

C o u n t r y R e p o r t

C a m b o d i a

*Natural Disaster Risk Assessment and
Area Business Continuity Plan Formulation for
Industrial Agglomerated Areas in the ASEAN Region*

March 2015

AHA CENTRE

Japan International Cooperation Agency

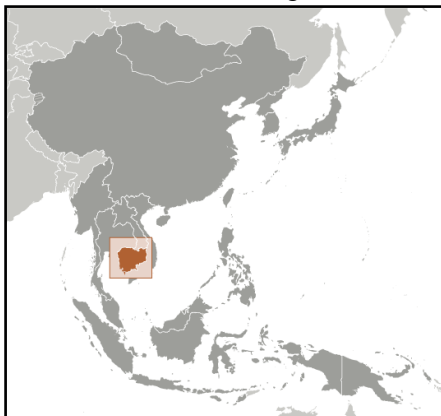
**OYO International Corporation
Mitsubishi Research Institute, Inc.
CTI Engineering International Co., Ltd.**

Overview of the Country

Basic Information of Cambodia ^{1), 2), 3)}



National Flag



| | |
|--|--|
| Country Name | Long form : Kingdom of Cambodia Short form : Cambodia |
| Capital | Phnom Penh |
| Area (km ²) | Total: 181,040 Land: 176,520 Inland Water: 4,520 |
| Population | 15,135,169 |
| Population density(people/ km ² of land area) | 86 |
| Population growth (annual %) | 1.8 |
| Urban population (% of total) | 20 |
| Languages | Khmer |
| Ethnic Groups | Cambodian (Khmer) 90% |
| Religions | Buddhism (some ethnic minority groups practice Islam) |
| GDP (current US\$) (billion) | 15 |
| GNI per capita, PPP (current international \$) | 2,890 |
| GDP growth (annual %) | 7.5 |
| Agriculture, value added (% of GDP) | 36 |
| Industry, value added (% of GDP) | 24 |
| Services, etc., value added (% of GDP) | 40 |

Brief Description

Cambodia is located at the south of the Indochina Peninsula, and the land area is about half the size of Japan. The country shares borders with Thailand, Vietnam, and Laos. The Mekong River, the largest river in Southeast Asia, flows through the east side of central Cambodia. Tonle Sap Lake is located at the west central side of the country, and the population is concentrated on the plain surrounding the river and the lake.

Cambodia joined ASEAN on April 30, 1999. Currently, Cambodia is known as the last country that joined ASEAN.

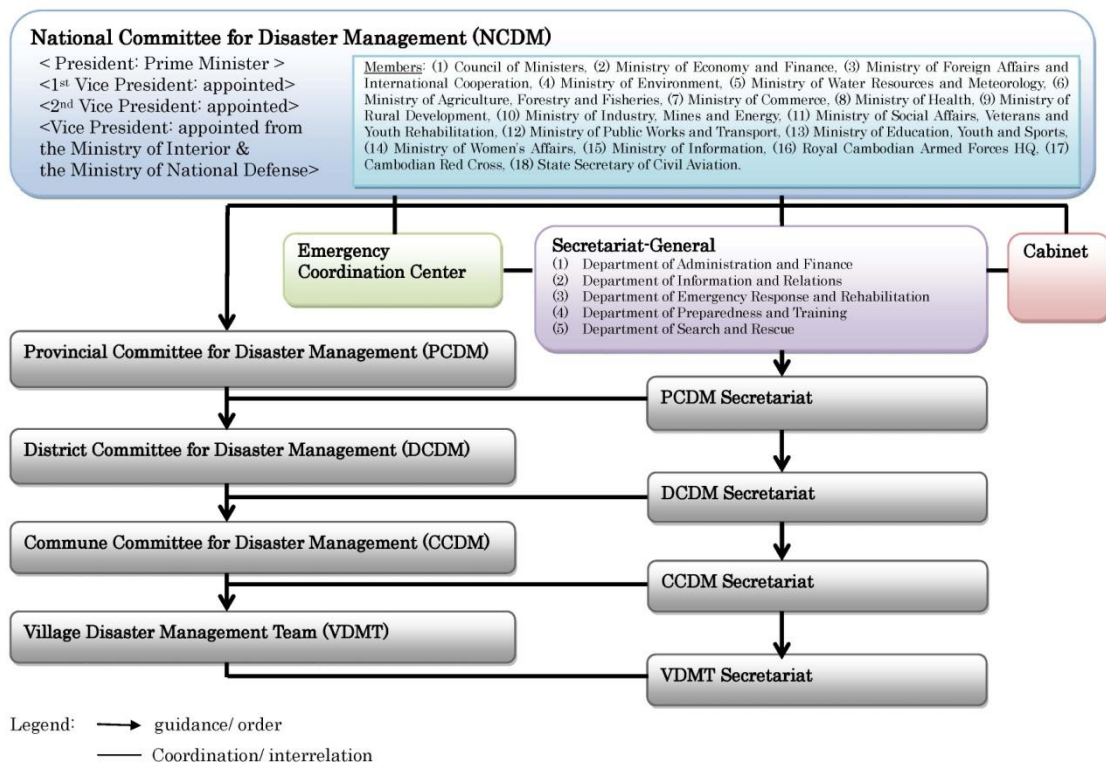
Cambodia is a constitutional monarchy and the present king is Norodom Sihamoni. The Cambodian

People's Party (leading party) and the Funcinpec Party form a coalition government and Prime Minister Hun Sen leads the government. Cambodia has experienced a long history of civil conflict, and suburban areas are still facing the problem of land-mine removal.

Natural Hazards

65% of the total number of disasters occurred in 1980-2011 were related to flood followed by drought (22%). It was noted that 75% of the disaster experienced were "water related hazard" (flood 65% and storm 13%). Similarly, flood affected 62% of the total number of people followed by drought (37%). However, all death caused by disaster were due to "water related hazard" (flood and storm), though most of the estimated damage cost were due to flood (87%) and drought (13%). Flood, storm, and drought are the major disasters in Cambodia.

Disaster Management System ^{4), 5)}



References:

- 1) Central Intelligence Agency (CIA) website (2014): <https://www.cia.gov> (Accessed: October 15, 2014)
- 2) Ministry of Foreign Affairs website (2013): <http://www.mofa.go.jp> (Accessed: October 15, 2014)
- 3) The World Bank Data Bank website (2012, 2013): <http://data.worldbank.org> (Accessed: October 15, 2014)
- 4) National Committee for Disaster Management (NCDM) (2012): A presentation material
- 5) NCDM (2012): A document, "NCDM-DMIS Aide Memoire"

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1. Introduction

This report is the first version of the Country Report for Cambodia, which gives information on natural disaster risks of the country, industrial parks, major traffic infrastructure and lifeline utilities, and legislative systems relating to disaster management and business continuity.

The country report is prepared as a reference document for individuals and organizations who are wishing to integrate disaster risk information for their decisions: such as investment to Cambodia, preparation of a business continuity plan (BCP) or disaster management plan of their organization, preparation of an Area Business Continuity Plan (Area BCP) of their area, and simply knowing natural disaster risks of their area.

Information contained in this report is macroscopic covering the entire country at the same level. When detailed risk information is necessary, hazard and risk assessments for an area of interest are required.

Since the country report was prepared with limited data and information as one of the components of the project¹ of ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre) and Japan International Cooperation Agency (JICA) with a limited data and information, a revision by national experts is required for further refinement.

The following are reference documents prepared by the project of AHA Centre and JICA.

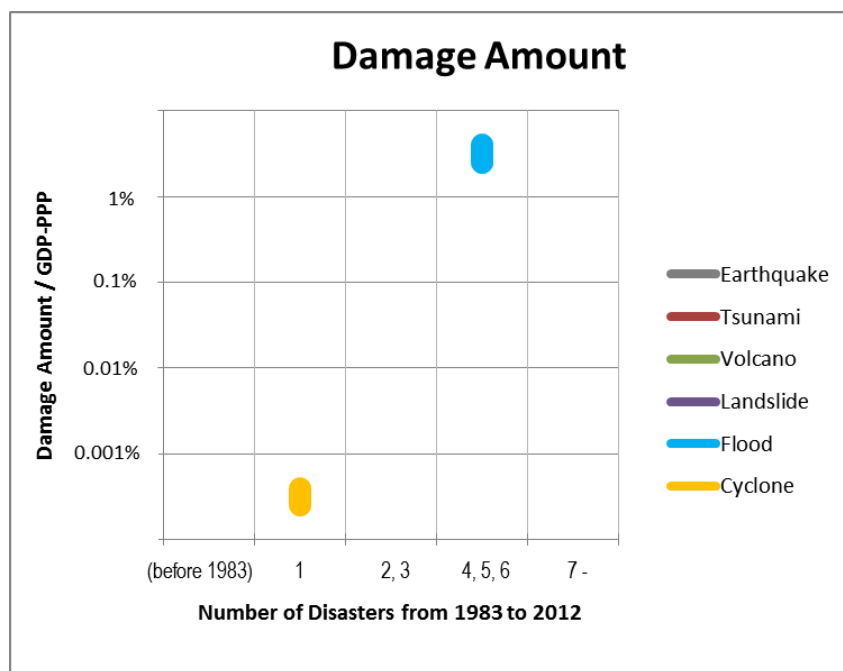
1. AHA Centre and JICA (2015): Planning Guide for Area Business Continuity, Area BCM Took Kits, Version 2.
2. AHA Centre and JICA (2015): The Country Reports; Brunei, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand, Singapore and Vietnam.
3. AHA Centre and JICA (2015): The Risk Profile Reports; Karawang and Bekasi of Indonesia, Cavite, Laguna and the Southern Part of Metropolitan Manila of the Philippines, and Haiphong of Vietnam.

¹ Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region, AHA Centre and JICA, 2013 to 2015.

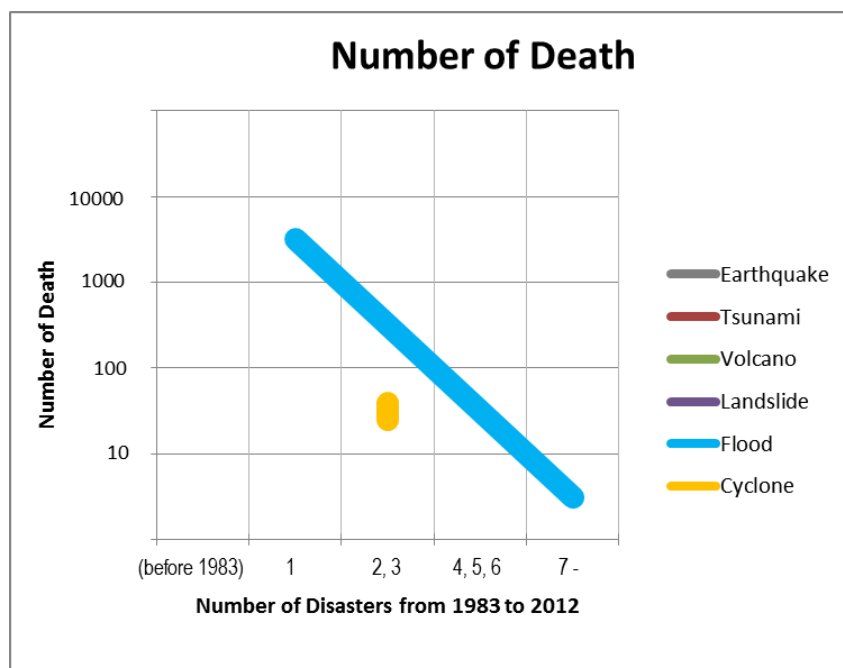
2. Natural Disaster Risks

2.1 Predominant Hazards

Floods and cyclones are predominant hazards to cause disasters in Cambodia. Several flood disasters with more than 100 deaths or damage amounting to more than 1% of GDP have been recorded. Including smaller disasters, flood disasters with a loss of life occurred every 2 years on average. Cyclone disasters have been recorded but their impact was smaller than that of floods.



Note: GDP-PPP, Gross domestic product based on purchasing-power-parity (PPP) valuation of country GDP, International Monetary Fund, World Economic Outlook Database, October 2012



Source of data and information:

- EM-DAT, The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium: <http://www.emdat.be>.
- Pacific Rim Coordination Center Disaster Data: <http://data.pacificrimnetwork.org/>.
- Global Unique Disaster Identification Number: <http://www.glide-number.net/glide/public/search/search.jsp>.
- National Geophysical Data Center (NGDC), National Oceanic and Atmospheric Administration (NOAA): <http://ngdc.noaa.gov/hazard/hazards.shtml>
- Dartmouth Flood Observatory, University of Colorado: <http://floodobservatory.colorado.edu/>

Figure 2.1 Impact of Natural Hazards in Cambodia

2.2 Flood

Risks

Locations of flood disasters in Cambodia are shown in Figures 2.2 and 2.3. Size of circles represents the scale of the disasters in terms of human losses and economic losses, respectively.

Floods cause damage on the plains in the rainy season. Floods caused by storm rainfall in the upper reach of the Mekong River inundate a large part of the Mekong Delta. Flash floods also occur because of the devastation of forest area in the upper basin. At the same time, the Tonle Sap (Great Lake) also causes floods. There have been a few typhoons and minimal damage caused by storm surges.

Recent notable floods occurred in August 2000, on August 18, 2002, and on August 10, 2011, all caused by storm rainfall. Mekong River flooding in August 2000 was caused by heavy rain, which started in the last eleven days of July.

- The flood of September 2000 was caused by storm rainfall in the upper basin of Lao PDR. Overflowing of the Mekong River caused the flood and a state of emergency was declared in Phnom Penh and the three regions of Stung Treng, Kratie, and Kompong Chamn. The road/ embankment (National Road No.1) was cut to protect the central part of Phnom Penh from the flood. This flood caused the most extensive damage in recent years.
- The flood on August 18, 2002 occurred in the northeast and the southeast parts of the country along the left bank of the Mekong River. In southern areas, there was severe drought damage.
- The flood on August 10, 2011 caused 250 fatalities and affected 1.6 million people. This flood is said to have been the largest flood since 2000, but Phnom Penh was able to escape severe flood damage.

Hot spots are of flood disasters include:

- Mekong Delta region, and
- Tonle Sap vicinity.



● : Hot Spots

Data Sources:


EM-DAT, The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium:
<http://www.emdat.be>.

Pacific Rim Coordination Center Disaster Data: <http://data.pacificrimnetwork.org/>.

Global Unique Disaster Identification Number: <http://www.glidnumber.net/glide/public/search/search.jsp>.

Figure 2.2 Locations of Flood Disasters in Cambodia: Human Losses



 : Hot Spots

Data Sources:

- EM-DAT, The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium: <http://www.emdat.be>.
- Pacific Rim Coordination Center Disaster Data: <http://data.pacificrimnetwork.org/>.
- Global Unique Disaster Identification Number: <http://www.glidnumber.net/glide/public/search/search.jsp>.

Figure 2.3 Locations of Flood Disasters in Cambodia: Economic Losses (% of GDP)

Background

Floods caused by storm rainfalls occur in the rainy season from July to October. Though about a half of the country is located in the alluvial plains of the two big rivers of the Mekong River Basin and the Tonle Sap River Basin, flood damage is extensive.

There are two types of floods. One is a long-term flood from the Mekong River and the other is flooding from the Tonle Sap River, which is caused by a sudden increase in the Tonle Sap (Great Lake) water level. Major cities in the alluvial plains have been damaged every year. The flood control measures for Phnom Penh city include protection through ring dykes and channels to drain to the marsh to the rear.

Sources of Hazard and Risk Information

Table 2.1 Sources of Hazard and Risk Information: Flood

| |
|---|
| National Committee for Disaster Management (NCDM) |
| http://www.ncdm.gov.kh/ |
| Province Committee for Disaster Management (PCDM) District Committee for Disaster Management (PCDM) |
| |
| Ministry of Water Resources and Department of Meteorology Cambodia (DOM) |
| http://www.cambodiameteo.com/map?menu=3&lang=en |
| Institute of Cambodia of Technology (ICT) |
| http://www.itc.edu.kh/itc/en/ |

Table 2.2 List of Reference Reports for Risk Analysis

| Organization | Post | Title/ Web Address | Form |
|---|--|---|---------|
| Asia Development Bank | Asian Water Development Outlook | Asian Water Development Outlook 2013: Asia-Pacific Water Forum | Report |
| | | http://www.adb.org/publications/asian-water-development-outlook-2013 | |
| World Bank | ASEAN Disaster Risk Management Initiative | Synthesis Report on Ten Asian Countries Disaster Risks Assessment: December 2012 | Report |
| | | http://www.unisdr.org/files/18872_asean.pdf | |
| The Nature Conservancy | ASEAN Disaster Risk Management Initiative | World Risk Report 2012: October 2012 | Report |
| | | http://www.ehs.unu.edu/article/read/worldriskreport-2012 | |
| World Bank | Framework and Options for Implementation | Advancing Disaster Risk Financing and Insurance in ASEAN Countries: April 2012 | Report |
| | | https://openknowledge.worldbank.org/bitstream/handle/10986/12628/714530v20ESW0W0AN0appendices0June12.pdf?sequence=1 | |
| International Development Research Centre | Economy and Environment Program for Southeast Asia (EEPSA) | Climate Change Vulnerability Mapping for Southeast Asia: January 2009 | Report |
| | | http://web.idrc.ca/uploads/user-S/12324196651Mapping_Report.pdf | |
| UNEP, GRID, UNISDR | | Global Risk Data Platform | Web Map |
| | | http://preview.grid.unep.ch/index.php?preview=map&lang=eng | |

Studies on Hazard and/or Risk Assessment

Some useful studies on flood hazard, risk, and vulnerability are publicly available presenting assessment results, case studies of countermeasures, as well as different methodological approaches. There are a few types of methodologies to assess risks and vulnerability including, for example, risks involving exposure to flooding events and population density. Vulnerability can be defined as a function of exposure, adaptive or coping capacity, and land-use etc. There are slightly different combinations of these factors with different studies for use. Therefore, these concepts must be defined in advance to plan a methodology for an assessment, in terms of which definitions are to be used in a certain analysis.

Locations of existing investigations and studies on flood are shown in Figure 2.4. Outline of those investigations and studies are attached in Appendix 2 and their summary is given in Table 2.3.

