City Profiles
Hanoi, Vietnam

Climate Resilient Cities

47801

A Primer on Reducing Vulnerabilities to Disasters

I/ CITY DESCRIPTION

Hanoi

Covering an area of more than 918 square kilometers, Hanoi comprises two different topographical features: the delta and the Middle Region of the North. Most of the deltaic land lies on both sides of the Red River and its tributaries. The Middle Region comprises Soc Son district and a portion of Dong Anh district, a prolongation of the Tam Dao mountainous mass stretching towards the Delta, which is 7–10 meters or sometimes even hundreds of meters above sea level. Hanoi has been merged with Ha Tay and some parts of Hoa Binh and Vinh Phuc since August 1, 2008. Since official information about population, area, average elevation, etc. of the newly merged Hanoi is not available yet, the profile refers to inner Hanoi only.

Since Independence Day in 1945, there have never been any dike failures that have caused flooding in Hanoi City.[1] The dike system has never broken due to disasters, even during the biggest flood years of 1969, 1971, and 1996.

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Research indicates that the impact of sea-level rise from global warming could be catastrophic for Vietnam. A five-meter sea-level rise in Vietnam would have an impact on up to 16 percent of the land area, 35 percent of the population, and 35 percent of gross domestic product (GDP).[2] The highest impact in Vietnam would be on the Red River Delta and the Mekong Delta. The research uses satellite maps of the world overlaid with comparable data for 84 coastal developing countries to calculate the toll of such changes on people, GDP, urban areas, and agriculture in five developing regions.

Vietnam experiences a tropical monsoon climate. The wide range of latitudes and the marked variety of topographical relief means that the climate tends to vary considerably from region to region. Mean annual temperature ranges from 18–29°C, and a distinct seasonal difference is felt between the dry season in November to April and the warm rainy season from May to October. Mean annual rainfall ranges from 600 millimeters to 5,000 millimeters, 80–90 percent of which is concentrated in the rainy season.[3]

Its location and topography make Vietnam one of the most disaster-prone countries in the world, suffering from typhoons, tropical storms, floods, drought, seawater intru-

Data for this city profile are largely based on "The Science and Practice of Flood Disaster Management in Urbanizing Monsoon Asia" by Nguyen Van Le, prepared for and presented at the regional workshop in Chiang Mai Thailand in April 2007.

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sions, landslides, and forest fires. Of these, the most damaging and frequent are typhoons, tropical storms, and floods. Over recent decades, the damage due to natural disasters has increased drastically. This trend may continue as climate change is expected to alter the current storm system and precipitation regimes.

Sea-level rise of 30 centimeters to one meter over the next 100 years is expected, which is projected to cause capital value loss every year of up to US$17 billion (80 percent of the country's annual GDP) if no protective measures are taken.

Projections of population change and development suggest that, even without any changes in climate or sea level, the number of people at risk is expected to rise 60 percent by 2025, and that the US$720 million of capital value currently at risk from annual flooding may increase ten-fold, or 5 percent, of Vietnam's GDP.[4] Rising sea levels will almost certainly occur and increase this risk even further. Sea-level rise of 30 centimeters to one meter over the next 100 years is expected, which is projected to cause capital value loss every year of up to US$17 billion (80 percent of the country's annual GDP) if no protective measures are taken.[5] The increased risk is not restricted to coastal areas; in fact, rise of river beds and backwater effects will also cause serious problems to inland river regions, with a total of 40,000 km^2 flooded annually.[6]

Changes to precipitation regimes expected under climate change scenarios will further exacerbate flooding problems. Most climate models indicate overall increases in precipitation. The concentration of Vietnam's annual rainfall over a short rainy season makes the system sensitive to rainfall increases.[7] Wet-season rainfall increases are expected to increase peak flows considerably and reduce the return period of a 100-year event to 20 years.[8]

Nam Dinh Province

Nam Dinh Province lies in the Red River Delta Region, which, like the Mekong Delta Region in the south of the country, is fertile and highly productive agriculturally. The low-lying land provides ideal conditions for wet rice cultivation. This high productivity has made the Red River Delta Region one of the most densely populated and intensely cultivated areas of coastal Vietnam.[9] Nam Dinh's close proximity to the capital, Hanoi, means that transport and communication links are relatively good.

