

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

L a o P D R

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

March 2015

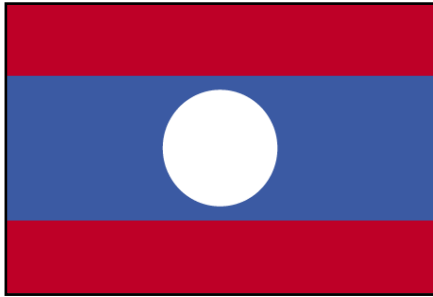
AHA CENTRE

Japan International Cooperation Agency

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

Overview of the Country

Basic Information of Lao PDR ^{1), 2), 3)}



National Flag



Country Name	Long form : Lao People's Democratic Republic Short form : Lao PDR, Laos
Capital	Vientiane
Area (km ²)	Total: 236,800 Land: 230,800 Inland Water: 6,000
Population	6,769,727
Population density(people/ km ² of land area)	29
Population growth (annual %)	1.8
Urban population (% of total)	36
Languages	Lao
Ethnic Groups	There are 49 ethnic groups including Lao (at least half of the total population)
Religions	Buddhism
GDP (current US\$) (billion)	11
GNI per capita, PPP (current international \$)	4,570
GDP growth (annual %)	8.1
Agriculture, value added (% of GDP)	28
Industry, value added (% of GDP)	36
Services, etc., value added (% of GDP)	36

Brief Description

Laos is located on the Indochina Peninsula, and bordered by China to the north, Myanmar to the west, Vietnam to the east, and Cambodia and Thailand to the south. It is the only landlocked country in ASEAN. The Mekong River runs north-south across Laos. The country is also characterized by its large mountainous regions.

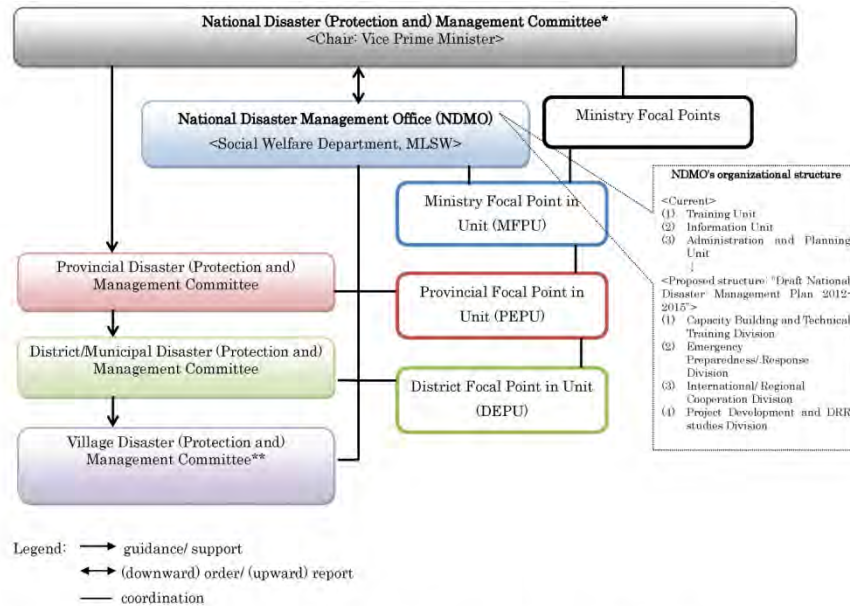
Laos became a member of ASEAN on July 23, 1997, together with Myanmar. Unlike other ASEAN countries, Laos does not have a large metropolis, and the country is thinly populated.

Laos is a People's Democratic Republic, and Choummaly Sayasone is the President and the head of state of Laos. The central government also controls local level administration. The country has no local assembly.

Natural Hazards

The major natural disasters in Lao People's Democratic Republic (PDR) are flooding, storm, and drought in terms of number of disaster, and total number of affected people. On the other hand, deaths due to disasters were attributed to flooding and storm. Estimated damage costs were caused by storm (95%) and flood (5%). The number of deaths was reported due to drought. It may be considered that people are affected mainly by flood (water) whereas economic losses are mainly caused by storms (considered from its strong winds).

Disaster Management System ⁴⁾



Note: *NDMC is renamed by the draft decree on National Disaster Protection and Management (Provisional English Translation by the JICA Study Team). Differences are bracketed off. ** Committee at the village level is established especially where there is high risk. It is currently called the Village Disaster Protection Unit (VDPU) in the draft National Disaster Management Plan 2012-2015.

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) Japan International Cooperation Agency (JICA) (2012): Data Collection Survey on ASEAN Regional Collaboration in Disaster Management

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1. Introduction

This report is the first version of the Country Report for Lao PDR, 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 Lao PDR, 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.

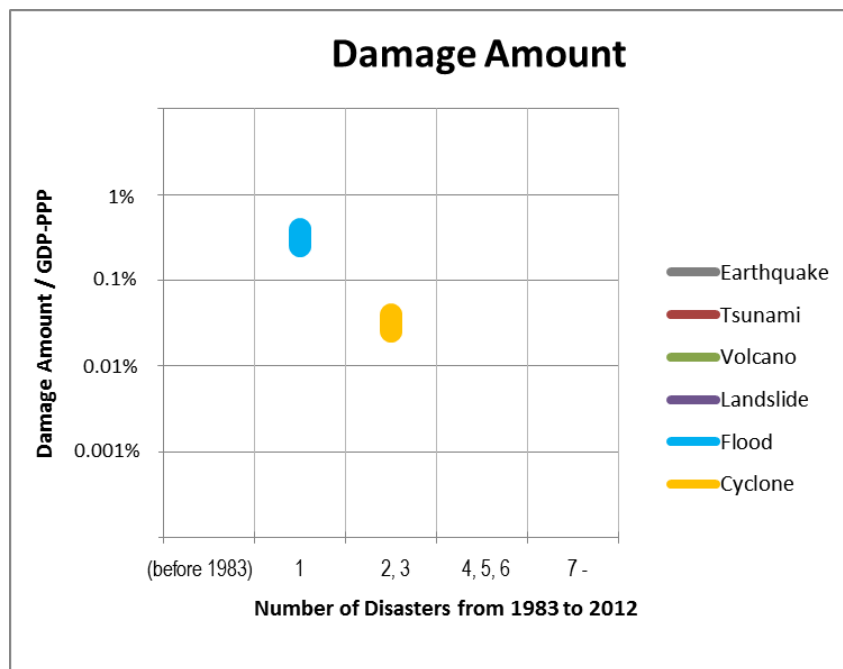
1. AHA Centre and JICA (2015): Planning Guide for Area Business Continuity, Area BCM Took Kits, Version 2.
2. AHA Centre and JICA (2015): The Country Reports; Brunei, Cambodia, Laos, Malaysia, Myanmar, the Philippines, Thailand, Singapore and Vietnam.
3. AHA Centre and JICA (2015): The Risk Profile Reports; 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.

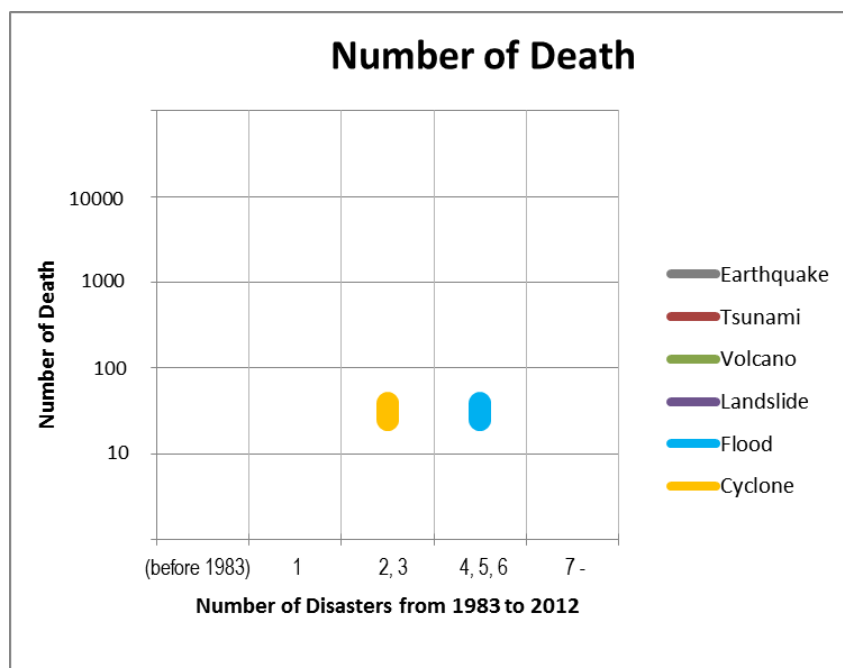
2. Natural Disaster Risks

2.1 Predominant Hazards

Flood and cyclone disasters have been recorded. The impacts of floods and cyclones, in terms of the number of deaths, are the same but floods occur more frequently.



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.glideumber.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 Lao PDR

2.2 Flood

Risks

Locations of flood disasters in Lao PDR are shown in Figure 2.2. Size of circles represents the scale of the disasters in terms of human losses .

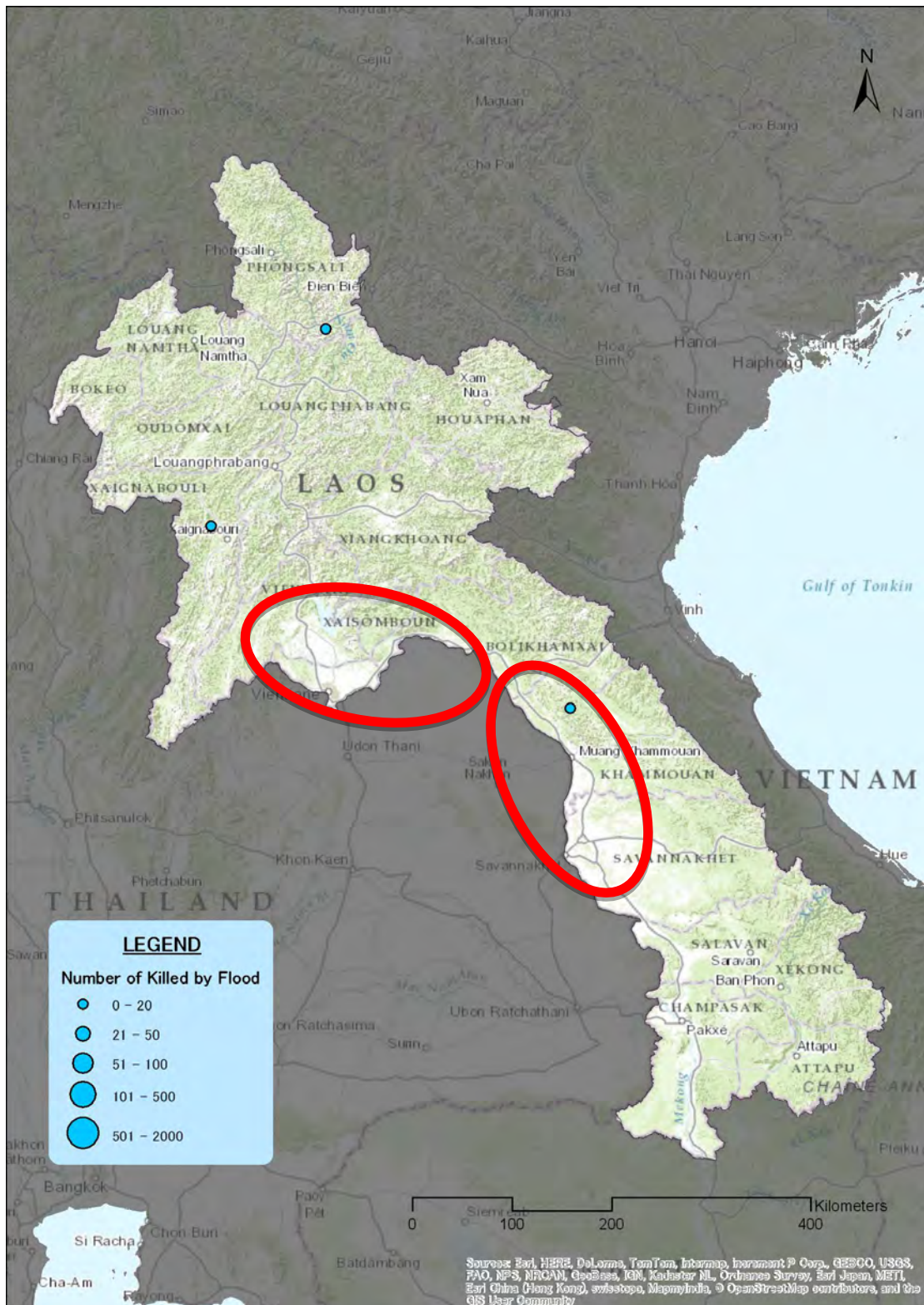
Floods in the Lao People's Democratic Republic (PDR) occur in the central to north regions affected by tropical monsoons in the rainy season (from June to November). September to October coincides with the typhoon season, and typhoons that land cause flood damage in the plains and basin areas.

Recent notable floods were caused by storm rainfalls accompanying monsoons in August 2008 and on July 27, 2011.

The flood of August 2008 was caused by the storm rainfalls of August 4 to 14, which were brought by the tropical cyclone "Kamuri" or Typhoon No.8. The flood caused severe damage in Louangprabang, Vientiane, Khammouane, Bolikhamsai, and Savannakhet along the middle reach of the Mekong River. The storm rainfalls also caused landslides at various sites in the central and northern mountainous regions, and 382.8 mm of rain was observed at the rainfall station Houei Sai, which belongs to the Department of Meteorology and Hydrology (DMH). According to the EM-DAT (The International Disaster Database) the flood caused the deaths of about 10 people and affected about 200,000.

The flood on July 29, 2011 was caused by storm rainfall brought by Typhoon Nock-ten. It caused severe damage, including damage to agricultural crops in Khammouane and Savannakhet, which are located in the southern region. The flood caused the deaths of 30 people and affected approximately 430,000 people.

Middle reach of the Mekong River is one of the food prone areas.



 : 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.glide-number.net/glide/public/search/search.jsp>.

Figure 2.2 Locations of Flood Disasters in Lao PDR: Human Losses

Sources of Hazard and Risk Information

Table 2.1 Sources of Hazard and Risk Information: Flood

National Disaster Management Committee (NDMC)
National Disaster Management Office (NDMO)
http://ndmo.laopdr.org/ndmo.htm
Province & District Disaster Management Committee (DMC)
Water Resources and Environment Agency (WREA)
http://www.monre.gov.la/wrea/en.html
National Agriculture and Forestry Research Institute (NAFRI)
http://www.nafri.org.la/
United Nations in Lao PDR
http://www.unlao.org/
National University of Laos (NUOL)
http://www.nuol.edu.la/

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	

Organization	Post	Title/ Web Address	Form
International Development Research Centre	Economy and Environment Program for Southeast Asia (EPPSA)	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	
UNISDR, GAR		Desinventar Disaster Information Management System	Web Map
		http://www.desinventar.net/	

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 2.3. 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.
Lao PDR	There are comprehensive disaster hazard, risk, and vulnerability assessments primarily using existing secondary data and information. Regarding flooding, 8 major river inundation areas are focused upon for assessment. Scenario development and mapping are also included.

