1974 and 2010.

Following negotiations between the central and local governments, and with the help of experts from the Netherlands, Jakarta has taken several steps to prevent flooding, including widening three major rivers, constructing a giant seawall, and making other structural changes. Both the central and local governments continue to be involved in flood prevention efforts.

Jakarta has an early warning system in place to alert people 9–10 hours before a flood occurs. The government is also building high-rise, low-cost buildings for people currently living in houses along the banks of Ciliwung River. The early warning system and high-rise buildings are intended to save lives.

2. Participatory Mapping to Fill Data Gaps for Better Flood Information Management in Jakarta

Mr. Edi Junaedi Harahap, Head of Information and Controlling Division, Jakarta Disaster Management Office, Indonesia

Photo: World Bank

Maps are effective tools for describing the earth's surface. However, most of the maps used for disaster-related decision making don't consider local knowledge, even though local environments are best described by the people who live in them.

Participatory mapping, also called community-based mapping, combines the tools of modern cartography with participatory methods to represent the spatial knowledge of local communities. It has been piloted in Jakarta in response to people's limited access to hard-copy maps, their difficulty in managing existing data, and absence of high-resolution data.

The Jakarta government has promoted participatory mapping for a number of reasons. It wants decision making, both before and after a disaster, to be based on more complete and accurate spatial and tabular data. It also believes the data will be useful in development planning, damage and loss assessment, and post-disaster planning. Finally, it values participatory mapping as a way to engage communities and to keep mapping open and accessible to various stakeholders for further use.

The actual process of mapping includes the participation, collaboration, and technical expertise of multiple stakeholders, including local governments and development partners.[2] During the pilot, community

[2] Partners include Indonesia National Agency for Disaster management (BNPB), North Jakarta Municipality, Central Jakarta Municipality, West Jakarta Municipality, East Jakarta Municipality, South Jakarta Municipality, Australia–Indonesia Facility for Disaster Reduction/ the Australian Agency for International Development (AIFDR/AusAID), World

members and students from local universities and schools also helped to collect data and develop risk maps. The project covered six regions, 44 sub-districts, and 267 villages (124 of them affected by flooding).

To map villages, the project held workshops at municipality offices. Villages were provided with a package of maps and information prior to the workshop, and during the workshop trained university students worked with village representatives to map their area. The mapping was done for sub-village boundaries, government buildings, hospitals, clinics, schools, places of worship, etc., as they existed before flooding, and also for 15 sub-sectors that were affected by flooding.

Participation by villages was very high, both before and after flooding. As a result of 11 workshops, data on over 6,000 structures were digitized, 2,668 sub-villages were mapped, and impacted assets in 15 sub-sectors were identified. Prior to a disaster, the risk information can be used as a base map for planning purposes, to better understand the impacts of a disaster. After a disaster, the information can be used to estimate damages and losses and to develop priority plans for rehabilitation and reconstruction.

Participatory mapping in Indonesia is being supported by OpenStreetMap (OSM) tools (figure 2). OSM is an open-source initiative staffed by volunteers, who use GPS, aerial imagery, and free software to add information to a worldwide map that can be used free of charge. Seventy-two students from the Indonesia University have been trained by OSM to support data collection and digitization of data for each village. The university is an important partner in the project, providing education, research, and service to the community. In the future, participatory mapping efforts in Jakarta are planned to cover also hazards other than floods, and risk data to be used in sectoral planning.

Bank/GFDRR, United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), the University of Indonesia, and Humanitarian OpenStreetMap Team (HOT).

Figure 2 OpenStreetMap Screenshot

Source: © Mr. Edi Junaedi Harahap, Jakarta Disaster Management Office. Used with permission.

3. Effective Flood Risk Assessment Methodologies

Dr. Tae Sung Cheong, National Disaster Management Institute, Korea

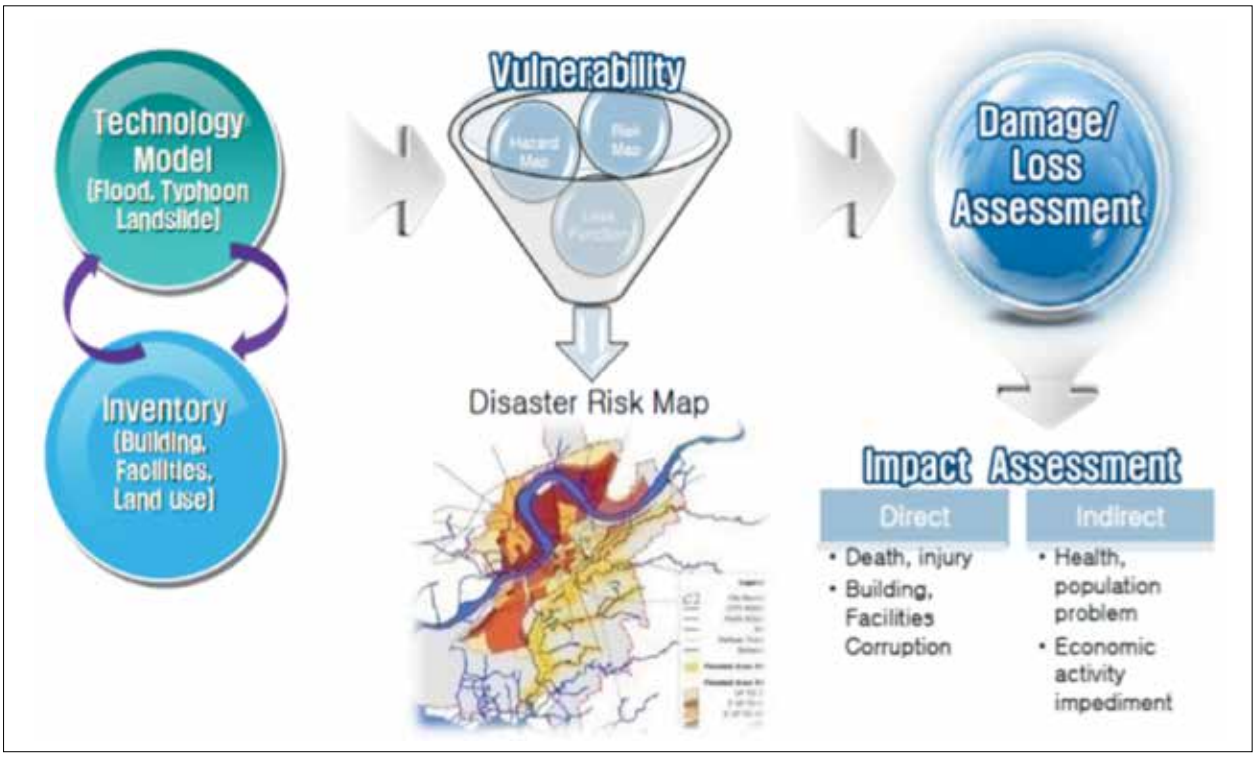
Photo: World Bank

Data collection, integration, and sharing— between countries and within countries—are crucial in flood risk management. If each line ministry has its own data system, key tasks (such as risk reduction planning or devising emergency evacuation routes) can become unnecessarily complicated.

Local governments should make both non-structural measures, such as early warning systems, education, and training, and hard measures, such as stream restoration, a priority, and include these in their budget. DRM priorities should reflect the needs and demands of the communities. There are a number of guidelines available to local governments and communities for priority identification. Steps feeding into the decision-making process include identification of objectives, criteria, and alternatives; ranking and weighting of identified alternatives; and sensitivity analysis.

Flood risk assessment should include an assessment of possible damage and loss. A mere hazard map is insufficient for this task. Investing in risk data is vital. In carrying out flood risk assessments, Korea takes into account whether populations have previously faced disaster or not, since their capacity to cope with disaster will differ depending on their earlier experience. Using a technology model, hazard information (on flood, typhoons, and landslides) is combined with an inventory of buildings, facilities, and land use. The result feeds into the vulnerability assessment (upon which a disaster risk map can be developed), and finally a damage and loss assessment is produced. The assessment accounts for both direct and indirect impacts to be measured (figure 3).

Figure 3 Concept of Flood Risk Assessment



Source: © Dr. Tae Sung Cheong, National Disaster Management Institute, National Emergency Management Agency. Used with permission.

There are two kinds of flood risk assessments used in Korea: an information-based assessment that produces a measured flood map (e.g., showing the depth of flooding) and an estimated flood map (showing damages and losses); and a model-based assessment. A disaster information tool links different databases and inventories with information from physical and assessing models. The assessment platform integrates all disaster information, simulates scenarios, and serves different risk information users. For the government, it helps with preparedness and prevention; for the finance and insurance industries, it provides information for flood insurance; and for individuals or businesses, it facilitates assessment of asset losses.

Going forward, Korea's risk assessment efforts face several challenges. There are insufficient data for hazards and exposure. There is also a lack of experts on climate change, risk assessment, and geologic/hydrometeorological hazards at the local level. Finally, the political will to adhere to local plans and investment programs may be weak.

Summary of Discussion

The discussion focused on data collection and sharing, participatory approaches, and the use of risk information.

- **Answering the question about data collection in Indonesia**, Mr. Harahap explained that there are specific agencies tasked with data collection. The government makes data accessible across all agencies, which has been beneficial for flood mapping. The Indonesian government has a plan to teach mapping skills to people in the provinces, which in the short term will allow them to participate in hazard mapping and in the long term will improve budgeting and DRM implementation in general. As part of improved contingency planning, the goal for each province is to develop a participatory map that can be used for flood risk management, and for each provincial agency to provide the central government with data. Each province would be able to estimate risk based on its own previous experience and the data collected.

- **Sharing experience from the Philippines**, Ms. Ignacio noted that the Philippine government plans to adopt participatory mapping through OpenStreetMap in parallel to the ongoing Project NOAH (Nationwide Operational Assessment of Hazards). OSM was successful in Indonesia and can prove useful in the Philippines, where it would be implemented by the Metro Manila Development Authority with the support of developing partners.

- **Discussing effective ways to share data**, Dr. Phi suggested that databases should be comprehensive but also easy to update and access, to encourage information use and participation from the community. According to Mr. Neussner, it is a challenge to interest members of the community in accessing data, and it is also a challenge to prepare data. Mr. Harahap stated that Indonesia, too, has found the data collection process challenging, and that its main focus is now to improve existing data. Ms. Wang explained that in China, basic data on land use and river systems are not public. Data for flood hazard maps have to be sought from relevant government departments.