II/ PRIORITY HAZARDS/VULNERABILITIES

Flood Preparedness and Prevention for Hanoi

Hanoi faces the following risks and challenges in flood preparedness and prevention:

- Risks of large floods in the Red River are even greater than the historical flood in 1971 (due to climate change and destruction of upstream forests);
- Risk of rising water levels, given the same water discharge capacity over the previous years, has increased. Moreover, the situation of the river bed and overcrowded bridge construction has resulted in restricted building zones for houses (over the height of inner dikes);
- Increasing negative situations persist with high river flooding in combination with strong storm and heavy rainfall in Northern Delta during high tide periods (due to global climate change);
- Difficulties may arise from regulating flood discharge: advance relocation of 10,000 people from flood areas (worsened by their unwillingness to leave their homes) and risks of disruption of key flood resistance construction during emergency response;
- Dam breakdown is possible in upstream reservoirs during a big flood, (due to climate change in combination with heavy rainfall in large areas in the Red River Basin);
- Management of the flood-diversion zone is already challenging. The urbanization process is growing sharply. High population growth (due to increasing migration from rural areas to seek employment in the city) has put further pressure on dike management; and

- There are limitations in medium- and long-term forecasting for rainfall, floods, and storms.

Inundation in Hanoi City

Inundation is a threat to Hanoi given the following:

- The old and low capacity of underground sewage irrigation is unable to discharge water when rainfall is higher than 100 millimeters per hour;
- Many ponds and lowland areas have been replaced by construction and buildings, which leads to the reduction of water restoration capacity. and
- The urbanization boom has led to inefficient solid waste disposal, resulting in inundation and stagnation of underground water.

Nam Dinh Province Flood Protection

The Red River Delta Region, and in particular Nam Dinh Province, is currently affected by large and rapid changes in floodwater levels. Inundation occurs annually, due partly to very high river levels in the rainy season causing deep flooding in the Delta Region, but also due to tidal flooding at the coast, which brings shallower, saline floodwaters to low-lying coastal regions.

Nam Dinh Province is currently protected by a system of dikes and levees that have been built and added over the last 1,000 years by local communities.[10] This system protects the agricultural land from inundation and allows rice production on which the local economy is dependent.

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Disaster risk management is carried out at a local level within Nam Dinh Province. There is a well-defined vertical structure for the demarcation of responsibilities and roles within Vietnam. Each province and subsequent district is responsible for implementation of national policies. The main focus of policies is the prevention of risk from identified natural disasters. In Nam Dinh, the main recurring risk is from typhoons.

III/ ADAPTATION MEASURES: ENHANCING RESILIENCE TO CLIMATE CHANGE IMPACTS

Hanoi

Hanoi is engaging in the following adaptation activities:

- Actively improve the flood preparedness and prevention standards for sustainable development. Current flood prevention probability level is 0.8 percent, but the target is 0.4 percent, and then 0.2 percent in the future;
- Strengthen the dike system to protect the right bank of the Red River (Asian Development Bank project);
- Strictly monitor, investigate, and respond to dike emergencies through institutional strengthening:
  - The Regulations for Dike Management were revised and upgraded to the Ordinance for Dike Management in 1989, revised again in 2000, and currently changed to the Law for Dike Management in 2006;
  - The Ordinance for Flood and Storm Control in 1990 and 2000 (revised) was developed into the Ordinance for Emergencies in 2000;
  - The Network of Committees for Floods and Storms Control is to be strengthened at all levels;
  - Dike Management Teams' efficiency and communication standards are to be improved, including (a) organization and development of dike-guard task forces, (b) local pioneer task forces for dike protection, and (c) search and rescue task forces in the army;
  - Flood and storm contingency funds raised by local people; and
  - National contingency fund and other revenue.
- Clear river bed and unlock river flows to ensure prompt flood discharge in the Red River, including lifting collapsed war-damaged bridges, lowering the elevation of inner dikes, relocating houses and construction from the restricted barrier of floods, and dredging river estuar deposits;

- Build upstream water reservoirs to control the flood pressures for Hanoi;
- Strengthen flood discharge and construction (following design procedures) to protect Hanoi in flood emergencies. Issue detailed socio-economic policies for flood discharge and control processes to ensure social equity;
- Plant and protect upstream forests (e.g., 5 million hectares forestation program with targets an increase in forest coverage up to 40 percent by 2010); and
- Implement "channelization" initiative for selected parts of the Red River that flow within the Hanoi zone.

After an international workshop on flood mitigation, emergency preparedness, and flood disaster management in Hanoi in 1992, the *First National Strategy and Action Plan for Disaster Mitigation* was developed and approved in 1994 (updated 1995). The Plan addressed the following important water-related disasters in Vietnam: river floods; flooding from the sea; increased runoff; erosion and siltation of river beds; slope instability, mudflows, and landslides; torrential rains in combination with strong winds; failures of water-retaining structures; and seawater intrusion into groundwater. The Plan had three main goals: forecasting and warning, disaster preparedness and mitigation, and emergency relief.