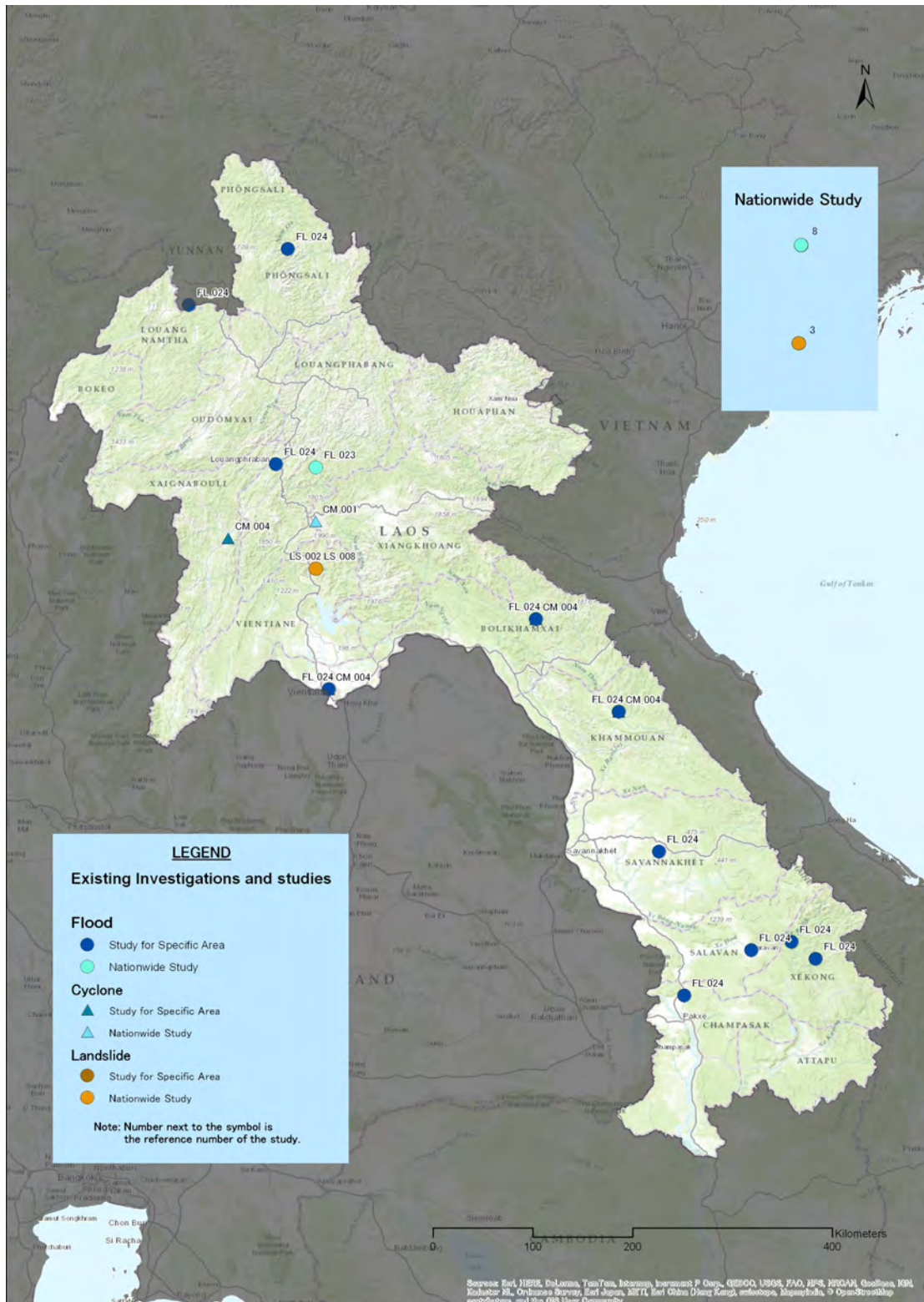


Figure 2.3 Locations of Existing Investigations and Studies: Flood, Cyclone, Landslide

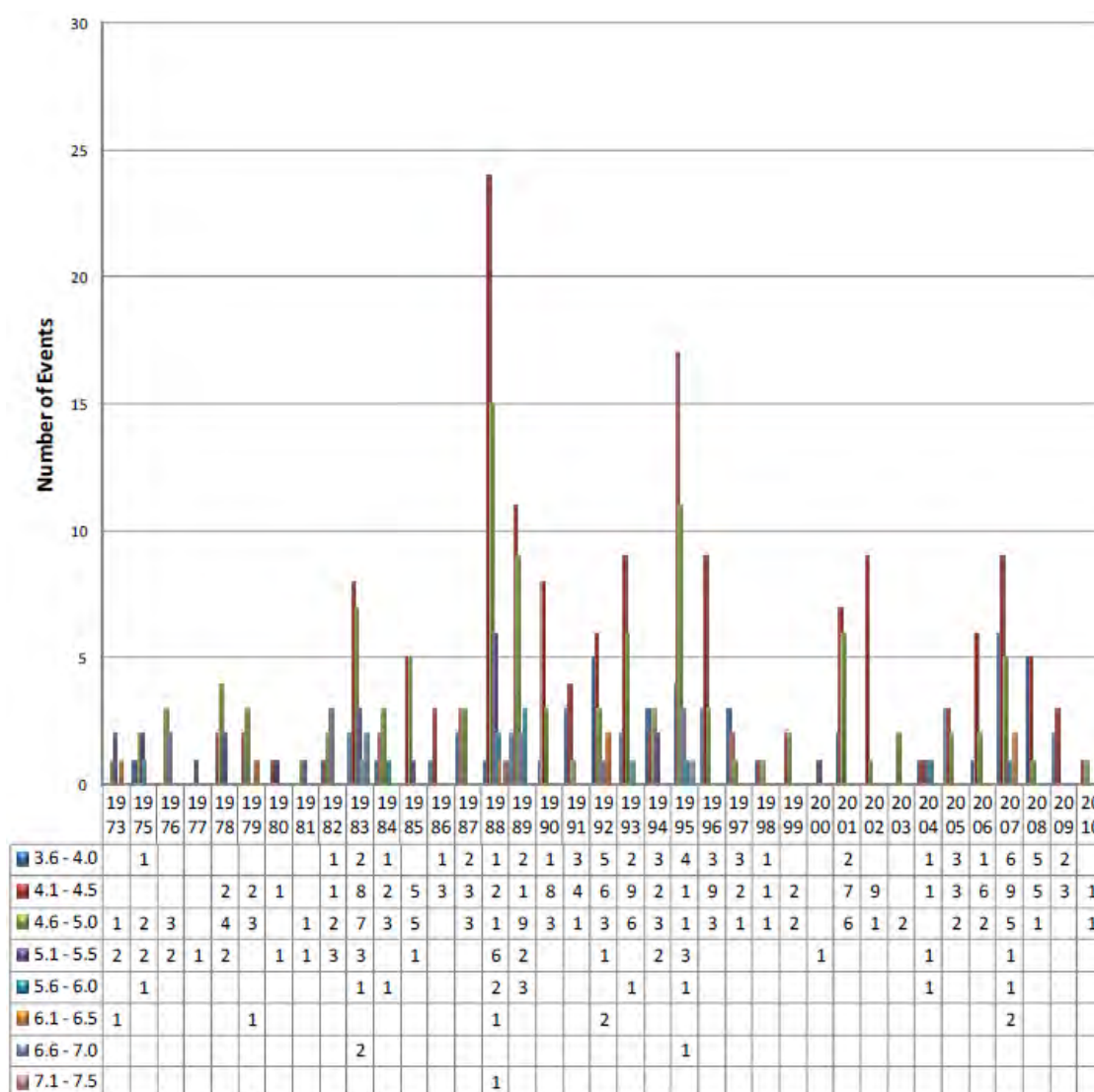
References for Data and Further Reading

- 1) ADPC (2010) Developing a National Risk Profile of Lao PDR, Part1: Hazard Assessment, Vientiane, UNDP
- 2) ADPC (2010) Developing a National Risk Profile of Lao PDR, Part2: Exposure, Vulnerability and Risk Assessment, Vientiane, UNDP
- 3) ADRC: "Countries; Lao PDR", Information on Disaster Risk Reduction of the Member
- 4) ADRC: "Lao People's Democratic Republic, Flood, 2008/08/14", Details of Disaster Information
- 5) ADRC (2011): "Lao People's Democratic Republic, Tropical Storm, 2011/07/29"
- 6) Arief Anshory Yusuf & Herminia Francisco (2009). Climate Change Vulnerability Mapping for Southeast Asia, Singapore: EEPSEA
- 7) Association of Japanese Residents in Lao PDR: "Disasters in Laos by the tropical cyclone "Kammuri" on August, 2008 in Japanese"
- 8) China View (2008): "Vientiane on high alert for flooding", 2008-08-14
- 9) The International Federation of Red Cross and Red Crescent (IFRC) (2011): "Lao PDR, Floods", 19 August 2011
- 10) Ministry of Foreign Affairs of Japan (2013): "Information on Laos in Japanese", 06 2013
- 11) Relief Web, OCHA (2011): "Floods DREF Operation No MDRLA002 Update No 1", Report from IFRC, 19 Aug 2011
- 12) Velasquez, Jerry et al (ed.) (2012). Reducing vulnerability and exposure to disasters: Asia-Pacific disaster report 2012, ESCAP/UNISDR AP
- 13) 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
- 14) World Bank, UNISDR (2010). Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment.

2.3 Earthquake

Risks

Lao PDR is prone to moderate to negligible earthquakes. The country has witnessed several small and moderate scale earthquakes in the past in northern and western parts of the country. Only one earthquake of more than M7 has been reported in the past. Also, no significant disasters were recorded in the past. The details of earthquake events for the last 38 years are plotted in Figure 2.4.



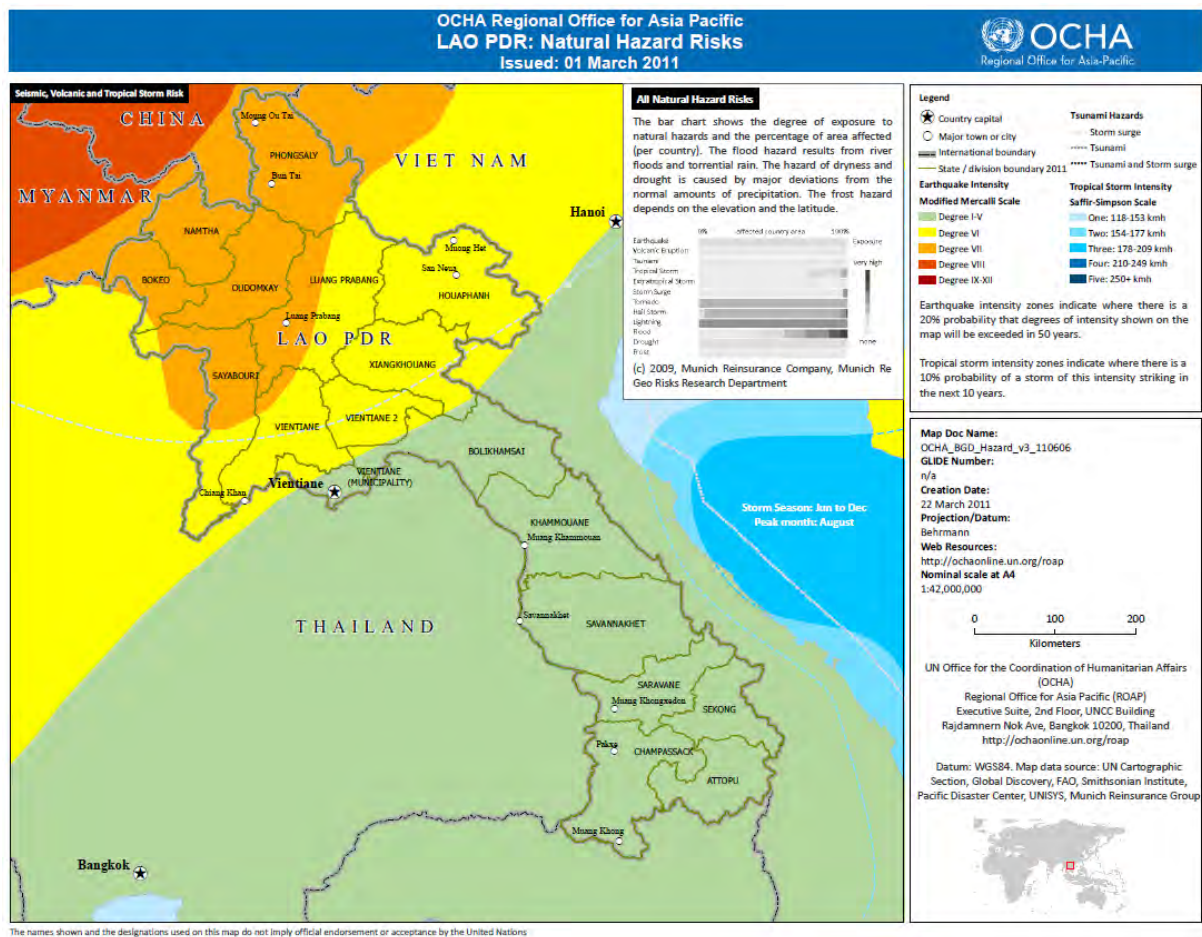
Source: USGS catalogue

Figure 2.4 Earthquake events in Lao PDR

Background

Figure 2.5 shows earthquake risk in Lao PDR. 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.

As per the map, Phongsaly, Namtha, Bokeo, Oudomxay, northern half part of Sayaboury, western half part of Luang Prabang, and a northern smaller portion of Vientiane are exposed to earthquakes, with intensity VII or less expected. Eastern half part of Luang Prabang, Houaphanh, Xiang Khohang, Vientiane 1 & 2, southern half part of Sayaboury and the northwest of Vientiane are exposed to earthquake, with intensity VI or less expected. Remaining regions fall under low seismic risk.



Source:OCHA

Figure 2.5 Natural Hazard Risk of Lao PDR (Seismic, Volcanic and Tropical Storm Risk)

Responses by Lao PDR

The Department of Meteorology and Hydrology (DMH) installed broadband seismographs and strong motion accelerometers at Luang Prabang and Laksao in 2008 with assistance from the China Earthquake Administration (CEA). The DMH has been observing earthquakes since 2009 and observed 34 earthquakes in 2009.

The DMH is conducting hypocenter determination by collecting the data in surrounding countries such as China, Vietnam, and Thailand through the internet because it does not have much of its own data. Therefore, it takes one hour for the hypocenter to be determined after the earthquakes occur.

Meteorological and hydrological monitoring and early warning systems (severe weather, typhoon, heavy rainfall, very hot weather, flood, and flash flood) are operated by the DMH. Earthquakes are outside of their scope.

Sources of Hazard and Risk Information

Table 2.4 Sources of Hazard and Risk Information: Earthquake

Department of Meteorology and Hydrology (DMH)
http://dmhlao.etllao.com/

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 2.5.

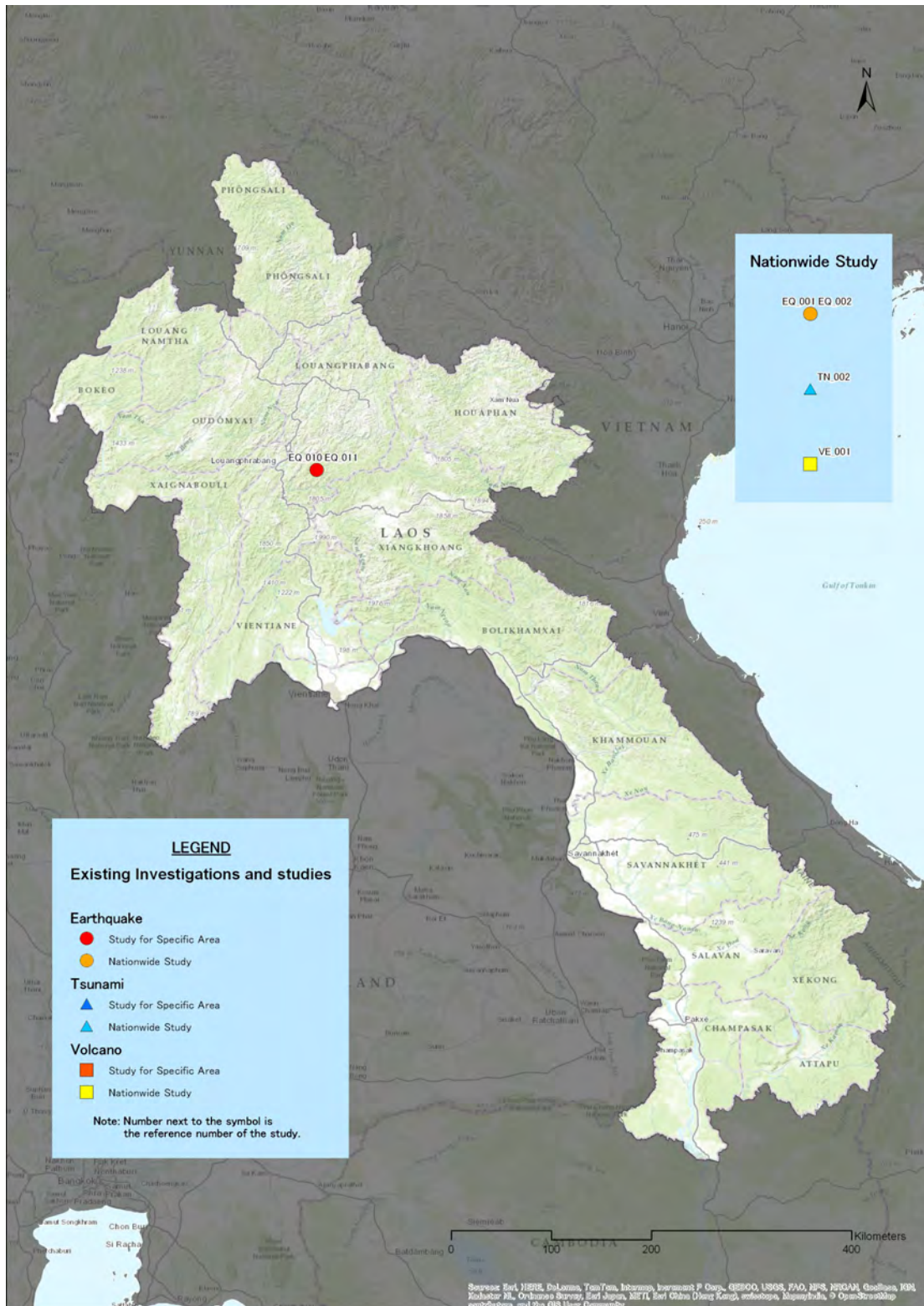


Figure 2.6 Locations of Existing Investigations and Studies: Earthquake, Tsunami and Volcano

Table 2.5 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.
Lao PDR	There are few records of earthquake disaster in Lao PDR, but the UNDP prepared a multi-hazard risk profile for 18 provinces. Multi-hazard profiles include earthquakes, floods, landslides, epidemics, unexploded ordinances (UXOs), droughts, and storms.