- **Discussing the importance of risk maps**, Mr. Singson emphasized the importance of using rainfall data over a significant period in preparing hazard maps. Japan, he noted, uses some 200 years of data. Mr. Harahap explained that Indonesia's rainfall data usually cover 50 years and sometimes 100 years, but that the flood in Jakarta in January 2013 was not caused by rainfall but by the overflow of river water and the unexpected breaking of a dam. Mr. Singson added that local government in the Philippines needs to be more concerned about disaster risks, and needs to do more to make people aware of and understand these risks.

- **Based on his experience in Korea**, Dr. Cheong said, it is important for the central government to educate and train local governments; that way, if a disaster occurs where there was thought to be no risk, local governments can use their own tools to add local experience and historical data to existing risk maps. Dr. Cheong also suggested that when there is a great deal of information,

it's important to understand and use the information that is relevant. If there is a clear focus or target, it is easier to use the right information.

- **Commenting on the role of scenarios,** Dr. Hong described a master plan for hazard mitigation developed by the Global Green Growth Institute and the World Bank. Realistic disaster scenarios provide very useful output for decision makers, he said, but the creditability of that output is the main challenge for flood risk and hazard mapping. Dr. Cheong acknowledged that hazard maps are useful but added that risk assessment, with information on damage and loss, is also important for resilience and sustainability.

- **Talking about timely use of risk information**, Mr. Singson noted that the Philippines uses a text message system to inform local communities about flooding. Project NOAH aims to give a warning six hours before the flood occurs. Using flood modeling or forecasting maps, NOAH can also determine how high flood waters will rise.

Session III

Reducing Flood Risk Losses and Enhancing Resilience: Innovative Approaches

Moderator: ***Dr. Chusit Apirumanekul, Asian Disaster Preparedness Center, Thailand***

Speakers:

Mr. Kees Bons, Flood Risk Management Specialist, Deltares

Secretary Rogelio L. Singson, Department of Public Works and Highways, the Philippines

Mr. N. D. Prabhath Ransara, Metro Colombo Urban Development Project, Ministry of Defense and Urban Development, Sri Lanka

Key Points

- Reducing flood risk should involve multifunctional solutions that work with nature and make use of ecosystem functioning to enhance safety, promote food and freshwater security, protect livelihoods, and adapt to climate change impacts.
- A "building with nature" approach relies on an iterative cycle of implementation and adaptation that focuses on practical solutions and encourages collaboration between different fields and stakeholders.
- The Philippines has adopted an integrated water resources management approach to reduce flooding. The Master Plan for Flood Management in Metro Manila and the Surrounding Areas identifies urgent structural and non-structural measures, prioritizes flood management initiatives in vulnerable areas, applies CCA and DRM strategies to flood management, addresses institutional fragmentation, and increases local government and community awareness and participation. Projects underway include slope protection and phytoremediation along riverbanks and easements through the use of coconets (made from coconut husk), which are both cost-effective and environmentally friendly.
- In Sri Lanka, Colombo's flood mitigation approach combines structural and ecosystem-based approaches. It seeks to improve drainage networks, set up a real-time prediction system and an early warning system, implement water-based transport services in canals, and develop waterside recreational areas.

1. Ecosystems-based Approaches: Future or Fantasy?

Mr. Kees Bons, Flood Risk Management Specialist, Deltares

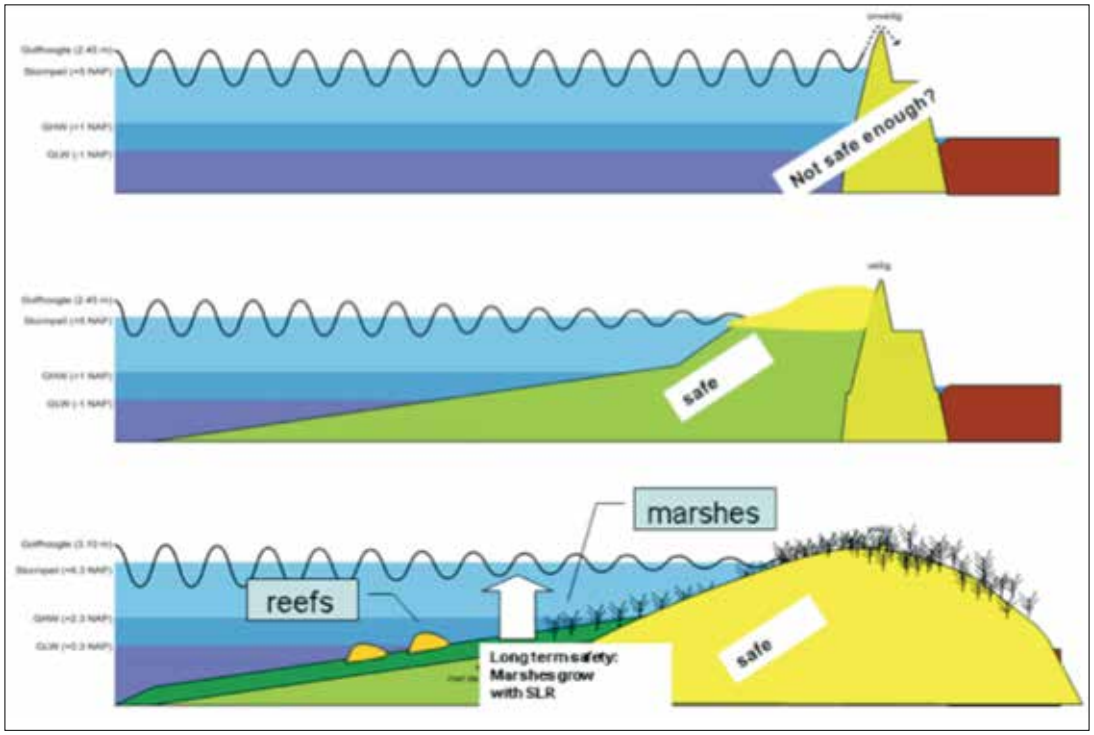
Photo: World Bank

In the 20th century, protection against flooding drove infrastructure development. Mono-functional designs were the preferred flood protection measures. But growing populations, use or overuse of available land and water, scarcity of resources, and the impact of climate change and sea-level rise are all now placing great pressure on river deltas.

The time has come to move away from mono-functional design and adopt multifunctional solutions that provide safety, economic, and ecological benefits. The goal should be to work with nature and make use of natural ecosystem functioning to enhance safety, promote food and freshwater security, protect livelihoods, and adapt to climate change impacts.

The "building with nature" approach uses ecosystem dynamics to ensure a safe environment that combines multiple functions to the society in an economically feasible way. The mindset that trusts science but not nature needs to change; when we work against nature or harm it, nature takes its revenge. Green adaptation concepts that use multifunctional design—for example, flexible dikes or soft levees—work in harmony with nature to protect against flooding in a cost-effective way (figure 4). Land reclamation as practiced by the Dutch for a thousand years is a low-tech green adaptation that improves safety at a low cost, creates productive habitats and more space, and increases drinking-water supply. So-called green dike systems rely on natural development, improve shore connectivity, and provide habitat for fish and birds, as well as recreational amenities for the population to enjoy. Wave-reducing forest dikes are another example of a low-cost low-tech measure that can provide protection to communities.

Figure 4 Building with Nature: Soft Eco-levee Using Reef, Marsh, Dune Combinations



Source: © Kees Bons, Deltares. Used with permission.

There is a wide range of opportunities for choosing appropriate levels of soft solutions, hybrid solutions, and engineered solutions. Deltares has supported research in this area in the Netherlands, the Mississippi Delta, and the Mekong Delta near Bac Lieu in Vietnam.

Ecosystem management is the key to green adaptation. Because ecosystems vary, we need to gather knowledge from the farmers, fishermen, and others who understand the local conditions. We also need biologists to join design and construction teams and to work across different fields and disciplines. Moreover, ecosystem solutions need time in order to be effective, and this need should be reflected in planning and in program execution. The institutions involved in designing and constructing ecosystem-based projects should be open to innovative (and integrated) solutions; they should think beyond mere hazard mitigation and ask, "What can the project do for the ecosystem, and what can the ecosystem do for the project?" Working in partnership and through alliances can help us share costs and expertise, find win-win solutions, and improve our awareness and communication of risks and possible solutions. Finally, the "building with nature" approach gives rise to an iterative cycle of implementation and adaptation; it involves generic practical solutions, collaboration between thinkers and doers, and interactions between government, scientists, and the market.

2. Metro Manila Integrated Flood Risk Management Master Plan

Secretary Rogelio L. Singson, Department of Public Works and Highways, the Philippines

Photo: World Bank

There are a number of causes of flooding in Metro Manila, including (1) typhoons (on average 20 per year); (2) lack of an integrated plan or strategic program to address perennial flooding and related disasters (landslides, lack of potable water, siltation); (3) massive urbanization and lack of effective land use plans; and (4) illegal structures that constrict waterways. Annually, flooding and related disasters cause damages in the amount of US$160 million, kill 640 people, affect 3.4 million people, and damage 71,000 houses.

In response, as part of the Philippine Development Plan 2011–2016, the government has undertaken an integrated water resources management approach to reduce flooding. This approach includes the development of flood control plans for major river basins; prioritizes construction of flood control structures in vulnerable areas; applies CCA and DRM strategies to flood management; and seeks to increase local government and community awareness and participation. The approach is being coordinated with relevant central government departments and ministries, local government units, and communities.

One of the programs undertaken as part of this approach is the development and implementation of the Master Plan for Flood Management in Metro Manila and the Surrounding Areas. The plan identifies urgent structural and non-structural measures. Specific goals include enforcing easement standards and clearing priority rivers and waterways; developing a resettlement action plan and providing housing options; upgrading pumping stations; widening and dredging waterway channels; and constructing dikes and river walls. The plan also addresses the fragmentation of responsibility among the 30 agencies that deal with water and flood management/mitigation.

The government also embarked on strengthening flood modeling, forecasting, and early warning systems through Project NOAH, which combines structural and non-structural measures for flood risk management.

The Department of Public Work and Highways, one of the agencies involved in the integrated approach, is funding and implementing various flood control and small water impounding projects. Its slope

Figure 5 Estero de Paco—Widening, Dredging, and Slope Protection Using *Coconets*

Source: © Rogelio L. Singson, Department of Public Works and Highways. Used with permission.

protection and phytoremediation using *coconets* along riverbanks and easements (figure 5) is both cost-effective and environmentally friendly. Another interesting initiative is the establishment of groups of "river warriors"—volunteers from non-governmental organizations (NGOs), the private sector, communities, and households living near rivers who actively engage in local flood mitigation and environmental protection.

Long-term measures being planned by the government include construction of flood control dams upstream; use of natural floodplains near waterways; implementation of land use ordinances; enforcement of waterways laws; and strengthening of local government and community awareness and participation in DRM.