Table 2.3 Summary of Existing Investigations and Studies: Flood

| Country/Region | Summary of Existing Studies and Reports |
|-----------------|--|
| ASEAN | There are a few reports that study natural disasters for ASEAN and the Pacific regions at large in recent years. Disaster risks are assessed by scenario, exposure, vulnerability, damage, and loss. An assessment framework is also sought to give an overview of risks, hazard and vulnerability. |
| Cambodia | The National Committee for Disaster Management and Ministry of Planning has recognized flooding as one of the major disasters and has created a strategic plan. However, hazard, risk, and vulnerability assessments are limited to a level of a rough situation analysis. There is an identification of risky areas for the whole country. In some areas there are more exploratory studies to assess risks as well as implementation of countermeasures. |



Figure 2.4 Locations of Existing Investigations and Studies: Flood, Cyclone and Landslide

References for Data and Further Reading

- 1) ADRC: *"Countries: Cambodia," Information on Disaster Risk Reduction of the Member*
- 2) ADRC: *"Cambodia, Flood, 2000/08"*
- 3) ADPC (2000): *"Mitigating flood risk in Cambodian communities"*
- 4) ADRC: *"Cambodia, Flood,2002/08/27"*
- 5) Arief Anshory Yusuf & Herminia Francisco (2009). *Climate Change Vulnerability Mapping for Southeast Asia*, Singapore: EEPSEA
- 6) Asian Urban Disaster Mitigation Program (2011). *Coping with Flood in Cambodian communities, Enhancing Community Solidarity*. Pathumthani: Asian Disaster Preparedness Center
- 7) EngRinbo (2008) *Cambodia: Mainstreaming Flood and Drought Risk Mitigation in East Mekong Delta*: Bangkok
- 8) Ministry of Foreign Affairs of Japan (2013): *"Information on Cambodia in Japanese," 01 2013*
- 9) NPO, Think the Earth (2011): *"Flood in Cambodia in Japanese (2011.12.17 update)"*
- 10) Relief Web, OCHA (2000): *"Published, Cambodia: Floods Appeal No. 22/2000 Situation Report No. 4," Report from IFRC, 27 Oct 2000*
- 11) Relief Web, OCHA (2002):*"Cambodia - Floods OCHA Situation Report No. 1," Report from UN Office for the Coordination of Humanitarian Affairs, 27 Aug 2002*
- 12) Relief Web, OCHA (2011): *"Worries about long-term flood fallout," Report from IRIN, 17 Oct 2011*
- 13) Royal Haskoning, Deltares, Unesco-IHE. (2009) *Flood Risk Management in the Border Zone between Cambodia and Vietnam: The Mekong River Commission Secretariat*
- 14) UNITAR / UNOSAT, Map produced by UNOSAT: *"Flood in Cambodia,2011"*
- 15) Velasquez, Jerry et al (ed.) (2012). *Reducing vulnerability and exposure to disasters: Asia-Pacific disaster report 2012*, ESCAP/UNISDR AP
- 16) World Bank, UNISDR (2010). *Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment*

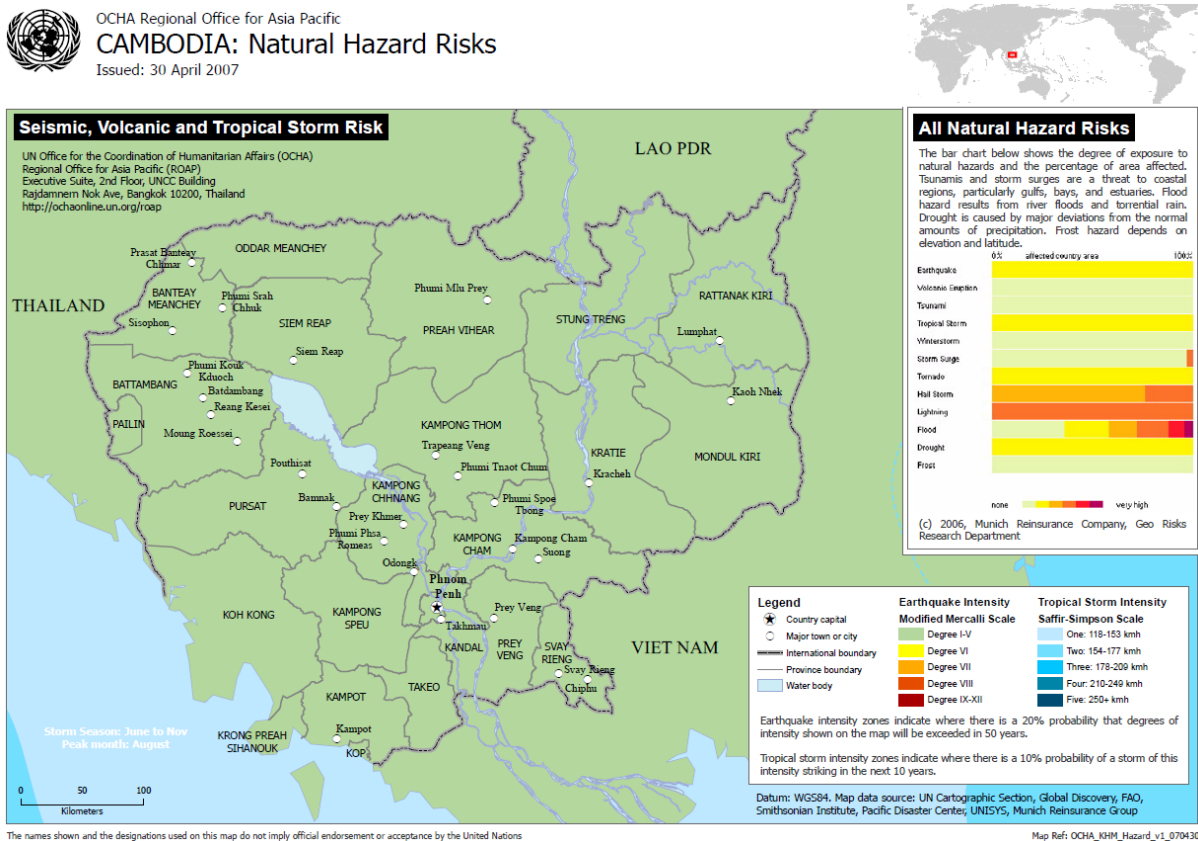
- 17) World Bank (2011). Advancing Disaster Risk Financing and Insurance in ASEAN Countries: Framework and Options for Implementation, Washington: Global Facility for Disaster Reduction and Recovery

2.3 Earthquake

Risks

Earthquake disasters are not common in Cambodia. There is no record of significant disaster caused by earthquakes.

Figure 2.5 shows seismic and other natural hazard risks in Cambodia. The zones indicate where there is a probability of 20% that degrees of intensity shown on the map will be exceeded in 50 years. This probability figure varies with time; i.e., it is lower for shorter periods and higher for longer periods. All of Cambodia is categorized as V and below on the Modified Mercalli Scale.



Source: OCHA

Figure 2.5 Natural Hazard Risks of Cambodia (Seismic, Volcanic, and Tropical Storm Risk)

Responses by Cambodia

There are no special measures focusing on earthquake disaster.

Reports on Hazard and/or Risk Assessment

Useful information and studies on earthquake hazard, risk, and vulnerability were collected from resources available in the public domain including websites. The information and studies include methodologies with analysis and assessment.

There is no standardized or authorized methodology for risk and vulnerability assessment. Therefore, the methodology should be selected or updated in accordance with the purpose when risk and vulnerability assessments are required.

Locations of existing investigations and studies on earthquake are shown in Figure 2.6. Outline of those investigations and studies are attached in Appendix 2 and their summary is given in Table 2.4.

Table 2.4 Summary of Existing Investigations and Studies: Earthquake

| Country/Region | Summary of Existing Studies and Reports |
|-----------------|--|
| ASEAN | There are natural hazard assessment reports for ASEAN region created by international organizations like World Bank etc. They summarize frequency, vulnerability, loss, and others subject for each disaster. Some reports describe the methodology and assessment points/items. |
| Cambodia | There is no record of earthquake disaster in Cambodia and no investigations or studies limited to this country and its regions were found. |

References for Data and Further Reading

- 1) EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be – Université Catholique de Louvain – Brussels – Belgium.
- 2) Japan International Cooperation Agency (JICA) (2012): “Data Collection Survey on ASEAN Regional Collaboration in Disaster Management”
- 3) United Nations Office for the Coordination of Humanitarian Affairs (OCHA), Regional Office for Asia Pacific (ROAP) (2011): “Cambodia: Natural Hazard Risks,” Downloaded from http://reliefweb.int/sites/reliefweb.int/files/resources/0635CB2C3B54A768C12572DB0025F816-ocha_ND_khm070430.pdf
- 4) UNISDR (2009). Global assessment report on disaster risk reduction, Risk and poverty in a changing climate

2.4 Tsunami

Risks

It is well known that tsunamis are generated by sea floor earthquakes. However, an undersea volcanic eruption, an undersea landslide, or other disturbances above or below water can also generate a tsunami. There is very low probability that a large earthquake along the coast of Cambodia will generate a tsunami and cause a major disaster. In fact, there is no record of significant disaster caused by a tsunami.

However, tsunami disasters may occur due to large earthquakes occurring outside the country.

Responses by Cambodia

There are no special measures focusing on tsunami disaster.

Reports on Hazard and/or Risk Assessment

Useful information and studies on tsunami hazard, risk, and vulnerability were collected from resources available in the public domain including websites. The information and studies include methodologies with analysis and assessment.

There is no standardized or authorized methodology for risk and vulnerability assessment. Therefore, methodology should be selected or updated in accordance with the purpose when risk and vulnerability assessment are required.

Locations of existing investigations and studies on tsunami are shown in Figure 2.6. Outline of those investigations and studies are attached in Appendix 2 and their summary is given in Table 2.5.

Table 2.5 Summary of Existing Investigations and Studies: Tsunami

| Country/Region | Summary of Existing Studies and Reports |
|-----------------|--|
| ASEAN | Tsunami induced by the Sumatra earthquake on December 26, 2004 caused major damage to ASEAN countries. The disaster is summarized by organizations like ADB. |
| Cambodia | There is no record of tsunami disaster in Cambodia and no investigations or studies limited to this country and its regions were found. |

References for Data and Further Reading

- 1) ADB (2005). From Disaster to Reconstruction: A Report on ADB's Response to the Asian Tsunami
- 2) EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be – Université Catholique de Louvain – Brussels – Belgium.
- 3) Japan International Cooperation Agency (JICA) (2012): “Data Collection Survey on ASEAN Regional Collaboration in Disaster Management”

2.5 Volcanoes

Risks

Yeak Loam Lake is known as a crater lake. However, there are no active volcanoes in Cambodia. Also, there is no record of significant disaster caused by volcano. However, there is a possibility that a volcanic eruption in neighboring countries might wreak a volcanic ash fall on Cambodia.

Background

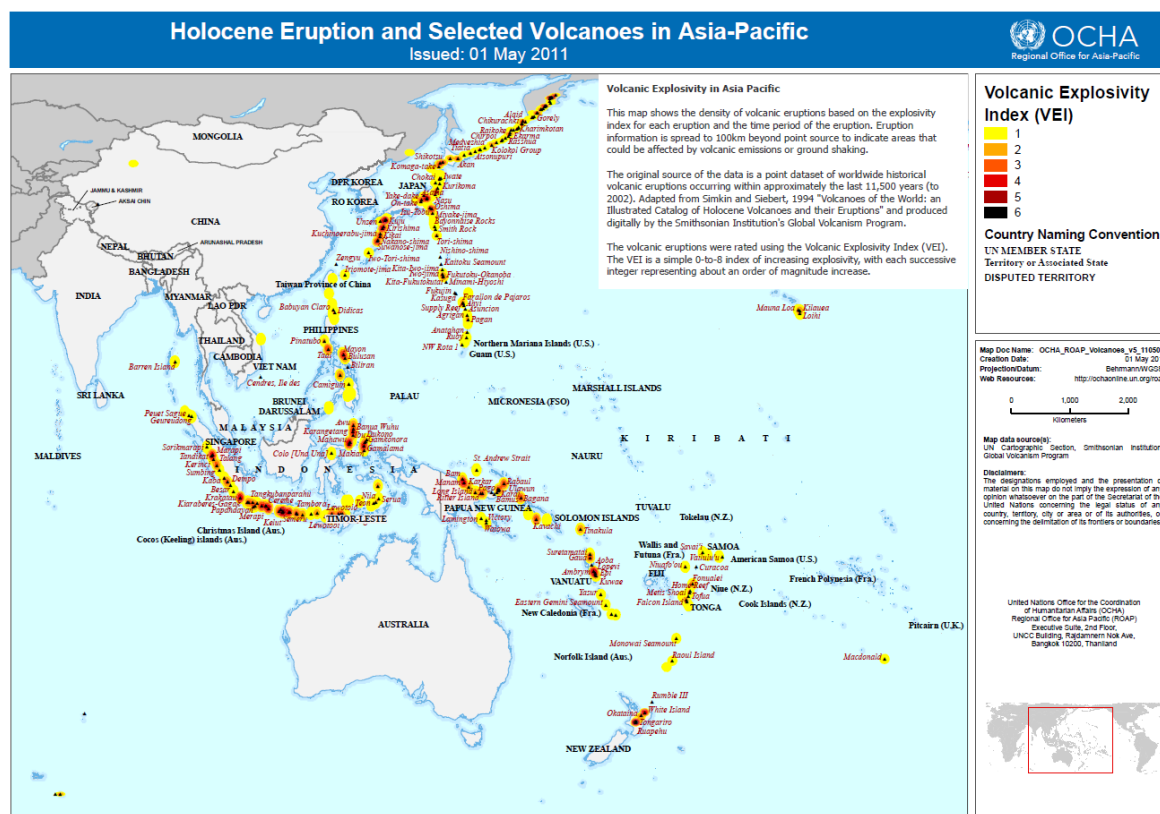
Major hazards caused by volcanic eruption are lava flow, pyroclastic flow, "Lahar" (volcanic mud flow), and volcanic ash fall. Lava flow is a flow of melted rock along the slope. Pyroclastic flow is the flow of a mixture of hot dry masses of fragmented volcanic materials and volcanic gas along the slope. "Lahar" is originally an Indonesian term and is also called volcanic mud flow. It is the flow of a mixture of volcanic materials and water along the slope. These flows cause enormous damage to the side and foot of the volcano, but generally do not have an extended reach. However, volcanic ash fall often spreads widely via the trade winds or the westerlies, causing damage over an extensive area. Figure 2.7 shows the volcanoes in the Asia-Pacific region which erupted during the Holocene. The Holocene is a geological epoch from 10,000 years ago to the present. The map indicates that many volcanic eruptions have occurred in Indonesia, Philippines, and other neighboring countries.

Responses by Cambodia

There are no special measures focusing on volcanic disaster.

Reports on Hazard and/or Risk Assessment

Useful information and studies on volcanic hazard, risk, and vulnerability were collected from resources available in the public domain including websites. The information and studies include methodologies for analysis and assessment.



Source: OCHA

Figure 2.7 Holocene Eruption and Selected Volcanoes in Asia-Pacific

There is no standardized or authorized methodology for risk and vulnerability assessment. Therefore, methodology should be selected or updated in accordance with the purpose when risk and vulnerability assessment are required.

Locations of existing investigations and studies on volcano are shown in Figure 2.6. Outline of those investigations and studies are attached in Appendix 2 and their summary is given in Table 2.6.

Table 2.6 Summary of Existing Investigations and Studies: Volcano

| Country/Region | Summary of Existing Studies and Reports |
|-----------------|--|
| ASEAN | UNOCHA summarized the scale of the explosion of volcanoes around the Asia-Pacific region using the Volcanic Explosivity Index (VEI). |
| Cambodia | There is no record of volcanic disaster in Cambodia and no investigations or studies limited to this country and its regions were found. |

References for Data and Further Reading

- 1) EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be – Université Catholique de Louvain – Brussels – Belgium.
- 2) Japan International Cooperation Agency (JICA) (2012): “Data Collection Survey on ASEAN Regional Collaboration in Disaster Management”
- 3) OCHA -ROAP (2011). Holocene Eruption and Selected Volcanoes in Asia-Pacific
- 4) Lee Siebert, Tom Simkin, and Paul Kimberly (2011): “Volcanoes of the World - Third Edition,” Smithsonian Institute/University of California Press
- 5) United Nations Office for the Coordination of Humanitarian Affairs (OCHA), Regional Office for Asia Pacific (ROAP) (2011): “Holocene Eruption and Selected Volcanoes in Asia-Pacific,” Downloaded from:
http://reliefweb.int/sites/reliefweb.int/files/resources/map_619.pdf

2.6 Cyclone and Meteorological Hazards

Risks

Cambodia is located between latitudes 10° and 15° to the north and 102° and 108° to the east. The climate of the country is divided into two seasons: rainy season (mid-May to October) and dry season (mid-November to mid-March). Moist air is drawn towards land from the ocean, bringing southwest monsoon rains to Cambodia. Monsoon rains are fairly predictable with afternoon rains usually lasting no more than 2-3 hours. The annual rainfall in the central flat regions is about 1,500 mm. Conversely, the annual monthly rainfall is 10 mm in January and February and 200 mm in September and October. Furthermore, the annual rainfall varies from 2,000 mm in the eastern mountains to more than 4,000 mm in the southwest coastal area.

Though the landfall of tropical cyclones and typhoons does not occur often in Cambodia, they often affect the country indirectly from July to November.

Table 2.7 Tropical Cyclone Disasters in Cambodia (EMDAT: 1980 - 2012)

| Year (Month) | Cause | Fatalities | Total Affected |
|----------------|----------------------------|------------|----------------|
| November 1997 | Tropical Cyclone (Linda) | 25 | - |
| October 1999 | Flood (Storm Surge) | - | 124,475 |
| November 2009 | Tropical Cyclone (Sancti) | 2 | - |
| September 2009 | Tropical Cyclone (Ketsana) | 17 | 178,091 |

Flooding is a major meteorological hazard in Cambodia. The country is prone to frequent floods alongside the Mekong River and the Tonle Sap Lake. Due to this proximity, the extent and amount of damages caused by floods are amplified. As one-fourth of the plains in the country are damaged annually, it has become a major obstacle to economic development.

Flooding patterns in Cambodia are of two types: inundations due to overflow from dykes and flash floods. The water level in the Mekong River indicates the changes throughout the year. For example, before the rainy season (late-March to May) the water level in the Mekong River is normally 2 m. During the rainy season, the water level usually rises up to about 9 m. When the water level reaches the height of the dyke, excess water overflows from the top of the dyke. Crops usually suffer the most,

while human suffering is limited since the water level rises gradually. However, heavy rains due to typhoons and tropical cyclones coinciding with the rainy season causes water levels to rise rapidly, resulting in significant human loss due to flash floods.

Disasters were recorded 15 times during the past 30 years. In recent years, Cambodia has experienced destructive floods in 2000 and 2011. In most cases, flood damage occurred near the Tonle Sap Lake and the Mekong River Basin, as well as in some provinces facing the Gulf of Thailand.

Table 2.8 Weather Disasters in Cambodia (EMDAT: 1984 ~ 2013)

| Cause | No. of events | Killed | Total Affected | Damage (millions US\$) |
|-------------------------------|---------------|--------|----------------|------------------------|
| Drought | 5 | - | 6,550,000 | 138 |
| Flood (including flash flood) | 15 | 1,396 | 11,120,662 | 919.1 |
| Storm | 4 | 44 | 302,566 | 0.01 |

According to a report compiled by the National Committee for Disaster Management (NCDM) on 16 November 2000, the death toll was at 347 (80% of which were children). Of the 750,618 families (3,448,629 individuals) affected by the flooding, 85,000 families (387,000 individuals) had to be temporarily evacuated. Furthermore, 317,975 houses were damaged while 7,068 were destroyed. Based on the same report, the total physical and direct damages were estimated to be around US\$ 150 million. The flood of 2000 affected all four countries in the Mekong River Basin including Lao PDR, Cambodia, Vietnam, and Thailand. It was, however, in Cambodia where the most severe effects of the flood occurred, based on reports compiled by the Mekong River Commission (MRC). The deaths in Cambodia constituted 43% of the total deaths (800) from all countries, while direct damages represent 40% of the total damages, estimated to be around US\$ 400 million.

Background

During mid-May to October in Cambodia, heavy rains are brought about by the southwest monsoon, especially in September and October. Due to the heavy rainfall coming from the upstream area, the country suffers from flood damages resulting from overflows from the Tonle Sap Lake in the mid-western area of the country and the Mekong River in the mid-eastern region.