References for Data and Further Reading

- 1) Asian Disaster Preparedness Center (ADPC), in collaboration with Public Work and Transport Institute (PTI) and National Disaster Management Office (NDMO), with the support of UNDP Lao PDR Country Office (2010), "DEVELOPING A NATIONAL RISK PROFILE OF LAO PDR"
- 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"
- 4) OCHA-ROAP (2011). LAO PDR: Natural Hazard Risks
- 5) UNISDR (2009). Global assessment report on disaster risk reduction, Risk and poverty in a changing climate
- 6) United Nations Office for the Coordination of Humanitarian Affairs (OCHA), Regional Office for Asia Pacific (ROAP) (2011): "LAO PDR: Natural Hazard Risks", Downloaded from
["http://img.static.reliefweb.int/sites/reliefweb.int/files/styles/attachment-large/public/resources-pdf-previews/116605-OCHA_LAO_Hazard_v3_110606.png"](http://img.static.reliefweb.int/sites/reliefweb.int/files/styles/attachment-large/public/resources-pdf-previews/116605-OCHA_LAO_Hazard_v3_110606.png)

2.4 Tsunami

Risks

Lao PDR is an inland country and there is no tsunami risk caused by sea floor earthquakes.

Background

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.

Responses by Lao PDR

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 2.6.

Table 2.6 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.
Lao PDR	There is no record of tsunami disaster in Lao PDR 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

There are no volcanoes in Lao PDR and no record of significant disaster caused by volcanic eruption in its history.

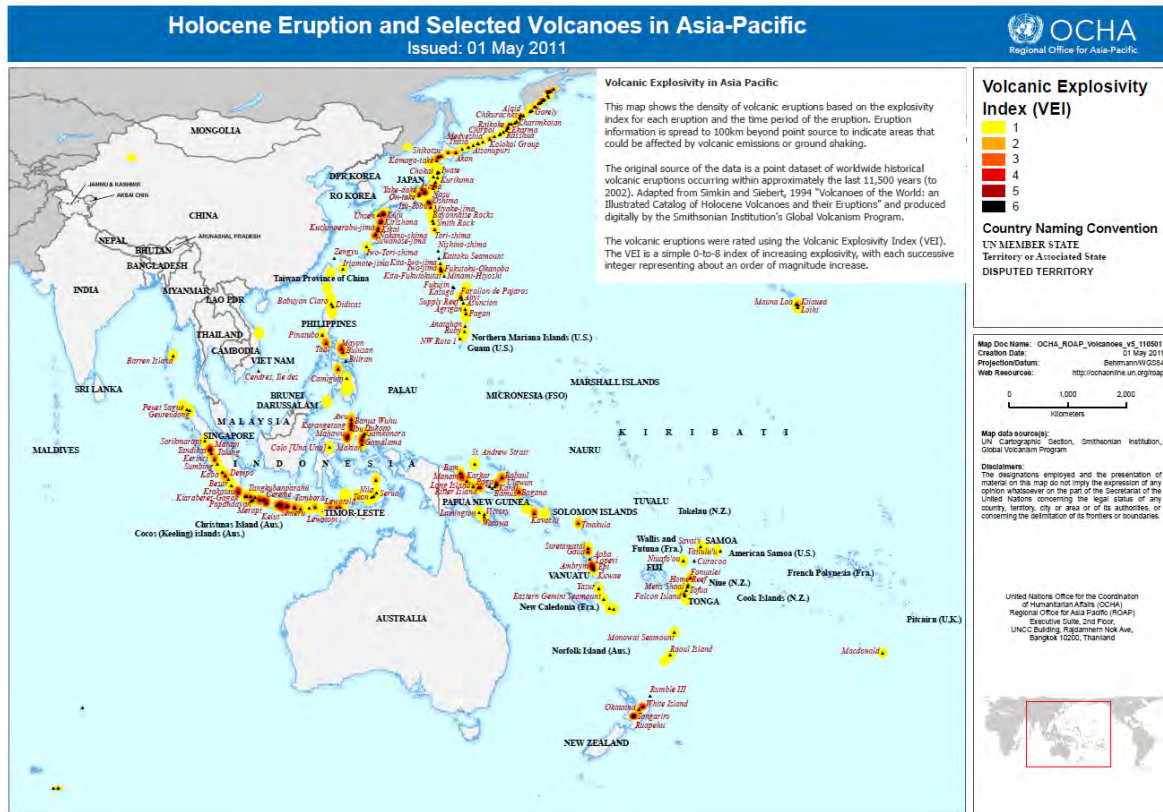
Background

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. Therefore, there is a possibility that a volcanic eruption in neighboring countries might wreak a volcanic ash fall on Lao PDR.

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 Lao PDR

Meteorological and hydrological monitoring and early warning systems (severe weather, typhoon, heavy rainfall, very hot weather, flood, and flash flood) are operated by the Department of Meteorology and Hydrology (DMH). However, volcanic hazard is outside of their scope.



Source: OCHA

Figure 2.7 Holocene Eruption and Selected Volcanoes in Asia-Pacific

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.

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 2.7.

Table 2.7 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).
Lao PDR	There is no record of volcanic disaster in Lao PDR 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) Lee Siebert, Tom Simkin, and Paul Kimberly (2011): “Volcanoes of the World - Third Edition”, Smithsonian Institute/University of California Press
- 4) OCHA -ROAP (2011). Holocene Eruption and Selected Volcanoes in Asia-Pacific
- 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

Lao PDR is located between latitudes 20° and 22° to the north and longitude 100° and 108° to the east. This country has a tropical monsoon climate. Affected by the southwest monsoon, it has two seasons with heavy and frequent rains from mid-May to mid-October (rainy season) and a cold dry season from November to February. The inter-monsoon period from March to April becomes dry and hot. Annual rainfall ranges from 900 mm to 3,500 mm. In particular, rainfall on the windward side of the mountain area is very high.

The country suffers from flooding caused by monsoons and typhoons (tropical cyclones). Floods occur almost every year in the Mekong River basin in the central and southern parts of this country. As a general condition, floods are experienced from September to October. Accounting for more than half of the country, areas susceptible to flood damage are major agricultural areas of rice cultivation. The northern and eastern parts of the country are often affected by landslides and flash floods triggered by heavy rains. Typhoons (tropical cyclones) which are generated around the Philippines sometimes affect Lao PDR after making landfall in Vietnam.

Table 2.8 Tropical Cyclone Disasters in Terms of Number of Deaths (1980- 2011)

Year (Month)	Typhoon, Cyclone (name)	Deaths	Total Affected
1991	Storm	-	38,315
July, 1992	Tropical Cyclone	22	268,877
July, 1993	Storm	8	120
August, 1995	Tropical Cyclone	26	1,000,000
October, 2009	Tropical Cyclone (Ketsana)	16	128,887

Data Sources:

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

Floods are considered to be the most frequent and damaging disaster to occur in Lao PDR. They are brought about by rainfall with tropical cyclones and the southwest monsoon. In particular, floods occur in four main areas: Vientiane plain, Kamumuan Province (Takeku), Savannakhet Province, and Champasak Province (Pakse).

There are two causes of heavy rains in Lao PDR: the enhanced southwest monsoon caused by typhoons (tropical cyclones) close to the Philippines and Vietnam and the lasting southwest monsoon accompanied by the stagnation of tropical cyclones in neighboring Vietnam.

Table 2.9 shows meteorological disasters in Lao PDR (1984~2013).

Table 2.9 Meteorological Disasters in Lao PDR (EMDAT: 1984 ~ 2013)

Cause	No. of events	Killed	Total Affected	Damage (millions US\$)
Drought	4	-	750,000	1.0
Flood (including flash flood)	14	135	3,259,740	22.8
Storm	5	72	1,436,199	406.0

Background

The climate of Lao PDR is under the influence of seasonal monsoon winds (i.e. the southwest monsoon and the northeast monsoon). The southwest monsoon brings a stream of warm moist air causing abundant rain over the country, especially during September and October. Rainfall during this period is not only caused by the southwest monsoon, but also by tropical cyclones which produce a large amount of rainfall.

In average, two tropical cyclones affect the country in a year. Tropical cyclones approaching Lao PDR after it has rained abundantly tend to cause magnified disaster damage.

Tropical cyclone Ketsana entered the southern part of Lao PDR on 29 September 2009, causing extensive damage to personal properties, social and physical infrastructure, and to the area's productive capacity. Savannakhet and Pakse were worst affected since they were directly in the path of the typhoon and are directly on the Mekong River. Attapeu Province was the worst hit with nearly 90% of the province affected. Before Ketsana, Typhoon Moracot in August 2009 had already brought significant damage to several provinces and the Kammuri flooding of August 2008 had affected about 200,000 people and damaged 50,000 ha of arable land.

More than 180,000 persons were directly affected and 28 storm-related deaths were caused by Ketsana. Affected regions were 5 provinces and 26 districts, 18 of which were seriously damaged.

Table 2.10 Affected 26 Districts in the 5 Provinces by Typhoon Ketsana

Attapeu 5 districts	Salavan 8 districts	Xekong 4 districts	Savannakhet 6 districts	Champasak 3 districts
1. Xaysetha 2. Sanxay 3. Phouvong 4. Sanamxay 5. Samakxixay	6. Ta Oi 7. Samuoi 8. Salavan 9. Vapy 10. Toomlarn 11. Khongxedone 12. Kaakhonepheng 13. Lao Ngram	14. Lamarm 15. Thateng 16. Dakcheung 17. Kaleum	18. Sepone 19. Nong 20. Phine 21. Xonbuly 22. Thapangthong 23. Songkhone	24. Champasak 25. Pathoomphone 26. Moonlapamok

Source: The Typhoon Ketsana in the Lao People's Democratic Republic

Between 24 and 26 June 2011, Typhoon Haima No. 4 hit the northern and central provinces of Lao PDR, passing through the Houaphan, Xiengkhouang, Xayaboury, Vientiane, Bolikhamxay, and Khammouane provinces with wind speeds of 10 km per hour. On 26 June 2011, torrential rains due to Typhoon Haima caused widespread flooding in 4 provinces: Bolikhamxay, Xayaboury, Vientiane and Xiengkhouang.

The floods caused extensive damage to people's livelihoods, property, and to social and physical infrastructure along the major river banks.

Table 2.11 Affected Areas by Typhoon Haima

Province	Affected					
	District	Village	Family	Population	Death	Injured
Xayaboury	9	78	6490	32816	2	
Bolikhamxay	4	39	4414	28395	2	
Xiengkhouang	8	236	3082	11385	8	1
Vientiane	11		2613	10464	5	
Khammouane	4	62	845	4233		
Houaphan		7			1	

The Southwest Monsoon influenced the Mekong River Basin from mid-May onwards. Strong to intensive activity occurred from early June and the monsoon was almost stationary until mid-July. This was one of the main causes of isolated heavy rain in the middle and lower reaches of the Lower Mekong Basin early in the flood season. Tropical Low Pressure (TLP) systems and Inter-Tropical Convergence Zones (ITCZ) appeared periodically from early June to the end of August, with an average

duration of 3-7 days. For most of September, continued ITCZ activity had a significant influence on and resulted in continuous intensive heavy rain with water levels rising in the middle and lower reaches of the Mekong River, particularly in the tributaries in the middle reach of the Lower Mekong Basin. In addition, during the flood period, six tropical cyclones were affected.

Climate change vulnerability and impact in Lao PDR are as follows.

- Increases in annual mean temperatures may be around 0.1-0.3 °C per decade; annual dry seasons may be longer; the country may experience more intensive rainfall events; and, more frequent and severe droughts and flooding events.
- Chapter 4 of the 4th IPCC report (2007) indicates that the Mekong basin may witness increasing maximum monthly flows of 35-41% and decreasing minimum monthly flows of 17-24% over the course of this century, which will substantially increase flooding risks during the wet season and cause water scarcity during the dry season.

Responses by Lao PDR

The National Disaster Management Committee (NDMC) is responsible for coordinating disaster prevention and protection activities and efforts in the country. It promotes the disaster reduction activities of the existing Line Ministries and Provinces on natural disaster management and protection, which consists of representatives of key ministries, institutions, and provinces. The National Disaster Management Office is a policy implementation organization under the Ministry of Labour and Social Welfare (MLSW). There are local level committees at the provincial, district, and village levels.

Meteorological service in Lao PDR is the responsibility of the DMH (Department of Meteorology and Hydrology) under the Ministry of Natural Resources and Environment (MONRE).

The NDMC has overall responsibility for hydrometeorology early warning information services countrywide which includes the following.

- Observe hazard situations and generate meteorological and geophysical data.
- Analyze data for issuing forecasts and warnings for aviation, agriculture, transport, etc.

- Issue forecasts and warnings for any approaching events that might cause damage and loss to life and property.
- Disseminate warning about hazards to relevant users through speedy communication.
- Scrutinize, compare, and publish data for appraisal of long term weather trends and earthquakes.
- Analyze extreme events observed in the past and their future trends, e.g. climate change, weather modification, land-ocean-atmosphere interaction and seasonal weather prediction.

The DMH issues the following products and provides various services.

- Daily forecast
- Three-day city forecast
- Weekly forecast
- One month forecast
- Three-month forecast
- Warnings on severe weather
- Warnings on tropical cyclones and typhoons
- Warnings on heavy rain, flooding, flash flooding, related to extreme high temperatures

Sources of Hazard and Risk Information

Table 2.12 Sources of Hazard and Risk Information: Cyclone and Other Meteorological Hazards

DMH (Department of Meteorology and Hydrology)
http://dmhlao.etllao.com/index.html

Table 2.13 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/sdpc/1338/d2-5a.pdf
UNISDR (2010)	Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment http://www.unisdr.org/files/18872_asean.pdf
UNDP (2010)	Developing a National Risk Profile of LAO PDR Part.1 Hazard Assessment
UNDP (2010)	Developing a National Risk Profile of LAO PDR Part.2 Hazard Assessment

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 implement monitoring and detecting tropical cyclones on a regional basis under the framework of WMO. Table 2.14 indicates the responsible territory allocated to ASEAN members and its leading country.

Table 2.14 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 hazard are shown in Figure 2.3. Outline of those investigations and studies are attached in Appendix 2 and their summary is given in Table 2.15.

Table 2.15 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.
Lao PDR	Typhoons generated around the Philippines sometimes affect Laos after landing in Vietnam. 87,403 people in 362 villages located in 36 regions of Vientiane, Bolikhamsai, Xiengkhouang, and Xayaboury Provinces were directly affected by Typhoon Haima in June 2012.

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.38-42.
- 2) DMH (Website): <http://dmhlao.etllao.com/>
- 3) Earl James Goodyear, Ph.D. (2011): "Draft National Disaster Management Plan 2012 – 2015"
- 4) ESCAP/WMO Typhoon Committee. (<http://www.typhooncommittee.org/>)
- 5) JMA/WMO Workshop on Quality Management in Surface, Climate and Upper-air Observations in RA II (Asia) 2011
- 6) Lao PDR (2009): "The Typhoon Ketsana in the Lao Peoples Democratic Republic's"
- 7) Lao PDR (2011): "Typhoon Haima in the Lao Peoples Democratic Republic's"
- 8) Mekong River Commission (2011): "Flood Situation Report 2011", MRC Technical Report Paper No.36 2011, pp.25-27, pp.5-11
- 9) WMO National Meteorological or Hydrometeorological Services of Members (http://www.wmo.int/pages/members/members_en.html)
- 10) 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

No records of landslides were found in the EM-DAT (<http://www.emdat.be/>) or any other available disaster database. However, a landslide with fatalities occurred in 2011.

The abundance of flash floods in the northern area indicates a possibility of landslides in those mountain areas.

During the typhoon in 2011, landslides and slope collapse occurred repeatedly. A large-scale landslide accompanied by fatalities blocked National Highway 13 along with more than 300 m of road.

Exposure related to climate change is distributed in the mountain areas of northern part of the capital and southern border area.

Responses by Lao PDR

Road rehabilitation for landslides has been conducted by the Department of Road (DoR) belonging to the Ministry of Public Works and Transport (MPWT) and Department of Public Works and Transportation (DPWT) in every province.

Reports on Hazard and/or Risk Assessment

Locations of existing investigations and studies on landslide are shown in Figure 2.3. Outline of those investigations and studies are shown in Appendix 2 and their summary is given in Table 2.16.

Table 2.16 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.
Lao PDR	The hazard area covers the entire country consisting mainly of hills and mountains, with the exception of the Mekong River lowland where the capital of Vientiane is located. According to the result of a nationwide hazard and vulnerability assessment by UNDP (LS-008), flash floods in the northern mountainous region are common and those areas are susceptible to landslide. Some exposure is distributed around mountain areas north of the capital and the south part of the country near the border. Laws and governmental organizations are not yet developed. The project for an early warning system is ongoing.

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 Lao PDR

11 industrial parks (specific economic zones or special economic zones, SEZs) were identified by the study, and as shown in Figure 3.1. They are distributed along the middle reaches of Mekong River, especially around Vientiane, the capital of Lao PDR.

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

To a large extent, the government has used SEZs in Lao PDR to pursue political development goals. This is clear in the decision to initially establish SEZs outside of Vientiane, even though the capital would have been the most favorable to foreign investors. To some extent, this will be true of future SEZs in Lao PDR, with SNCSEZ plans to establish several SEZs in rural areas to drive job creation outside of urban areas. Nonetheless, some of the present and future SEZs are likely to be in locations suitable to foreign investors. It is worth noting that even for fully private specific economic zones, the government is likely to be actively involved in the zone's operations. For example, there have been concerns over security in Boten Specific Economic Zone. As a result, in 2011 the government stepped in and amended the existing concession agreement, banning casinos and allowing Lao authorities to take charge of security issues. This resulted in losses for some Chinese investors in the zone.