3. Reducing Flood Risk in the Metro Colombo Region: Structural and Ecosystem-based Approaches

Mr. N. D. Prabhath Ransara, Metro Colombo Urban Development Project, Ministry of Defense and Urban Development, Sri Lanka

Photo: World Bank

Rainfall in Sri Lanka has multiple origins; monsoonal rain and convectional rain account for major shares of the annual rainfall. The mean annual rainfall varies from under 900 mm in the driest parts (southeastern

and northwestern) of the country to over 5,000 mm in the wettest parts. High-intensity rainfall occurring over short periods is among the causes of recent flooding in Sri Lanka. Other causes of flooding include inadequate outfall capacity of drainage networks, inability of drainage systems to cater for higher-return-period rainfall, reduction of retention areas, flow hindrances in secondary canal systems (causing localized flooding), dumping of solid waste into canals (reducing drainage capacity), and unauthorized construction encroaching on bodies of water. Some indirect causes of flooding include unplanned urban development, lack of public awareness, failure to invest in drainage projects, and poor coordination among agencies.

Colombo experienced catastrophic floods in November 2010. Since then, a mitigation approach for the Metro Colombo Area (104 km^2) has been developed to improve the main drainage network, improve the secondary drainage network (to prevent localized floods), set up a real-time control system for predicting floods and an early warning system for minimizing impacts, implement water-based transport services in canals, and develop waterside recreational areas to promote continual improvement and management of drainage networks.

A number of long-term measures have been proposed for improving the main drainage network. Proposed structural measures include streamlining the canal network to enhance conveyance capacity, widening floodgates and constructing pumping stations at Kelani River outfalls, creating new diversions leading to new outfalls, opening channels and microtunnels, and creating upper catchment lakes to delay inflow and to regain and augment storage.

Proposed non-structural measures include preparation of a wetland management master plan to preserve wetlands for flood retention, a solid waste management plan to eliminate dumping of solid waste into canals, acquisition of a canal reservation strip to stop illegal settlements and encroachments, and enforcement of rules and regulations related to drainage. These measures present a number of challenges, including ensuring a safety level for a 50-year return period. For this hydrological modeling, LiDAR surveys and validation are being used, along with scenario simulations.

Summary of Discussion

The discussion focused on the role of institutional arrangements, land use planning, and challenges facing local governments.

- **Commenting on the issue of institutions**, Mr. Harahap said that in Indonesia, it is difficult to coordinate between various departments involved in one master plan. Sharing experience from the Philippines, Mr. Singson noted that relying on government agencies is the most difficult part of coordination. In the Philippines, the "river warriors"—the community volunteers dedicated to protecting local rivers—were formed under a tripartite agreement between the government, NGOs, and private companies, with funding from government agencies and private sector donations. Mr. Singson clarified that the Metro Manila Integrated Flood Risk Master Plan is a part of the Philippines Development Plan 2011–2016. It is the first flood control plan adapted by the National Economic Development Authority, which monitors its progress.

- **Discussing the issue of informal settlements**, Mr. Bons said that resettlement is a major social issue and that a master plan must accommodate future influxes of people. Mr. Singson added that if the master plan doesn't provide for affordable housing, regulating riverside settlements will become a never-ending struggle. Ms. Raghunath and Mr. Singson talked about the role of financial incentives in limiting such settlements and about the need to resettle poor squatters in high-rises, away from the danger zone. Citing the example of Japan, Dr. Baba suggested that governments should relocate populations to new land with new development, including schools, markets, and other amenities. Mr. Singson explained that in Metro Manila, one option is to relocate people near their workplace; another is to subsidize their transportation.

- **Discussing land use planning**, Ms. Fen and Mr. Bons agreed that a natural river flow and balanced ecosystem require space. Mr. Bons described a city in the Netherlands where the local people decided to make river space a priority. After discussions with land owners, the

government gave more land to the rivers and compensated the people who had to be relocated. The lesson is that people can adapt when they are offered acceptable solutions.

- **Talking about challenges facing local governments**, Ms. Chang mentioned that local governments often lack the capacity to try to prevent disaster. Politicians seem to prefer big projects that require big money, even when simple and cheap solutions are available. Local governments could buy land to be transformed into parks, and could establish comprehensive plans for flood reduction. This has been done in Bangkok, which was following the example of Japan. Dr. Cheong said in Korea, the central government provides funding to local governments for recovery and flood prevention; local governments must follow certain guidelines but have some autonomy in which projects to pursue.

- **All the participants agreed on the importance of eco-friendly approaches**. Mr. Singson recommended using *coconets* instead of concrete for slope protection near water channels. This approach is environmentally friendly and cost-effective, and is being used with success in many developed countries.

- **Sharing lessons learned from Thailand's 2011 flood**s, Dr. Apirumanekul noted that data sharing within a country is very important. Japan helped the Thai government to adapt the necessary technology for data sharing.

Session IV

Reducing Flood Risk Losses and Enhancing Resilience: Community-based Approaches

Moderator: ***Dr. Chusit Apirumanekul, Asian Disaster Preparedness Center, Thailand***

Speakers:

Mr. Olaf Neussner, Disaster Risk Management, Chief Advisor, GIZ; and Mr. Hilton Hernando, Philippine Atmospheric, Geophysical and Astronomical Services Administration

Mrs. Dondmaa Enebish, Ministry of Construction and Urban Development, Mongolia; and Ms. Khulan Mandat, Specialist of the Development Program and Project, Municipality of Ulaanbaatar, Mongolia

Dr. WooSuk Han, Associate Research Fellow, Environment and Water Resources Research Division, Korea Research Institute for Human Settlements

Mr. Guratno Hartono, Director of Building and Neighborhood Development, Indonesia

Key Points

- Community engagement and agreement among stakeholders are critical for reducing flood risk, ensuring that measures undertaken are equitable and effective, and meet the needs and priorities of the entire affected population.
- Local Flood Early Warning Systems are most effective where community participation is strong. They have functioned successfully in the Philippines and could be replicated in other countries.
- Reducing flood risk in Ulaanbaatar requires attention to populations living in rapidly expanding peri-urban settlements on the periphery that lack access to services. Mongolia is currently carrying out community-based disaster preparedness training and plans in the future to revise and improve its legal and urban planning systems to integrate DRM and CCA.
- Korea is affected by climate change impacts. Heavy rainfall, strong typhoons, and landslides are already occurring; exacerbating these weather events are poor urban planning and development of vulnerable areas. Korea is adopting successful international practices such as low-impact development to adapt to flood risk. Its strategy for urban disaster prevention includes a "Total Disaster Prevention" policy that uses urban components (parks, roads, buildings) to decrease damages from natural disasters.
- Neighborhood development, which is central to the National Community Empowerment Program–Urban program in Indonesia, reduces flood risk by taking a bottom-up approach and integrating community needs and conditions into spatial planning.

1. Community Involvement and Local Flood Early Warning with Low-tech Approaches for Small Rivers in the Philippines

Mr. Olaf Neussner, Disaster Risk Management, Chief Advisor, GIZ

Mr. Hilton Hernando, Philippine Atmospheric, Geophysical and Astronomical Services Administration

Photo: World Bank

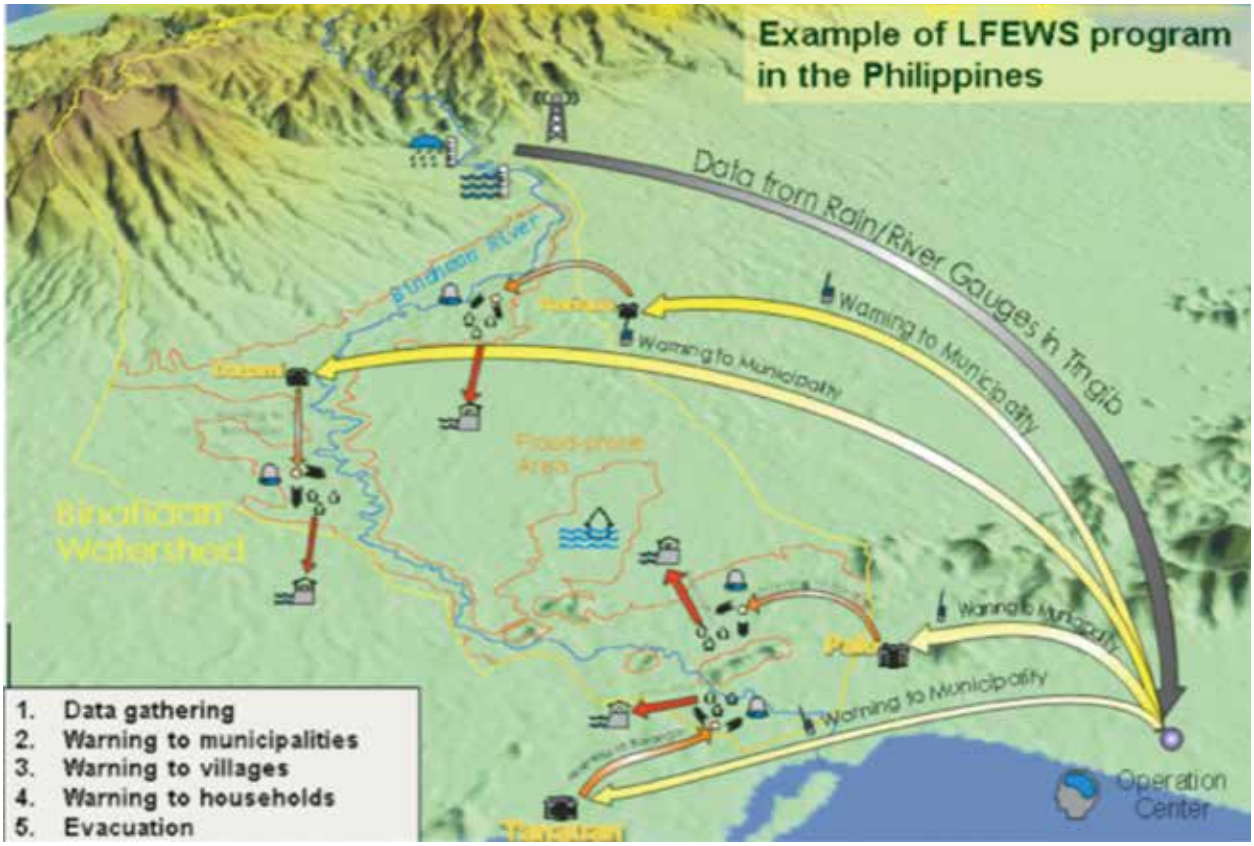
On average, the Philippines is affected by some 30 flood events annually. Five of its river basins are equipped with a telemetered flood forecasting and early warning system; for smaller basins and watersheds, the preferred option is the Local Flood Early Warning System (LFEWS). LFEWS is an inexpensive system based on four key elements: (1) risk knowledge; (2) monitoring and warning; (3) information dissemination and communication; and (4) response capability. The system is most effective where community participation is strong.