In August of 2000, floods brought serious damage to the northern, eastern and southern provinces, especially Takeo Province. Three provinces along the Mekong River (Stung Treng, Kratie, and Kompong Cham) and the Municipality of Phnom Penh all declared a state of emergency. 121,000 families were affected, more than 170 people were killed, and around \$10 million worth of rice crops were destroyed. Immediate needs included food, shelter, the repair or replacement of homes, household items, and sanitation facilities as water levels in the Delta continued to fall.

As the southwest monsoon begins to blow in on the Indochina Peninsula, it signals the start of the rainy season. Generally, as the southwest monsoon and ITCZ become active, it accumulates a large amount of rainfall. The provinces located along the Mekong River are immediately affected by floods due to heavy rains in the northeastern parts of the country caused by storms and rainfall in neighboring countries (Lao PDR and Thailand). Due to these heavy rains in the upper Mekong countries, water levels in Cambodia may rise (flood stage level). Since Cambodia already receives much rain around this time, flooding may occur. This could then lead to damage, as Cambodia is located in a very low part of the Mekong River Delta. Cambodia is not as prone to typhoons as its neighbors, Lao PDR and Vietnam. Despite this, some provinces of Cambodia have been hit by storms and typhoons. In 1997, Typhoon Linda hit the Poulo Wei islands, causing the destruction of 81 fishing boats and affecting hundreds of residents.

Climate change vulnerability and impact in Cambodia are as follows.

- Cambodia's temperature may increase by up to 1.35 - 2.50 °C in 2100. Annual rainfall may increase between 3 to 35 percent from current conditions. The lowland areas seem to be more likely to be affected by climate change than the highland areas by 2100.
- In Koh Kong province (1,160 km²), if the sea level rises by 1 m, about 0.4 per cent (4,444 ha) will be under water. The rainfall of the 4 main river basins of Koh Kong may increase between 2 percent to 15 percent, resulting in increased water flow of 2-10 m³/s.

Responses by Cambodia

All relevant ministers and institutions collaborate closely with the National Disaster Management Committee (NCDM) as necessary during an emergency situation. In addition, the NCDM adopts the Cambodian Red Cross as its main partner to jointly conduct relief operations in times of disaster. The NCDM has a General Secretariat which acts as an implementing unit within the NCDM Headquarters and which provides advice to the Royal Government on DM issues. There are also CDM structures at the provincial/municipal and district levels.

The Department of Meteorology (DOM), which is under the Ministry of Water Resources and Meteorology (MoWRAM), is responsible for meteorological services in Cambodia. However, the Department of Hydrology and River Works (DHRW) from the same Ministry is responsible for flood forecasting. The main missions of both institutions can be found below.

Table 2.9 Organizations Responsible for Cyclone and Meteorological Hazards

| Organization | Responsibilities |
|--|---|
| Department of Meteorology (DOM) | <ul style="list-style-type: none"> ■ To establish and manage Cambodian meteorological stations. ■ To provide weather forecasts in short- and long-term ranges for all concerned sectors. ■ To predict abnormal meteorological phenomena and issue alerts to enable the establishment of protective procedures. ■ To increase knowledge and communicate with national and international actors on meteorology technologies. ■ To strengthen and broaden Cambodian cooperation on meteorology with other meteorological organizations, United Nations agencies, and the World Meteorological Organization. ■ To prepare annual reports on meteorological conditions in the Kingdom of Cambodia. |
| Department of Hydrology and River Works (DHRW) | <ul style="list-style-type: none"> ■ To prepare plans on the installation of hydrological stations on the main streams to facilitate water resources development. ■ To prepare short-, medium- and long-term strategic plans on the prevention and protection of erosion, sedimentation, and river banks. ■ To research and monitor surface and ground water regimes by managing installed hydrological stations and collating data to serve various water related sectors. ■ To implement and monitor water levels, water discharge and sediment in the river basins system. ■ To implement water quality monitoring activities at main hydrological stations. |

| | |
|--|---|
| | <ul style="list-style-type: none"> ■ To study and research hydrological phenomena, models, computations, and surface and ground water potentials. ■ To manage and exchange hydrological information; to issue forecasts and early warnings for possible floods and droughts to facilitate the timely adoption of mitigation measures. ■ To establish geographical information system (GIS) relevant to all river basin features, hydrological networks and locations of water resources development infrastructures and so on. |
|--|---|

Sources of Hazard and Risk Information

Table 2.10 Sources of Hazard and Risk Information: Cyclone and Other Meteorological Hazards

| |
|---|
| Department of Meteorology (DOM) |
| http://www.cambodiameteo.com/map?menu=3&lang=en Tel: +85-5 - 23 72 60 44 |
| Department of Hydrology and River Works (DHRW) |
| http://www.dhrw-cam.org/ Tel: +85-5 - 23 72 60 44 |

Table 2.11 Other Sources of Information: Cyclone and Other Meteorological Hazards

| Institution | Literature name |
|---|--|
| Economy and Environment Program for Southeast Asia (2010) | Climate Change Vulnerability Mapping for Southeast Asia http://css.escwa.org.lb/sdpd/1338/d2-5a.pdf |
| UNISDR (2010) | Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment http://www.unisdr.org/files/18872_asean.pdf |

Reports on Hazard and/or Risk Assessment

“Cyclone” is a term to describe many types of low pressure systems, of which tropical cyclones/typhoons are the main types creating disasters in the ASEAN region. Leading countries are monitoring and detecting tropical cyclones on a regional basis under the framework of WMO. Table 2.12 indicates the responsible territory allocated to ASEAN members and its leading country.

Table 2.12 Members of WMO Tropical Cyclone Committee

| | Warning Zones | Members (ASEAN) | Leading Country |
|---|-------------------------------|--|-----------------|
| Western North Pacific Ocean and South China Sea | 0° - 60°(N) 0° - 100°(E) | Cambodia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, Vietnam | Japan |
| Bay of Bengal and the Arabian Sea | 5°S - 45°(N) 30°E - 90°(E) | Myanmar, Thailand | India |
| South Pacific and South-East Indian Ocean | 0°-50°(S) 90° - 170°(E) | Indonesia | Fiji |

The dates and information utilized in this report have been acquired from various reports on the studies and research conducted on tropical cyclones and meteorological hazards published on the internet. Collected documents include evaluation results of hazards/risks, as well as their evaluation methods. With regard to tropical cyclones/typhoons, a meteorological organization of each country compiles a summary on the damage situation, including the number of casualties or loss of human lives, and the estimated amount of damage, etc.

Locations of existing investigations and studies on cyclone and other meteorological hazards are shown in Figure 2.4. Outline of those investigations and studies are attached in Appendix 2 and their summary is given in Table 2.13.

Table 2.13 Summary of Existing Investigations and Studies: Cyclone and Other Meteorological Hazards

| Country/Region | Summary of Existing Studies and Reports |
|-----------------|--|
| ASEAN | Study reports on natural disasters in the whole ASEAN region are available. |
| Cambodia | Typhoon landings in the center of Vietnam sometimes bring heavy rain to Cambodia. The Meteorological Doppler Radar System was introduced in 2012 for the improvement of accuracy in weather forecasting. |

References for Data and Further Reading

- 1) Asian Disaster Preparedness Center: "Overview of early Warning Systems for Hydrometeorological Hazards in selected countries in Southeast Asia," pp.23-26
- 2) Department of Meteorology (Website):
<http://www.cambodiameteo.com/map?menu=3andolang=en>

- 3) Department of Hydrology and River Works (Website) :
<http://www.dhrw-cam.org/>
- 4) ESCAP/WMO Typhoon Committee. (<http://www.typhooncommittee.org/>)
- 5) IPCC Fourth Assessment Report: Climate Change 2007
- 6) JMA/WMO Workshop on Quality Management in Surface, Climate and Upper-air Observations in RA II (Asia) 2011
- 7) Mekong River Commission (2011): "Flood Situation Report 2011," MRC Technical Report Paper No. 36 2011, pp.25-27, pp.33-34
- 8) WMO National Meteorological or Hydrometeorological Services of Members (http://www.wmo.int/pages/members/members_en.html)
- 9) WMO (2010). First Meeting of the Task Team on "Meteorological, Hydrological and Climate Services for Improved Humanitarian Planning and Response", WMO Headquarters, Geneva, Switzerland (31 August - 2 September, 2010)

2.7 Landslides

Risks

Risk of landslide in Cambodia is low. However, some landslides have been confirmed in mountain areas near the Gulf of Thailand.

Reports on Hazard and/or Risk Assessment

Locations of existing investigations and studies on landslide are shown in Figure 2.4. Outlines of those investigations and studies are shown in Appendix 2 and their summary is given in Table 2.14.

Table 2.14 Summary of Existing Studies and Reports by Country: Landslide

| Country/Region | Summary of Existing Studies and Reports |
|-----------------|---|
| ASEAN | There have been a few reports that study landslides for ASEAN and the Pacific region at large in recent years. Disaster risks are assessed by scenario, exposure, vulnerability, damage, and loss. An assessment framework is also sought to give an overview of risks, hazard, and vulnerability. |
| Cambodia | The occurrence of landslide disaster in Cambodia is unconfirmed. Hazard map LS-008 indicates a low level of hazard distribution in the mountainous area near the coast, but no hazard area is distributed in the Mekong lowland area near the capital city of Phnom Penh. There is no assessment of landslide in LS-008, but some weak exposure is recognized near the border with Thailand in LS-013. There are on-going projects on early warning systems and hazard mapping in connection with DHRW. |

References for Data and Further Reading

- 1) Economy and Environment Program for Southeast Asia (EEPSEA) (2009): "Climate Change Vulnerability Mapping for Southeast Asia," p. 19
- 2) World Bank, UNISDR (2010). Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment
- 3) World Bank, UNISDR (2011). Disaster Risk Management Programs for Priority Countries- 2nd edition

3. Industrial Parks

3.1 Distribution of Industrial Parks in Cambodia

22 industrial parks (Special Economic Zones, SEZs) were identified by the study, and as shown in Figure 3.1, most of them are distributed around Phnom Penh, the capital of Cambodia, and along the coast of the Gulf of Thailand.

A list of the industrial parks in Cambodia is given in Appendix 3, and a brief description of the selected industrial parks is given in reference².

² AHA Centre and JICA (2014), Risk Assessment Reports for ASEAN and its Countries, Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Areas in the ASEAN Region.



Figure 3.1 Distribution of Industrial Parks in Cambodia

While 22 SEZs have been registered, there is a vast difference in the level of development between these SEZs, with few offering high-level infrastructure and facilities for foreign investors. SEZs around Phnom Penh and Sihanoukville are most developed, while the majority of parks in border areas are undeveloped. The relatively more developed SEZs are better equipped to communicate with foreign investors. A few of these have their own websites: Phnom Penh SEZ, Sihanoukville SEZ, the Port Authority of Sihanoukville, Tai Seng Bavet SEZ, and Manhattan SEZ. However, information on these websites is often incomplete or out of date, especially in the case of Tai Seng Bavet SEZ and Manhattan SEZ. Contacting SEZ staff outside of the more developed SEZs in Phnom Penh and Sihanoukville is difficult, as few staff speak English or Japanese. This suggests that most of these sites are ill prepared to support foreign investors.

The CSEZB also has limited ability to support foreign investors. It provides some online information on SEZs on location, size, level of development, and, in some cases, a list of tenant companies. This information is generally reliable, but can also be incomplete or out of date. It is difficult to contact the CSEZB through official channels. None of the email addresses provided on the official CSEZB website are operational. We were also unable to locate any English-speaking or Japanese-speaking staff at the CSEZB.

3.2 Historical Evolution of Industrial Parks

Industrial parks in Cambodia that offer incentives to foreign investors are all classified as Special Economic Zones (SEZs). Such zones were briefly introduced during Prince Sihanouk's Sangkum Reastr Niyum-regime in the 1960s, but none of these initial projects survived the rise of the Khmer Rouge government. SEZs did not start to develop on a significant level until much more recently. In December 2005, SEZs were introduced by Sub-decree Numbers 147 and 148. Sub-decree 147 restructured the Council for the Development of Cambodia (CDC), Cambodia's highest decision-making body for public and private investment, and set up the Cambodian Special Economic Zone Board (CSEZB) as a branch of the CDC. Sub-decree Number 148 laid the legal foundation for the establishment and management of SEZs. SEZ development began in 2005 with Manhattan SEZ in Svay Rieng province. To date, the

Cambodian government has approved 22 SEZs, less than half of which are currently in operation.

SEZs near the capital Phnom Penh and the coastal town Sihanoukville have attracted relatively high levels of investment. In Phnom Penh and neighboring Kandal province, the Phnom Penh SEZ and Goldfame Pak Shun SEZ (Kandal) are in operation. In Sihanoukville (in Preah Sihanouk province), four SEZs have been approved, three of which are currently in operation: Sihanoukville SEZ 1, Sihanoukville SEZ 2 (established in 2010 as a cooperation zone between Cambodia and China), and the Sihanoukville Port SEZ (a joint initiative between the Cambodian and Japanese governments inaugurated in 2012).

The majority of the SEZs are however located along Cambodia's borders with Thailand and Vietnam. Most of these remain undeveloped and have yet to attract investment. Exceptions are, on the Vietnamese-Cambodian border, Manhattan SEZ and Tai Seng SEZ (both in Bavet town, in the southeastern Svay Rieng province). Also in operation, on the Thai-Cambodian border, are Neang Kok Koh Kong SEZ (in southwestern Koh Kong province), and Poi Pet O'Neang SEZ (in Western Banteay Meanchey province).

Currently, SEZs in Phnom Penh and Preah Sihanouk province continue to receive the majority of investments, while border area SEZs experience continuing problems with lack of infrastructure and power supply, precluding investment. In 2012, the General Director of the Ministry of Commerce pledged that the government will establish infrastructure and electricity in border SEZs to drive their development. However, a detailed plan of how this will be achieved and funded has not been issued. Between 2006 and 2011, SEZs received 96 investment projects with a total value of USD 1.15 billion, which generated 61,400 jobs. Since 2011, the CDC says that these figures rising, with total investment in SEZs increasing by 683% year-on-year in 2011. In 2010, there were 22 investments worth USD 91.25 million. In 2011, there were 39 investments worth USD 715.25 million. 2012 figures are not available, so it is unclear if this trend has continued.

3.3 Recent Trends and Japanese Investment

Japanese investment is most significant in the Phnom Penh SEZ (PPSEZ). The PPSEZ is a Cambodian-Japanese joint venture company, run by a Japanese manager, Mr. Hiroshi Uematsu. As of October 2012, 15 out of 33 companies operating in the PPSEZ were Japanese, one was joint Chinese/Japanese, and one was joint Korean/Japanese. Japanese companies include Tiger Wing (shoes), Ajinomoto (food processing), Sumi Wiring (automobile wiring), and Minebea (cellphone parts). In 2009, Ajinomoto invested USD 6 million in the PPSEZ. Since 2011, there has been an increase in Japanese investment in the automotive and electronics sectors. In 2011, investments included an electric equipment assembly plant set up by Marunix. Sumi Wiring Systems Co Ltd, a local subsidiary of Sumitomo Corp., started operations in May 2012. In January 2013, Denso Corp. announced that it will begin making motorcycle parts in PPSEZ in July 2013, with total investment projected at JPY 35 million. In March 2013, Japanese Combi Corp. also announced plans for a new baby-product factory to open in 2014, with total investment estimated at to USD 1.5 million. Despite this trend, a lack of skilled human resources in the manufacturing sector has to date largely prevented Japanese investment in high-tech areas.

There is some Japanese investment in coastal Sihanoukville. In Sihanoukville SEZ 2, 2 out of a total of 26 companies operating in the SEZ are Japanese; ASLE Electronic (Cambodia) Co. Ltd. (produces electronic wires) and Izumi Electronics (Cambodia) Co. Ltd. (produces TV frames). Japanese investment in this area is expected to grow as the Sihanoukville Port SEZ is developed. The SEZ was developed as a Japanese government ODA project starting in 1996. Its development was financed by Japanese soft loan of JPY 3.6 billion. The Sihanoukville Autonomous Port was inaugurated in 2012. Given this, the Sihanoukville Port SEZ is projected to become a key site for Japanese investment, though its infrastructure is still being developed. The Japanese government is to fund at USD 75 million multi-purpose terminals to be built in 2013.

There is also some Japanese investment in SEZs along Cambodia's borders, though this is not expected to grow until significant infrastructure improvements are made. In Tai Seng Bavet, Svay Rieng province, 2 out of a total of 11 companies operating are Japanese: Towa (Cambodia) Co. Ltd. (menswear), and Nakayama Shoji

(Cambodia) Co. Ltd. (baby underwear). In Manhattan SEZ, Svay Rieng province, 1 out of a total of 22 companies is Japanese, Morofuji Packaging Co. Ltd (plastic bags).

3.4 Risks of Natural Hazards

For the first glance of risks of natural hazards to industrial parks and individual enterprises, it is useful superimpose your location on the distribution maps of natural disasters given in Chapter 2. Figures 3.2 and 3.3 are maps showing relationships of locations of industrial parks, and flood disasters represented by human losses and economic losses, respectively. For the detailed assessment of the risks of natural disasters to industrial parks and individual enterprises, hazard and risk assessment are required for an area of interest.

A description of general investment risks of Cambodia is attached in Appendix 4.



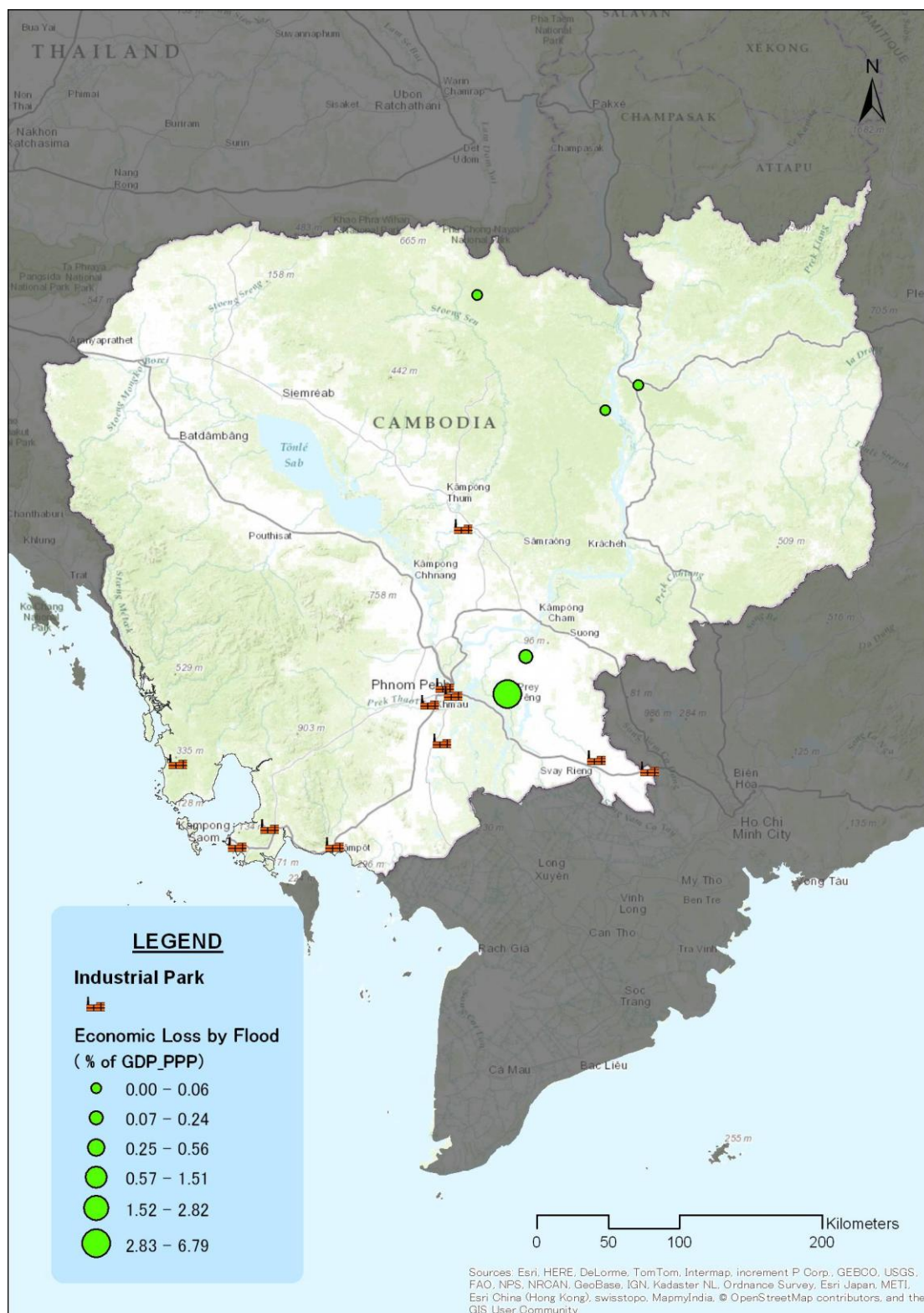
Data Source:

EM-DAT, The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium:
<http://www.emdat.be>.