The level of development of Lao PDR's ten economic zones varies significantly, and only a few are equipped to communicate with and support foreign investors. Only Vita Park and Savan-Seno Site C run their own websites. Most economic zones did not have staff that spoke foreign languages, do not have marketing teams, and were very unwilling to provide information about their parks. Some information in English is available on the SNCSEZ website on location, land tenure, developer, land leasing fees, electricity and water fees, and investment projects for most SEZs. However, through our conversations with park operators it became clear that much of the information available online is inaccurate. For instance, descriptions of park.

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 (SEZs) in Lao PDR

infrastructure often lists planned infrastructure that is planned as if it already exists, even though there is no clear funding or timeline for this infrastructure to be built. Our research suggests that only VITA Park and Savan-Seno SEZ can presently provide quality service and support to foreign investors.

3.2 Historical Evolution of Industrial Parks

Industrial parks in Lao PDR that offer incentives to foreign investors are all classified as specific economic zones or special economic zones. The development of such zones in Lao PDR began rather recently. It corresponded with the rapid growth of the industrial sector, urbanization, and large-scale investment in transportation connections (domestically and regionally) that Lao PDR experienced in the first decade of the 2000s. Economic zone development commenced with the signing of Prime Ministerial Decree Number 148, which established the Savan-Seno SEZ, in 2003.

The National Committee for Special Economic Zones (NCSEZ) is responsible for economic zone development. Chaired by the deputy prime minister, its members include the ministers of Finance, Public Works and Transport, Planning and Investment, and Industry and Commerce. In 2010, the Secretariat of the NCSEZ (SNSEZ) was established under the Ministry of Planning and Investment with the mandate to promote, administer and facilitate the development of economic zones. SNSEZ manages two types of economic zones: specific economic zones and special economic zones. Specific economic zones can be 100% government-owned, public-private partnerships, or 100% private-owned. By contrast, special economic zones are either 100% government-owned or public-private partnerships. Special economic zones, which can contain several specific economic zones, must cover at least 1000 hectares. Currently, there are 10 approved specific and special economic zones in Lao PDR.

The first SEZs to be established were the Savan-Seno SEZ in Savannakhet (2003), Boten SEZ in Luangnamtha (2003), and the Golden Triangle SEZ in Bokeo (2007). Savan-Seno was chosen for its favorable location in central Savannakhet province, at the center of the East-West Economic Corridor and adjacent to the Second Lao-Thai friendship bridge. While progress was initially slow, this changed with the establishment of Savan Park in 2008 through a contract with Malaysian developer Pacifica Streams Development Company. Savan-Seno SEZ has since experienced rapid development.

Boten SEZ and the Golden Triangle SEZ, established on the Lao-Chinese and Lao-Thai borders respectively, both attracted Chinese investment in casinos and entertainment establishments. Following security concerns, Boten's concession agreement was amended in 2011 and the zone made casino-free as the Laotian government announced that its focus should turn to commerce.

Since the late 2000s, seven more SEZs have been established. Five of these are located in and around the capital Vientiane, namely VITA Park (2011), Saysetha Development SEZ (2010), That Luang SEZ (2011), Long Thanh SEZ (2012), and Dongphosey SEZ (2012). The government originally planned for SEZ development to start around Vientiane in 1995, but this was delayed by a lack of resources for infrastructure development and a government decision that as Vientiane was able to attract investment, SEZs should begin in other areas. VITA Park, in Vientiane's Xaythany district, was thus the first SEZ to be established in the capital when it was approved in 2009. This was followed by the establishment of Saysetha Development Zone in 2010, also in Xaythany district. Set up in 2011, That Luang Lake Specific Economic Zone is being developed by Chinese developer, Wan Feng Shanghai Real Estate Company. The firm has announced that it aims to spend 15-20 years on the USD 1.6 billion project. In 2012, Long Thanh Specific Economic Zone and Dongphosy Specific Economic Zone were established through domestic investment. Another two recently established projects are located in central Khammuane province: Phoukyo SEZ (2010), and Thakhek SEZ (2012).

The number of approved economic zones is set to expand rapidly. In December 2012, the Laotian government announced its plan to set up 41 economic zones, 25 of which are to be established by 2022. The majority of these are to be established in border and rural areas, in order to create jobs further from urban centers. The government has announced that it will need FDI of USD 3 billion for infrastructure development to establish these zones over the next decade, excluding investment by companies operating in the SEZs. Plans for obtaining these funds remain unclear.

3.3 Recent Trends and Japanese Investment

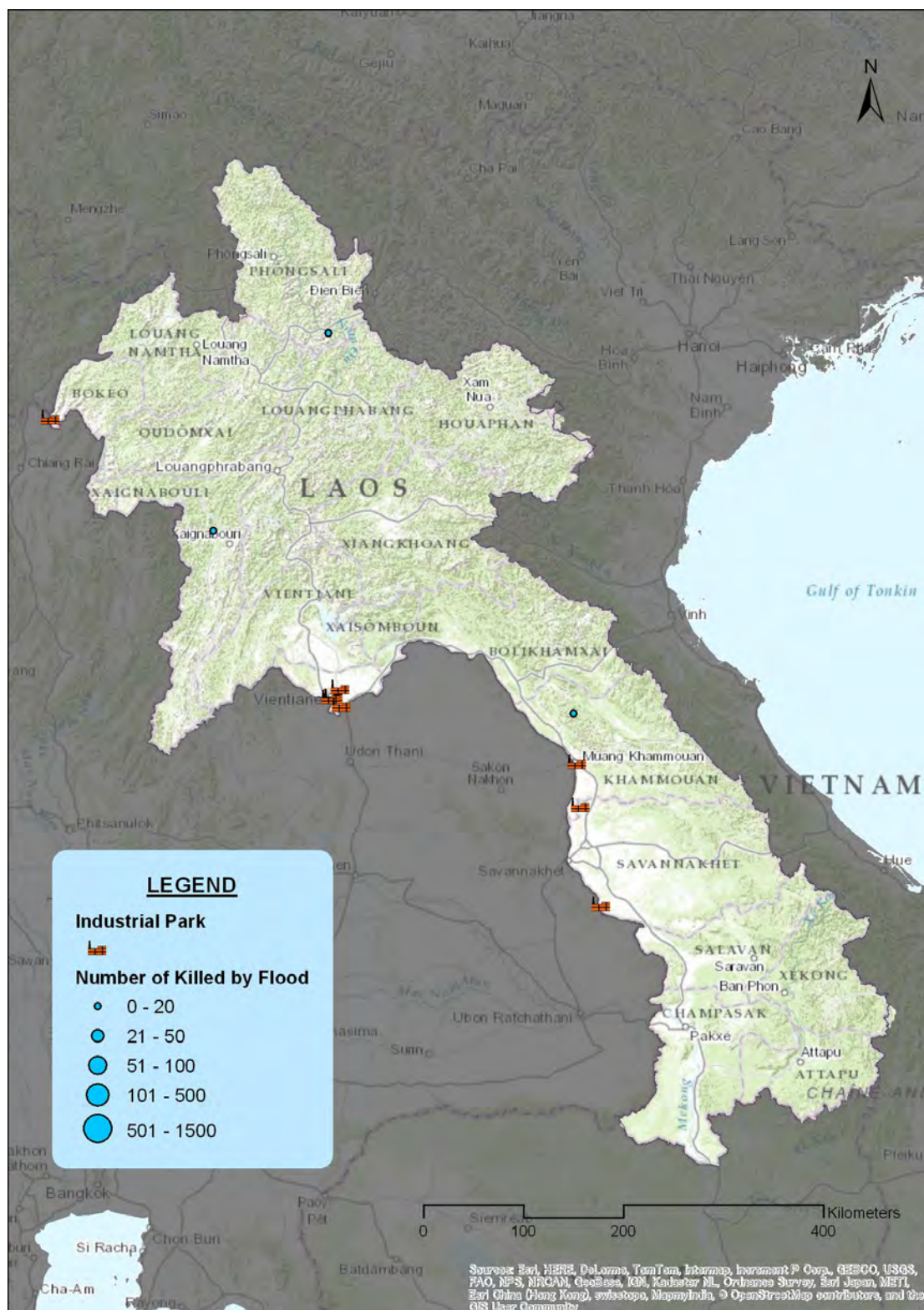
Two economic zones in Lao PDR have Japanese investment. In Savan-Seno SEZ, five out of a total of 41 companies investing in the zone are Japanese. Savan-Seno SEZ is split into four sites, A, B, C, and D. The B zone, which is under development, targets Japanese investment. Japanese company Logitem started operations in Site B in 2008, occupying 3 ha out of a total of 20 ha. Development of Site B was initially slow however, as Japanese companies generally preferred Vientiane to Savan-Seno SEZ, probably due to Savan-Seno SEZ's poorer infrastructure links to Vietnam and China when compared to Vientiane. Recently, this has changed. In March 2013, Japanese multinational Nikon started construction of a USD 8 million factory, scheduled to become operational by October 2013. In April 2013, Savan-Seno announced that negotiations are underway with a Japanese investor for a 20% stake of the USD 30 million B-zone project. In December 2012, a joint venture to build a production plant in the C-zone, to be completed during spring 2013, was announced by Japanese toy manufacturer Bureau Company Ltd (65%), KP Company Ltd (Lao PDR), (30%), and KP Nissei Mizuki Lao Company Ltd (5%); the registration fund is USD 1 million and the investment fund is estimated at USD 2 million.

According to estimates in January 2012, Japan is the biggest investor in VITA Park, with total investments at USD 10 billion. This makes VITA Park one of the chief targets for Japanese investment in Lao PDR. Out of seven foreign companies that have developed production facilities in VITA Park, two are Japanese.

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. Figure 3.2 is a map showing a relationship of locations of industrial parks, and flood disasters. 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 Lao PDR 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.glide-number.net/glide/public/search/search.jsp>.

Figure 3.2 Industrial Parks and Flood Disasters: Lao PDR

4. Transport Infrastructure and Lifeline Utilities

4.1 Overview of Transport Infrastructure

Road

In the Lao People's Democratic Republic (Lao PDR), the traffic network, especially the road network, is a significantly important means of transportation between the neighboring countries since it is a landlocked country. Currently, there are national roads from route No.1 to route No.20, and the main parts of them make up the Asian Highway. Their total length is 7,200 km. A large portion of road is unpaved and made of sand and gravel or earth (Paved: 55%).

Major road networks are AH11 and AH12, which run north-south, and AH13 and AH16. AH refers to the Asian Highway. All extend to neighboring countries, meaning that Lao PDR is a connection hub for transportation (Table 4.2).

Major road networks of Lao PDR are shown in Figure 4.1.

Table 4.1 Status of Roads as of 2011 (Unit: km)

Type	Asphalt Pavement	Gravel Pavement	Dirt Road	Total
National Road	4,433	2,191	611	7,235
Prefectural Road	697	4,165	3,101	7,963
Country Road	183	2,633	2,313	5,129
Rural Road	85	3,666	12,689	16,440
City Road	575	895	445	1,915
Particular Road	143	324	437	904
Total	6,116	13,874	19,596	39,586
Ratio	15.4%	35.0%	49.5%	100.0%

Source: JETRO, Lao PDR Infrastructure Map



Figure 4.1 Major Road and Railway Networks and Airports of Lao PDR

Table 4.2 Asian Highway in Lao PDR

Route No.	National Road No.	Length (km)	Criteria of Selection
AH3	No. 3	244	Industrial Estate / Agriculture
AH11	No. 13	823	Connection between Capitals / Industrial Estate / Agriculture
AH12	No. 13	684	Connection between Capitals / Industrial Estate / Agriculture
AH13	No. 2w	166	Industrial Estate / Agriculture
AH15	No. 8	133	Industrial Estate / Agriculture
AH16	No. 9E	241	Industrial Estate / Agriculture / Major Port
	Total)	2,290	

Source: Ministry of Land, Infrastructure, Transport and Tourism, Asian Highway Database 2005

Railway

In Lao PDR, there is only one railway. The 35 km track links Thailand to Lao PDR. The sections are non-electrified with 1,000 mm narrow gauge. In October 2010, the government planned to build a 420 km railway from China.

Major railway networks are shown in Figure 4.1.

Port

The total length of the waterways of the Lao PDR is 4,600 km. The primary component of this system is the Mekong River and its tributaries. Vessels up to 400 DWT can operate on this waterway. There are 21 river port facilities. Since Lao PDR is a landlocked country, ports of Thailand, Cambodia and Vietnam are used for marine transportation.

Airport

There are 42 airports, including 3 international airports, of which 9 have paved runways. In July 2013, a new terminal opened in the Luang Prabang International Airport.

Locations of major airports of Lao PDR are shown in Figure 4.1.

Table 4.3 International Airports in Lao PDR

Airport Name	Type	Administrator	Location	Runway
Wattay	Military/Public	Military of Laos	Vientiane	3,000m×45m
Luang Prabang	Public	Government	Luang Prabang	2,200m×45m
Savannakhet	Public	Government	Savannakhet	1,633m×38m

Source: Wikipedia, List of airports in Lao PDR

4.2 Overview of Lifeline Utilities

Electricity

Electric du Laos (EDL) is the state corporation of Lao PDR that owns and operates the country's electricity generation, electricity transmission, and electricity distribution business. In addition, an Independent Power Producer (IPP) and local governments manage small-scale power generation.

Their total generating capacity is 684.1MW as of 2005, of which hydroelectric power generation makes up 679.49 MW (98.7%).

Locations of major power stations and dams are shown in Figure 4.2.

Table 4.4 Generation Capacity in the Lao PDR as of 2005

Ownership	Type	Capacity (MW)	Generation (million kWh)
Edl	Hydroelectric	307.5	1,715.0
IPP	Hydroelectric	362.1	1,794.4
Local Government	Hydroelectric	5.2	N.A.
	Diesel, Solar	9.2	N.A.
Total		684.1	3,509.4

Source: Chubu Electric Power, Japan, Survey Report of Electrification Work which Utilized the Biomass in an Un-electrified Area 2008.3

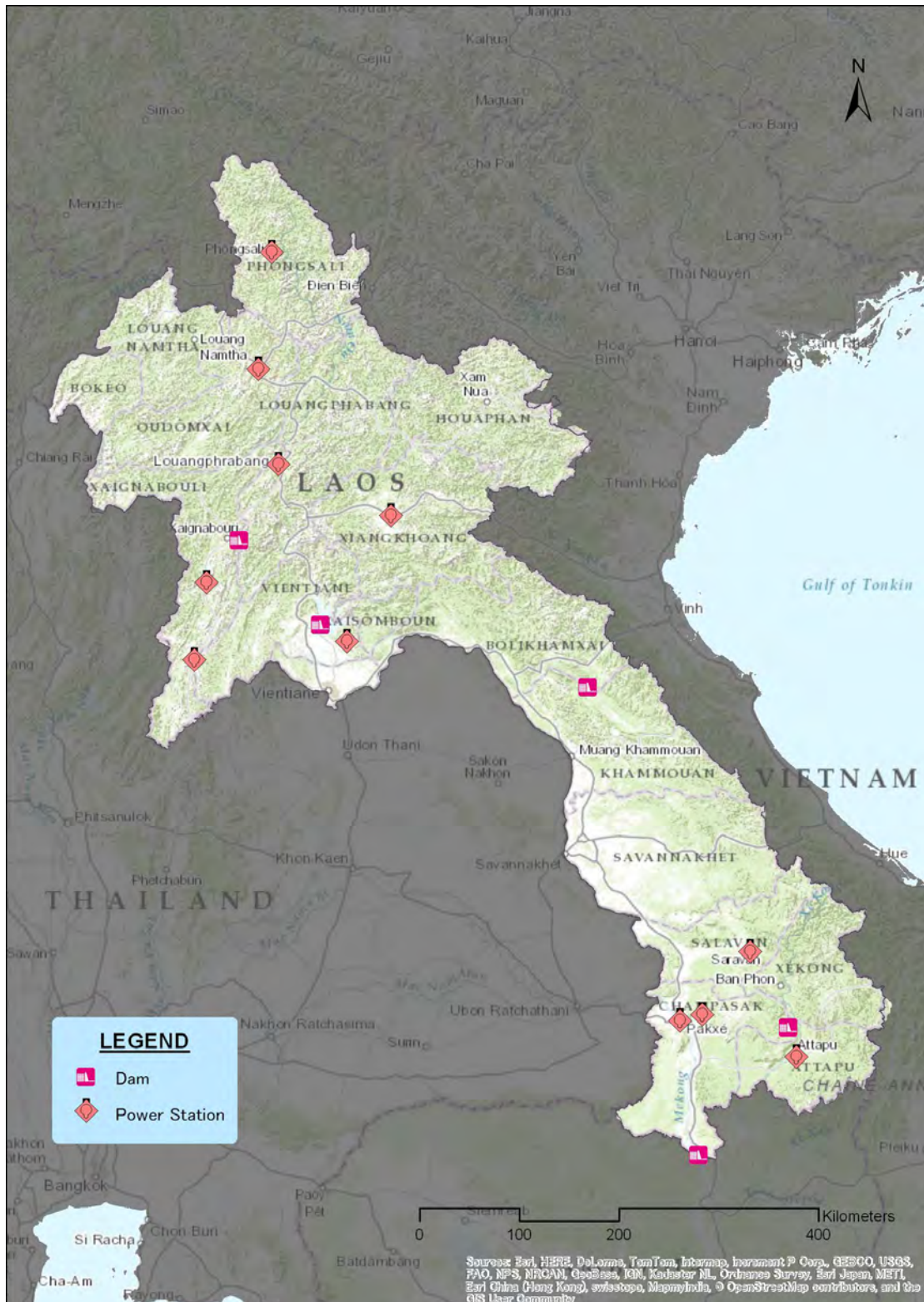


Figure 4.2 Major Power Stations and Dams of Lao PDR

Water Supply

In 1999, the Management and Development Plan of the Water Supply Sector was formulated. It set a goal to supply safe piped water to 80% of the urban population. Currently, 77% of the urban population has attained access to safe water and gradually, the effects of the improvement plan have been revealed. However, the water service rate remains low at 26.7%, and the rate of non-revenue water is still high at 29%. Installed water supply pipes have a total length of 2,500 km.