The first element of LFEWS, risk knowledge, involves community participation in risk mapping (local knowledge is encoded in GIS for overlaying on existing maps) and knowledge on the part of community members about the location of assets and households. The second element, monitoring and warning, involves a range of equipment, such as manual and automatic (radio-linked) water-level gauges, and activities, such as rainfall observation (often undertaken by students as a school activity). The third element, information dissemination and communication, distinguishes three flood levels, alert/standby (level 1), preparation (level 2), and evacuation (level 3). It divides responsibility among three groups, the municipal disaster risk reduction and management (DRRM) office, the DRRM committee, and households (which spread information about the flood using bells, megaphones, text messaging, and other means). The fourth element, response capacity, also involves participation by community members, who take part in drills for warning, evacuation, and search and rescue.

A good example of an LFEWS program in the Philippines is the Binahaan watershed early warning system (figure 6). After the system gathers data, warnings are issued to municipalities, villages, and households, followed by area evacuation. When a severe flood occurred in Binahaan in January 2011, community members and governmental rescue professionals worked hand in hand.

An LFEWS costs approximately US$30,000–US$40,000 to set up in the Philippines and becomes cost-effective after eight years of use. Run by non-professionals with guidance from professionals, the LFEWSs in the Philippines have functioned successfully and issued only one false alarm. Overall, the LFEWS is an exemplary method that could be replicated in other countries. One of its limitations is that while involvement of volunteers in response is strong, their involvement in data transmittal is weaker.

Figure 6 Binahaan Flood Early Warning System



Source: © Olaf Neussner, GIZ, and Hilton Hernando, Philippine Atmospheric, Geophysical and Astronomical Services Administration. Used with permission.

2. Reduction of Flood Risk in Ulaanbaatar City

Mrs. Dondmaa Enebish, Ministry of Construction and Urban Development, Mongolia

Ms. Khulan Mandat, Specialist of the Development Program and Project, Municipality of Ulaanbaatar, Mongolia

Photo: World Bank

Ulaanbaatar is Mongolia's largest and densest city, housing 40 percent of the country's population in less than 0.3 percent of its land area. The most common disasters affecting Ulaanbaatar are flash floods, earthquakes, and building and forest fires. Especially at risk are those living in the "GER" areas which are rapidly expanding peri-urban settlements on the periphery with lacking access to city services. Recent information indicates that some 2,260 households in six districts are living in high-flood-risk areas. In 2012, about 85 percent of these were sent notices warning them of the risk. These households are also vulnerable in the event of an earthquake, given the poor construction of their housing.

Mongolia faces significant challenges in managing disaster risk and adapting to climate change. Response to increased risk of flooding in Mongolia, which is linked to climate change, environmental pollution, growing population, and other factors,

is hampered by a legal system and an urban planning system that do little to address the requirements of DRM and CCA. In addition, coordination among ministries and institutions involved in DRM is weak; funding and budgets for DRM are inadequate; necessary personnel for measuring and controlling disaster risk is lacking; and training and education related to disaster management are insufficient.

Construction of flood protection facilities in Ulaanbaatar began in the 1960s. The city currently has a variety of channels (made of concrete, stone, and earth) as well as embankments and other protections (along the Tuul, Selbe, and Dund Rivers) that together total over 130 km. Because of increasing population and settlements, however, 70 percent of these protection measures are considered obsolete. To address this problem, between 1996 and the present additional drainage networks and pump stations have been constructed, and other infrastructure has been rebuilt or rehabilitated. The plan going forward (through 2018) is divided between rehabilitation of existing construction (40 percent) and construction of new infrastructure and buildings (60 percent).

Under the General Development Plan for Ulaanbaatar City Until 2020, GIS data will be used in operating flood dams, creating a system for handling rainfall runoff, rehabilitating pump stations, and surveying and filtering water holes. Community-based disaster preparedness training and practice is already being carried out in nine districts; among those participating are students in secondary schools, colleges, and universities, as well as employees in offices and plants. Residents of areas especially vulnerable to flooding are also being trained.

Mongolia is planning to revise and improve its legal system to address DRR and CCA, and to raise norms and standards for planning and building. Moreover, it intends to establish an integrated system of education on DRR and CCA; to improve coordination between related ministries, institutions, and organizations (for example, through sharing of information and integrated planning); and to establish a DRR and CCA information management system. Mongolia also plans to follow international best practice and to share information and knowledge with other countries in the region, including South Korea, Vietnam, the Philippines, Indonesia, Cambodia, and Nepal.

3. Preparing for Climate Change: The Urban Disaster Prevention Strategy

Dr. WooSuk Han, Associate Research Fellow, Research Division, Environments and Water Resources, Korea Research Institute for Human Settlements

According to the Korea Meteorological Administration (KMA), climate change is progressing more rapidly in Korea than it is globally. During the last 100 years, the average temperature of the world has increased 0.74°C, whereas the average temperature in Korea has increased 1.7°C. The number of days of heavy rainfall and strong typhoons will increase in Korea as the temperature increases further; between the present and end of the century, precipitation is expected to increase by 17 percent, and (according to the Intergovernmental Panel on Climate Change) sea levels will rise by 59 cm.

Flooding and related disasters are already affecting Korea. By 2010, extreme and in some cases record-setting weather events (floods, heavy snowfalls, heat waves, and strong winds) had been observed in all parts of Korea. In Seoul in 2011, heavy rainfall caused severe flooding and landslides, killing 53 people and causing serious damage to buildings and infrastructure.

The primary causes of natural disasters in Korea are localized heavy rains, typhoons, and heavy snows triggered by climate change. Due to climate change uncertainties, it is difficult to predict which places will experience disasters. Exacerbating these weather events are poor urban planning and design that fail to consider disaster prevention, along with development of vulnerable areas such as low-lying and coastal regions and steep slopes.

Practices in other countries offer valuable lessons in preventing disasters. The United States, for example, has used low-impact development for flood and heat wave prevention. This approach to urban design seeks to mimic a site's predevelopment hydrology using techniques that reduce runoff through storage, infiltration, evaporation, or detaining. Commenced in 1986, Japan's 'Super Bank" Project protects embankments built in preparation against severe flooding in highly concentrated urban areas such as Tokyo and Osaka. In Tokyo, the Underground Control Basin Project was also built to prepare for climate change

impacts. In general, Japan actively responds to climate change through urban development in old and new settlements. Rotterdam in the Netherlands also offers lessons in preventing disasters; it has employed a range of techniques—including green roofs, water storage systems, and multipurpose run-off areas—to adapt to increased flood risk.

Korea's strategy for urban disaster prevention recognizes the need for a new disaster prevention paradigm implemented through urban planning. The Ministry of Land, Transport and Maritime Affairs has accordingly developed a Total Disaster Prevention policy that modifies urban planning guidelines to ensure that all urban components (such as parks, roads, and buildings) are used to decrease damages from natural hazards. This is supported through the development of the Urban Planning Simulation System, which includes the following elements: (1) Vulnerability Assessment Model (regional and local); (2) Urban Development Condition Analysis Model; and (3) Total Disaster Prevention Effectiveness Analysis Model to support decision-making. Effective implementation of the Total Disaster Prevention policy will require political and technical support.

4. National Community Empowerment Program–Urban: Efforts of Indonesian Government in Poverty Alleviation through Community-based Empowerment

Mr. Guratno Hartono, Director of Building and Neighborhood Development, Indonesia

Photo: World Bank

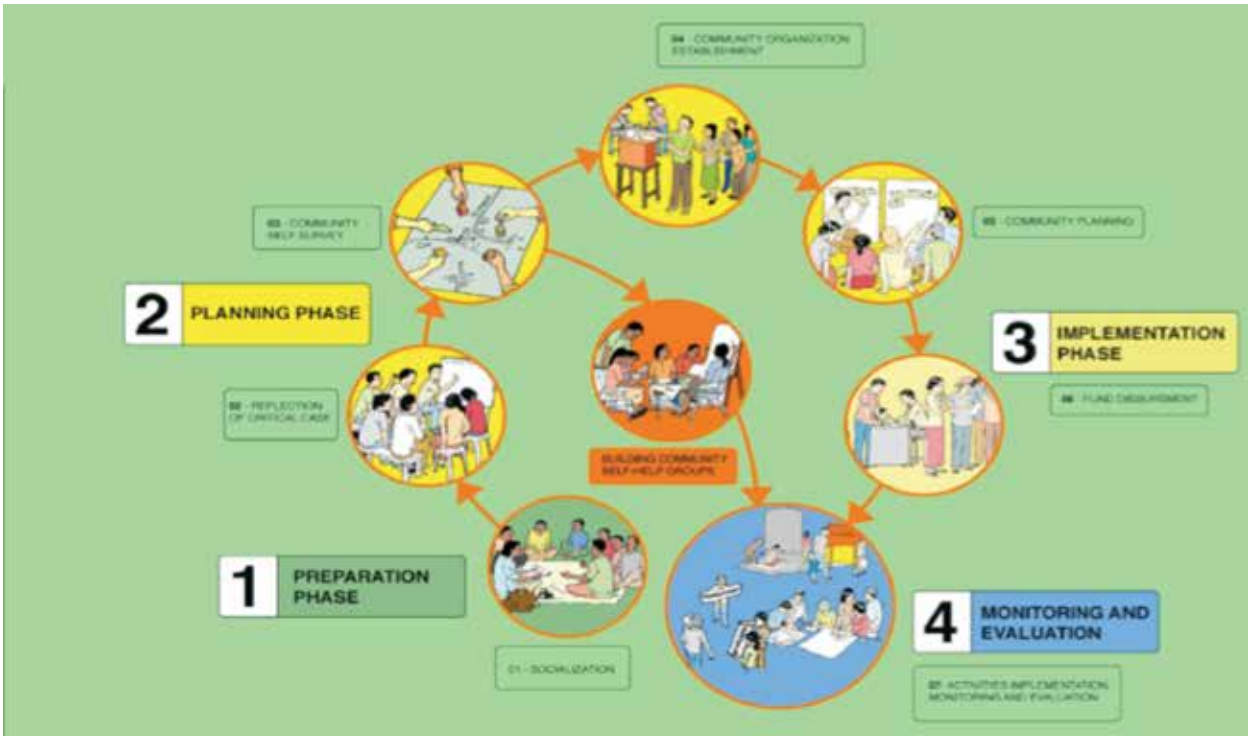
The National Community Empowerment Program (NCEP)–Urban is the largest Indonesian poverty alleviation program focusing on urban areas. Through its community-driven development (CDD) approach, the program aims to help poor communities by improving infrastructure, assisting with social and economic problems, and promoting good governance. The basic process it employs is the community activity cycle (illustrated in figure 7) to empower communities, local governments, and concerned groups.