Pacific Rim Coordination Center Disaster Data: <http://data.pacificrimnetwork.org/>.

Global Unique Disaster Identification Number: <http://www.glidnumber.net/glide/public/search/search.jsp>.

Figure 3.2 Industrial Parks and Flood Disasters: Human Losses



Data Sources:

- EM-DAT, The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium: <http://www.emdat.be>.
- Pacific Rim Coordination Center Disaster Data: <http://data.pacificrimnetwork.org/>.
- Global Unique Disaster Identification Number: <http://www.glidnumber.net/glide/public/search/search.jsp>.

Figure 3.3 Industrial Parks and Flood Disasters: Economic Losses

4. Transport Infrastructure and Lifeline Utilities

4.1 Overview of Transport Infrastructure

Road

The total road system is 47,207 km long as of 2012, of which 5,600 km is national roads and 6,607 km provincial roads. New roads have been constructed year by year as an important national task. The road density is 0.26 km/km² as of 2012. The entire road system is under the jurisdiction of the Ministry of Public Works and Transport (MPWT).

As an international road, the Asian Highway links Cambodia to neighboring countries. The Asian Highway consists of the National Roads 1, 3, 5, 6, 7, 33, and 48. Their total length is 1,345 km.

Major road networks of Cambodia are shown in Figure 4.1

Table 4.1 Road Networks

| Road Type | Road Distance (km) | Pavement Distance (km) | Pavement Rate (%) | Jurisdiction |
|------------------------|--------------------|------------------------|-------------------|--------------|
| 1-Digit National Roads | 2,258 | 2,115 | 94 | MPWT |
| 2-Digit National Roads | 3,342 | 1,868 | 56 | |
| Provincial Roads | 6,607 | 1,000 | 15 | |
| Rural Roads | 35,000 | | | MRD |
| Total Length | 47,207 | 4,983 | | |

Source: MPWT, Infrastructure Development and Transport Logistics 2012

Railway

In Cambodia, there are two railway networks: one is the southern line (264 km) which links Phnom Penh to Sihanoukville, and another is the northern line (386 km) which links Phnom Penh to Poipet. The latter includes 48 km of missing rail from Sereysophoan to Poipet. Narrow gauge 1,000 mm rails are used for the track.



Figure 4.1 Major Road and Railway Networks of Cambodia

The southern line is capable of transporting a 20-ton axle load and consists of 29 stations (currently 7 stations are under operation). The northern line is capable of transporting a 15-ton axle load and consists of 49 stations (currently 7 stations are under operation). New container yards are under construction between Sihanoukville Port and railway stations.

If the missing link of the northern line is restored, it may become easier to access Thailand and a major increase in railway transport is expected. By restoring tourism, revitalization of the region is also expected.

Major railway networks are shown in Figure 4.1

Port

Sihanoukville Autonomous Port (PAS) is the sole international and commercially deep seaport of the Kingdom of Cambodia. The total operational land area is 129.6 ha, and new container yards are under construction. The recent container throughputs at Sihanoukville Autonomous Port are shown in the following table. The annual throughput has increased largely, which reflects recovery from the economic crisis of 2008.

Table 4.2 Container Throughput at Sihanoukville Autonomous Port

| Year | 2008 | 2009 | 2010 | 2011 | 2012 |
|-----------------------------|---------|---------|---------|---------|--------------------|
| Container Throughput (TEUs) | 258,775 | 207,861 | 222,928 | 237,941 | 260,000 (estimate) |

Source: MPWT, Infrastructure Development and Transport Logistics 2012

International container freight is also handled at Phnom Penh Port. Currently the annual throughput is one (1) million tons and 50,000 TEUs, but development work to increase its capacity to handle five (5) million throughputs a year is in preparation.



Figure 4.2 Major Ports and Airports of Cambodia

Airport

Currently, there are 16 airports in Cambodia, of which only 3 airports (Phnom Penh International Airport (PPIA), Siem Reap International Airport (SRIA), and Sihanoukville International Airport) operate regular flights. Sihanoukville International Airport was reopened in 2007, but only two (2) airline companies have been operating there. Regular flights have been operating between Sihanoukville and Siem Reap since December 2011, but the number of passengers does not reach the level of other two (2) airline companies.

Locations of major airports of Cambodia are shown in Figure 4.2.

Table 4.3 International Airports

| Airport | Runway | Area(ha) | Administrator | Remark |
|---------------|--------------|----------|---------------|-----------------------|
| Phnom Penh | 3,000 m×45 m | 387 | RGC / SCA | |
| Siem Reap | 2,550 m×45 m | 197 | RGC / SCA | |
| Sihanoukville | 2,500 m×40 m | 124 | RGC / SCA | Reopened in July 2007 |

RGC / SCA: Royal Government of Cambodia / Societe Concessionaire l' Aero port

Source: ASEAN-Japan Center, Cambodia Investment Guide, January 2012

4.2 Overview of Lifeline Utilities

Electricity

The Electricity Law was promulgated in February 2001 with the view to regulate the electric power sector, and the Electricity Authority of Cambodia (EAC) was established to integrate the electric power supply. In Cambodia, diesel power generation is the main source of energy.

Table 4.4 Types of Electric Power Generation

| Type | % |
|------------------|-------|
| Diesel | 89.21 |
| Hydropower | 5.00 |
| Coal-Fired Power | 4.61 |
| Biomass Power | 1.18 |

Source: Cambodia Business Supporting Desk Report, Okayama Prefecture, Japan, Situation of Electricity in Cambodia

For domestic utilization, more than 80% of the energy used is electricity in urban area, while mainly kerosene is used in rural area. It has been planned to provide electricity services to all the villages by 2020. Thus, it is anticipated that energy usage will transition to electricity in these areas, with the electricity demand expected to increase rapidly.

The construction of transmission lines to import electricity from Thailand and Vietnam will be completed by the end of 2012, and the power lines which connect Laos and other neighboring countries are also to be completed in 2016. Construction work on hydroelectric power stations or thermal power plants as electric power sources are also proceeding simultaneously.

Table 4.5 Power Demand Prediction (MW)

| In 2012 | In 2015 | In 2018 | In 2020 |
|---------|---------|---------|---------|
| 1,062 | 1,643 | 2,283 | 2,770 |

Source: ASEAN-Japan Center, Cambodia Investment Guide, January 2012

Electric power generation and distribution has been conducted by the state-run Electricite de Cambodia (EDC) and an Independent Power Producer (IPP). Electricity imports from neighboring countries cover the shortage.

Locations of major power stations and dams are shown in Figure 4.3.



Figure 4.3 Major Power Stations and Dams of Cambodia

Water Supply

The Ministry of Water Resources and Meteorology (NOWRAM) is responsible for water resource development and management, while the Ministry of Rural Development (MRD) is responsible for water supply and sanitation in rural areas. In addition, the Ministry of Industry, Mines and Energy (MINE) is responsible for the supply of drinking water in small and medium rural cities. It is also responsible for the management and control of private companies that enter into the water supply business.

In Phnom Penh, Phnom Penh Water Supply Authority (PPWSA) is responsible for the water supply. In Siem Reap, Siem Reap Water Supply Authority (SRWSA) is responsible for the water supply. In urban area, 87 % of people have access to the water supply system, while, the rate falls to 58% in rural area.

Moreover, in urban areas, 67.4 % of the residents can obtain water piped into their lots. However, in farm villages, the rate is as low as 29.4%. Obtaining water from outside sources involves heavy labor. The current diffusion rate of piped water remains as low as 14%.

Sewerage

In Cambodia, the sewerage coverage ratio is 11%, and the total length of sewer system is 150 km. Private companies have not yet entered the sewerage market. In Phnom Penh, the sewerage coverage ratio is 20%, with coverage ratio decreasing considerably in the area outside its 10 km radius.

The sewerage system has a close relationship with the storm water drainage system. In Phnom Penh, inundation damage is frequent. This is because the maintenance work was not conducted on storm water drainage facilities during the civil war from 1970 to 1980s, causing and the drainage capacity to be decreased.

Communications

Internet

After the liberalization of telecommunication services market in 2002, 37 companies received ISP (Internet Service Provider) licenses. Among these companies, about 15

companies currently provide commercial services. The number of broadband subscribers is 22,000 people, and the diffusion rate is 0.15%.

Mobile Phone

Resulting from the prevalence of a prepaid payment system which enables low-income people to use mobile phones, this sector shows a high annual growth rate of 51.5 %. Two (2) companies, Metfone and CamGSM, hold almost the entire market share. New companies such as Smart Mobile and CADCOMMS continue to enter the market.

Fixed-line Phone

Since Metfone started commercial services in February 2009, the number of subscribers has increased sharply.

Terrestrial Broadcasting

Broadcasting services are provided by TVK and other 11 networks. TVK and TV5 provide coverage for the entire country.

Satellite Broadcasting

There are said to be about 120,000 satellite broadcast subscribers.

Waste

General

Data for the national level is not obtained for an investigation of the whole country. The Environmental Association has issued a 3R National Strategy and conducts workshop with relevant organizations and agencies. Data is available only for Phnom Penh.

Waste Disposal in Phnom Penh

The Department of Public Works and Transport (DPWT) is responsible for waste management in Phnom Penh. Waste is classified into city waste and hazardous waste. City waste is handled by public company CINTRI, and hazardous waste is handled by the organizations that generated it. The main component of waste is food.

Table 4.6 Summary of Daily Disposal 2003

| Items | City Waste (Tons per day) | Household Waste Only (Tons per day) |
|-------------------------|------------------------------|--|
| Average of both seasons | 890.6 | 584.1 |
| Average of dry season | 905.7 | 597.3 |
| Average of rain season | 875.4 | 570.9 |

Source: Tokyo Metropolitan Government Bureau of Environment, Cambodia Phnom Penh City 2012

Final Disposal Site

More than 3,500 tons of waste is incinerated annually.

Table 4.7 Outline of Final Disposal Plants in Phnom Penh

| Disposal Methods | Open Dumping | Sanitary Landfill |
|------------------|-------------------------------|-------------------------|
| Number of Plants | 1 | 1 |
| Location | Stung Mean Chey Disposal Site | Dong Kor Landfill Site |
| Disposal Area | 6.8ha | 26ha (11ha land filled) |
| Throughput | 361,000 tons | 438,000 tons |
| Administration | PPWM | |

Source: Tokyo Metropolitan Government Bureau of Environment, Cambodia Phnom Penh City 2012

4.3 Natural Disasters and Infrastructure

Since transport infrastructure and lifeline utilities have crucial for business continuity of enterprises, it is important to know their risks to natural disasters. For the first glance of the risks, it is useful superimpose locations of transport infrastructure and lifeline utilities on the distribution maps of natural disasters given in Chapter 2. Figures 4.4 and 4.5 are examples focusing on flood disasters. Following description of natural disasters may be useful to interpret the figures. For the detailed assessment of the risks of natural disasters to transport infrastructure and lifeline utilities, hazard and risk assessment are required for an area of interest.

Floods cause damages on the plains in the rainy season. Floods caused by storm rainfall in the upper reach of the Mekong River inundate a large part of the Mekong Delta. Flash floods also occur because of the devastation of forest area in the upper

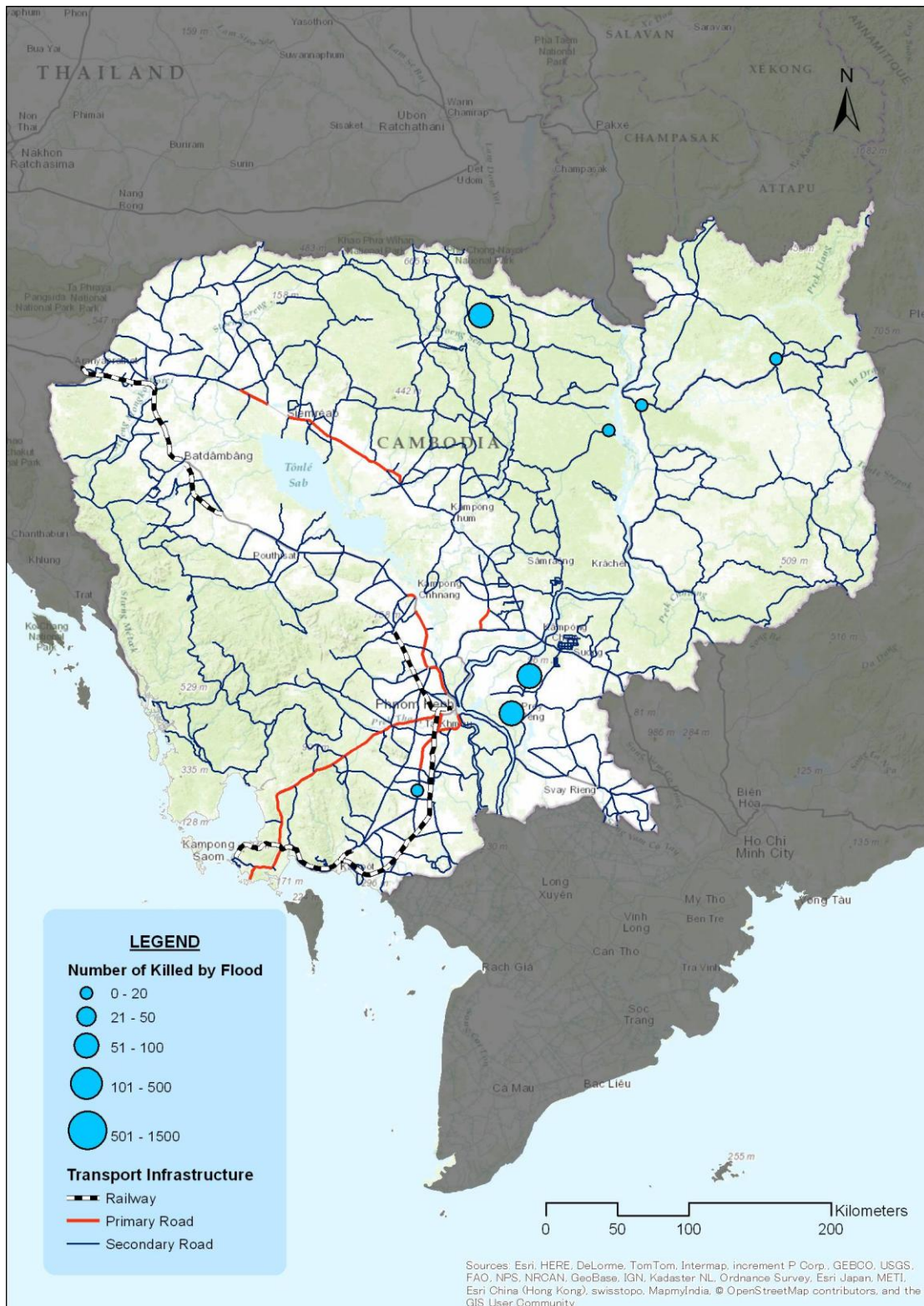
basin. At the same time, the Tonle Sap (Great Lake) also causes floods. There are have only been a few typhoons and minimal damage caused by storm surges.

In Cambodia, flooding is the most serious natural disaster from the viewpoint of the extent of damages, and drought ranks second. When a disastrous flood occurred in Thailand in 2011, Cambodia was also damaged seriously as it is located downstream of Thailand. In the 2011 flooding, various infrastructures such as roads, bridges, schools, and riverbeds were destroyed or damaged, with houses, farmlands, farm facilities, and hospitals are experiencing damage.

Many Japanese companies operate business in economic zones (SEZ), so damage to infrastructure such as roads and bridges caused by flooding has a grave impact on freight distribution. After a large flood in 2000, flood barriers were installed around Phnom Penh and three other cities in the east, national and provincial roads were rehabilitated, and bridges and canals were improved. However, these measures were not sufficient to handle the scale of the disaster in 2011.

Flooding spreads easily due to the impacts of the Tonle Sap Lake which is located in the mid-western area and has a high water level, the international Mekong River which is located in the mid-eastern area, and the east mountain area which blocks flow.

Moreover, flash floods may occur due to deforestation in the forest zone and defective irrigation facilities. These factors have likely played a role in spreading flood waters.



Data Source:

EM-DAT, The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium:

<http://www.emdat.be>.

Pacific Rim Coordination Center Disaster Data: <http://data.pacificrimnetwork.org/>.

Global Unique Disaster Identification Number: <http://www.glidnumber.net/glide/public/search/search.jsp>.

Figure 4.4 Flood Disasters and Major Road and Railway Networks: Cambodia



Data Sources:

- EM-DAT, The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium: <http://www.emdat.be>.
- Pacific Rim Coordination Center Disaster Data: <http://data.pacificrimnetwork.org/>.
- Global Unique Disaster Identification Number: <http://www.glidnumber.net/glide/public/search/search.jsp>.

Figure 4.5 Flood Disasters, and Dams and Power Stations: Cambodia

5. Legislative Systems

5.1 Legislative Systems for Disaster Management

Disaster Management Laws

Table 5.1 Laws and Regulations of Disaster Management in Cambodia

| | Laws / Regulations | Supervisory Authority | Matter |
|---------------|---|--|-----------------------------------|
| <i>Law</i> | Law on National Disaster Management (Draft) | National Committee for Disaster Management | Disaster Management |
| <i>Decree</i> | Sub-decree No.35 ANK | under survey | Disaster Management, Organization |
| <i>Decree</i> | Sub-decree No.61 ANK | under survey | Organization |

Laws for disaster management have not been developed in Cambodia. In the absence of disaster management law, Sub-decree No. 35 ANK has been a core principle for disaster management and defined the establishment of the National Committee for Disaster Management (NCDM). In addition, based on Sub-decree No.61 ANK, the Commune Committee for Disaster Management has been established at the local level.