In 2010, there was a problem with insufficient water supply resulting from a drop in water pressure. The shortage of waterworks engineers is also a severe problem. Basically, the water supply in the country is divided into the urban water supply and the rural water supply. The rural water supply is managed by the Ministry of Health while the urban water supply is managed by 26 business entities (as of 2004) under the jurisdiction of the Water Supply Authority (WASA) which was established in 2000.

Sewerage

In Lao PDR, sewage facilities have not yet been installed. All urban waste water and industrial waste water is discharged without being treated into the wetlands behind Vientiane city. This causes a severe environmental pollution. In rural areas, the wastewater situation is the same as the urban area. The government has planned to promote the spread of temporary toilets, but almost all of them are infiltration type toilets. In large buildings such as public buildings, hospitals, and hotels, septic tanks have been installed.

In 2009, the National Environmental Standard was promulgated, and a strict effluent standard has been enforced that will require water quality monitoring and on-the-spot inspections. In the future, wastewater management will be strengthened.

However, there is a possibility that water quality will continue to deteriorate due to the expansion of urban areas and the corresponding increase in untreated wastewater.

Communications

Internet and Broadband

Internet services are not widely used since access fees remain high, despite a declining trend in fees since 2009. ADSL is the main service type used, but users have been limited to business corporations and government organizations.

In 2005, Planet Online started wireless internet services, and Sky Telecom installed the first broadband connection with ADSL in 2006.

Mobile Phone

There are four service providers in the mobile phone market: Lao Telecommunication Company Limited: LTC (26.6%), Enterprise of Telecommunications Lao: ETL (24.3%), Beeline Lao (10.0%), and Unitel (39.2%). They have built a proprietary infrastructure. Unitel started W-CDMA-type 3G services in October 2009. The number of subscribers to the service has been increasing sharply, and it is anticipated that the number of subscribers will reach 5.481 million, which is equivalent to an 87.2% diffusion rate.

Fixed-line Phone

Fixed-line phone services are provided mainly by two companies: LTC (81%) and ETL (19%). The number of subscribers is 108,000, which is only a 1.7% diffusion rate as of the end of 2011. The insufficient infrastructure in rural areas keeps the number of subscribers low.

Terrestrial Broadcasting

LNTV provides terrestrial analog broadcasting service. China Central Television (CCTV) has opened a new office in LNTV, and it provides services in both English and Chinese.

LNTV developed its facilities with the aid of China in 2009, which enables it to deliver high quality broadcasts.

Waste

General

According to the study report by WHO, the amount of daily domestic waste per capita as of 2001 is 750g. In Vientiane, the total amount of waste is about 638 tons as of 2011, which explains the recent sharp increase. The waste amounts of Luang Prabang and Sayabouri are 68 tons and 35 tons respectively. (Cf. The waste amount in Vientiane is estimated as 300-400 tons.)

The waste collection ratio of Vientiane is less than 20%, and the ratios of Luang Prabang and Savannakhet are about 60% and 40% respectively. The uncollected waste is generally piled up or burned in open fields, which have caused insects and offensive odors in the past. This uncollected waste is due to inefficient methods of waste collection and transmission, and the use of dump tracks instead of waste collection vehicles.

General

At the KM 32 final waste disposal site in Lao PDR, open dumping of waste is conducted, separating out only hospital waste. The total area is 62 ha, of which 14 ha is being used.

In Lao PDR, the amount of waste is estimated as 300- 400 tons per day, but the disposal capacity of the final disposal site is 150-200 tons. The excess waste is disposed of without treatment. In the shallow uncontrolled landfill, about 40-50% seems to be organic waste. Uncontrolled landfill is seen in other cities such as Sayaburi. This is subject to penalties, for which Traffic Police are responsible.

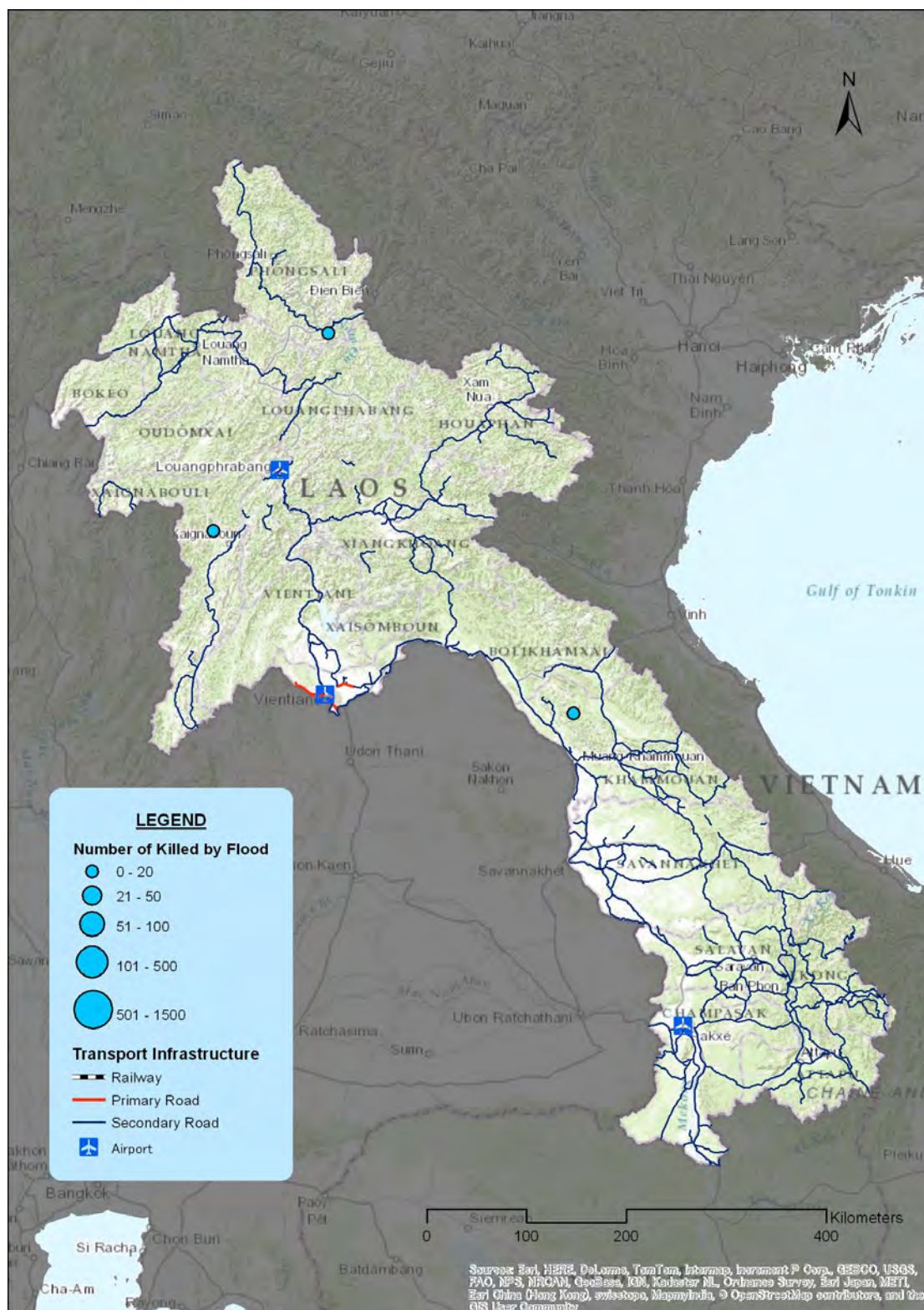
Currently, JICA assists and leads its implementation of controlled landfill. Moreover, some CDM projects have also started.

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

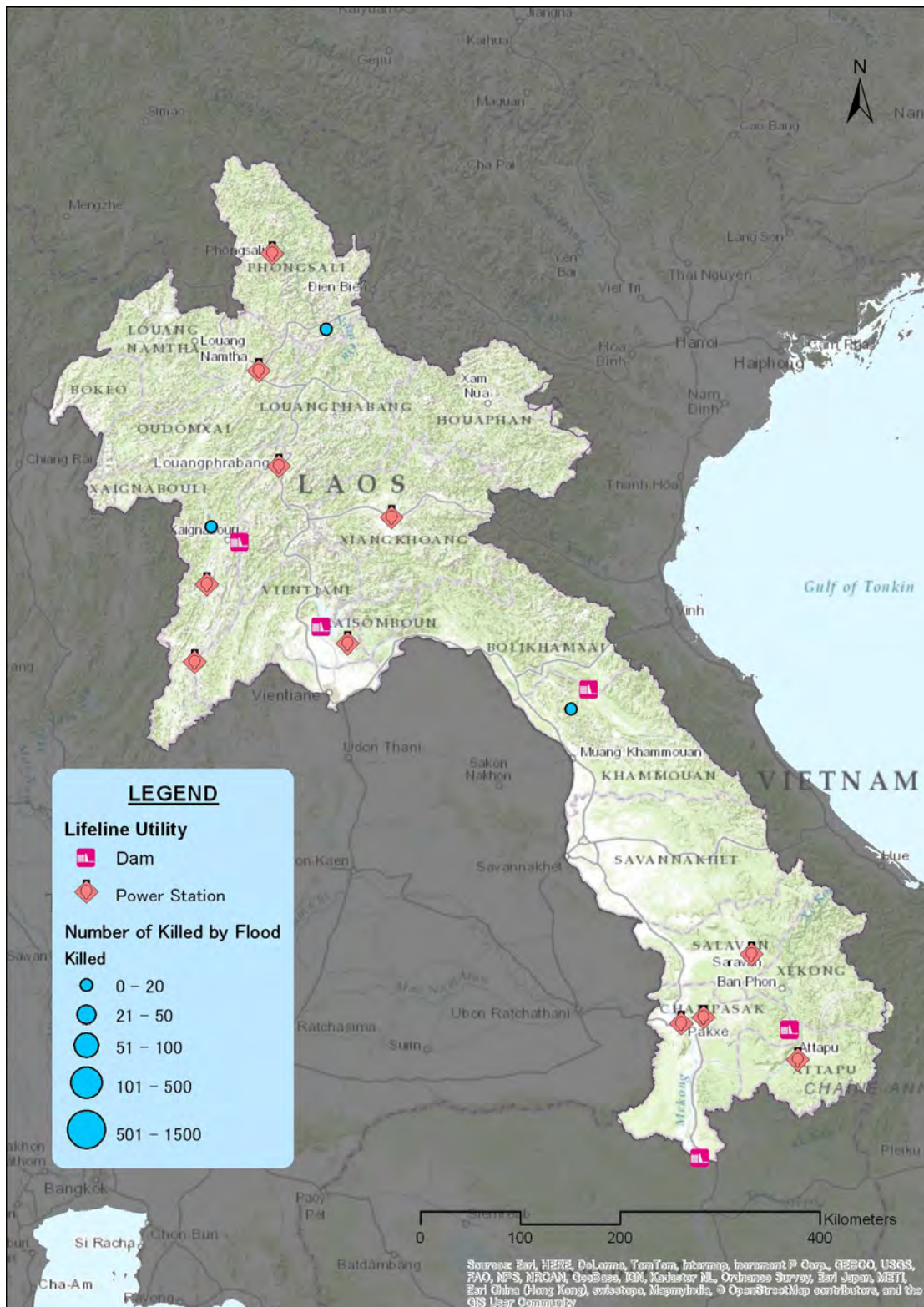
on the distribution maps of natural disasters given in Chapter 2. Figures 4.3 and 4.4 are examples showing risks of transport infrastructure, and power stations and dams to flood disasters, respectively. For the detailed assessment of the risks of natural disasters to transport infrastructure and lifeline utilities, hazard and risk assessment are required for an area of interest.

Flood disaster caused by heavy rain and landslides in mountainous area are expected to be the main natural disasters in Lao PDR. In recent years, a severe flood in 2008 caused major damage in Vientiane and other provinces. In addition, the risk of landslides is also considered high in mountainous areas; however, since principal roads for logistics are limited in those areas, there will be less of an impact on the economy.



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 4.3 Flood Disasters and Major Transport Infrastructure



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.glide-number.net/glide/public/search/search.jsp>.

Figure 4.4 Flood Disasters and Major Power Stations and Dams

5. Legislative Systems

5.1 Legislative Systems for Disaster Management

Disaster Management Laws

Table 5.1 Laws and Regulations of Disaster Management in Lao PDR

	Laws / Regulations	Supervisory Authority	Matter
<i>Decree</i>	The Prime Minister's Decree No.158, 1999	under survey	Disaster Management
<i>Decree</i>	NDMC Decree No.097, 2000	National Disaster Management Committee	Disaster Management

It is expected that the Prime Minister's Decree to order the preparation of a Disaster Management Law will be issued by around October 2012. If the decree is issued as assumed, preparation will be started for the law to be enacted in 2013.

The functions and responsibilities of each section in NDMC are defined in the "NDMC Decree No. 097".

Disaster Management Strategies and Plans

Table 5.2 Strategies and Plan for Disaster Management in Lao PDR

	Laws / Regulations	Supervisory Authority	Matter
<i>Plan</i>	Strategic Plan on Disaster Risk Management in Lao 2020, 2010 and Action Plan (2003-2005)	Ministry of Labour and Social Welfare	General Disasters
<i>Plan</i>	National Disaster Management Plan 2012-2015	under survey	General Disasters
<i>Plan</i>	National adaptation plan for action - NAPA (2009)	under survey	General Disasters

The Strategic Plan on Disaster Risk Management in Lao 2020, 2010 was issued in the form of Decree No.158 by the Ministry of Labor and Social Welfare (MLSW) in 2003. The plan lists long-term aims up to 2020 and goals for the medium-term until 2005 and 2010. In 2011, the National Disaster Management Plan 2012-2015 was drafted and reviewed. A decree from the Prime Minister is necessary for the above new plan to be implemented even after it is finalized.

In its 2009 report “Disaster Risk Management Programs for Priority Countries,” the Global Facility for Disaster Reduction and Recovery (GFDRR) highlights Lao PDR as one of the priority countries the World Bank will continue to support in 2010-2012.

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 Lao PDR.

5.3 Legislative Systems for the Environment and Pollution Control

Environmental Laws and Regulations

Table 5.3 Laws and Regulations regarding the Environment in Lao PDR

	Law / Regulations	Supervisory Authority	Matter
Law	Environmental Protection Law, 1999	Science, Technology and Environment Agency	Environment, Environmental Assessment

As the basic law on environmental management in Lao PDR, the Environmental Protection Law was enacted in 1999. The Environmental Protection Law prescribes regulations for disaster management, and the function of NDMC in a time of disaster is defined as organizing disaster related agencies.

Pollution Control Laws and Regulations

Due to the absence of published documents for the legal system on environmental pollution control in Lao PDR, it is difficult to obtain specific information about the regulations.

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

Table 5.4 Laws and Regulations for Land, Rivers, and Building Code in Lao PDR

	Laws / Regulations	Supervisory Authority	Matter
<i>Law</i>	Land Act	under survey	Land Use
<i>Law</i>	Forest Act, 1996	under survey	Forestry
<i>Law</i>	Water Act	under survey	River

Due to the absence of published documents about the legal system in Lao PDR, it is difficult to obtain specific information about regulations.

There are several basic laws on the sectors related to disaster management. The Land Act was developed and stipulates land use. The development and usage of river systems is regulated by the Water Act. In addition, there is a Forest Act for the protection of forestry land.

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

6. Implementation of BCP

6.1 Major Natural Disasters and Awareness Disaster Management

Because Lao PDR has a lack of experience with disasters that cause extensive damage in urban areas, the awareness of disaster risk has not been increased. Enterprises in Lao PDR consider international influences such as political uncertainty and economic fluctuations, especially in Thailand, as business risks that have more weight than natural disasters.

6.2 Current State of BCP Implementation

Implementation of BCP in Enterprises

Since the risk of natural disaster is considered relatively low in Lao PDR, most enterprises recognize that disaster risk management is not urgently required and are not well-prepared for disasters. The concept of BCP is completely unknown among general enterprises, and there are few enterprises that are able to implement BCP. Furthermore, only a few enterprises have prepared disaster risk mitigation plans. They are also unable to conduct risk assessment and contingency management for disasters.

Japanese enterprises in Lao PDR have not implemented BCP either. The lower disaster risk is one of the advantages of moving into Lao PDR. Therefore, most enterprises do not regard disaster risk management as necessary for their business situation.