The NCEP-Urban program seeks to effect social transformation through a multistage intervention: first, universal principles and values are introduced; next, community planning is established; block financing is then used for empowerment activities (infrastructure, social, and economic activities); finally, neighborhood development takes place through a community-based approach.

Neighborhood development is central to the NCEP-Urban program. It focuses on changing community behavior, improving the quality of life for poor people, and promoting productive and sustainable neighborhoods. One of its goals is to integrate the planning, development, and management of neighborhoods (at the ward or village level) into local government or macro planning areas (at the city or district level). The expected output from this integration is a ward-level planning document with activities designed to enhance community organization, produce social capital, and strengthen infrastructure that supports public welfare.

Neighborhood development contributes to flood risk reduction because its approach to spatial planning is bottom-up, emerging from ward conditions and community needs. The experience of Karangwaru, a locale that was involved in the neighborhood development program, is instructive. The neighborhood developed flood mitigation plans in response to the condition of the Buntung River flowing through it. The river was polluted and full of trash, making Karangwaru more vulnerable to localized flooding. Through the program, the community implemented proper spatial planning and succeeded in reducing flood risk and improving the quality of life for the community.

Figure 7 Community Activity Cycle



Source: © Guratno Hartono, Building and Neighborhood Development, Indonesia. Used with permission.

Summary of Discussion

The discussion focused on the importance of involving communities in flood risk management, on climate uncertainties, and on the need for institutional coordination.

- **Speaking about community-based disaster risk management**, Dr. Phi noted that implementation can be challenging. Vietnam needs to improve social capacity and perception. The Philippines and Mongolia prioritize structural improvement because it is easier to apply. Vietnam also has to integrate low-impact development, such as sustainable drainage, into its current approach.

- **Discussing the importance of communities**, Mr. Neussner suggested that big cities with many high-rise buildings, such as Seoul, Jakarta, Bangkok, and Manila, do not have communities in the traditional sense anymore; citizens are connected through media or the Internet. In less-urbanized cities further away from the capital with fewer facilities and services, neighbors know each other and are better prepared to work together as a community. These cities should be treated differently from advanced cities. It is challenging to work at the traditional community level in big urbanized cities. Ms. Stanton-Geddes noted that people in mega cities may be reached through social hubs like universities, local NGOs, or religious groups. This kind of activity energizes the community. In smaller cities, people show neighborhood feelings. Indonesia and Mongolia rely on communities of neighbors in their approach to DRM. Mr. Bons said that when communities are tasked with flood response, members of the community want to fulfill their duty as soon as the flood occurs. This kind of involvement leads them to see where processes could be improved.

- **In the context of the Local Flood Early Warning System**, Mr. Neussner mentioned that EWS messages are sent by the operations centers to villages, sometimes by radio or phone. In the village, the message gets spread. While people appreciate the information, in some cases they are reluctant to evacuate because of fear of looting; sometimes a male family member stays in

the home to protect family assets. It is important to ensure the safety of people's property during a disaster so that people are willing to evacuate and lives can be saved.

- **Talking about institutional coordination**, Mr. Singson pointed out that local government and national government should coordinate their approach to river basin management. Mr. Hernando said the Philippines has adopted integrated water resource management where the province is a part of the community. Dr. Apirumanekul added that in Thailand, urban and rural populations have different approaches to disaster, and that the central government tends to focus flood prevention efforts on cities more than villages.

- **Discussing climate change uncertainties**, Dr. Han said that while rainy days have decreased in Korea, rainfall volume has increased. Korea is preparing to handle changes of this kind associated with climate change. Dr. Phi agreed about the difficulty of making predictions about the weather and suggested a focus on integrated water management in order to create cities that are blue as well as green. According to Ms. Jing, climate change can be challenging to deal with because many Asian cities do not have a regional approach to development. Dr. Han noted that some local governments deal with climate change issues but that in Korea, the central government has strict laws regarding climate change and hazard management and makes the final decisions.

Session V

Flood Risk Early Warning System, Monitoring, and Control System

Moderator: ***Dr. Chusit Apirumanekul, Asian Disaster Preparedness Center, Thailand***

Speakers:

Dr. Lee Chulkyu, National Institute of Meteorological Research, Korea Meteorological Administration, Korea

Mr. Virana Sonnasinh, Ministry of Natural Resources and Environment, Lao PDR

Ms. Yang Fen, Beijing Institute of Water, China

Ms. Wang Jing, China Institute of Water Resources and Hydropower Research, China

Key Points

- Urban floods can result in loss of life and also create transportation problems, disrupt water or power supplies, and cause other damages and losses. Flood maps are an important tool in DRM because they raise the public's awareness of flood risk, provide basic data for assessing flood losses, and are useful in planning for emergency evacuations. Urban flood simulation modeling is another important tool that aids in analysis of the situation before, during, and after the disaster.
- Forecasting errors may lead to under-preparation or over-preparation; a balance must be struck between failure to warn adequately and the corrosive effects of too many false alarms. Information derived from hydrometeorological research can be used to monitor and predict meteorological disasters such as floods and droughts. For optimal prediction of precipitation, a combination of hydrometeorological techniques is used.
- In Lao PDR, timely forecasting and warning by the Department of Meteorology and Hydrology has helped government agencies prepare for flooding. Over time, Lao PDR has learned the importance of strong political commitment for successful large-scale flood preparedness, the degree to which unplanned urban development increases flood damages and losses, and the possibility of resource misallocation arising from the absence of a standard format for assessing flood damages.
- In China, Beijing has a flood control system in place as well as plans to improve the system using both structural and non-structural measures. Planned improvements include flood control and drainage infrastructure, flood simulation, early warning system, and education.

1. Weather and Climate Decision Support System

Dr. Chulkyu Lee, National Institute of Meteorological Research, Korea Meteorological Administration, Korea

Photo: World Bank

Information derived from hydrometeorological research can be used to monitor and predict meteorological disasters such as floods and droughts. Hydrometeorological information has a range of applications: it can be used in meteorological modeling, drought monitoring and prediction, high-impact weather monitoring, and validation of satellite observations. It also has applications for hydrology, including hydraulic structure/water resources management, river flood or flash flood prediction, drought monitoring and prediction, and projection of future water resources.

In Korea, hydrometeorological monitoring and prediction technology is used to support management of floods and water resources affected by high-impact weather events. Figure 8 shows observation sites at the basin of the Andong Dam in Korea, where data simulated from the Land Surface Model (LSM) are validated, observation data are assimilated into the model, and other research is carried out. At the sites, real-time gridded hydrometeorological information at high resolution (1 hour/1km) is gathered using the LSM and the TOPLATS (TOPMODEL-Based Land Surface-Atmosphere Transfer Scheme) model. An online data display system shows data collection status and temporal variation of meteorological parameters.

For optimal prediction of precipitation, hydrometeorological techniques are blended or combined. Water resources may also be investigated where ground-based observations are not available, and a basin-based areal rainfall map may be produced using radar.

Figure 8 Hydrometeorology Observation Sites at the Basin of Andong Dam

Source: © Dr. Lee Chulkyu, National Institute of Meteorological Research. Used with permission.

2. Early Warning Systems in Lao PDR

Mr. Virana Sonnasinh, Ministry of Natural Resources and Environment, Lao PDR

Photo: World Bank

Lao PDR is highly vulnerable to flooding. Vientiane, the capital city, has been flooded by heavy rainfall on several occasions, including in 2008, when water levels surpassed the record set in 1966. Much of the damage caused by floods in Lao PDR can be attributed to inadequate early warning systems, as well as a lack of supplies (including boats) for evacuation and the inability of rescue teams to access unplanned and illegal urban settlements. The National Disaster Management Committee, with members from more than a dozen different ministries, oversees DRM in Lao PDR, but the committee lacks funds and manpower, and has not been as effective as it could be.

Flood forecasting, warning, and dissemination in Lao PDR are the responsibility of the Department of Meteorology and Hydrology (DMH). Flood bulletins are compiled and updated daily; forecasting focuses on water levels and is based on data from six stations (Luang Prabang, Vientiane, Paksane, Thakhek, Savannakhet, and Pakse). Depending on the water level that is forecast, the DMH issues one of two warnings: an initial warning, when water is close to a certain threshold, and an urgent warning, when the threshold has been exceeded. The warning is issued to the media and various ministries. When the warning is urgent, the National Disaster Management Office sends the information to the provincial disaster management offices. Finally, the warning message is also broadcast through national and local radio stations.

Timely forecasting and warning by the DMH has helped government agencies at all levels better prepare for flooding. But there is much room for improvement in flood preparedness. A lack of boats and other supplies impedes evacuation and rescue efforts. Data coverage needs to be improved, particularly north of Luang Prabang, and better use could be made of existing data. Likewise, user awareness about the available risk information provided by the DMH could be increased.

A number of important lessons about flooding in Lao PDR have been learned over time. First, a strong political commitment is crucial for successful large-scale flood preparedness. Second, unplanned urban development and spontaneous settlements increase flood damages and losses. Third, the lack of a standard format for assessing flood damages can lead to misuse of resources.

3. Countermeasures against Urban Flood in Beijing

Ms. Yang Fen, Beijing Institute of Water, China

Photo: World Bank

Beijing is the home to approximately 20 million people. It has two important reservoirs and five main rivers. In recent years, urban floods (figure 9) in Beijing have occurred suddenly and frequently because of extreme weather and sudden local rainstorms, as opposed to in the past, when most flooding was due to high water levels in the Yongding River.

Beijing's flood control system includes the following elements: (1) flood diversion and storage; (2) safe water discharge; (3) source reduction; (4) monitoring, forecasting, and regulation; and (5) departmental links and social participation. The current system includes a reservoir with a total volume of 9.4 billion m^3, a 2,000 km rainwater pipeline (covering 95 percent of the central town), and 130 rainwater pump stations. Other components include a series of reservoirs and sluices, designed to increase water storage when flooding threatens; embankments along

Figure 9 Urban Flood Events

Source: © Yang Fen, Beijing Institute of Water. Used with permission.

the Yongding River (built to a 200-year flood control standard) and the Beiyun River (50-year standard); regulation of small and medium-size rivers (20-year drainage standard); and storm water utilization measures, designed to increase filtration, store water, and reduce downstream pressure.