The NCDM has been discussing the development of the Law on National Disaster Management since 2011. A draft of the Law on National Disaster Management has been published and is to be enacted in 2013.

Disaster Management Strategies and Plans

Table 5.2 Strategies and Plan for Disaster Management in Cambodia

| | Laws / Regulations | Supervisory Authority | Matter |
|-----------------|--|-----------------------|------------------|
| <i>Policy</i> | National Policy on Emergency Management, 1997 | under survey | General Disaster |
| <i>Policy</i> | National Contingency Policy for Flood, 2011 | under survey | Flood |
| <i>Strategy</i> | NCDM Institutional Development Strategy in 2001 | NCDM | General Disaster |
| <i>Plan</i> | Strategic National Action Plan for Disaster Risk Reduction 2008-2013 | NCDM | General Disaster |
| <i>Plan</i> | National Strategy Development Plan 2009-2013 | NCDM | General Disaster |

In the Strategic National Action Plan for Disaster Risk Reduction 2008-2013, developed in 2009, activities for disaster risk reduction have been identified and include: protecting rural areas from the natural hazards of flood and drought, enabling communities for disaster preparedness and risk reduction, and reducing the vulnerability of the poor to external factors including natural hazards. As of 2012, however, the Action Plan has not been implemented.

The NCDM developed the Institutional Development Strategy, which stipulates the establishment of an effective inter-ministerial system for dealing with disaster preparedness, response, and rehabilitation for five years from 2001.

For our report, documents regarding the National Policy on Emergency Management and the National Contingency Policy for Flood have not been found, thus details about the policies are not clear.

5.2 Regulations and Standards for Business Continuity Management

No regulations, standards or guidelines for business continuity management in time of disaster have been identified in Cambodia.

5.3 Legislative Systems for the Environment and Pollution Control

Environmental Laws and Regulations

Table 5.3 Laws and Regulations regarding the Environment in Cambodia

| | Law / Regulations | Supervisory Authority | Matter |
|---------------|--|-------------------------|--------------------------|
| <i>Law</i> | Law on Environmental Protection and Natural Resources Management, 1996 | Ministry of Environment | Environmental Assessment |
| <i>Law</i> | Law on the Water Resources Management, 2007 | Ministry of Environment | Water Pollution |
| <i>Decree</i> | Sub-Decree No.72 Anrk.bk on Environmental Impact Assessment Process, August 1999 | Ministry of Environment | Environmental Assessment |

The Law on Environmental Protection and Natural Resources Management requires the implementation of environmental assessments for all domestic development projects in Cambodia. The target projects and environmental assessment processes are defined in the Sub-Decree No.72 Anrk.bk.

In addition, the Law on Water Resources Management has been established and the basic policy for management of water resources is regulated by this law.

Pollution Control Laws and Regulations

Table 5.4 Laws and Regulations for Environmental Pollution Control in Cambodia

| | Laws / Regulations | Supervisory Authority | Matter |
|-------------------|--|------------------------------|-----------------|
| <i>Sub-Decree</i> | Sub-Decree No.27 Anrk.bk on Water Pollution Control, April 1999 | Ministry of Environment | Water pollution |
| <i>Sub-Decree</i> | Sub-Decree No.42 Anrk.bk on Air Pollution Control and Noise Disturbance, July 2000 | under survey | Air pollution |
| <i>Sub-Decree</i> | Sub-Decree No.36 Anrk.bk on Solid Waste Management, April 1999 | under survey | Solid Waste |

Regulations on environmental pollution control in Cambodia are regulated by sub-decrees.

The sub-decrees defining environmental pollution regulation related to industrial activities are listed above. Sub-Decree No.27 Anrk.bk regulates water quality and effluent in rivers, Sub-Decree No.42 Anrk.bk regulates air and noise pollution, and Sub-Decree No.36 Anrk.bk regulates the of management of solid industrial waste.

5.4 Legislative Systems for Development including Land Use, Rivers, and Building Code in Cambodia

Table 5.5 Laws and Regulations for Land, Rivers, and Building Code in Cambodia

| | Laws / Regulations | Supervisory Authority | Matter |
|---------------|--|--|----------|
| <i>Law</i> | Law on Land, 2001 | Minister of Land Management, Urban Planning and Construction | Land use |
| <i>Law</i> | Law on Forestry, 2002 | under survey | Forest |
| <i>Decree</i> | Sub-Decree On Community Forestry Management | under survey | Forest |
| <i>Decree</i> | Sub-Decree on River Basin Management (Draft) | under survey | River |

Legal provisions pertaining to land use and forests are stipulated in the Law on Land and the Law on Forestry.

Regulations for the development and use of river basins are to be enacted by governmental sub-decree. A draft of the document has already been published.

In our research, a specific building codes enacted in Cambodia could not be verified.

6. Implementation of BCP

6.1 Major Natural Disasters and Awareness Disaster Management

The major natural disasters that are expected to have a higher risk of causing damage in Cambodia are heavy rain and floods. The expectation for damage by flooding has seemed to rise due to climate change in recent years. However, high tide disasters and storm surges are not considered, because urban regions including Phnom Penh city are located inland. There has not been any severe damaged caused by landslide disasters.

In Phnom Penh, most enterprises consider that damage caused by floods is not a consideration for their business and the economy, even though minor flooding on roads is a frequent occurrence due to undeveloped drainage facilities in the city. In addition, because of lack of experience with natural disasters, their awareness of disaster risk is underdeveloped.

In rural regions, floods cause major damage in the farming industry. Moreover, people also consider avian influenza epidemics to be a hazardous disaster needing a governmental control policy.

6.2 Current State of BCP Implementation

The concept of BCP is not known among government agencies and enterprises in Cambodia. BCP is also unknown even in non-governmental agencies such as the Chamber of Commerce and Industry. Currently, there appear to be no enterprises or agencies that have considered developing a BCP.

Most Cambodian enterprises have little interest in preparing for corporate risk management of natural disasters. Only some major companies have tried to establish policies for disaster contingency plans.

Though some enterprises such as automotive parts manufacturers, located mainly in Thailand with branches or factories in Cambodia, may have advanced schemes for disaster risk management, most enterprises generally do not expect and are not prepared for disaster risks.

6.3 Efforts on Promoting BCP Implementation

The National Committee for Disaster Management (NCDM) is in charge of the national disaster management system in Cambodia. Since national disaster management policy consists of the preparation and development of disaster mitigation systems at the community level, the government does not place importance on disaster risk mitigation for the economy and business, but instead on human damage and public life as the contingency policy. The dissemination of BCP is regarded as a goal for the future, with first priority placed on the development of disaster risk mitigation systems among enterprises and local governments.

Regarding disaster risk management, strategic conferences by national specialized institutions and projects for meteorological disasters by non-governmental international institutes are being conducted due to the increased attention placed on climate change.

6.4 Problems Facing for Implementation of BCP

A lack of funds, knowledge, and other resources regarding disaster risk management discourages enterprises and individuals from developing disaster preparedness plans. In order to disseminate BCP in Cambodia, it is necessary to first raise BCP awareness among enterprises through seminars or other educational tools. International agencies specializing in disaster risk must provide support for enhancing knowledge and skills pertaining to disaster risk management.

Appendix 1: Method for Evaluating Predominant Hazards

The “Damage Amount / GDP” and “Number of Deaths” are used as the indices to show the impacts of the disasters considered and 6 natural hazards will be studied and compared. At the beginning of the study, only the “Damage Amount / GDP” was used as an index because the results can be used for Area BCP planning. However, the scarcity of information related to damage amounts became clear as the study progressed. As the information on the “Number of Deaths” is substantial compared to the damage amount, the “Number of Deaths” has been added as an index of impact.

The process of the study is as follows;

- 1) Based on the Damage Amount / GDP or Number of Death, each disaster is classified according to the ranking system outlined in Table A1.
- 2) The number of disaster events for each country is added by type of hazard and disaster rank, and then classified into Table A2 below,
- 3) The above information is then plotted on the impacts - frequency matrix by country,
- 4) As for earthquakes, tsunamis and volcanic hazards, if an event occurred before 1983 that was of the same (or higher) disaster rank as the maximum disaster rank recorded between 1983 to 2012, a point is plotted on the matrix which corresponds to the relevant disaster and frequency rank (=1).

Table A1 Disaster Rank and Damage

| Disaster Rank | Damage Amount / GDP ³ | Number of Death |
|---------------|----------------------------------|-----------------|
| 5 | 1.0% - | 10,001 - |
| 4 | 0.1% - 1.0% | 1,001 - 10,000 |
| 3 | 0.01% - 0.1% | 101 - 1,000 |
| 2 | 0.001% - 0.01% | 11 - 100 |

³ Gross domestic product based on purchasing-power-parity (PPP) valuation of country GDP, International Monetary Fund, World Economic Outlook Database, October 2012

| | | |
|---|----------|------|
| 1 | - 0.001% | - 10 |
|---|----------|------|

Table A2 Frequency Rank and Number of Events

| Frequency Rank | Number of Events from 1983 to 2012 | Average Frequency (Events / Year) |
|----------------|---------------------------------------|--------------------------------------|
| 5 | 7 or more | 1/5 - |
| 4 | 4 to 6 | 1/10 - 1/5 |
| 3 | 2 to 3 | 1/15 - 1/10 |
| 2 | 1 | 1/30 |
| 1 | Large Events occurred before 1983 | - |

Appendix 2: Data Sheets Outline of Existing Investigations and Studies

| | | | |
|------------------------|--|-----------------|------|
| No.: | FL-001 | Published Year: | 2010 |
| Study/ Report Name: | Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment | | |
| Access to Information: | www.unisdr.org/files/18872_asean.pdf | | |
| Research Organization: | UNISDR/World Bank | | |
| Study Area (Country): | ASEAN (10 countries) | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Flood | | |
| Main Data Sources: | CRED EM-DAT, ADRC, NGDC, GSHAP, MRC, WAMIS, DWR, Munich Re, World Bank, UNISDR, GAR, In Terragate, IFNet, CCFSC, DESINVENTAR | | |

Summary of the Study:

1) Overview

Disaster risks are assessed for years (1970-2009) by 1) Scenario, Exposure, Vulnerability, Damage and Loss analysis using existing database. The dominant disaster risks are cyclonic storms (typhoons), earthquakes, tsunamis, floods, epidemics, landslides, droughts volcanic eruptions and forest-fires. In total 1,211 reported disasters caused over 414,900 deaths.

2) Vulnerability

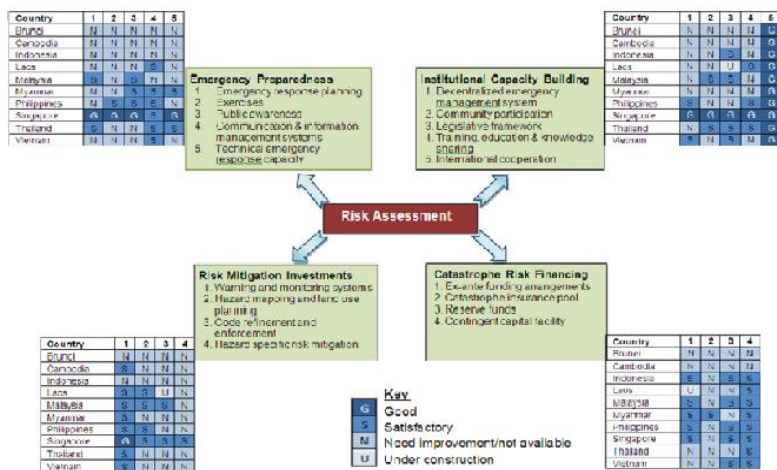
Method: the number of disaster events, deaths, affected population and economic losses are plotted against hazard types for 5 year intervals.

To estimate social vulnerability=> the average number of people killed.

ASEAN 17.7 death/year/million, Cambodia 3.56, Indonesia 20.38, Lao PDR 4.22, Malaysia 1.26, Myanmar 72.35, Philippines 11.93, Thailand 4.63, Vietnam 4.60. Brunei and Singapore have no data.

3) Risk assessment framework

A status of risk assessment framework is assessed by country to view the current capacity of risk assessment. The evaluation table is show below.



| | | | |
|------------------------|---|-----------------|------|
| No.: | FL-002 | Published Year: | 2012 |
| Study/ Report Name: | Key Indicators for Asia and the Pacific 2012 43 rd edition | | |
| Access to Information: | www.adb.org/publications/key-indicators-asia-and-pacific-2012 | | |
| Research Organization: | ADB | | |
| Study Area (Country): | ASEAN (10 countries) | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Vulnerability by % population and area | | |
| Main Data Sources: | | | |

Summary of the Study:

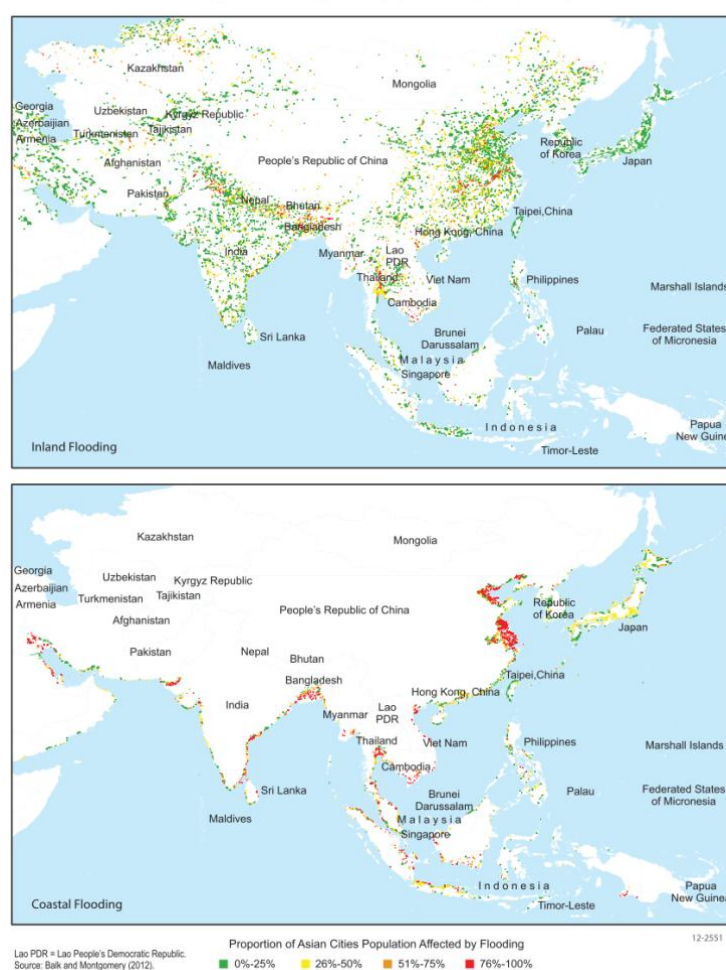
This report summarizes vulnerability of urban cities to flood in Asian and Pacific countries including the ASEAN region. The floods are classified as coastal flood and inland flood that may affect urban cities. Vulnerabilities are estimated by population and areas % at risk of flooding. Top 40 cities in Asian countries with 1 million population or more that are vulnerable to flooding are listed.

Key findings:

The Southeast Asia (ASEAN) region's vulnerability to coastal flooding: 36.1% with Vietnam (73.9%), Thailand (60%).

In terms of inland flooding, the vulnerability for Southeast Asia is 14.7%. The estimated vulnerability: Vietnam (38.6%), the Lao PDR (34%), Thailand (29%).

Figure 19 Vulnerability to Inland (top) and Coastal (bottom) Flooding



| | | | |
|------------------------|---|-----------------|------|
| No.: | FL-003 | Published Year: | 2010 |
| Study/ Report Name: | Progress Report on Flood Hazard Mapping in Asian Countries ICHARM Publication No.16, ISSN 0386-5878/ Technical Note of PWRI No. 4164 | | |
| Access to Information: | http://www.icharm.pwri.go.jp/publication/pdf/2010/4164_progress_report_on_fhm.pdf | | |
| Research Organization: | UNESCO (ICHARM)/PERI | | |
| Study Area (Country): | ASEAN (10 countries) | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Hazard Map | | |
| Main Data Sources: | | | |

Summary of the Study:

1) Overview

This is a seminar report on Flood Hazard Mapping production process for Asian Countries. Target countries were (China, Cambodia, Indonesia, Laos, Vietnam, Thailand, the Philippines and Malaysia).

2) Accuracy of Hazard Map

Two types of mapping methods are: i) interview based mapping (community-based), ii) quantitative hydrological data simulation models.

For the local usage, a simpler version is also effective. Examples of practical hazard maps are demonstrated as follows.