6.3 Efforts on Promoting BCP Implementation

Governmental policy on disasters in Lao PDR attaches a high value to the mitigation of human damage, but not to the economy or business conditions. The Lao government does not proactively promote disaster risk mitigation for the non-governmental sector.

The SMEs Promotion Law defines the governmental policy for supporting SMEs and schemes for SME activities in Lao PDR. There is a comprehensive policy for national disaster risk management, but no specific management systems for individual companies have been considered in the policy. Agencies aiming to support SMEs such as the Chamber of Commerce and Industry cannot provide any assistance for implementing BCP or disaster management in enterprises.

6.4 Problems Facing for Implementation of BCP

One of the main issues for BCP implementation in Lao PDR is that recognition of BCP by governmental agencies or enterprises has not been sufficiently promoted. In addition, due to the shaky understanding of disaster risk, disaster management for business is not common among general enterprises.

In urban regions, the improvement of utility systems and social infrastructures such as power, water supply, and roads is being promoted. The main social infrastructure, which is regarded as the framework of corporate disaster risk management in cities, is being refined gradually.

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
1	- 0.001%	- 10

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

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

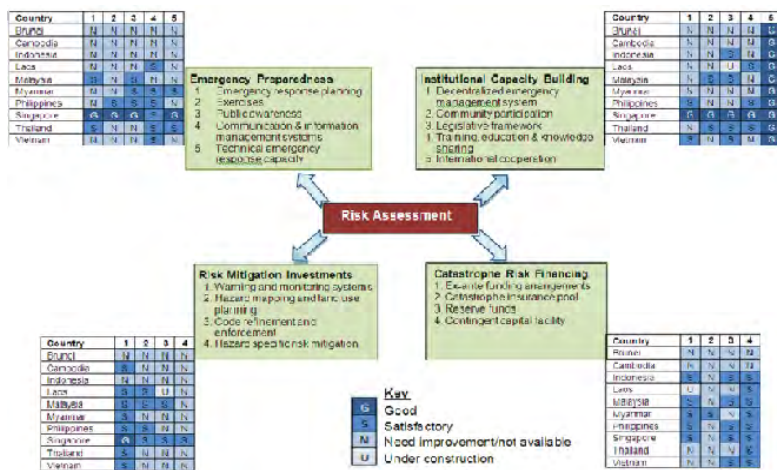
Method: the number of disaster events, deaths, affected population and economic losses are plotted against hazard types for 5 year intervals.

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:

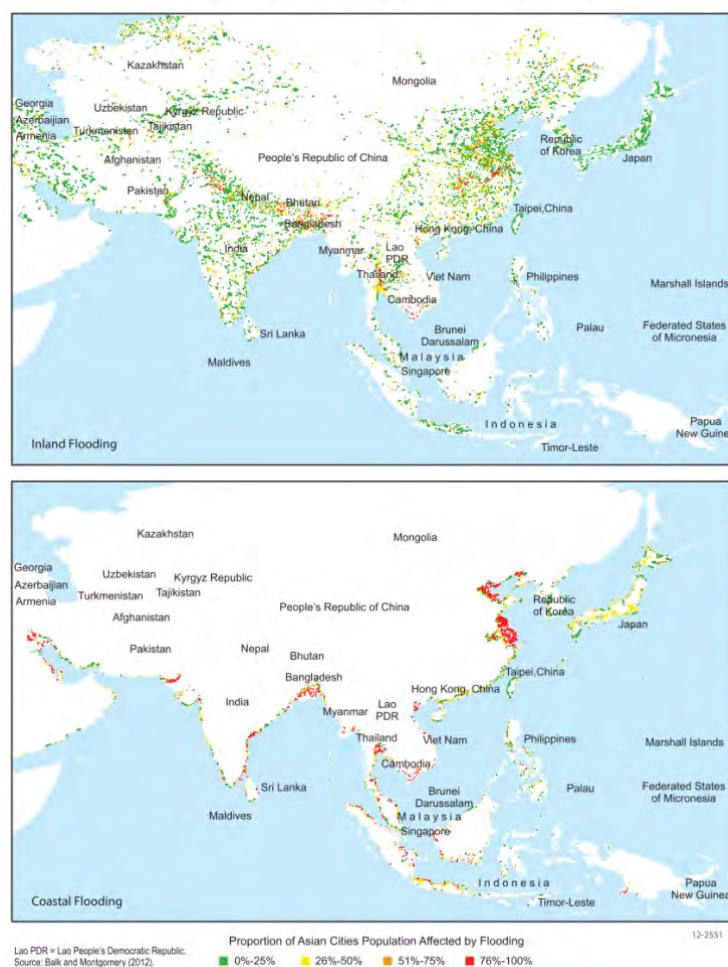
This report summarizes vulnerability of urban cities to flood in Asian and Pacific countries including the ASEAN region. The floods are classified as coastal flood and inland flood that may affect urban cities. Vulnerabilities are estimated by population and areas % at risk of flooding. Top 40 cities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

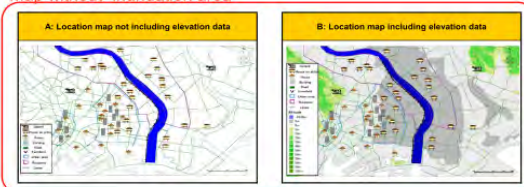
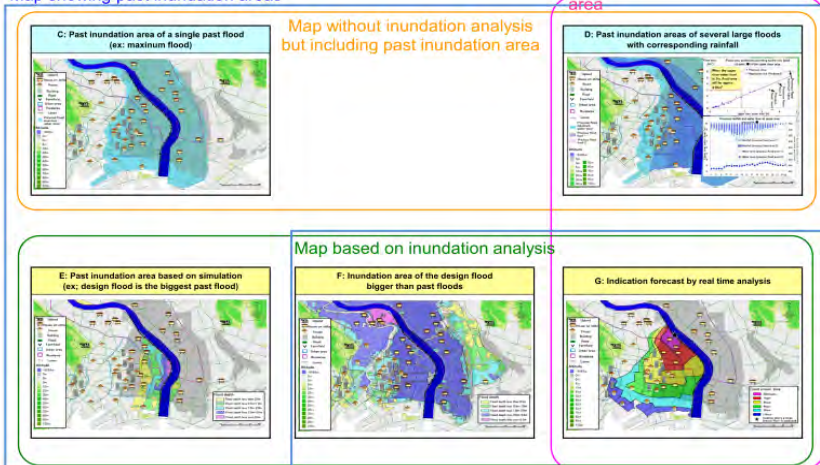


Table 3-2 List of Maps according to the level

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 Transboundary 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

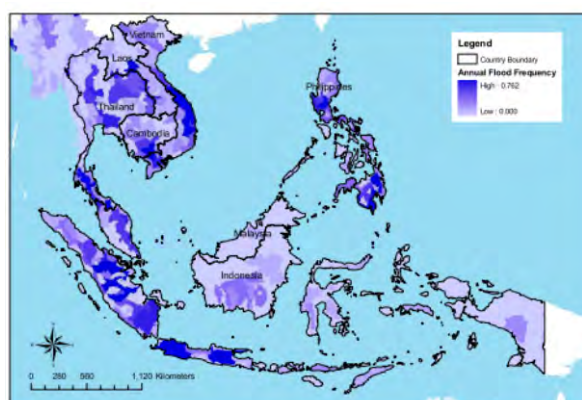
This study assesses vulnerability of Southeast Asian countries (Thailand, Vietnam, Laos, Cambodia, Indonesia, Malaysia, and Philippines) of climate change including flooding. Vulnerability is defined as a function of exposure (potential loss due to a hazard), sensitivity (the potential gravity of losses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

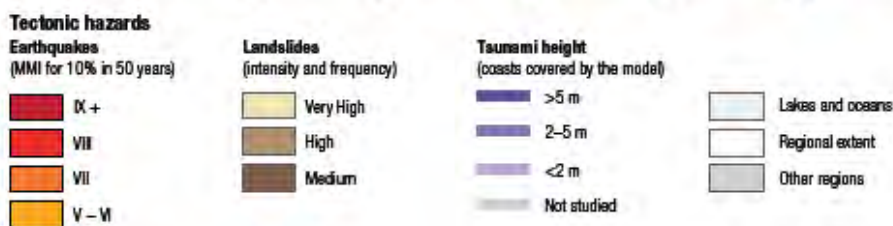
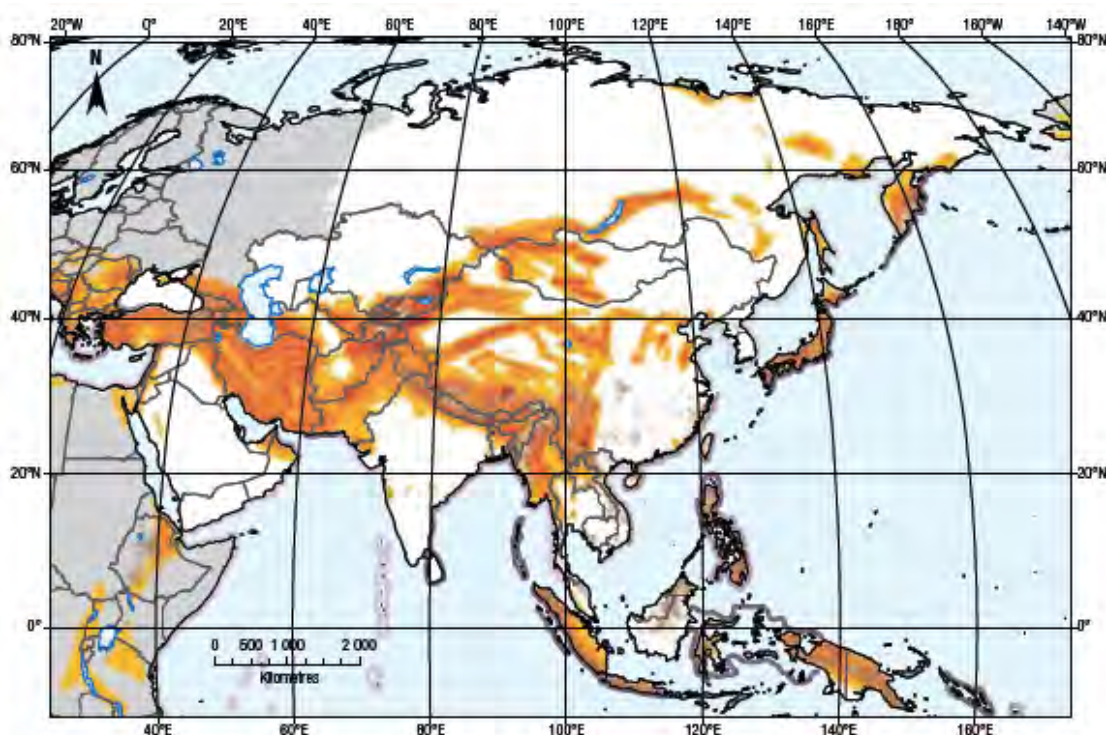
No.:	FL-023	Published Year:	2010
Study/ Report Name:	Developing a National Risk Profile of Lao PDR, Part1: Hazard Assessment		
Access to Information:	http://www.gripweb.org/gripweb/sites/default/files/National%20Hazard%20Profile%20Laos%20Draft.pdf		
Research Organization:	FAO		
Study Area (Country):	Lao PDR		
Studied Hazard:	Flood		
Studied Damage/ Risk:	Area, population, public buildings		
Main Data Sources:	Hydrological data (DoMH), Landuse (National Geographic Dept.), Elevation (Aster resolution 30 Meters), River network and catchments (Google Earth ad National Geographic Dept.) Software: ArcGIS9.3, HEC-GeoHMS, -GeoRAS, -RAS		
<p>Summary of the Study:</p> <p>1) Hazard Assessment</p> <p>Hazard Assessment is conducted with baseline data collection and scenario development and Mapping. Hazard map are developed for 8 rivers: Nan Ou, Nam Ngum, Nam Ngiap, Nam Xan, Se Bangfai, Xe Banghiang, Xe Don and Xe Kong. The return periods scenarios are 10, 50 and 100 years.</p> <p>2) Assessment Results</p> <p>The results provide flood inundation areas (sq km²) and depth by river basin, provinces and districts.</p> <ol style="list-style-type: none"> 1. Nam Ngiap River: inundation in Borikhan and Pakxan districts in Borikhamxay province, Hom district in Xaysomboun SR province) 2. Nam Xan River: Borikhan, Pakxan districts in Borikhamxay province 3. Nam Ou River: Mai and Khoa districts in Phogsaly province, (4 districts: Ngoy, Nambak, Pakxeng, Pak Ou) in Luang Prabang provinces 4. Se Bangfai: Mahaxai, Xebangfai, Nongbok districts in Khamunae province, Xaibouri, Ataphon districts in Savannakhet. 5. Xe Banghiang: (7district: Xephon, Phin, Champon, Nong, Xonbouri, Songkhon and Thapangtho) in Savannakhet province 6. Xe Kong River: (9 districts: Karum, Lamam in Sekong province, Thateng, Pakxong, Sanxai, Sanamxai, Samkkhixa, Phouvong, Xaisettha in Attapeu province) 7. Nam Ngum River: Borikhumxay, Vientiane, Vientiane municipality 8. Xe Don River: Saravane province (5 districts), Champassack (3 districts) 			

No.:	FL-024	Published Year:	2010
Study/ Report Name:	Developing a National Risk Profile of Lao PDR, Part2: Exposure, Vulnerability and Risk Assessment		
Access to Information:	http://www.gripweb.org/gripweb/sites/default/files/Lao_RiskProfile_Part2.pdf		
Research Organization:	UNDP/ADPC		
Study Area (Country):	Lao PDR		
Studied Hazard:	Flood (multiple hazards)		
Studied Damage/ Risk:	Area, population, public buildings		
Main Data Sources:	Hydrological data (DoMH), Landuse (National Geographic Dept.), Elevation (Aster resolution 30 Meters), River network and catchments (Google Earth ad National Geographic Dept.) Software: ArcGIS9.3, HEC-GeoHMS, -GeoRAS, -RAS		
<p>Summary of the Study:</p> <p>1) Vulnerability and Risk Assessment A comprehensive vulnerability and risk assessment using secondary data. The elements exposed to flood hazard zone are human lives (population), housing, hydropower, education and health infrastructure. 100-year return period is assessed.</p> <p>2) Process Flood exposure of building and agriculture is assessed using GIS tools. The housing, education and health sectors exposure is assessed to determine the depths of flood water.</p> <p>3) Result: 100-year return period Health sector: 26 health facilities are estimated to be exposed to flooding. 12 of which are estimated to fall into the D3 (high: 36-60%) damage level. Savannakhet and Louang Phrabang are at higher damage level Housing: in Vientiane and Savannakhet, bamboos and other types of housing are D4 (very high: >=61 %) damage level, many brick houses in Savannakhet are at D3 level damage risk. School: 250 schools are exposed to flooding. Savannakhet being the highest at risk (44 schools at D3) Agriculture: paddy crops do not survive when they are 12-16 days submerged under water.</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:			

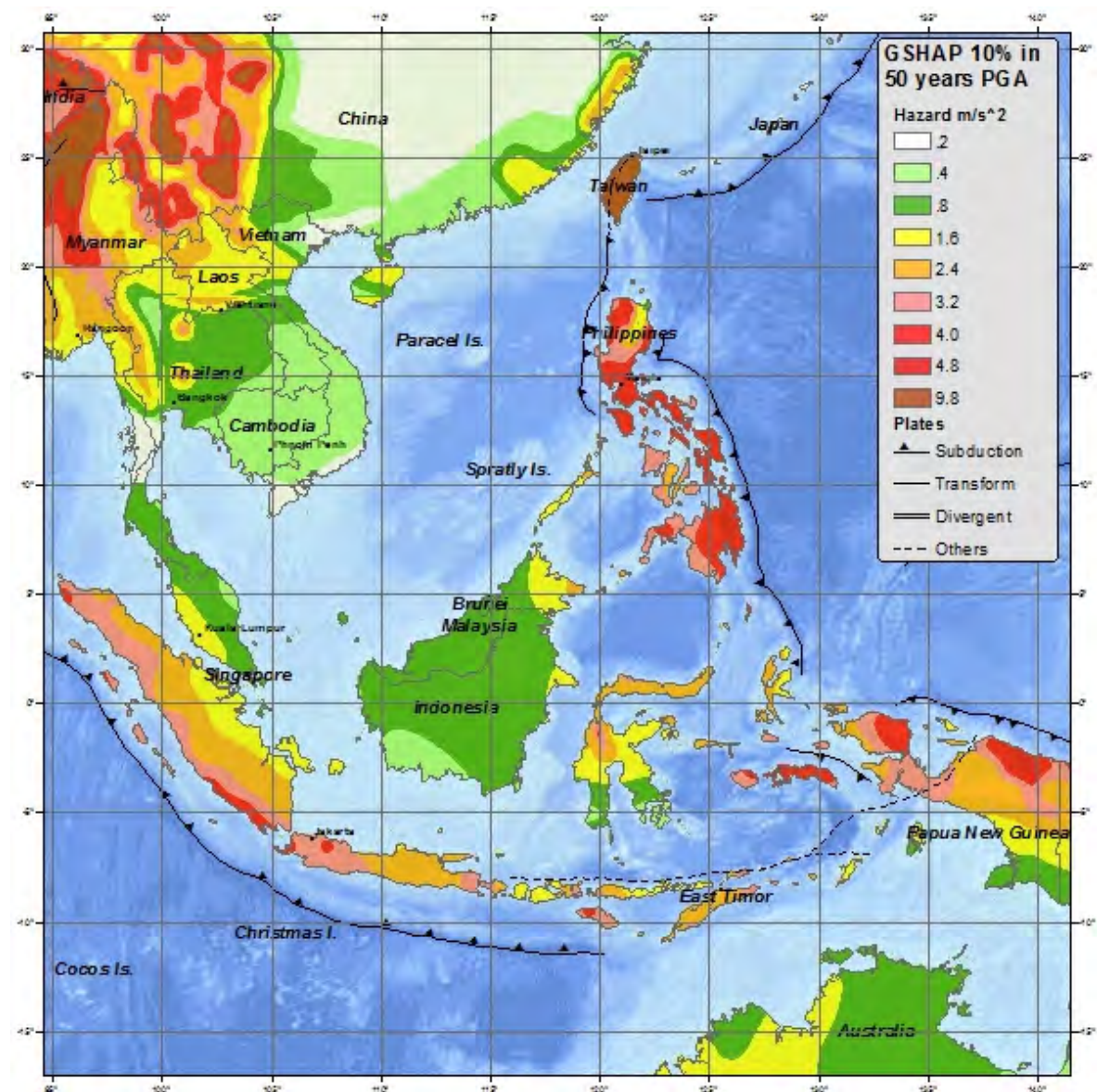
Summary of the Study:

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:



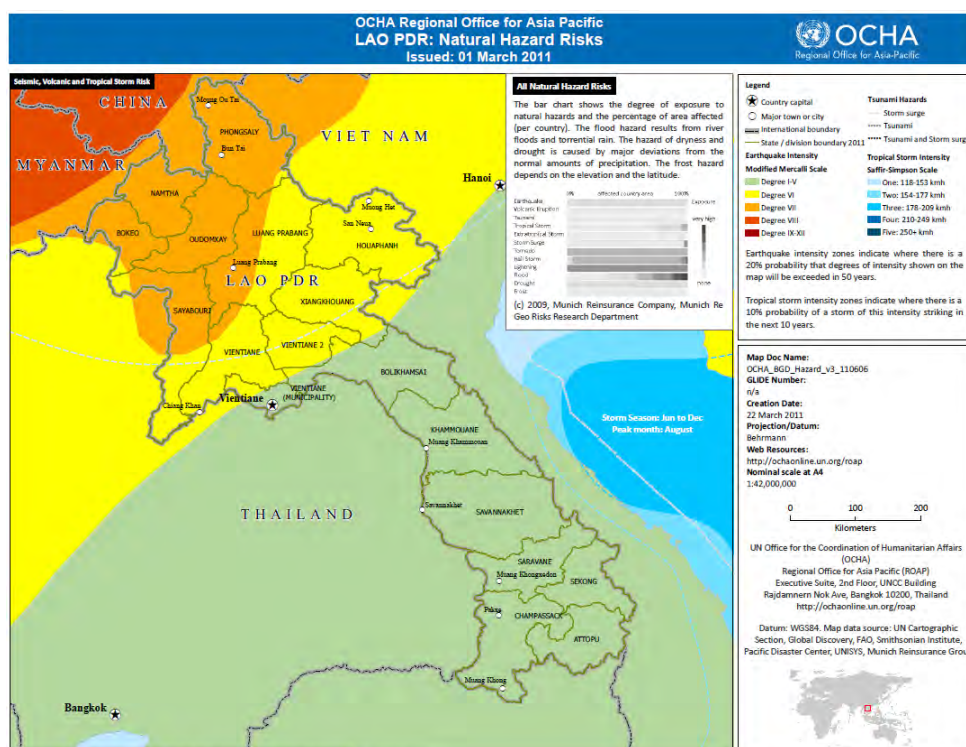
No.:	EQ-010	Published Year:	2011
Study/ Report Name:	LAO PDR: Natural Hazard Risks		
Access to Information:	http://reliefweb.int/sites/reliefweb.int/files/resources/OCHA_LA_O_Hazard_v3_110606.pdf		
Research Organization:	United Nations Office for the Coordination of Humanitarian Affairs Regional Office for Asia and the Pacific (OCHA-ROAP)		
Study Area (Country):	Laos		
Studied Hazard:	Seismic , Volcanic and Tropical Storm		
Studied Damage/ Risk:	All Natural Hazard Risks		
Main Data Sources:	UN Cartographic Section, Global Discovery, FAO, Smithsonian Institute, Pacific Disaster Center, UNISYS, Munich Reinsurance Group.		

Summary of the Study:

Earthquake intensity zones indicate where there is a 20% probability that degrees of intensity shown on the map will be exceeded in 50 years.

Tropical storm intensity zones indicate where there is a 10% probability of a storm of this intensity striking in the next 10 years.

The bar chart shows the degree of exposure to natural hazards and the percentage of area affected.



No.:	EQ-011	Published Year:	2010
Study/ Report Name:	DEVELOPING A NATIONAL RISK PROFILE OF LAO PDR		
Access to Information:	http://www.gripweb.org/gripweb/?q=countries-risk-information/disaster-risk-profiles/national-risk-profile-laos		
Research Organization:	UNDP, GRIP		
Study Area (Country):	18 Provinces / Laos		
Studied Hazard:	Earthquakes , Floods, Landslides, Epidemics, Unexploded ordnances (UXOs), Drought and Storms		
Studied Damage/ Risk:	Earthquake , Flood, Storm, Drought		
Main Data Sources:	NDMA Laos, PTI Laos, UNDP Laos, ADPC, GRIP, UNDP		

Summary of the Study:

This report provides analyses and assessments of seven potential hazards in Lao PDR. The seven hazards include earthquakes, floods, landslides, epidemics, unexploded ordnances (UXOs), drought and storms.

The Report consists of a Hazard profile and Exposure, Vulnerability and Risk Assessment (EVRA) profile. The first step of a risk assessment is to evaluate the elements at risk exposed to different hazards. The exposure can be defined as the total value of elements at risk. Elements at risk defined in this study are population, housing, transportation, health and education infrastructure, hydropower and agriculture which are exposed to hazards in a given area.

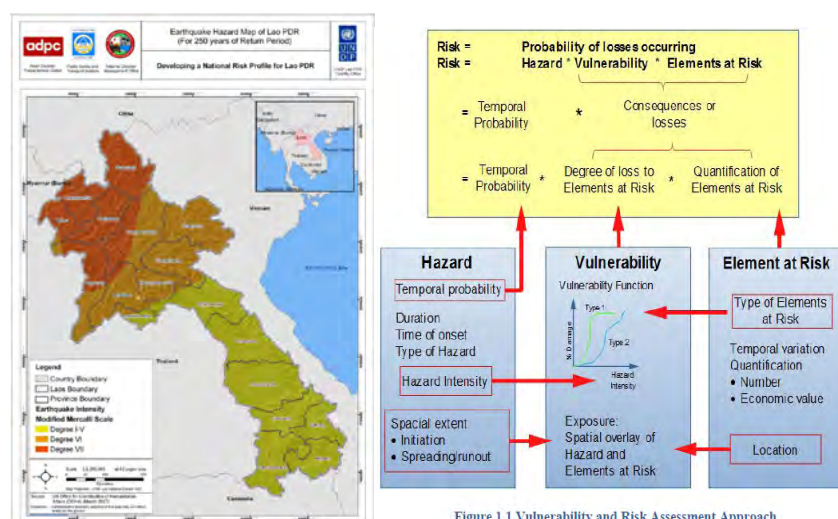


Figure 1.1 Vulnerability and Risk Assessment Approach

Table 1.2 Scope of EVRA for Various Hazards with Their Severity

Type of Hazard	Criteria to be considered for EVRA
1. Earthquake	For 250-year return periods which divides the country into three zones (MMI scale)
2. Flood	100-year return periods where the area is categorized as inundated area with water level > 2 m
3. Drought	Dry season - Moderate to extreme drought susceptibility where its area falls under 20 percent or above probability of having drought
4. Storm	50-year return periods where the area is categorized as class 2 and class 3

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:			

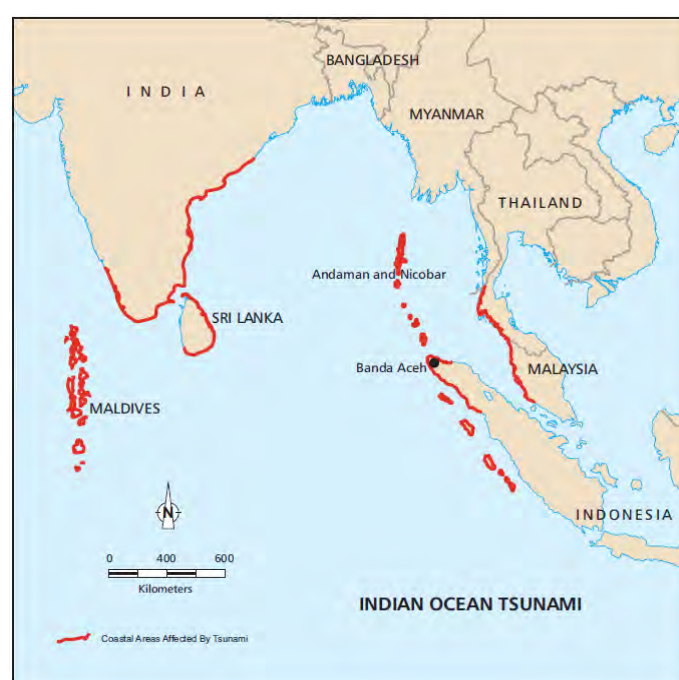
Summary of the Study:

This report summarizes ADB's response to the earthquake and tsunami during the first year. It highlights major activities, details 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.

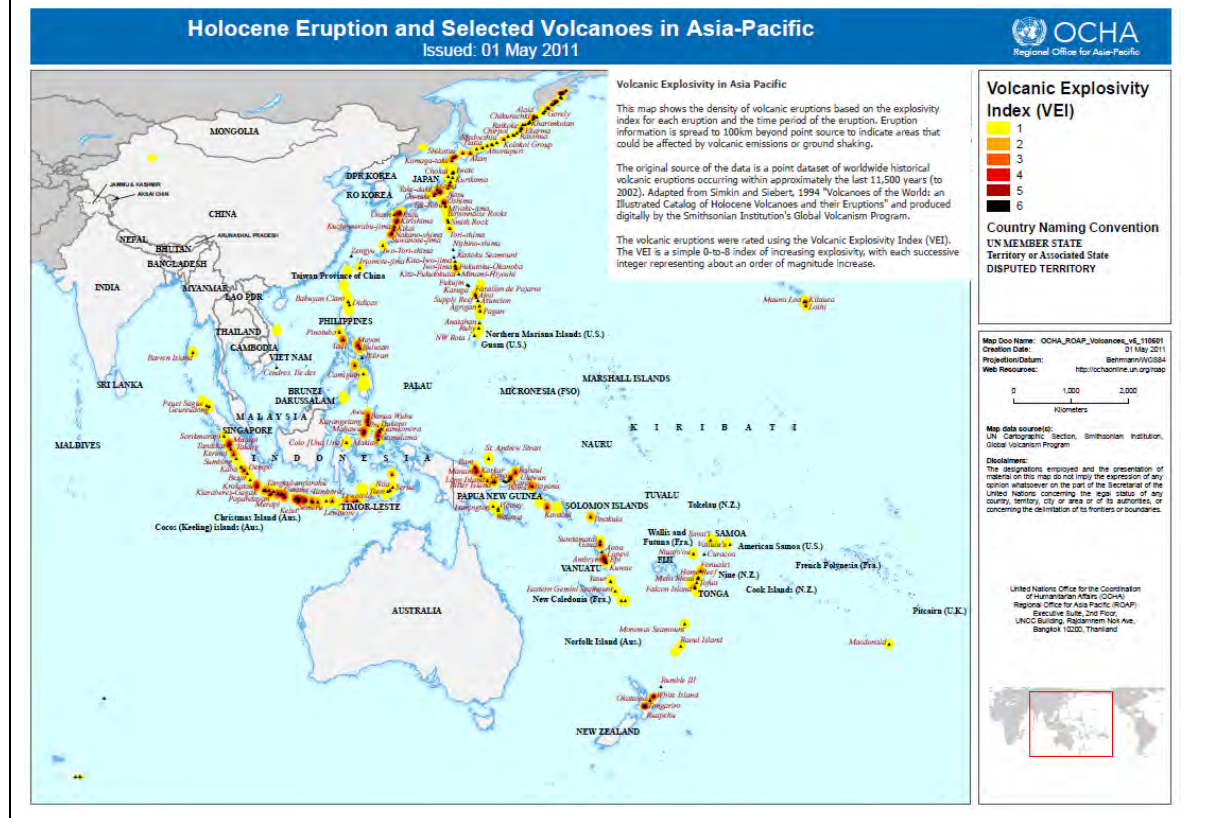


No.:	VE-001	Published Year:	2011
Study/ Report Name:	Holocene Eruption and Selected Volcanoes in Asia-Pacific		
Access to Information:	http://reliefweb.int/sites/reliefweb.int/files/resources/map_619.pdf		
Research Organization:	United Nations Office for the Coordination of Humanitarian Affairs, Regional 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:

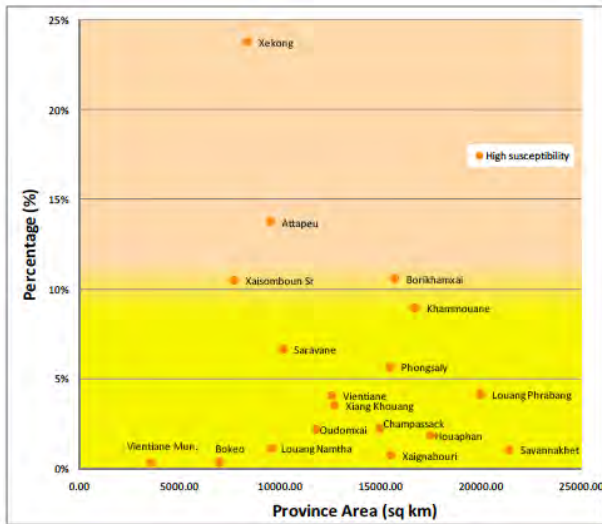
- Review the international initiatives on early warning system
- Conduct a rapid appraisal of existing early warning system for hydro-meteorological hazards in DIPECHO target countries, and
- Undertake short case studies to assess community-level vulnerability and response to hydro-meteorological hazards.

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.

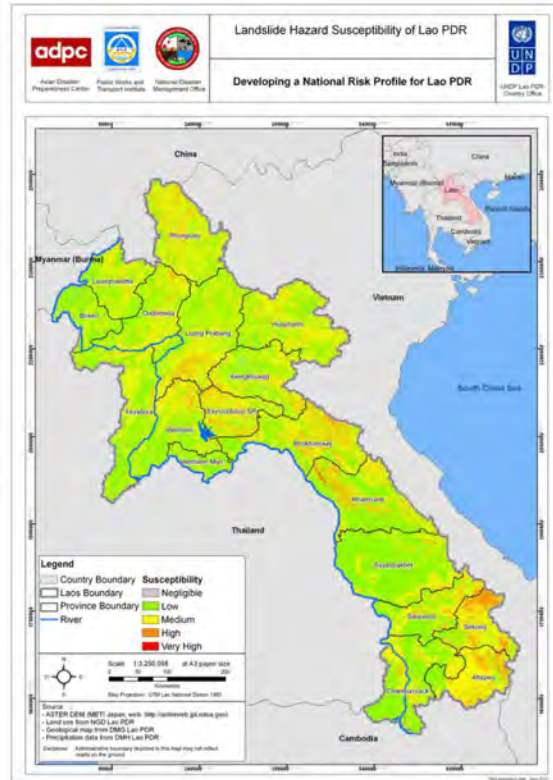
In urban areas, burgeoning populations are in many instances located in areas vulnerable to hazards such as tropical storms. This study is limited to the EWS for hydrometeorological hazards focusing on tropical cyclone and floods as recommended in the proposal approved by the European Commission Humanitarian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