Beijing has plans to improve its flood control and drainage system with the following four principles: (1) ensure safety; (2) devise a plan for overall systemic management; (3) integrate structural and non-structural measures; and (4) coordinate near-term and longer-term planning. The construction of flood control and drainage infrastructure (including flood detention facilities, permeable pavements, etc.) will take four years. Beijing seeks to enhance flood risk management by using flood simulation and a risk grading system, as well as by defining the urban flood risk areas. Beijing also plans to improve the mechanisms for emergency management: it will establish an early warning system and link it with media to expand coverage, improve safe work mechanisms (such as security warnings), and build a command platform for flood control (including rainfall and flow monitoring, EWS, dispatching, and reporting). Finally, the city will strengthen education in flood control and disaster mitigation and disseminate information about flood prevention, rescue and escape, and mitigation.

4. Urban Flood Inundation Warning and Flood Hazard Mapping in China

Ms. Wang Jing, China Institute of Water Resources and Hydropower Research, China

Photo: World Bank

Urban inundation takes place in China almost every year. Although flooding sometimes occurs because of high water levels in the Xijiang River (figure 10), the most common urban flooding scenario involves heavy rainfall from storms and typhoons, which are very common in China.

Urban floods in China have certain notable characteristics. They create transportation problems and other disruptions, as water pools under overpasses and bridges and flows into underground spaces. Flash floods accompanied by debris flows can also lead to loss of life. Severe losses arising from waterlogging are another feature of urban floods; in Zhejiang Province in 1998–1999, for example, waterlogging was responsible for 40 percent of disaster-related losses. Finally, the secondary disasters associated with urban

Figure 10 Heavy Flooding Caused by Xijiang River

Source: © Wang Jing, Ministry of Water Resources. Used with permission.

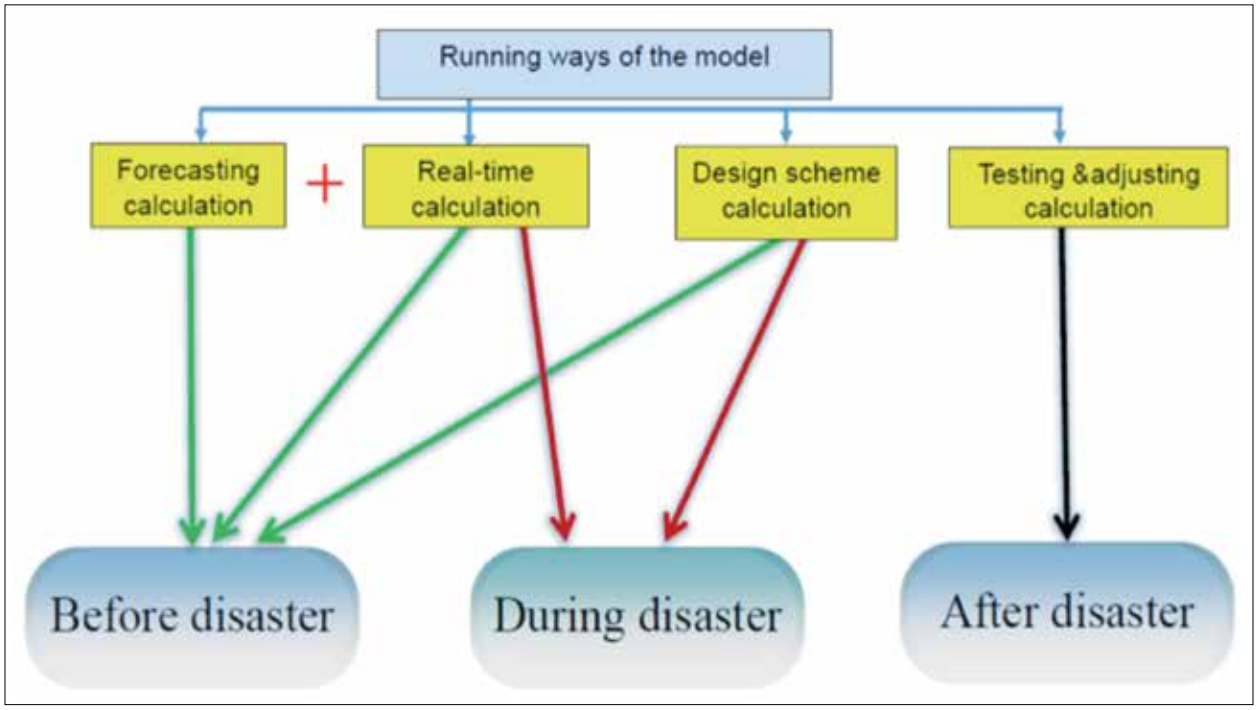
flooding are often severe and can affect a city's lifeline (for example, water supply, power supply, and gas supply).

Urban flood simulation modeling is an important tool for DRM in China. The Ministry of Water Resources simulates flooding using hydrological and hydraulic models and GIS technology; it also uses a numerical model. The urban flood simulation model can be run in different ways for forecasting calculation, real-time calculation, design scheme calculation, and testing and adjusting calculation. The model helps to analyze the situation before, during, and after the disaster (figure 11) to aid decision makers in determining next steps.

Since 1986, China has also used flood hazard mapping for flood control and flood-related decision making. Flood maps raise the public's awareness of flood risk, provide basic data for assessing flood losses, and are useful in planning for emergency evacuations. Ongoing tasks related to flood mapping, which is being carried out in 661 Chinese cities, include revising standards and regulations, improving technical platforms, and conducting pilots. As part of flood hazard mapping, reports are developed; standards and regulations for hazard mapping are being established; technical platforms and templates are being created; pilots are selected; and technical training is provided. The goal is to use flood hazard maps across many fields, for example to support flood control and decision making, defense emergency planning, assessment of flood losses, construction of flood detention facilities, determination of evacuation routes and places, and drainage planning.

China's cities are in a stage of rapid development, making it likely that urban flood risk will increase. But even if urban inundation cannot be completely avoided, China must act to decrease flood losses—not only by improving and reconstructing its drainage system, but also by considering the storage, detention, infiltration, and utilization of rainwater in the process of infrastructure construction. Flood simulation technology is an important non-structural measure that can provide support to flood hazard mapping, flood prevention warning, and decision-making. Already today, there are many applications of this approach in China.

Figure 11 Urban Flood Simulation Model



Source: © Wang Jing, Ministry of Water Resources. Used with permission.

Summary of Discussion

- **Discussing rainfall and flood data collection,** Dr. Lee said that Korea is currently producing annual data and surface data to help forecast disasters. Mr. Singson mentioned the funding needed to hire staff to measure floods or river heights. The Philippines has the historical data needed for flood modeling and forecasting, but acquiring the data can be costly. Mr. Neussner pointed out that there is a tendency to underestimate or overestimate river flows, and that very accurate flood models need to consider local conditions and community behavior. Mr. Bons added that predicting flooding in low-lying areas is difficult; prediction is like gambling if the measurement is not set up accurately. According to Dr. Apirumanekul, in Thailand people believe in historical data more than computer-generated data because many people do not know how to use modern technologies. He added that when a flood occurs, there is an emergency response to the disaster, but no agency is tasked with collecting data.

- **Citing last year's heavy rainfall in China**, Ms. Jing said that many cities have observation stations for investigation so that actual data can be compared to the simulation data to make the flood forecasting model more accurate. She noted that man-made factors are also considered in the simulation, for instance to reflect distribution chains of a whole area. Mr. Sonnasinh said that Lao PDR has developed hazard maps that are distributed to the community, as prediction of floods is difficult. Thus in times of disaster, community members move to a safe place by themselves. Mr. Singson said that free software related to flood management has been developed and is available.

- **Highlighting the need for community engagement,** Ms. Stanton-Geddes mentioned that Indonesia and Mongolia engage students for capacity and awareness building. Mr. Harahap added that students are also involved in the early warning system. Dr. Phi noted that there are considerable gaps between flood risk management planning and actual community need, and said that the government in Vietnam is working to minimize them.

- **Discussing early warning systems,** Mr. Sonnasinh said that in Lao PDR, the National Disaster Management Committee is responsible for the early warning system, but there is no law governing it. Ms. Mandat added that in Mongolia, there is a national early warning system law. Mr. Ransara said that Sri Lanka has three organizations responsible for the early warning system. Mr. Basworo explained the three kinds of alarm in Indonesia: alarm 3 is least urgent, but alarm 1 or 2 signals immediate evacuation. Mr. Bons mentioned that Indonesia has two institutes that will provide regional training in the early warning system next year.

Session VI
Implementation Challenges and Opportunities: Open Discussion

Moderator: ***Dr. Chusit Apirumanekul, Asian Disaster Preparedness Center, Thailand***

Speakers: ***All participants***

Participants discussed the challenges their countries face as well as opportunities that exist to improve flood risk management.

Lao PDR

Challenges

- Greater community awareness, better coordination between institutions, and more timely dissemination of flood-related information are needed.
- The budget and human resources to support DRM are insufficient.
- There are no standards for flood damage assessment, which can mar effective allocation of resources for recovery and prevention.
- Flood prevention should be incorporated into urban development, since existing infrastructure, equipment, and services are inadequate for monitoring, warning, and evacuation.
- Strong political commitment is crucial for successful large-scale flood preparedness.

Opportunities

- A number of initiatives are already under way. The government has proposed further action for risk assessments and better land use planning. There is scope for learning about implementation of adaptation program from other countries.
- In the long term, there is a need to adapt innovative technology and incorporate DRM into national development planning.

Photo: World Bank

Workshop participants from Lao PDR.

The Philippines

Challenges

- Like many other countries in the region, the Philippines faces the challenges related to rapid urbanization, community involvement, and access to scientific risk data for planning, forecasting, and warning purposes.
- Government representatives can be reluctant to assume responsibility for disaster warning because they don't want to be responsible for issuing a false warning. The Philippines can learn from other countries about effective practices and appropriate institutional set-ups for disaster warning.
- Each country has different structures for dealing with disaster preparedness and response. In the Philippines, there are multiple agencies dealing with disaster-related issues—for example, the fire department does not fall under the national DRM agency. Complex institutional arrangements can make data sharing and collection more difficult, as well as response.

Opportunities

- Community involvement is particularly important for the long-term sustainability of development programs.
- Community early warning systems have been effective in the Philippines. Learning from other countries and adapting appropriate solutions can further help the country.
- The government could look at the institutional set up for DRM in other countries to identify and adapt good practice.