Map without inundation area

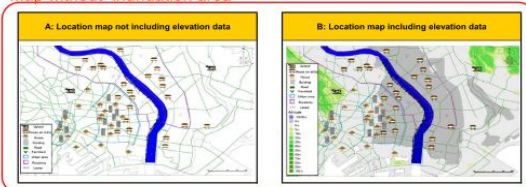
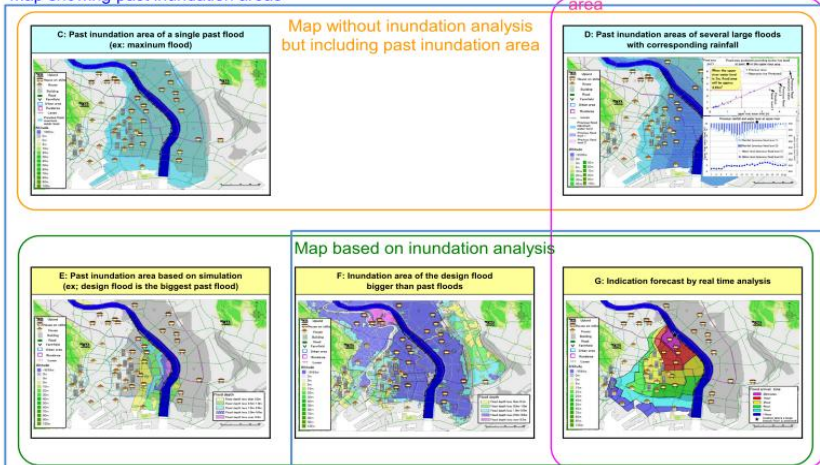


Table 3-2 List of Maps according to the level

Map showing past inundation areas



| | | | |
|--|--|-----------------|------|
| No.: | FL-004 | Published Year: | 2005 |
| Study/ Report Name: | A Primer: Integrated Flood Risk Management in Asia 2 | | |
| Access to Information: | www.adpc.net/maininforesource/udrm/floodprimer.pdf | | |
| Research Organization: | Asian Disaster Preparedness Center (ADPC)/UNICEF | | |
| Study Area (Country): | Asia including ASEAN countries | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Assessment method | | |
| Main Data Sources: | | | |
| <p>Summary of the Study:</p> <p>This is a comprehensive and practical how-to-handbook for policy makers and implementation stakeholders of flood risk management in Asia, with updated resources to (1) authorize programs; (2) formulate decisions; (3) plan, develop and implement decisions; (4) support implementation of decisions. There are extensive glossaries of words and concepts in relation to flood risk management.</p> <p>Topics include:</p> <p>Chapter 2: Types and levels of flood: riverine flood, slow-onset, rapid-onset, normal flood (1 year flood), catastrophic flood (100 year flood). Causes of flood: meteorological, hydrological and anthropogenic.</p> <p>Chapter 3: Policies, legal and institutional arrangement plans:</p> <p>Chapter 4: Flood risk assessment, data required for an assessment of potential damages and losses, Flood frequency calculations</p> <p>Chapter 5: Importance of watershed and floodplain management for flood risk management</p> <p>Chapter 6: Structural interventions: flood storage reservoir, dykes, levee and embankment, EIA, cost benefit analysis</p> <p>Chapter 7: Flood-proofing measures, relocation, elevation, dry-flood proofing, wet-flood proofing, flood-proofing measures categories: permanent, contingent and emergency measures</p> <p>Chapter 8: Flood preparedness planning: preparedness framework, activities, flood forecasting, public awareness</p> <p>Chapter 9: Effective emergency response in environment health management, evacuation camps, delivery of goods</p> <p>Case studies of ASEAN countries include:</p> <p>Disaster Management and Relief in Malaysia,</p> <p>Hazard Assessment in the Philippines,</p> <p>Flood mitigation mix measures/community level management in Thailand,</p> <p>Mekong River Commission Mediation of Trans-boundary Flood Issues</p> | | | |

| | | | |
|------------------------|---|-----------------|------|
| No.: | FL-005 | Published Year: | 2009 |
| Study/ Report Name: | Climate Change Vulnerability Mapping for Southeast Asia | | |
| Access to Information: | http://web.idrc.ca/uploads/user-S/12324196651Mapping_Report.pdf | | |
| Research Organization: | Economy and Environment Program for Southeast Asia (EEPSEA) | | |
| Study Area (Country): | ASEAN (Thailand, Vietnam, Laos, Cambodia, Indonesia, Malaysia, and Philippines) | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Vulnerability to climate change, flood frequency | | |
| Main Data Sources: | Urban Extent Database (GRUMP version 1) of the (CIESIN) GEODATA portal (the Environmental Database; http://geodata.grid.unep.ch/extras/datasetlist.php) BAKOSURTANAL | | |

Summary of the Study:

1) Overview

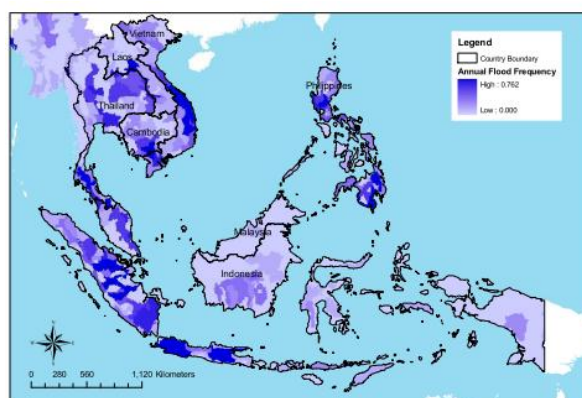
This study assesses vulnerability of Southeast Asian countries (Thailand, Vietnam, Laos, Cambodia, Indonesia, Malaysia, and Philippines) of climate change including flooding. Vulnerability is defined as a function of exposure (potential loss due to a hazard), sensitivity (the potential gravity of losses and damage), and adaptive capacity (how much to adapt a hazard situation).

2) Vulnerability assessment

Vulnerability is assessed by adaptive capacity (HDI, PPP, Gini-coefficient, Education, road, electricity...), population density (human sensitivity) and hazard map (hazard occurrence frequency data from 1980-2000). Adaptive capacity influences vulnerability. When adaptive capacity is low, vulnerability is high.

3) Area analysis

Cambodia is among the most vulnerable in ASEAN despite its relatively low exposure to climate hazards. The eastern coast of Vietnam is susceptible to cyclones, but adaptive capacity is high to manage to moderate its vulnerability. Bangkok and Jakarta have high adaptive capacities but not enough to moderate their extreme vulnerability with high population densities and significant exposure to climate hazards. A map shows annual flood frequency of the region.



Appendix 2B. Flood frequency (event per year from 1980-2001)

| | | | |
|---|---|-----------------|------|
| No.: | FL-006 | Published Year: | 2012 |
| Study/ Report Name: | Reducing Vulnerability and Exposure to Disasters The Asia-Pacific Disaster Report 2012 | | |
| Access to Information: | http://www.unisdr.org/we/inform/publications/29288 | | |
| Research Organization: | ESCAP/UNISDR | | |
| Study Area (Country): | ASEAN (10 countries) | | |
| Studied Hazard: | Hydro-meteorological Hazard | | |
| Studied Damage/ Risk: | Economic losses, fatalities, houses, risk-sensitive plans of investment | | |
| Main Data Sources: | | | |
| <p>Summary of the Study:</p> <p>1) Overview</p> <p>The Asia-Pacific region represents 75% of all global disaster fatalities. The economic and population growth contribute to a greater exposure to natural disasters. The population was doubled from 2.2 to 4.2 billion between 1970 and 2010. But the number of people who are exposed to flooding has increased from 29.5 to 63.8 million. The urban settlements are more vulnerable as the urban population increased from 17 to 44% of the total population between 1950 and 2010.</p> <p>2) Vulnerability</p> <p>Generally, smaller and less diversified economies are more vulnerable to disaster risks. Flood mortality risks are higher in rural areas with a densely concentrated and rapidly growing population with weak governance.</p> <p>3) Risk</p> <p>Risks are associated with economic and mortality risks. The exposure to flooding events constantly increases as of 1980 but mortality risks are decreasing as countries strengthened their risk governance capacities. However economic risks are increasing, due to slow adaptation of the existing fixed assets, such as old buildings and infrastructure, and institutional instruments such as land use planning and building regulation to cope with flooding particularly in rapidly urbanizing areas.</p> <p>4) Spatial and land use plan</p> <p>The national spatial and land use plans and policies are a key to reduce flood risks. Brunei, Indonesia, Lao PDR, Malaysia, Philippines, Singapore and Vietnam have land-use policies, plans or measures for DRR.</p> | | | |

| | | | |
|---|--|-----------------|------|
| No.: | FL-007 | Published Year: | 2002 |
| Study/ Report Name: | Coping with flood in Cambodian communities, Enhancing community solidarity through capacity building | | |
| Access to Information: | www.adpc.net/AUDMP/library/safer_cities/2.pdf | | |
| Research Organization: | Asian Disaster Preparedness Center | | |
| Study Area (Country): | Cambodia, Kampong Cham | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Community risk management, vulnerability | | |
| Main Data Sources: | | | |
| <p>Summary of the Study:</p> <p>This is a case study of a community-based flood mitigation and preparedness project (1998-2001). 23 Cambodian villages are targeted to develop an organizational framework for flood vulnerability reduction.</p> <p>Activities included: risk mapping, learning about first aid, organization skills and financial management by volunteer members in the communities to identify, estimate and rank local disaster risks (risk assessment).</p> <p>The case provides an example of step-by-step activity implementation in a rural community setting to enhance preparedness and mitigate risk for flooding event.</p> <p>The lessons learnt from the project was</p> <ol style="list-style-type: none"> 1. It is necessary to involve all groups in the community to make a risk mapping useful. 2. Risk mapping needs to be incorporated into community planning over a longer period of time. 3. Community-based activities can foster a solidarity network building for safety and cooperation to mitigate the flood risks within a community. <p>Asian Disaster Preparedness Center P.O. Box 4, Klong Luang, Pathumthani 12120, THAILAND Contact: Tel: (66-2) 524-5354, Fax: (66-2) 524-5350 E-mail: adpc@ait.ac.th URL: http://www.adpc.ait.ac.th</p> | | | |

| | | | |
|--|---|-----------------|------|
| No.: | FL-008 | Published Year: | 2011 |
| Study/ Report Name: | Advancing Disaster Risk Financing and Insurance in ASEAN Countries: Framework and Options for Implementation, Volume2: Appendix 1 | | |
| Access to Information: | https://www.gfdr.org/sites/gfdr.org/files/documents/DRFI_AS_EAN_Appendices_June12.pdf | | |
| Research Organization: | GFDRR/World Bank | | |
| Study Area (Country): | ASEAN (10 countries) | | |
| Studied Hazard: | Flood (multiple disasters) | | |
| Studied Damage/ Risk: | Damage, affected population, vulnerability index | | |
| Main Data Sources: | World Bank, EM-DAT, Relief Web, GFDRR, CIA fact book | | |
| <p>Summary of the Study:</p> <p>1) Overview</p> <p>Disaster risks were compiled for ASEAN countries with data between 1982 and 2011. The following items are analyzed: disaster profile (% of different disasters), damage (\$), affected population, vulnerability index (estimated number of people killed/year).</p> <p>2) Disaster profile: Typhoon is the dominant incidence causing flood and landslide in most countries except Singapore and Brunei</p> <p>Cambodia: 45% flood (Mekong river), 9% storm, 16% drought, 29% epidemic</p> <p>Indonesia: west and dry zones most severely hit (Jakarta, Medan, Bandung)</p> <p>Lao PDR: 50% flood, 22% epidemics, 13% storm, 13% drought</p> <p>Malaysia: dominantly flood</p> <p>Myanmar: multiple hazards, earthquake serious risk</p> <p>Philippines: dominantly typhoons causing other hazards in conjunction</p> <p>Thailand: multiple hazard (flood, drought, storms and landslide)</p> <p>Vietnam: 49% storm, 37% floods, 5% epidemic, 3% landslide, 2% drought</p> <p>3) Vulnerable areas</p> <p>Mekong River Delta in Vietnam, all regions of the Philippines, most regions in Cambodia, North and East Lao PDR, Bangkok in Thailand, the west and south of Sumatra and western and eastern Java in Indonesia.</p> <p>4) Vulnerability</p> <p>Urban (especially coastal) areas are more vulnerable against disasters due to a rapid population growth, urbanization, deforestation, and unplanned land use.</p> | | | |

| | | | |
|------------------------|---|-----------------|------|
| No.: | FL-013 | Published Year: | 2009 |
| Study/ Report Name: | Flood Risk Management in the Border Zone between Cambodia and Vietnam | | |
| Access to Information: | http://ns1.mrcmekong.org/download/fmmp-reports/V6E_FRMBZ_KH_VN_2.pdf | | |
| Research Organization: | The Mekong River Commission Secretariat | | |
| Study Area (Country): | Vietnam Cambodia | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Damages, risk assessment | | |
| Main Data Sources: | MRC ISIS model, local authorities | | |

Summary of the Study:

1) Overview

In this project, existing flood risk management plans are considered along the Mekong River in the following areas by conducting carefully thought assessments to estimate risks of damages of housing, agriculture and infrastructure. The project area covers 25 districts in Cambodia (10 districts in Takeo province, 7 districts in Kandal province, 5 districts in Prey Veng province, and 3 districts in Svay Rieng province) and 34 districts in Vietnam (11 districts in An Giang province, 11 districts in Dong Thap province, 5 districts in Kien Giang province, 6 districts in Long An province, and 1 district in Tien Giang province).

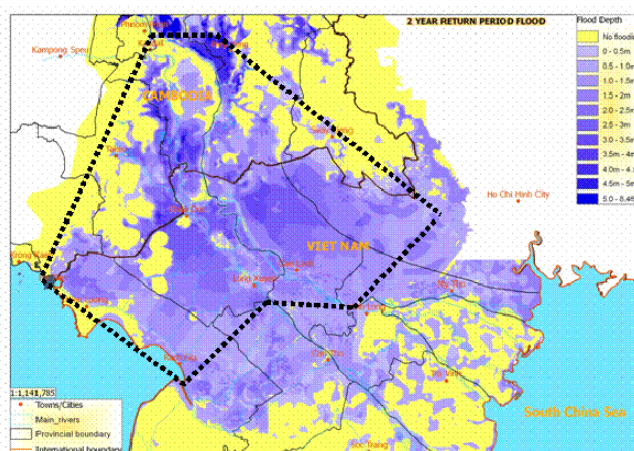
1. In Vietnam:

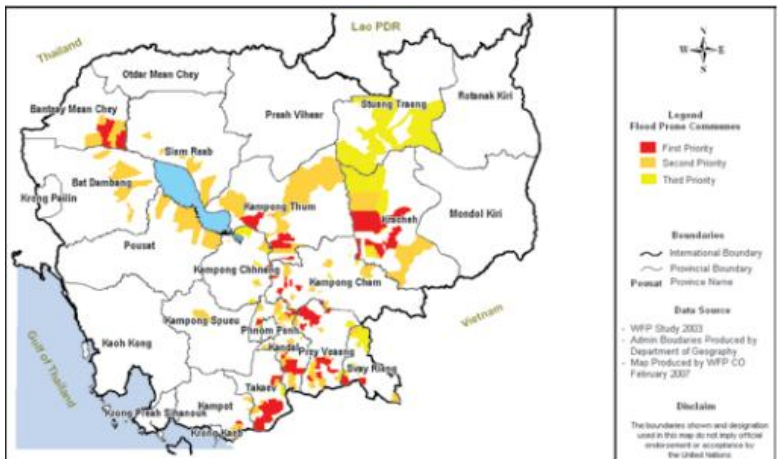
a. Long Xuyen Quadrangle (LXQ) b. Area between Bassac and Mekong north of the Vam Nao c. Plain of Reeds (POR) north of the Nguyen Van Tiep Canal

2. In Cambodia:

a. Floodplains on the West Bassac (WB) b. Floodplains between Bassac and Mekong c. Floodplains on the left bank of the Mekong and south of the NR #1, also referred to as East Mekong.

The conclusion of the damage risk assessment suggests that if one country takes measures to mitigate flood risks, the risk in the other country increases. Therefore, mitigation measures have to be taken in both countries to lower the risks of flooding. A joint project or an international watercourse management to reduce risks of the flood is sought for.

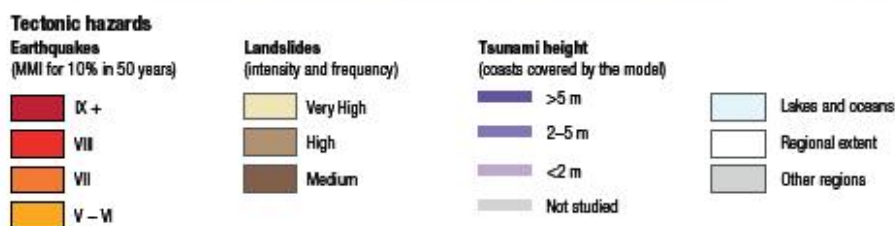
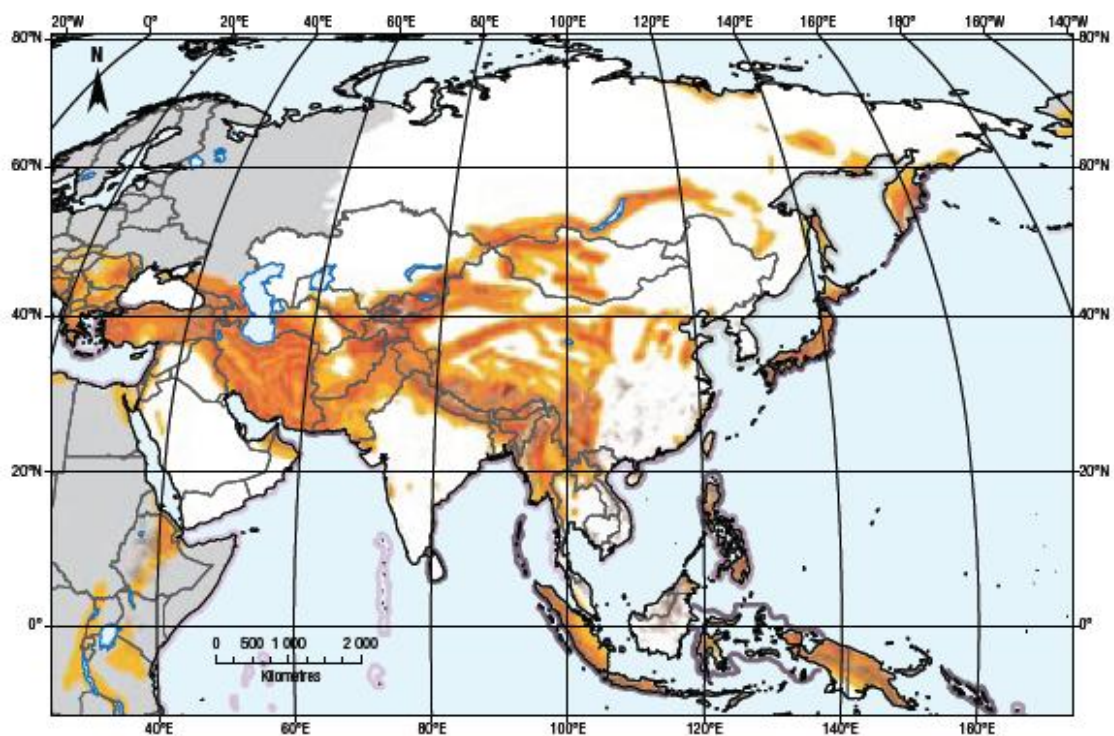


| | | | |
|--|---|-----------------|------|
| No.: | FL-014 | Published Year: | 2008 |
| Study/ Report Name: | Strategic National Action Plan for Disaster Risk Reduction 2008 ~ 2013 | | |
| Access to Information: | http://www.unisdr-apps.net/confluence/display/bib/Strategic+National+Action+Plan+%28SNAP%29+for+Disaster+Risk+Reduction | | |
| Research Organization: | National Committee for Disaster Management and Ministry of Planning | | |
| Study Area (Country): | Cambodia | | |
| Studied Hazard: | Flood | | |
| Studied Damage/ Risk: | Area, institutional improvement | | |
| Main Data Sources: | | | |
| <p>Summary of the Study:</p> <p>1) Overview</p> <p>This is a national strategic plan to deal with natural disasters. Flood is a common natural hazard in Cambodia and paper summarizes the status of flood risk and plans to tackle for Cambodia to manage flood and achieve the Millennium Development Goals (MDGs).</p> <p>2) Flood situation</p> <p>There are two types of flood in Cambodia: 1. Mekong flood – Rainfall in the upper catchments causes a slow but steady rise in water levels lasting for several days. Mekong river floods are common in the provinces of Stung Treng, Kratie, Kampong Cham, Prey Veng, Svay Rieng, Kandal, and Takeo.</p> <p>2. Flash floods – Repeated heavy rainfall in mountainous areas, which flows to streams and tributaries of the Mekong River branch of river cause flash floods. Flash floods are common in the provinces of Kandal, Kampong Speu, Kampot, Pursat, Battambang, Kampong Chhnang, Rattanakiri, Preah Vihea, and Odor Meanchey.</p> <p>Major flooding events affecting a significant population occur every five years or so (in 1961, 1966, 1978, 1984, 1991, 1996, 2000, 2001 and 2002).</p> <p>The figure below shows the location of the most flood prone areas in Cambodia.</p> | | | |
|  | | | |

| | | | |
|------------------------|--|-----------------|------|
| No.: | EQ-001 | Published Year: | 2009 |
| Study/ Report Name: | Global assessment report on disaster risk reduction (2009) Risk and poverty in a changing climate | | |
| Access to Information: | http://www.unisdr.org/we/inform/publications/9413 | | |
| Research Organization: | United Nations International Strategy for Disaster Reduction Secretariat (UNISDR) | | |
| Study Area (Country): | Worldwide | | |
| Studied Hazard: | Tropical cyclones, Floods, Landslides, Earthquakes (10% in 50 years MMI), Drought, Tsunamis, Forest and other biomass fires | | |
| Studied Damage/ Risk: | Multi-hazard risk | | |
| Main Data Sources: | | | |