The Disaster Management Unit has since developed a *Second National Strategy and Action Plan for Disaster Mitigation and Management* for the period 2001–2020. This addresses all major phases of the disaster cycle and has the following 10 basic principles:

1. Disaster planning will be based on multi-hazard identification and risk assessment and on the different types of hazards and levels of disaster risk in different parts of the country.
2. Disaster preparedness and forecasting are the preferred methods of disaster mitigation.
3. Disaster preparedness and mitigation are the task of each local area throughout the country.
4. Measures for ensuring the long-term benefits of disaster mitigation for the whole community are to be given the highest priority.
5. Measures for reducing the risk of a particular type of disaster must be compatible with reducing the risk of other types of disasters.
6. All measures must be carefully considered, both for practicality and technology, and these measures have to be realistic in the Vietnamese context in its current and future state of development.
7. Reduction of disaster risk must be compatible with traditional disaster-coping mechanisms of local communities and must support hunger eradication and equitable poverty reduction.
8. Measures for disaster preparedness and mitigation must be consistent with the economic development level of each local area, as well as the desired general economic development of the country.
9. Measures for disaster mitigation must be compatible with measures for protecting the environment, protecting equitable development, sustaining natural resources, and preserving cultural heritage.
10. Cooperation and coordination between the central and local levels of government, state agencies, nongovernmental organizations, and the general public must be well established using a bottom-up approach starting at the grassroots level. Similarly, cooperation and coordination of external assistance needs to be strengthened and aggressively pursued.

The Ministry of Natural Resources and Environment (MoNRE) has just drafted the *Vietnam National Target Program on Climate Change,* which will be effective by the end of 2008.

Nam Dinh Province

The following range of disaster risk management measures have been identified for Nam Dinh Province according to the draft Second National Strategy and Action Plan, though many have yet to be implemented and/or enforced:[11]

- Afforest and protect existing upstream forest watersheds to reduce downstream floods;
- Build large- and medium-scale reservoirs upstream on big rivers to retain floodwaters;
- Strengthen dike systems to be able to resist design flood levels;
- Build flood diversion structures;

- Clear floodways to rapidly release floodwater;
- Strengthen dike management and protection works to ensure the safety of the dike systems;
- Construct emergency spillways along the dikes for selective filling of flood retention basins; and
- Designate and use flood retardation basins to decrease the quantity of water flow.

Nonstructural measures that have been identified include:

- Models for river flood forecasting should be developed to give prompt warnings and to be able to carry out quick and effective response measures;
- The National Disaster Committee and organizations for flood and storm control from central to local government levels have to be strengthened to mobilize flood and storm mitigation and management at all levels;
- Legal documents—such as the Regulation on Flood and Storm Warning; Ordinance on Flood and Storm Prevention; Ordinance on Dikes; and government regulations on construction of dikes, flood release, flash-flood prevention, disaster relief, activities of standing offices for flood and storm prevention, and damage measurement and assessment—have been prepared and need to be continuously reviewed and strengthened;
- Community disaster awareness should be enhanced through education, training, workshops, and circulation of disaster bulletins;
- Plans in accordance with all probable disaster situations have to be prepared, including disaster-specific measures, so that damage and losses can be mitigated;
- Shifting the cultivation season has to be studied as a measure to mitigate damage to agricultural production;
- Master plans have to be developed to mitigate hazards, to familiarize local populations, and to evacuate people where there is no available capability for limiting the impact of disasters that frequently occur; and
- From each disaster, lessons learned and experience must be collected for future application.

Notes

This "City Profile" is part of *Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters*, published by the World Bank. The analysis presented here is based on data available at the time of writing. For the latest information related to the Primer and associated materials, including the City Profiles, please visit www.worldbank.org/eap/climatecities. Suggestions for updating these profiles may be sent to climatecities@worldbank.org.

[1] Historical floods with great damage for Thang Long occurred in the years 1078, 1121, 1236, 1238, 1243, 1270, 1445, 1467, 1491, 1506, 1630, 1713, 1728, 1806, 1809, 1821, 1827, 1844, 1893, and 1915.

[2] S. Dasgupta, B. Laplante, C. Meisner, D. Wheeler, and J. Yan, The Impact of Sea-Level Rise on Developing Countries: A Comparative Analysis, Policy Research Working Paper 4136 (Washington, D.C.: World Bank, 2007).

[3] Ministry of Natural Resources and Environment (MoNRE), Socialist Republic of Vietnam (2003), International Communication, quoted in Viner and Bouwer (2006), "Linking Climate Change Adaptation and Disaster Risk Management for Sustainable Poverty Reduction," Vietnam Country Study, November 2006, European Union funded, Ref MWH 475000177.001-4 rev. 0.

[4] Zeidler, R.B. (1998), "Continental shorelines: Climate change and integrated coastal management," Ocean and Coastal Management 37: 41–62.

[5] Zeidler (1998).

[6] Zeidler (1998).

[7] MoNRE (2003).

[8] MoNRE (2003).

[9] Adger (2000), in Viner and Bouwer (2006) Linking Climate Change Adaptation and Disaster Risk Management for Sustainable Poverty Reduction, Vietnam Country Study, November 2006, European Union funded, Ref MWH 475000177.001-4 rev. 0.

[10] Viner and Bouwer (2006).

[11] Viner and Bouwer (2006).

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