Vietnam

Challenges

- With the safety of the people as its main goal, Vietnam faces the challenge of devising an integrated approach to urban flood risk management that can handle both climatic and non-climatic hazards. At the same time, it needs to proceed with adaption and building resilience.
- More cross-agency collaboration and cooperation is needed. Currently, one ministry is responsible for forecasting and warning, while a different ministry is responsible for response and recovery. Ideally, disaster preparedness and response should be brought under one umbrella.
- Resource constraints affect the establishment of the minimum protection levels. Similarly, human capacity constraints affect the operation functions of the flood protection system. To adequately protect people, significant financial support is required.
- Effective governance is essential for implementing DRM laws.

Opportunities

- One of the key priorities is to balance structural and non-structural measures. The participants learned about interesting approaches taken by NEMA that could be adapted to improve flood forecasting, warning, and evacuation systems, which need particular attention.
- The government should ensure minimum-level protection systems, while at the same time continue investing in adaptation and building resilience.

China

Challenges

- Institutions involved in flood management should have clear responsibility for specific tasks. These responsibilities should fit the scale of tasks.
- Preparation for flood response should take place before the crisis, not in the middle of a crisis.

Opportunities

- Institutional cooperation and common commitments are important for effective DRM. Institutions should assume their responsibilities and act accordingly.
- China can learn from and adapt global best practice, particularly long-term measures and use of innovative technologies.

Sri Lanka

Challenges

- A common commitment for DRM across institutions is needed.
- Sri Lanka seeks to achieve a flood safety level of +1.85 m (mean sea level) for a 50-year return period event.

Opportunities

- The country should develop needed infrastructure and use available technology for hazard management.
- Eco-friendly approaches should be pursued and aligned with urban planning.

Mongolia

Challenges

- The legal system needs to be strengthened to support a comprehensive DRM approach.
- Comprehensive flood risk management at both the national and provincial levels should be linked with future national development planning.
- The necessary budget for flood risk management should be allocated. Also, given resources constraints, available funding needs to be efficiently used and distributed.
- DRM training should be expanded to more communities at risk.

Opportunities

- Mongolia should implement its existing flood risk mitigation program.

- DRM training and capacity-building programs should be expanded to increase public risk awareness, especially in rapidly growing high-risk urban areas.
- In the long term, Mongolia should share risk information and DRM plans with other countries. It should improve links and cooperation between involved DRM agencies.
- Establishing a monitoring system like Korea and an early warning system like the Philippines or Indonesia could help reduce disaster risk in Mongolia. Mongolia needs assistance from these countries for successful implementation.

Photo: World Bank

Workshop participants from Mongolia.

Indonesia

Challenges

- There needs to be greater synergy between national and regional DRM strategies, along with greater involvement of stakeholders (such as universities, the private sector, and community organizations).
- DRM planning at the national level should include all relevant stakeholders.

Opportunities

- Institutions at both the national and local levels need to be strengthened.
- Capacity building needs to be strengthened across all institutions—government, community organizations, and other stakeholders. Training should include non-structural measures.
- Indonesia should scale up local DRM programs, for example, introduce participatory mapping in cities other than Jakarta.
- Indonesia could seek technical assistance to aid in disaster reduction at both the national and local levels.

Korea

Challenges

- Korea lacks the detailed data on hazards and exposure that are needed for risk identification and analysis.
- Korea has a limited pool of experts on climate change, risk assessment, and geologic/hydrometeorological hazards at the local level.
- The political will to adhere to local plans and investment programs must be maintained.

Opportunities

- Korea should develop an organic assessment platform to integrate disaster information and simulate potential disaster impacts.
- It should design an optimal risk identification work-flow process, , to assess damages and losses by means of disaster information and model results. This work-flow process compatible with other DRM processes and accessible to stakeholders.
- It should establish an implementation plan for the disaster information tool.
- It should develop a platform to adopt a national disaster management law that would support decision making and prioritization of preparedness and recovering projects, as well as preparation of hazard maps. The regulations should include an obligation to assess risk as well as potential damages and losses of all national development projects.

Wrap-up: Entry Points and the Way Forward

Moderator: ***Dr. Chusit Apirumanekul, Asian Disaster Preparedness Center, Thailand***

Lao PDR

- Strengthen real-time flood forecasting and timely dissemination of information by the Department of Meteorology and Hydrology, to support agencies at each level of government in making necessary arrangements and managing flood risk.

Philippines

- Expand community-based flood warning systems in remote areas. Community empowerment is helpful in addressing flood risk, and the Philippines should continue working with the German Society for International Cooperation (GIZ) in this area.

Vietnam

- Set up minimum-level systems to protect people, for example through strengthening flood forecasting and early warning systems, and learning from other international good practice; and continue to work on adaptation and building resilience.

China

- Expand understanding of non-structural measures and national emergency systems.
- Learn about participatory mapping and OSM, as piloted in Jakarta. The government could identify cities for OSM and provide necessary training for the public.

Sri Lanka

- Focus on green adaptation and eco-friendly DRM.
- Raise public awareness of and knowledge about DRM.

Mongolia

- Continue developing and implementing flood risk management strategies for municipalities.
- Learning from good practices in the region, improve monitoring and early warning systems.

Indonesia

- Develop guidelines for non-structural measures and establish DRM action steps for the local level, based on available flood risk hazard maps.
- Using participatory processes, set up evacuation lines at the community level and early warning system at the sub-district level; strengthen contingency planning at the sub-district level.
- Provide training to government officials responsible for DRM as well as to the private sector and relevant stakeholders.
- Seek technical assistance to reduce disaster risk at the national and local levels.

Korea

- Share advanced technologies, knowledge, and good practice with other countries.

Photo: World Bank

Ms. Wataya called the workshop an opportunity for Asian countries to come together as a group to discuss serious issues. Workshops of this kind are especially interesting and important, she believes, because the discussions happen face to face. She urged all participants to continue working in their own countries to overcome the challenges and take advantage of the opportunities discussed during the workshop. The East Asia and Pacific DRM team of the World Bank looks forward to continuing both formal and informal discussions with participant countries. All the matters discussed in the workshop were based on case studies and specific experiences in individual countries, so countries were able to both teach and learn from one another. According to Mr. Apirumanekul, the workshop was a chance for parties to work together where all parties benefit. Not all lessons will be useful for all countries, given the very different settings, but they will nonetheless open ways for modified approaches that suit countries' specific needs and capacities. Ms. Wataya hoped participants would begin addressing challenges immediately to get maximum advantage from the workshop.

Special Session: Site Visits

A site visit to NEMA was arranged to show participants current flood risk management technologies used in Korea, and demonstrate how Korea manages national emergencies. Participants heard an in-depth presentation on NEMA's activities by Dr. Tae Sung Cheong, saw videos offering practical guidance on disaster management, and visited the NEMA control room. Participants also visited the Climate Change Adaptation and Disaster Risk Reduction Exhibition (CADRE 2013), where they gained valuable information from exhibits on various risk mitigation areas.

Photo: World Bank

Workshop participants visiting NEMA.

Disaster Situation Control in Korea: Operations and Systems

Dr. Tae Sung Cheong, National Disaster Management Institute, Korea

NEMA distinguishes three types of disaster: natural (for example, typhoon, flood, earthquake), man-made (for example, fire, explosion, chemical accident), and social (for example, contagious disease, infrastructure paralysis). NEMA handles natural and man-made disasters; social disasters are handled by the Ministry of Security and Public Administration.

Korea has legislation in place to deal with disasters. In addition to the Disaster and Safety Management Basic Act, there are 19 laws dealing with various aspects of disaster management. Under non-emergency conditions, NEMA has a staff of 550 who deal with ongoing matters such as legislation, regulation, training, standards, and system development. In times of emergency, NEMA acts as the control tower for 38 central ministries and agencies, 230 local governments, and 202 fire departments. This two-tiered approach is cost-effective and highly efficient.

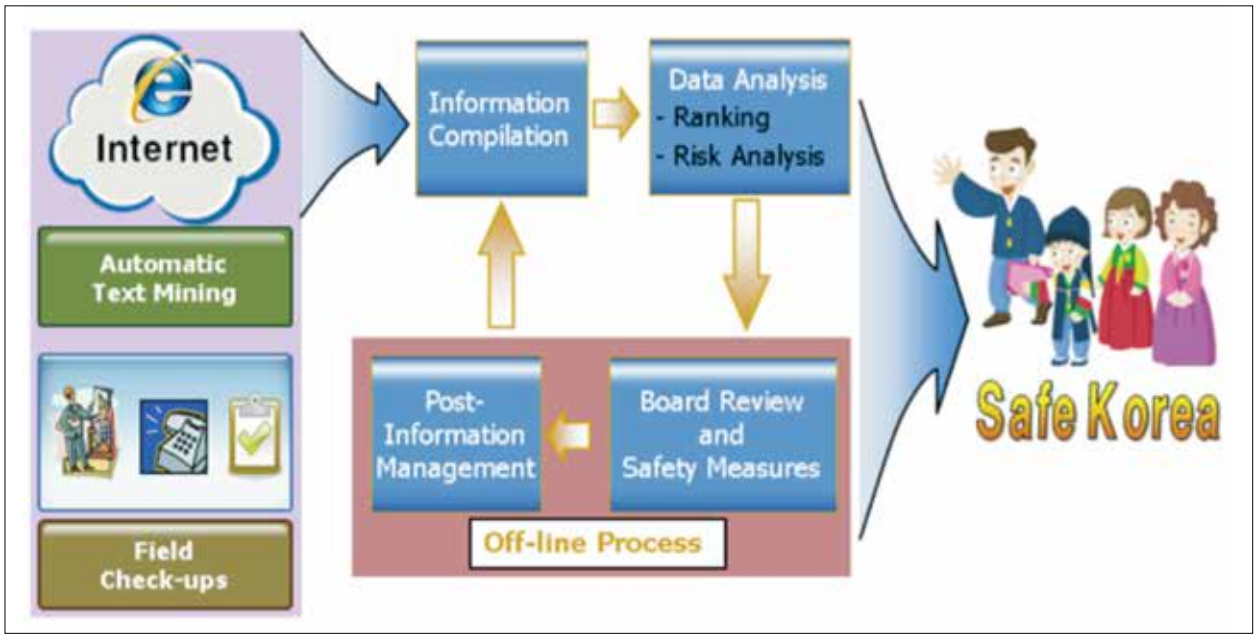
NEMA relies on information technology for its "one-step-ahead" response system, including digital elevation (3-D) and other thematic maps, real-time rainfall data by time and location, short-time rainfall prediction data, and drainage system information. Data analysis allows NEMA to predict the increase rate of river water volume, forecast location and severity of possible flood, and generate effective and accurate early warning and evacuation alerts.