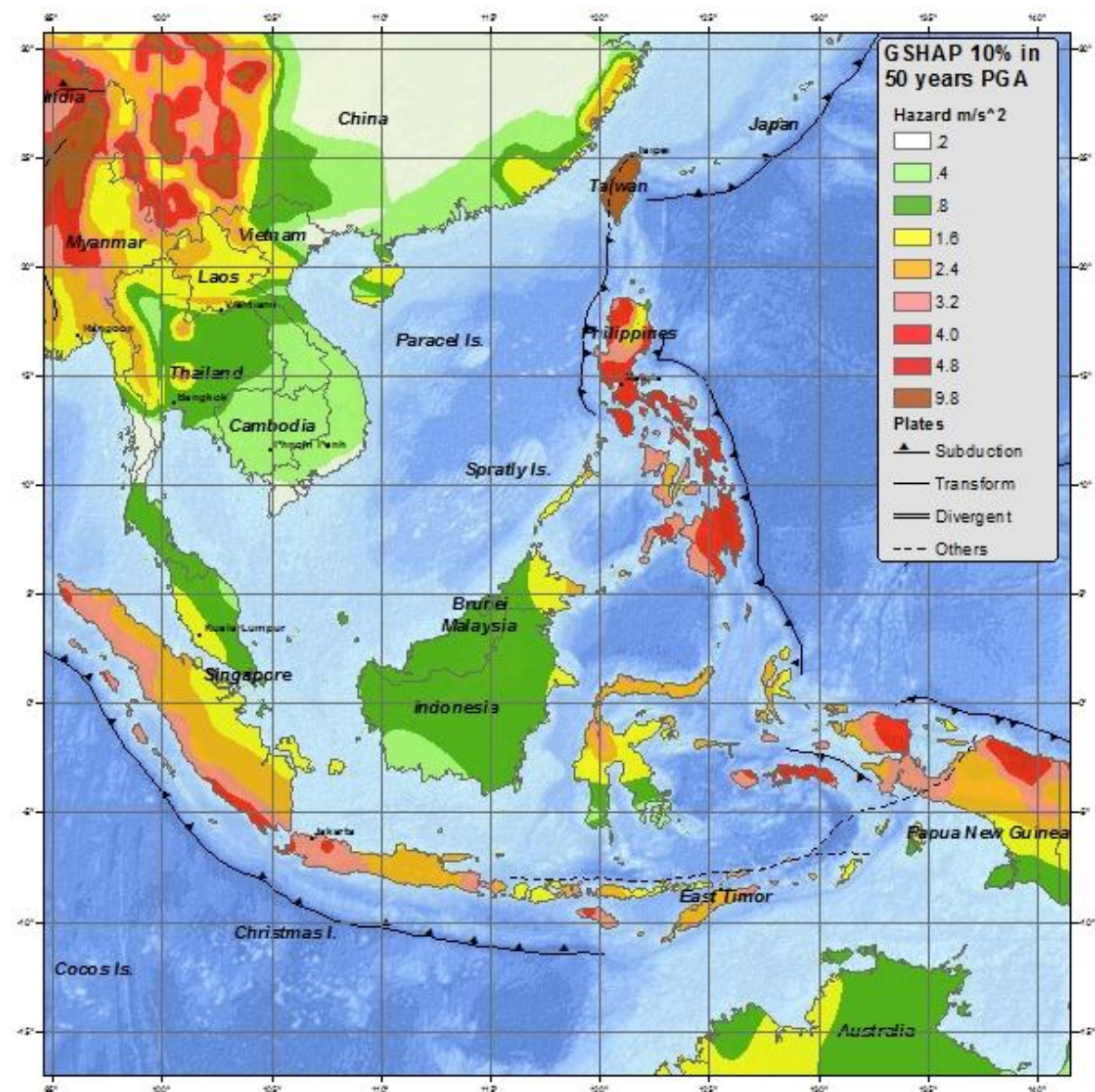
Summary of the Study:

An observation of disaster risk patterns and trends at the global level allows a visualization of the major concentrations of risk described in the report and an identification of the geographic distribution of disaster risk across countries, trends over time and the major drivers of these patterns and trends.



| | | | |
|------------------------|---|-----------------|---------|
| No.: | EQ-002 | Published Year: | unknown |
| Study/ Report Name: | Seismic Hazard Map | | |
| Access to Information: | http://earthquake.usgs.gov/earthquakes/world/indonesia/gshap.php | | |
| Research Organization: | GSHAP, USGS | | |
| Study Area (Country): | ASEAN | | |
| Studied Hazard: | Earthquake / 10% in 50 years | | |
| Studied Damage/ Risk: | | | |
| Main Data Sources: | | | |

Summary of the Study:



| | | | |
|------------------------|---|-----------------|------|
| No.: | TN-002 | Published Year: | 2005 |
| Study/ Report Name: | From Disaster to Reconstruction: A Report on ADB's Response to the Asian Tsunami | | |
| Access to Information: | http://www.adb.org/publications/disaster-reconstruction-report-a-dbs-response-asian-tsunami | | |
| Research Organization: | Asian Development Bank | | |
| Study Area (Country): | ASEAN | | |
| Studied Hazard: | Tsunami | | |
| Studied Damage/ Risk: | | | |
| Main Data Sources: | | | |

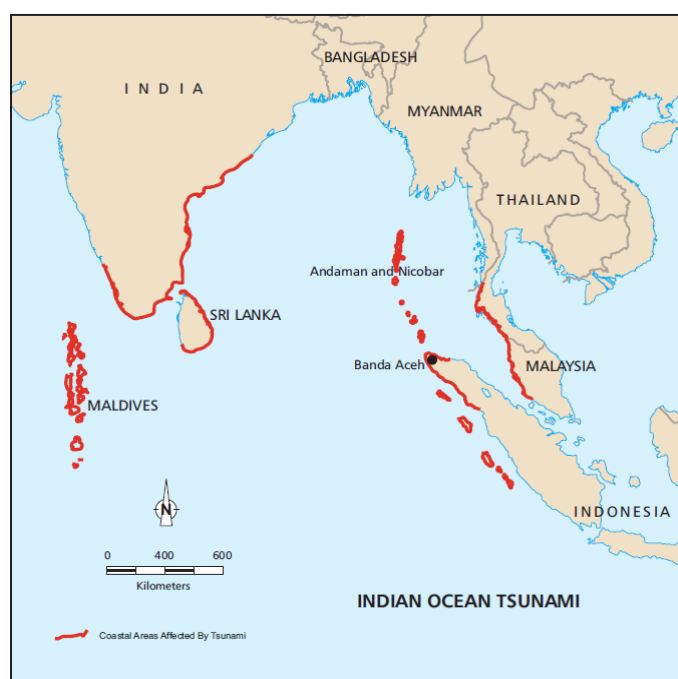
Summary of the Study:

This report summarizes ADB's response to the earthquake and tsunami during the first year. It highlights major activities, detailed project components, and identifies challenges ahead and lessons learned in responding to this unprecedented regional natural disaster.

Table 1: Tsunami Losses

| Country | Number of | | | Estimated Overall Damage (\$ billion) |
|-----------|-----------|---------|--------------------|---------------------------------------|
| | Dead | Missing | Displaced/ Injured | |
| India | 12,405 | 5,640 | 6,913 | 2,560 |
| Indonesia | 131,029 | 37,000 | 556,638 | 4,500 |
| Maldives | 82 | 26 | 29,577 | 0.472 |
| Sri Lanka | | 35,322 | 516,150 | 1,000 |
| Thailand | 5,395 | 2,817 | 54,500 | 0.711 |

Sources: Government of India; United Nations Development Programme; Government of the Maldives; Government of Sri Lanka; UN Resident Coordinator, Thailand.

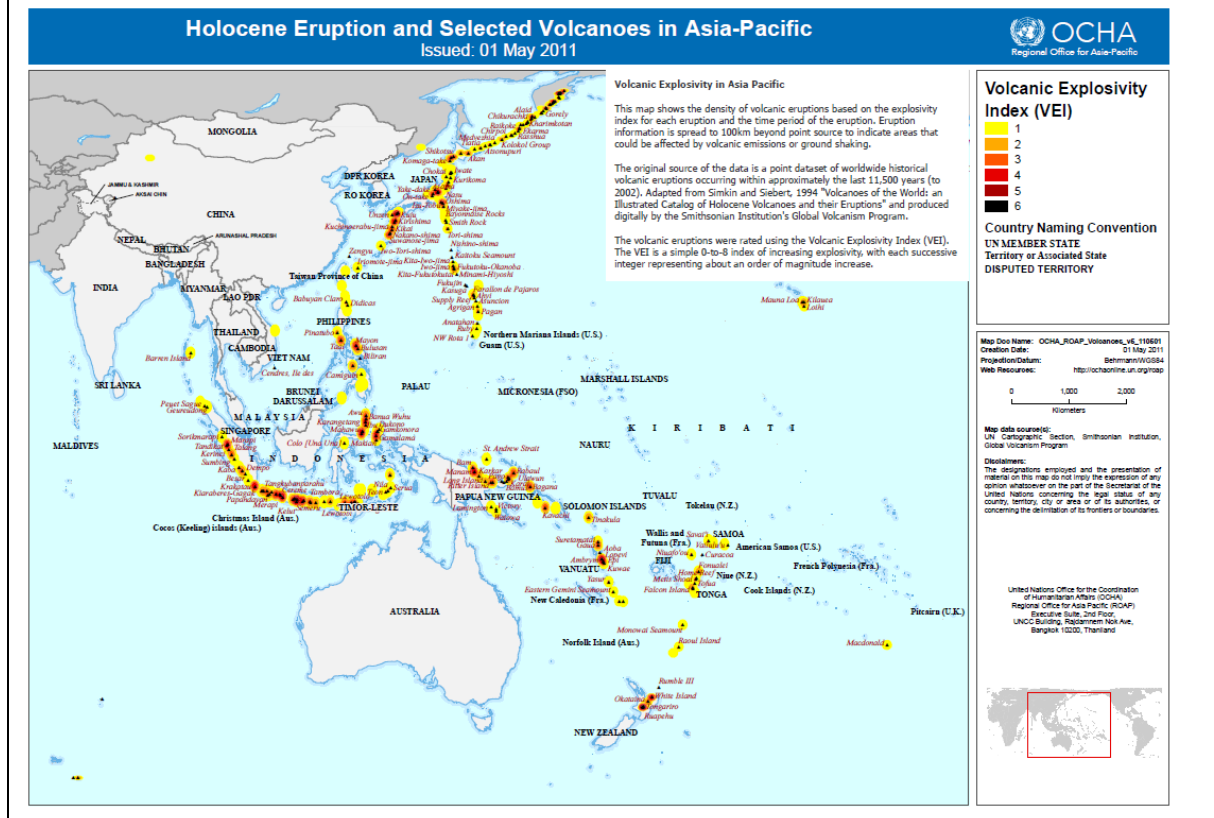


| | | | |
|------------------------|---|-----------------|------|
| No.: | VE-001 | Published Year: | 2011 |
| Study/ Report Name: | Holocene Eruption and Selected Volcanoes in Asia-Pacific | | |
| Access to Information: | http://reliefweb.int/sites/reliefweb.int/files/resources/map_619.pdf | | |
| Research Organization: | United Nations Office for the Coordination of Humanitarian Affairs, Regional Office for Asia Pacific (OCHA -ROAP) | | |
| Study Area (Country): | Asia-Pacific | | |
| Studied Hazard: | Volcanic Explosivity Index (VEI) | | |
| Studied Damage/ Risk: | | | |
| Main Data Sources: | UN Cartographic Section, Smithsonian Institution, Global Volcanism Program | | |

Summary of the Study:

This map shows the density of volcanic eruptions based on the explosivity index for each eruption and the time period of the eruption. Eruption information is spread to 100km beyond point source to indicate areas that could be affected by volcanic emissions or ground shaking.

The volcanic eruptions were rated using the Volcanic Explosivity Index (VEI). The VEI is a simple 0 to 8 index of increasing explosivity, with each successive integer representing about an order of magnitude increase.



| | | | |
|---|---|-----------------|------|
| No.: | CM-001 | Published Year: | 2002 |
| Study/ Report Name: | Overview of Early Warning in Cambodia, Indonesia, Lao PDR, Philippines and Vietnam | | |
| Access to Information: | http://www.adpc.net/pdr-sea/publications/OEWS.pdf | | |
| Research Organization: | Asian Disaster Preparedness Center | | |
| Study Area (Country): | Indonesia, Vietnam, Philippines, Lao PDR, Cambodia | | |
| Studied Hazard: | Storm(heavy rain) | | |
| Studied Damage/ Risk: | Hazard | | |
| Main Data Sources: | | | |
| <p>Summary of the Study:</p> <p>Globally, the incidence of hydro-meteorological disasters has doubled since 1996. In the past decade, more than 90% of the people killed by natural hazards and lost their lives due to droughts, windstorms and floods, of which 85% of the total deaths were reported from Asia (WDR, 2001). Strengthening disaster reduction strategies throughout the region is an important step towards ensuring that natural hazards do not result in social and economic disasters.</p> <p>The UN International Decade on Natural Disaster Reduction (IDNDR) Conference on Early Warning Systems for Reduction of Natural Disasters (held in Potsdam, Germany in September 1998) declared that the successful application of early warning is the most practical and effective measure for disaster prevention. Ultimately, the declaration continues, early warning systems must be comprehended by and motivate communities at greatest risk, including those disenfranchised and particularly disadvantaged people who must take appropriate protective actions. One of IDNDR's original program targets was for all countries to have in place, by the year 2000, ready access to global, regional, national and local warning systems as part of their national plans. Many governments and related disaster management organizations throughout Asia have already initiated Early Warning Systems; though, the resulting systems vary widely in their capacity to produce and communicate effective warnings. This report summarizes the findings of a study of Early Warning Systems in Cambodia, Indonesia, Lao PDR, Philippines and Vietnam, the countries targeted by the Disaster Preparedness Program of the European Commission Humanitarian Aid Office (DIPECHO). The study, conducted in accordance with the IDNDR objectives, was undertaken by Asian Disaster Preparedness Center's Partnerships for Disaster Reduction-South East Asia (PDR-SEA) project, which emphasizes the need to address disaster related issues within the context of sustainable development, with communities targeted as major beneficiaries¹. Most broadly, the project aims to develop the capacities of communities to prevent or mitigate the impact of disasters.</p> | | | |

This report attempts to raise awareness of the early warning systems in the respective countries and to provide a basis for further enhancing institutional mechanisms, technical capacities and community response options for reducing vulnerability to extreme climate events. The study has the following objectives:

- Review the international initiatives on early warning system
- Conduct a rapid appraisal of existing early warning system for hydro-meteorological hazards in DIPECHO target countries, and
- Undertake short case studies to assess community-level vulnerability and response to hydro-meteorological hazards.

Huge populations in the selected countries are highly vulnerable to hydro-meteorological hazards as large numbers of communities are settled in risk prone marginal areas. Fertile flood valleys, plains and deltas, such as the Lower Mekong River basin, are attractive to farmers as they provide access to livelihoods; but they are also most vulnerable to floods.

In urban areas, burgeoning populations are in many instances located in areas vulnerable to hazards such as tropical storms. This study is limited to the EWS for hydrometeorological hazards focusing on tropical cyclone and floods as recommended in the proposal approved by the European Commission Humanitarian Aid Office (ECHO).

| | | | |
|------------------------|--|-----------------|------|
| No.: | LS-006 | Published Year: | 2010 |
| Study/ Report Name: | Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment | | |
| Access to Information: | http://www.unisdr.org/files/18872_asean.pdf | | |
| Research Organization: | UNISDR/World Bank | | |
| Study Area (Country): | An assessment of disaster risks in ten ASEAN countries | | |
| Studied Hazard: | earthquakes, tropical cyclonic storms (typhoons), floods, landslides, tsunamis, droughts, and forest fires. | | |
| Studied Damage/ Risk: | Hazard profile and Risk profile | | |
| Main Data Sources: | CRED EM-DAT, ADRC, NGDC, GSHAP, MRC, WAMIS, DWR, Munich Re, World Bank, UNISDR, GAR, InTerragate, IFNet, and CCFSC, DESINVEN-TAR 1970-2009 | | |

Summary of the Study:

1) overview

This synthesis report on the Ten ASEAN Countries is based on a desk review of existing studies by academia, governments and international governmental and non-governmental organizations. Risk assessments are carried out directly based on recorded historical losses. The economic loss probability estimates presented in this report are not intended for designing catastrophe insurance schemes, which require a much more detailed approach that models hazard, exposure and vulnerability of buildings and infrastructure.

2) landslide and mudslide analysis

Landslide and mudslide analysis data sources are shown in above table (Main Data Sources). The landslide hazard risks maps were derived from the GAR Preview platform (GAR, 2009; <http://previewgrid.unep.ch>), has 10km grid resolution. This report explains overview, Regional setting, Hazard profile and Risk profile of each 10 countries separately.