No.:	CM-004	Published Year:	2011
Study/ Report Name:	Typhoon HAIMA in the LAO PEOPLE'S DEMOCRATIC REPUBLIC		
Access to Information:	http://www.gfdr.org/sites/gfdr.org/files/Haima_JDLNA_Report.pdf		
Research Organization:	GFDRR / World Bank		
Study Area (Country):	LAO PDR		
Studied Hazard:	typhoon		
Studied Damage/ Risk:	Hazard		
Main Data Sources:			
<p>Summary of the Study:</p> <p>On June 24-25, 2011, Typhoon Haima hit the Northern and Central parts of the Lao PDR causing heavy rain, widespread flooding and serious erosion in the provinces of Xiengkhouang, Xayaboury, Vientiane and Bolikhamxay. The National Disaster Management Office (NDMO) reported that more than 87,403 people of 362 villages in 36 districts had been directly affected by the disaster. At least 18 people were killed and one injured as a direct result of the floods. Flood water destroyed houses, crops, schools, hospitals, roads, bridges, electricity poles, extension lines, communication systems, and caused widespread damage to irrigation schemes, aquaculture infrastructure and riverbanks. The Lao Government acted quickly, helping the communities to evacuate, mobilising volunteers to search for and rescue the victims, and delivering immediate emergency aid as well as temporary restoration of life line facilities and houses of people. In addition, it has continued to provide food support to the most affected communities. During field visits by the Joint Damage, Losses and Needs Assessment (JDLNA) teams (25th July to 5th August 2011), communities expressed satisfaction with the timeliness and quality of the relief and early recovery support provided by various government agencies.</p> <p>This Report is a collective output of the collaboration and efforts made jointly between the Government of Lao PDR and the development partners in assessing the damage, losses and resource needed for recovery, restoration of people's livelihoods, and improving the climate resilience of the affected sectors in the short, medium and longer terms. This report also highlights some of the government commitments to improve its internal coordination and reporting system for disaster emergency response and preparedness between the line ministries at the central and local levels, as well as to establish the Monitoring and Evaluation (M&E) framework for long term reconstruction and recovery.</p>			

No.:	LS-002	Published Year:	2010
Study/ Report Name:	Developing a national risk profile of Lao PDR		
Access to Information:	http://www.gripweb.org/gripweb/?q=countries-risk-information/disaster-risk-profiles/national-risk-profile-laos		
Research Organization:	UNDP		
Study Area (Country):	Lao PDR		
Studied Hazard:	Flood, Storm, Landslide, Earthquake, Epidemic, UXO, Drought		
Studied Damage/ Risk:	landslide susceptibility zoning by semi-quantitative approach		
Main Data Sources:	Elevation :ASTER DEM, Land use: National Geographic Department (NGD), Geology: Department of Mines and Geology (DMG), Precipitation: Department of Meteorology and Hydrology (DMH)		
<p>Summary of the Study:</p> <p>1)overview</p> <p>This report presents a comprehensive national risk profile of Lao PDR including all hazard-prone areas (based on historic disaster events), identifying and assessing the exposure, vulnerability and risk of people, property, critical facilities, infrastructure and economic activities in those hazards prone areas; and creating preliminary national multi-hazard profiles, in terms of the type of hazard and affected sectors.</p> <p>2)out line of Landslide hazard</p> <p>Larger part of the country is falling under low to medium landslide susceptibility zones. Only 5.24 % of the country is prone to very high and high of landslide susceptibility. These high susceptible zones are localized in south east and central part of Lao PDR.</p> <p>The landslide hazard assessment methodology uses a semi-quantitative approach which considers explicitly a number of factors influencing the stability. Four thematic layers are created, such as: slope gradient, land use, rock condition (lithology), and rainfall. Those layers are then combined with different value of weighting. Slope influences 40% of landslide occurrence, land use contributes 20%, lithology for 20%, and rainfall attributes for 20%. The approach results to susceptibility map with ranks of 1 to 5 which defines the landslide susceptibility from safe (negligible) to very susceptible (very high). Provincial and district boundary marked as overlay layers for more detailed spatial distribution.</p>			



High susceptibility percentage vs provinc area crossplot about Land slide



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

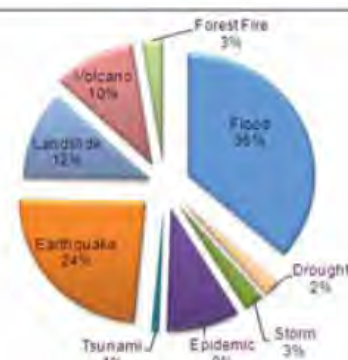


Figure 8: Percentage distribution of reported disasters in Indonesia

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:			

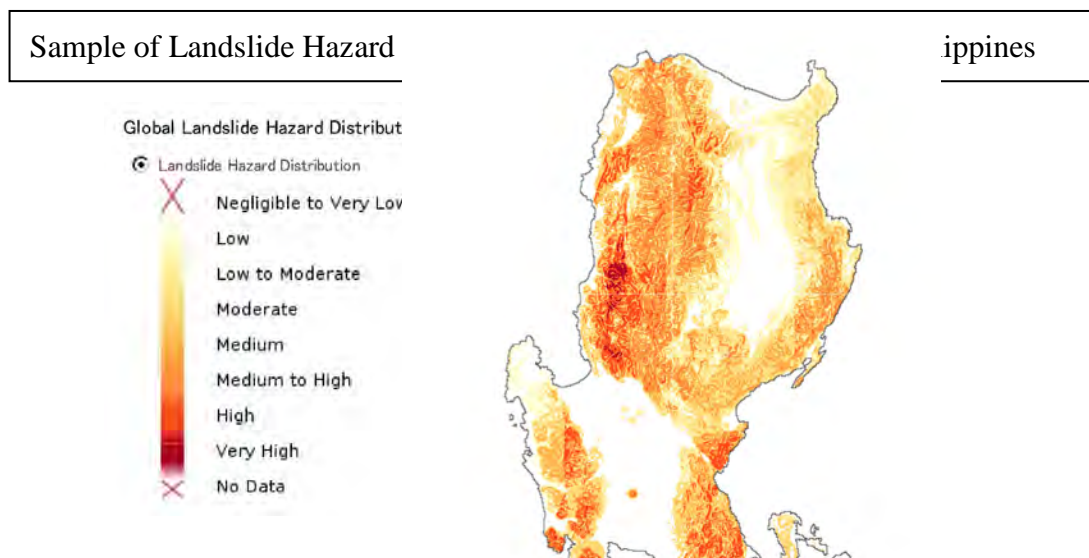
Summary of the Study:

1)overview

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.

2)

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.



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		

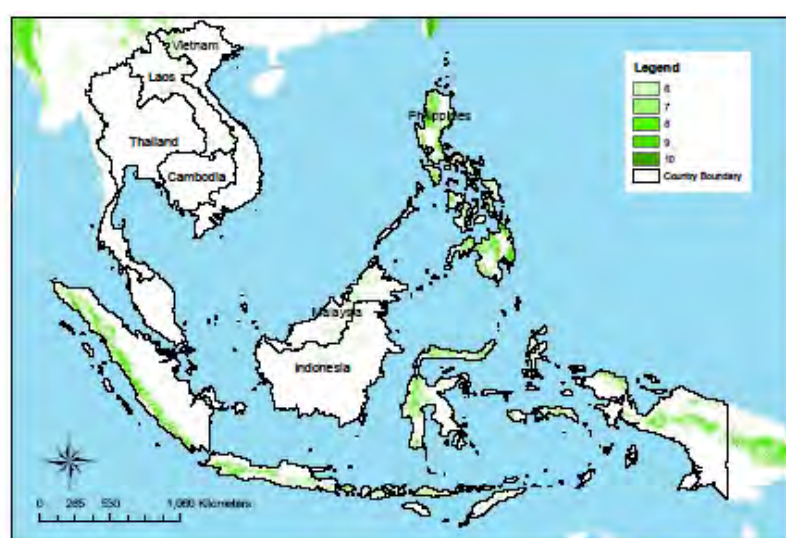
Summary of the Study:

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 Lao PDR

ID	Short List	Long List	COUNTRY	PROVINCE	PARK NAME	ADDRESS
LA0001	XXLA04	XXLA04	Laos		Savan-Seno Special Economic Zone	Savannakhet District
LA0002	XXLA05	XXLA05	Laos		VITA Park	Nonthong Village, Saithany District, Lao PDR
LA0003			Laos		Thatluang Lake Specific Economic Zone	Thatluang-Hongkai Vientiane, Laos
LA0004		XXLA01	Laos		Boten Beautiful Land Specific Economic Zone	Luang Namtha
LA0005			Laos		Saysetha Development Zone	Boulevard Kamphengmeuang Vientiane, Laos
LA0006			Laos		LongThanh Vientiane Specific Economic Zone	Rue Samsenthai Vientiane, Laos
LA0007			Laos		Thakhek Specific Economic Zone	13 Thakhèk, Laos
LA0008		XXLA02	Laos		Golden Triangle Special Economic Zone	Tonpheung District, Bokeo Province, Laos
LA0009		XXLA03	Laos		Phoukyo Specific Economic Zone	Kaysone Phomvihane (Thakhek District Khammuane Province)
LA0010			Laos		Dongphosy Specific Economic Zone	Wat Dongphosy Thanaleng, Laos
LA0011			Laos		Vientiane Industrial and Trade Area (VITA)	Rue Samsenthai Vientiane, Laos

Appendix 4: **General Investment Risk of Lao PDR**

(1) Political Risk

Laos is politically stable due to the long-term dominance of the Lao People's Revolutionary Party (LPRP) and the absence of an organized opposition. As such, business continuity is unlikely to be impacted as a result of political instability. The LPRP is the only legitimate party in the country. It seized power in 1975 following the end of the Vietnam War. The LPRP enjoys full control of the country. The party dominates every aspect of Lao political life, co-opting the entire administrative class. Its mass organizations also provide the ruling elite with a power base among the population at large. As a traditional communist state, real power lies within the party's central organs, mainly the Politburo. Factional divides within the LPRP do not threaten political stability. After the National Congress of the LPRP endorsed the key leadership changes and confirmed the continuity of one-party rule in Laos, there is little to suggest any prospect for a party split over major policy issues or that any other major political changes will take place over the near-to-medium term. The military plays a prominent role in politics and holds around half of all the posts in the Politburo. Under its current leadership, Laos is likely to continue on a course of cautious economic reform and gradual liberalization, with the LPRP simultaneously attempting to perpetuate its exclusive political control.

(2) Economic Risk

Reflecting decades of centralized control, Laos's economic base comprises a combination of subsistence agriculture and defunct state-owned enterprise, with growth sectors largely restricted to hydropower, mining, textiles, and tourism. Domestic demand is also driving some growth in services, construction, and manufacturing. Reforming of the inefficient state sector to galvanize growth in the private sector stands as a key policy challenge. The state-dominated financial system is shallow with high levels of non-performing loans, frustrating a more efficient allocation of resources to the private sector while imprudent credit growth remains a risk to monetary stability.

Other risks to Laos's economy derive from its expansionary growth strategy built around country's significant hydropower and mineral resources. While more than a

dozen hydro-projects under way are seen to turn Laos into a "regional battery," fostering growth and development in the long term, they also threaten to create unsustainable external imbalances in the near term. Heavy importation of capital machinery with no sufficient counterbalance from the export side until major projects come fully online will widen the current-account deficit, while extensive external borrowing to finance this gap will increase debt levels, putting significant pressure on the balance of payments and pulling resources from domestic sectors. Increased transfers, predominantly from bilateral and multilateral donors, will be required to boost the foreign-reserve position and support balance-of-payments stability.

High dependence on commodity prices in both the hydropower and mining sectors are also making the economy more vulnerable to external shocks, particularly over the short term, given the highly uncertain global mineral demand and price outlook. Over the medium-to-long term, Laos's recent accession to the World Trade Organization should help diversify the country's exports and capital inflows, partially mitigating this risk. On a more structural note, weak financial and private sectors, endemic corruption, lack of an adequate legal framework, and other inefficiencies fostered by the central planning will keep weighing on Laos's ability to attract foreign investment and its overall economic progress.

(3) Legal Risk

The legal system is based on French legal practices coupled with Lao customary law, traditions and socialist practices. There are no safeguards in place to protect the judiciary's independence meaning that the legal guarantees offered ultimately rely on the ruling the LPRP. In recent years, Laos has made some progress putting in place investor-friendly laws as part of the government's effort to enhance the country competitiveness and gain accession to the WTO. Since 2000, Laos has endorsed more than 90 new or improved laws, decrees and regulations relating to trade.

Among recently revised laws is the main law governing the registration of commercial activities, the Law on Enterprise. The New Enterprise Law was passed in 2006, taking effect in 2007. The act theoretically simplified registration procedures for business, made business registration information available to the public, and created a single access point, the Enterprise Registration Office, for businesses in Vientiane in 2008. Efficient implementation, however, remains problematic. Despite the government's efforts to simplify registration procedures for business, starting a business in Laos is still a

time-consuming and unpredictable process taking 92 days on average. The enterprise law does not differentiate between foreign and domestic companies in terms of registration requirements. Several types of business entity are possible: a sole trader private company; a partnership; a limited liability company; a public company; and a joint venture/private-state mixed enterprise, in which the state must hold at least 51% of shares. The new Investment Promotion Law was promulgated in March 2010, and has seen a similar lack of enforcement. The law theoretically merges the laws on domestic and foreign investors, and provides a more streamlined, standardized and harmonized framework for business requirements, procedures and incentives. In reality, most of these benefits have yet to be realized.

(4) Tax Risk

Laos' tax system is undergoing reform. The government is making positive efforts to align the tax regime with international practices and lower the tax burden for investors by reducing the corporate income tax rate. The reforms are part of Laos' drive to enhance its business environment and international competitiveness by leveling the playing field for domestic and foreign companies. Under the new amended 2011 Tax Law, Laos is expected to eliminate the Business Turnover Tax with the 10% value-added tax and reduce the maximum corporate income tax rate (Profit tax) from 28% to 24%, for domestic and foreign investors. Despite these upcoming reforms, challenges remain. Even after the reduction from 28% to 24%, the profit-tax rate is still well above the East Asia and Pacific average of 16.8%. In addition, there is a significant need for the government to strengthen the tax authorities' capacity to monitor and implement new legislation.

(5) War Risk

There is a low-level anti-government insurgency by guerrillas from the Hmong ethnic minority. Violence in urban areas is no longer a threat, especially compared to the late 1990s, when a series of small explosions occurred in Vientiane, including occasional roadside ambushes and grenade attacks. Between 1999 and 2004, Hmong guerrillas conducted a series of hit-and-run attacks in remote locations on government outposts and buses.

Intensified fighting with the Laos military in 2004 resulted in the surrender of many Hmong guerrillas in return for an amnesty. Since 2004, a consensual, albeit only verbal,

ceasefire has largely held in rural areas, although small bombings and attacks on government officials have since occurred infrequently. Dissidents in northern and central Laos have agreed to participate in peace talks with local officials. The ceasefire has largely arisen out of the erosion of the Hmong's will to fight, and its lack of food and medical supplies. Also, by resorting to violence, the Hmong insurgents have lost local support. In July 2007, Lao authorities arrested five Hmong allegedly plotting to attack seven targets, including the city hall, a hospital, the airport and a radio station in northwestern Bokeo province. The plot did not seem well developed or credible. Since then, there have been no indications of further plots aimed at public or commercial targets. Still, within Laos, infrequent low-intensity fighting is likely to continue between the Hmong and security forces, particularly in the northern rural areas where there are no commercial assets. Government officials and security forces are the primary targets.

Given this, we do not view the insurgency as posing risks significant risks to commercial operations and their business continuity.

Laos does not have any border disputes with its neighbors: Cambodia, China, Myanmar, Thailand and Vietnam. Since 2000, Thailand has prevented the Hmong from using its territory as a base for insurgency attacks, improving its relations with Laos.

(6) Terrorism Risk

Criminal gangs pose a moderate risk to life and property, especially in the Golden Triangle Area, which covers parts of Myanmar, Thailand and northwest Laos. The area produces vast amounts of heroin, which is traded and exported illegally by the gangs. These gangs pose a moderate risk to cargo in Laos, including cargo being transported on the Mekong River. Gangs are likely to steal and resell the cargo or extort crewmembers. In October 2011, criminal gangs attacked two Chinese cargo vessels on the Mekong River, killing 13 Chinese nationals. In response Laos has started joint patrols on the Mekong with forces from China, Myanmar and Thailand. These patrols are likely to continue as river-borne traffic, especially involving Chinese vessels, is likely to increase in the three-year outlook due primarily to increasing trade links between these countries. Attacks, however, remain a risk. In January 2012, gunmen fired shots at the Chinese ship 'Shengtai-11' on the Mekong River; there were no

reported injuries. Vessels are generally undamaged, the gangs seeking primarily to loot the cargo.

(7) Civil Unrest Risk

Labor unrest is rare, but we expect the risk of industrial action to increase as employment shifts from the agricultural sector to industry. Strikes are likely to be met with severe government force, including military and police intervention, as the government does not tolerate any civil disobedience. This reduces risks of business disruption. Figures from 2010 showed that roughly three out of five workers are employed in the agriculture sector. The small size of the industrial sector's workforce is a key factor underlying the virtual absence of labor unrest in the country. Moreover, as the communist government controls commodity prices, traditional triggers for industrial unrest like inflation and rising living costs are much less applicable to Laos.

Protests are similarly not tolerated by the government. It is likely that some anti-government groups do exist, though this is very difficult to corroborate, as the government is quick to limit their capability and influence. These groups, therefore, are unlikely to stage protests. There is some evidence of small-scale protests over local issues, involving a few hundred people. In September 2012, around 200 people protested against the government's plans to demolish their shops to make way for a mall in Talat Sao, Vientiane. However, this protest lasted for only an hour before the crowd was dispersed and the plans for the construction of the mall continued. Such protests are exceptions. Land use for hydroelectric and mining projects has not resulted in substantial protests or demonstrations, likely because the areas affected are relatively sparsely populated.

Looking ahead, as the economy transitions from an agricultural-based to an industrial one, the risk of civil unrest will increase, as has been the case in neighboring countries like Cambodia, China and Vietnam. However, this transition is still in its very early stages in Laos and consequently the risk of protests will be low for at least the next five years.