NEMA's response system has a variety of components. The National Disaster Management System (NDMS) deals with disaster prevention, preparedness, response, and recovery and is designed to reduce the time needed to compile damage data and recovery budgets after disasters. NEMA also uses Cell Broadcast Service (CBS), to send disaster information to cell phone users in a disaster area; Digital Multimedia Broadcasting (DMB) to convey disaster warnings to mobile devices; an unmanned rainfall warning system to measure water levels upstream for warnings downstream; an earthquake response system to support emergency rescue and relief response; a nationwide network of CCTV that allows disaster monitoring by local governments and agencies; and a remote sensing system that can be used for damage surveys.

NEMA also relies on the Disaster Premonitory Information Management System (figure 12), which conducts ongoing monitoring of defects in infrastructures (for example, bad welding in a bridge, building design modification, or cracks in a building). NEMA collects information on defects, analyzes the risks they pose, and seeks to have any safety issues resolved. Information on each case is kept in a database.

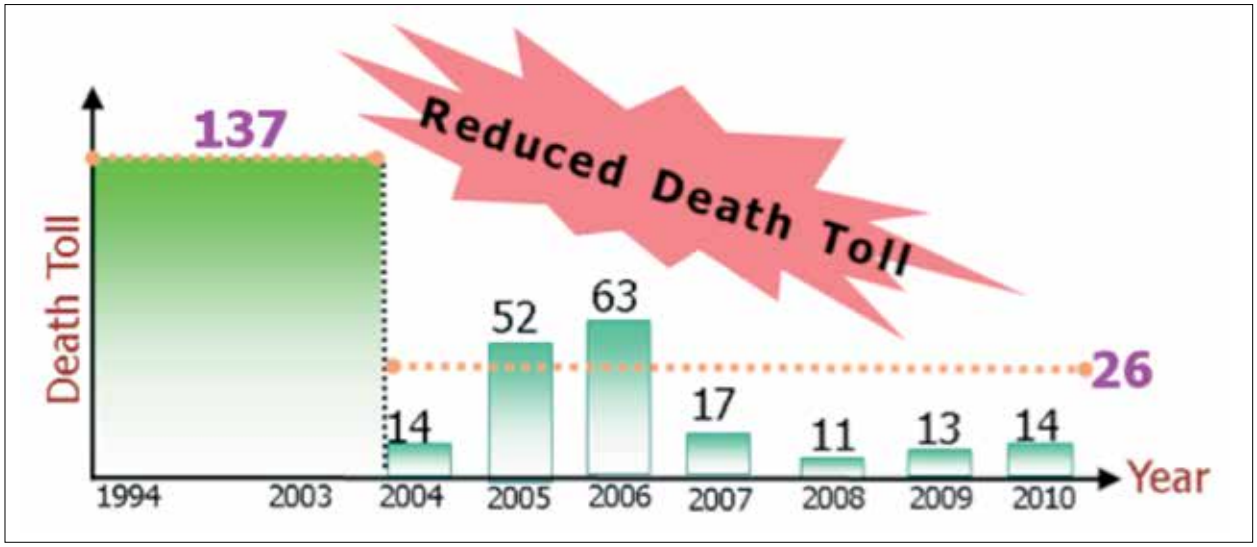
By strengthening its DRR capacity and establishing proactive and preemptive response systems, Korea has successfully reduced the death toll associated with disasters. Between 1994 and 2003, 137 people died on average as a result of disasters in Korea; between 2004, the year NEMA was established, and 2010, the average number of deaths due to disaster fell to 26 (figure 13).

Figure 12 Disaster Premonitory Information Management System



Source: © National Emergency Management Agency. Used with permission.

Figure 13 Reduction of Death Toll in Korea Caused by Natural Disaster



Source: © National Emergency Management Agency. Used with permission.

APPENDIX 1: Workshop Agenda

DAY 1: May 28, 2013		
8:30 – 9:00	Registration	
9:00 – 9:20	**Opening and Welcome Remarks**	
	Mr. Lester Dally Special Representative for Republic of Korea, The World Bank	
	Mr. Jo Sung Wan Vice Administrator, National Emergency Management Agency (NEMA), Republic of Korea	
	Mr. Prashant Team Leader, Strategy and Partnerships, GFDRR/World Bank	
	Dr. Sangman Jeong President, Korean Society of Hazard Mitigation	
9:20 – 11:00	**Session 1: Balancing structural and non-structural measures in flood risk management: An Overview**	
	Moderator: ***Dr. Chusit Apirumanekul***, Asian Disaster Preparedness Center (ADPC)	
	9:25 – 9:40 ***Mr. Kees Bons*** Deltares	Comparing Structural and Non-structural Measures
	9:40 – 10:05 ***Dr. Ho Long Phi*** The Center of Water Management and Climate Change, Vietnam	A Balanced Approach for Urban Flood Management: Ho Chi Minh City Case Study Q&A
	10:05 – 10:30 ***Dr. Hitoshi Baba*** Japan International Cooperation Agency (JICA)	Comprehensive Flood Risk Management strategy: Methodology and technology to make resilient urban development Q&A
	10:30-11:00 Discussion	
11:00 – 11:15	*Break*	
11:15 – 12:45	**Session 2: Challenges for making flood risk data widely accessible to stakeholders**	
	Moderator: ***Dr. Chusit Apirumanekul, ADPC***	
	11:20 – 11:45 ***Mr. Ery Basworo*** Managing Head, Jakarta Disaster Management Office, Indonesia ***Mr. Edi Junaedi Harahap*** Jakarta Disaster Management Office, Indonesia	The Flooding City of Jakarta Q&A Participatory Mapping to fill data gap for better flood information management in Jakarta Q&A
	11:45 – 12:10 ***Dr. Cheong Tae Sung*** National Disaster Management Institute (NDMI), Korea	Effective Flood Risk Assessment Methodologies Q&A
	12:10 – 12:45 Discussion	

DAY 1: May 28, 2013 (continuation)		
12:45 – 14:00	*Lunch*	
14:00-15:50	**Session 3: Reducing flood risk losses and enhancing resilience: Innovative approaches**	
	Moderator: ***Dr. Chusit Apirumanekul, ADPC***	
	14:05 – 14:30 ***Mr. Kees Bons*** Deltares	Ecosystems-based approaches - Future or Fantasy Q&A
	14:30 – 14:55 ***Minister Rogelio L. Singson*** Department of Public Works and Highways, the Philippines	Metro Manila Integrated Flood Risk Management Master Plan Q&A
	14:55 – 15:20 ***Mr. Narayanage Dinusha Prabhath Ransara*** Metro Colombo Urban Development Project, Sri Lanka	Reducing Flood Risk in Metro Colombo Region: Structural & Eco-System Based Approaches Q&A
	15:20 – 15:50 Discussion	
15:50 – 16:00	Break	
16:00 – 17:50	**Session 4: Reducing flood risk losses and enhancing resilience: Community-based approaches**	
	Moderator: ***Dr. Chusit Apirumanekul, ADPC***	
	16:05 – 16:30 ***Mr. Hilton Hernando*** Philippine Atmospheric, Geophysical & Astronomical Services Administration (PAGASA) ***Mr. Olaf Neussner*** Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ)	Community involvement and local flood early warning with low-tech approaches for small rivers in the Philippines Q&A
	16:30 – 16:55 ***Mrs. Dondmaa Enebish*** Ministry of Construction and Urban Development, Mongolia ***Ms. Khulan Mandat*** Specialist of the Development Program and Project, Municipality of Ulaanbaatar, Mongolia	Reduction of Flood Risk in Ulaanbaatar City Q&A
	16:55 – 17:20 ***Dr. WooSuk Han*** Korea Research Institute for Human Settlements (KRIHS)	The Urban Disaster Prevention Strategy preparing with climate change Q&A
	17.20 – 17.35 ***Mr. Guratno Hartono*** Director of Building and Neighborhood Development, Indonesia	National Community Empowerment Program–Urban: Efforts of Indonesian Government in Poverty Alleviation through Community-based Empowerment Q&A
	17:35 – 17:50 Discussion	
18:00	**Reception** Welcome speech, ***Mr. Kim Gye Jo***, Director General, Bureau of Disaster Prevention and Management, NEMA Remarks, ***Minister Rogelio L. Singson***, Department of Public Works and Highways, the Philippines	
20:00	**End of Day 1**	

DAY 2: May 29, 2013		
9:00 – 12:00	**Site Visits**	
	Central Control Center of National Emergency Management Agency	
	Dr. Tae Sung Cheong National Disaster Management Institute, Korea	Disaster Situation Control in Korea: Operations and Systems
	2013 Climate Change Adaptation and Disaster Risk Reduction Exhibition (CADRE 2013)	
12:15 – 13:45	*Lunch*	
13:45 – 15:35	**Session 5: Flood Risk Early Warning System, Monitoring, and Control System**	
	Moderator: ***Dr. Chusit Apirumanekul, ADPC***	
	13:50 – 14:15 ***Dr. Chulkyu Lee*** National Institute of Meteorological Research (NIMR), Korea Meteorological Administration	Development of Hydro-meteorological information Monitoring and Prediction Technology for supporting of Flood Warning System Q&A
	14:15 – 14:40 ***Mr. Virana Sonnasinh*** Ministry of Natural Resources and Environment, Lao PDR	Early Warning System in Lao PDR Q&A
	14:40 – 15:05 ***Ms. Yang Fen*** Beijing Institute of Water, China ***Ms. Wang Jing*** Ministry of Water Resources (MWR), China	Countermeasures against urban flood in Beijing Q&A Urban flood inundation warning and flood hazard mapping in China Q&A
	15:05 – 15:35 Discussion	
15:35 – 15:50	Break	
15:50 – 16:50	**Session 6: Implementation challenge – Open discussions**	
	Moderator: ***Dr. Chusit Apirumanekul***, ADPC	
	All delegation representatives	Discussion, action points and way forward
16:50	**Wrap-up** Moderator: ***Dr. Chusit Apirumanekul***, ADPC	
17:00	**End of Day 2**	

Venue of the Workshop: COEX, Convention and Exhibition Center (room no. 403), 159 Samseong-dong, Gangnam-gu, Seoul 135-731, Korea

MANAGING THE RISKS OF DISASTERS IN EAST ASIA AND THE PACIFIC

Disaster Risk Management Team
East Asia and Pacific Infrastructure Unit (EASIN)
The World Bank

1818 H Street NW, Washington DC 20433
Telephone: +1 202 458 7382
E-mail: eapdrm@worldbank.org
Internet: www.worldbank.org/eapdisasters

THE WORLD BANK

GFDRR
Global Facility for Disaster Reduction and Recovery