Assessment sample of Natural disaster (Indonesia)

| Disaster Risk Statistics (1970-2009) | | | | |
|--------------------------------------|-------------------------|---------------------|---------------|---|
| Disaster type | No. of disasters / year | Total no. of deaths | Deaths / year | Relative vulnerability (deaths/year/ million) |
| Flood | 3.20 | 5,420 | 135.50 | 0.56 |
| Drought | 0.20 | 1,329 | 33.23 | 0.14 |
| Storm | 0.23 | 1,692 | 42.30 | 0.18 |
| Epidemic | 0.83 | 3,886 | 97.15 | 0.40 |
| Tsunami | 0.08 | 83,525 | 2088.13 | 8.69 |
| Earthquake | 2.10 | 97,166 | 2429.15 | 10.11 |
| Landslide | 1.03 | 1,845 | 46.13 | 0.19 |
| Volcano | 0.93 | 661 | 16.53 | 0.07 |
| Wildfire | 0.23 | 300 | 7.50 | 0.03 |

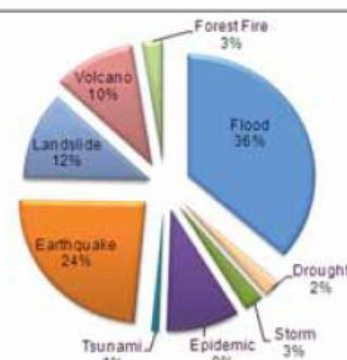


Figure 8: Percentage distribution of reported disasters in Indonesia

| | | | |
|---|---|-----------------|------|
| No.: | LS-007 | Published Year: | 2005 |
| Study/ Report Name: | Natural Disaster Hotspots: A Global Risk Analysis | | |
| Access to Information: | http://sedac.ciesin.columbia.edu/data/set/ndh-landslide-hazard-distribution/maps | | |
| Research Organization: | World Bank, | | |
| Study Area (Country): | Whole World | | |
| Studied Hazard: | Flood, Landslide, Drought, drought, earthquakes, storms, volcanoes | | |
| Studied Damage/ Risk: | | | |
| Main Data Sources: | | | |
| Summary of the Study: | | | |
| 1)overview | | | |
| <p>This study presents a global view of major natural disaster risk hotspots—areas at relatively high risk of loss from one or more natural hazards. It summarizes the results of an interdisciplinary analysis of the location and characteristics of hotspots for six natural hazards. Data on these hazards are combined with state-of-the-art data on the sub-national distribution of population and economic output and past disaster losses to identify areas at relatively high risk from one or more hazards. This study belongs to the project of Global Risk Identification Program (GRIP) by the world bank, which objects a framework which is improved evidence base for disaster risk management to enable the application and prioritization of effective disaster risk reduction strategies at the national, regional and global scales.</p> | | | |
| 2) | | | |
| <p>And a web site of CIESIN publishes detailed risk map of 6 hazards distribution studied in this project as shown in below. The maps are able to estimate risk levels at sub-national scales.</p> | | | |
| <div style="border: 1px solid black; padding: 5px; display: inline-block;">Sample of Landslide Hazard Distribution Map indicating Northern Philippines</div> | | | |
| <p>Global Landslide Hazard Distribut</p> <p>☉ Landslide Hazard Distribution</p> <ul style="list-style-type: none"> X Negligible to Very Low Low Low to Moderate Moderate Medium Medium to High High Very High X No Data | | | |

| | | | |
|--|---|-----------------|------|
| No.: | LS-008 | Published Year: | 2011 |
| Study/ Report Name: | Disaster risk management programs for priority countries - 2nd edition | | |
| Access to Information: | http://www.unisdr.org/we/inform/publications/20049 | | |
| Research Organization: | UNISDR(united nations office for disaster risk reduction) | | |
| Study Area (Country): | Indonesia, Vietnam, Philippines, Lao PDR, Cambodia, | | |
| Studied Hazard: | All natural hazards | | |
| Studied Damage/ Risk: | Profile, management framework, activities about disaster risk | | |
| Main Data Sources: | The world bank, EN-DAT | | |
| <p>Summary of the Study:</p> <p>1)overview</p> <p>This report is studying several aspects about disaster risk reduction, such as risk profile, management framework, activities and organization, concerning donor engagement and global facility to prepare comprehensive programs for disaster risk management and climate change adaptation for the next three to five years in each of the priority and donor earmarked countries by GFDRR (global facilities for disaster risk reduction). The following steps are undertaken to develop the country programs.</p> <ol style="list-style-type: none"> 1. Investigation of a) the underlying risk factors and b) the progress in the five priority areas of the Hyogo Framework for Action; 2. stocktaking of ongoing risk reduction and climate change adaptation programs by key stakeholders, including UN agencies, multilateral and bilateral donors, and other partners; 3. identification of key gaps at national, sector, and local levels; 4. solicitation of proposals from different government and non-government entities and concerned donor agencies; 5. analysis of the solicited proposals and consensus building in a consultative process involving a range of stakeholders, including relevant government ministries, UN organizations, multilateral and bilateral donors, INGOs and civil society actors; 6. development of strategic comprehensive programs of support based on the gathered information. <p>2)Framework and assessment of present condition</p> <p>In the report, those assessments are described as each countries separately.</p> <ol style="list-style-type: none"> 1: Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation 2: Identify, assess and monitor disaster risks and enhance early warning 3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels 4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience) 5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels | | | |

| | | | |
|------------------------|---|-----------------|------|
| No.: | LS-013 | Published Year: | 2009 |
| Study/ Report Name: | Climate Change Vulnerability Mapping for Southeast Asia | | |
| Access to Information: | http://web.idrc.ca/uploads/user-S/12324196651Mapping_Report.pdf | | |
| Research Organization: | Economy and Environment Program for Southeast Asia (EEPSEA) | | |
| Study Area (Country): | ASEAN (Thailand, Vietnam, Laos, Cambodia, Indonesia, Malaysia, and Philippines) | | |
| Studied Hazard: | Flood, Landslide, Drought, Tropical, cyclone Sea level rise | | |
| Studied Damage/ Risk: | Vulnerability to climate change, flood frequency | | |
| Main Data Sources: | Urban Extent Database (GRUMP version 1) of the (CIESIN) GEODATA portal (the Environmental Database; http://geodata.grid.unep.ch/extras/datasetlist.php) BAKOSURTANAL | | |

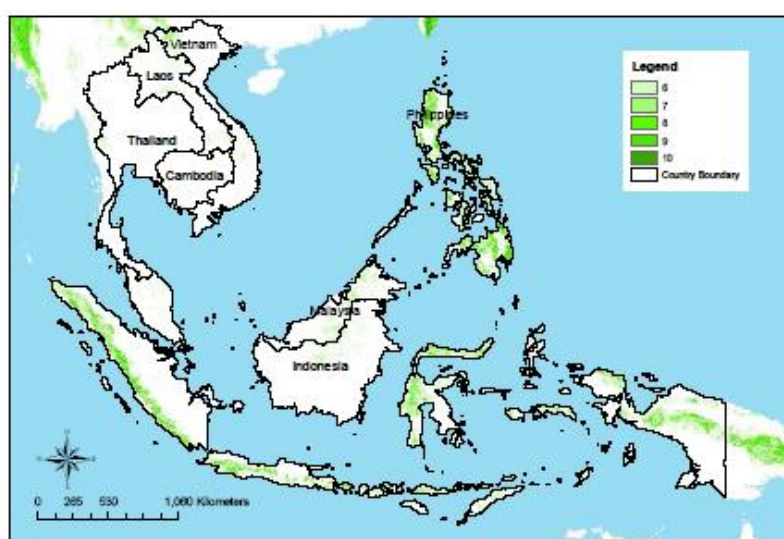
Summary of the Study:

This study assesses vulnerability of Southeast Asian countries (Thailand, Vietnam, Laos, Cambodia, Indonesia, Malaysia, and Philippines) of climate change including landslide. Vulnerability is defined as a function of exposure (potential loss due to a hazard), sensitivity (the potential gravity of losses and damage), and adaptive capacity (how much to adapt a hazard situation).

Adaptive capacity influences vulnerability. When adaptive capacity is low, vulnerability is high. Cambodia is among the most vulnerable in ASEAN despite its relatively low exposure to climate hazards. The eastern coast of Vietnam is susceptible to cyclones, but adaptive capacity is high to manage to moderate its vulnerability. Bangkok and Jakarta have high adaptive capacities but not enough to moderate their extreme vulnerability with high population densities and significant exposure to climate hazards.

A map shows annual landslide exposure of the region.

The map shows Landslide exposure changing rate caused by Climate change



Appendix 2D. Landslide exposure (2005)

Appendix 3: List of Industrial Parks in Cambodia

| ID | Short List | Long List | COUNTRY | PROVINCE | PARK NAME | ADDRESS |
|--------|---------------|---------------|----------|----------|----------------------------|---|
| KH0001 | | | Cambodia | | D&M Bavet SEZ | Bavet commune, Chantrea District, Svay Rieng Province |
| KH0002 | | | Cambodia | | Doung Chhiv Phnom Den SEZ | No Address |
| KH0003 | | XXKH01 | Cambodia | | Goldfame Pak Shun SEZ | Middle of Phnom Penh and Takeo |
| KH0004 | | | Cambodia | | Kampong Saom SEZ | Mittapheap Kampuchea Soviet |
| KH0005 | | | Cambodia | | Kampot SEZ | Kipling Ln Kampot |
| KH0006 | | | Cambodia | | Kiri Sakor Koh Kong SEZ | Boutum Sakor National Park |
| KH0007 | | XXKH02 | Cambodia | | Manhattan (Svay Reing) SEZ | Bavet Commune, Chantrea District, Svay Rieng Province |
| KH0008 | | | Cambodia | | MDS THMORDA SEZ | No Address |
| KH0009 | | | Cambodia | | N.L.C SEZ | No Address |
| KH0010 | | | Cambodia | | Neang Kok Koh Kong SEZ | No Address |
| KH0011 | | | Cambodia | | Oknha Mong SEZ | Oknha Mong Reththy, Phnom Penh |
| KH0012 | | | Cambodia | | P (SEZ) I C | Salatean and Preytob Village, Chhrokmates Commune, Svay teap District, Svey Rieng |
| KH0013 | XXKH03 | XXKH03 | Cambodia | | Phnom Penh SEZ | Unnamed Rd Phnom Penh Special Economic Zone |
| KH0014 | | | Cambodia | | Poi Pet O'Neang SEZ | No Address |
| KH0015 | | | Cambodia | | S.N.C SEZ | National Highway 6 |
| KH0016 | | | Cambodia | | Sihanoukville Port SEZ | Krong Preach Sianouk KHAN Mittapheap |
| KH0017 | | | Cambodia | | Sihanoukville SEZ 1 | Near air port Mittapheap Kampuchea Krong Preah Sianouk |
| KH0018 | XXKH04 | XXKH04 | Cambodia | | Sihanoukville SEZ 2 | Near air port Mittapheap Kampuchea Krong Preah Sianouk |
| KH0019 | | | Cambodia | | Stung Hav SEZ | No Address |
| KH0020 | | | Cambodia | | Suoy Chheng SEZ | No Address |
| KH0021 | | XXKH05 | Cambodia | | Tai Seng Bavet SEZ | Bavet District, Svay Rieng Province |
| KH0022 | | | Cambodia | | Thary Kampong Cham SEZ | 216 Preah Norodom Blvd Phnom Penh |

Appendix 4: General Investment Risk of Cambodia

(1) Political Risk

The government is stable, with little risk of political instability or changes to development policy threatening business continuity. The Cambodian People's Party (CPP) has wielded power for some 30 years, with Prime Minister Hun Sen practicing a model of "guided democracy." This involves promoting increased economic liberalization and infrastructure development while the party retains a tight grip on political control. In the last parliamentary election in July 2008, the CPP cemented its dominant position by securing a large majority. This has allowed the CPP to govern without a coalition partner. The CPP is also expected to win a clear majority in the upcoming 28 July 2013 general election, which will allow Hun Sen – who enjoys the confidence of his party and will stand for re-election – to further consolidate his power. Hun Sen is likely to expand his extensive personal business patronage network, especially over the lucrative hydrocarbons sector through the Cambodian National Petroleum Authority, which falls under his direct control.

The CPP faces no real threat to its effective monopoly over politics, the judiciary, and the security forces amid weak political opposition. The government's stability is likely to ensure the continuity of pro-business policies and of contracts signed by the current government. These include hydrocarbon exploration rights to six offshore blocks in the Gulf of Thailand (Chevron Corporation is currently drilling the largest block), hydropower projects developed by Chinese and Vietnamese companies and SEZ development plans. Corruption remains a severe risk, especially in the absence of any substantial checks on the government. Contracts and licenses risk being revoked if personal relationships with senior government officials are not maintained adequately through bribes.

(2) Economic Risk

Cambodia remains one of the poorest countries in Asia, with per capita income just now crossing the USD 1,000 mark. Political stability since 1998 has laid the foundation for larger foreign direct investment (FDI) inflows, which have so far primarily targeted the garment and textile sectors. The garment and footwear industries received a big boost in 2011 when the European Union relaxed its rules of origin and granted

Cambodia duty-free access to the European market. Investment in the sector will probably increase further in coming years, especially given repeated minimum-wage hikes in neighboring Thailand that will further boost Cambodia's relative cost competitiveness. Cambodia's relatively stable inflation profile also compares favorably with developments in neighboring Vietnam. Construction, agriculture, manufacturing, and services should all continue to grow in 2013, supporting economic growth of nearly 7.0%. Tourism has also revived in recent years and there is considerable potential for further expansion. The discovery of offshore oil reserves represents a significant upside potential for medium- and longer-term growth as well.

Nevertheless, given the high poverty incidence, massive infrastructure development needs, limited scope for domestically generated investment, and the hesitance of the financial crisis-weathered foreign investors, the country is expected to remain quite aid-dependent for many years to come. Continued macroeconomic reforms and steady FDI flow remain crucial for future development. Cambodia is one of the most highly dollarized economies in the world, reflecting the historical legacy of money abolition during the Khmer Rouge rule. Although this does not, in and of itself, impose severe constraints on business operations, the weak and underdeveloped domestic financial sector does. Deepening financial intermediation is a very important priority for Cambodia's policymakers. At the moment, most large-scale investment projects are financed externally since the domestic financial sector lacks the resource depth to support such activities. Overall, HIS anticipates that foreign investor interest in Cambodia will continue to intensify in coming years, which should support a solid average growth rate of 8.0% per year over 2015–2019.

(3) Legal Risk

Cambodia's legal system is still evolving after more than two decades of armed conflict that ended in 1991 and summarily dismantled the legal system. Cambodia is a civil law country; the new Civil Code came into effect in December 2011. The new system is a hybrid of customary law, and has also been influenced by Japanese and French legal traditions. The political will to make the country attractive to investors and, above all, the attainment of World Trade Organization membership in 2004 have driven forward the development of the legal system.

Nevertheless, daunting challenges remain: the rule of law is weak and the court system struggles to enforce its judgments. A significant shortage of trained judges and

other legal personnel remains also a challenge. While there is no systematic discrimination against foreign investors in Cambodia through a regulatory regime, both corruption and political overlay obstruct transparency. In addition, Cambodia still lacks some key commercial laws.

The Law on Commercial Enterprise 2005 is the first comprehensive company law in Cambodia. Under the law, the definition of a foreign business is: a legal entity formed under the laws of a foreign country where it has a place of business and which is doing business in Cambodia. It may conduct business in Cambodia as a commercial representative office, commercial relations office or agency ("representative office"); a branch; or a subsidiary. The passage of the law did not ease the procedure of setting up a business in Cambodia, which takes an average of 9 procedures and 85 days.

(4) Tax Risk

The tax regime in Cambodia is largely undeveloped. The tax base is small and poor tax collection has contributed to low revenues. However, a range of tax incentives for investors and relatively low corporate income tax rates render the country more attractive to foreign-invested enterprises. Corporate tax is levied at a flat rate of 20%, which is one of the lowest in the region. Due to the government's preoccupation with other development issues, the rapid development of a more sophisticated system should not be expected and, as a result, the system will continue to lack sophistication, nor will it enjoy any expansion in the short term. Cambodia does not have any double-taxation agreements in place, but it has entered into various investment promotion and trade agreements with a number of countries. Companies operating within SEZs benefit from income tax, customs, import duty and VAT incentives.

(5) War Risk

The government has good relations with neighboring Laos and Vietnam and their borders are clearly demarcated. Relations with Thailand are strained over a disputed border area around the Preah Vihear temple complex bordering Thailand's Sisaket province. In October 2008, skirmishes broke out between Cambodian and Thai forces in that area and recurred sporadically. While the fighting mostly consisted of small arms firing, artillery was occasionally used, causing thousands of villagers to flee. The

skirmishes subsequently tapered off after the election of the Puea Thai party in Thailand in August 2011. The Puea Thai is the party of former Thai Prime Minister Thaksin Shinawatra who has good relations with Cambodia's Premier Hun Sen. In April 2013 both governments began arguing their cases at an International Court of Justice hearing, which will announce its verdict in October 2013. However, irrespective of the decision, if the Puea Thai loses power the risk of renewed fighting will increase.

During the recent skirmishes, the regional grouping Association of Southeast Asian Nations (ASEAN), of which both Cambodia and Thailand are members, helped to de-escalate the situation. ASEAN would likely be involved again if fresh fighting breaks out. ASEAN's involvement plus the reluctance of Cambodia and Thailand to enter a full conflict over their border dispute, which concerns a small, rural area without significant commercial relevance, means it is unlikely any fighting will involve the use of air power or the countries' naval forces.

Cambodia and Thailand also have not fully demarcated their maritime border in the Gulf of Thailand, but this has been dealt with in a more cooperative manner, making it unlikely to result in maritime skirmishes or conflict. Offshore energy resources are present in the disputed area with three blocks containing as estimated 10-11 trillion cubic feet of gas reserves subject to overlapping claims with Thailand. Cambodia wants to jointly develop the overlapping areas with Thailand so as to begin bidding rounds as quickly as possible, but Thailand prefers that the countries justify the existing claims instead. Talks are unlikely to take place in the next year given the Thai government's reluctance to negotiate. As Cambodia is eager to proceed quickly and reach an agreement with Thailand, it is unlikely that its naval vessels will intentionally harass commercial vessels working at Thai offshore facilities including those of Chevron Corporation and Salamander Energy plc.

(6) Terrorism Risk

A significant militant attack is unlikely. There are no international or regional militant groups operating in the country. While IEDs have been used in politically-motivated attacks, this is rare. Since 2007, there have only been two such attacks. In January 2009, three IEDs were placed near the Ministry of National Defense and a TV station, but were found and destroyed by police. In July 2007, a 10kg IED exploded at the Cambodia-Vietnam friendship monument in a park near the prime minister's residence, causing limited property damage.

A historic regional rivalry with Thailand has led to an attack on Thai-owned asset that caused serious property damage. In January 2003 the Cambodian press wrongly attributed comments to a Thai actress claiming Thai ownership of the historic Angkor Wat temple in Cambodia. Subsequent anti-Thai protests destroyed the Thai Embassy in Phnom Penh and several Thai-owned businesses.

A largely defunct anti-communist movement, the Cambodian Freedom Fighters (CFF), led by California-based Cambodian-American Chun Yasith, is assessed as posing a negligible threat. Formed in 1998 when political upheaval sent some Cambodians into exile, reports suggest the CFF never exceeded 100 armed fighters in strength. Its only noteworthy activity was a November 2000 armed attack on government buildings in Phnom Penh in which members of the security forces were wounded and the attackers killed or wounded. In April 1999, around five CFF members were arrested in connection with a plot to detonate an IED at a fuel depot. The CFF is not known to have engaged in any militant activity since the 2000 attack and in our view is a spent force.

Armed criminal gangs pose a moderate risk of cargo theft, especially between Kratie and Stung Treng provinces in central-east Cambodia, where Highway 7 is particularly at risk. These gangs are also likely to extort transport vehicles. There is also a moderate risk of armed theft in the inland waterways and on the railway system.

(7) Civil Unrest Risk

While foreign direct investment has doubled since 2010 and manufacturing has relocated to Cambodia due to low wages, the government has not correspondingly improved land rights or worker treatment. As such, we assess industrial unrest and land protests will likely become more frequent in the two-year outlook. Industrial protests, involving strikes and demonstrations over pay and working conditions, occur almost every month, many in the garment sector. They are generally peaceful and conducted amongst heavy police presence, thus posing a low risk to property. Strikes are generally localized to one factory and coordination between factories is normally poor, reducing risks of significant or widespread business disruption due to strikes.

No large-scale ethnic divide threatens stability in Cambodia. However, the country suffers from sporadic unrest in both rural and urban areas, due to land seizures and growing economic inequality. A particularly contentious issue has been the awarding

of land to private enterprises and individuals, often requiring seizures and evictions. In the last few years a growing number of contentious land grabs and forced evictions, particularly in the capital Phnom Penh, have met with large-scale protests and violent confrontations with authorities. Until the authorities are able to adequately compensate those who have lost their land, these kinds of violent incidents are bound to recur. These protests are particularly likely in Rattanak Kiri, Banteay Meanchey, Kratie and Preah Sihanouk, and in cities including Phnom Penh, Sihanoukville and Siem Reap.

Local communities and environmentalists are likely to protest peacefully against the construction of hydroelectric dams on the Mekong River, which, they claim will have negative repercussions on the environment. Political violence has traditionally been more prevalent during election campaigns, where recourse to targeted killings has been more likely. However, as the popularity of the CPP has grown and it has consolidated its power since the 2008 elections, the level of political violence has fallen.