Country Report

Summary of Information on ASEAN Member States

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.

Location Map

Country	Area (km2)	Population	GDP billion (current US$)	GNI per capita, PPP (current international $)
Brunei	5,770	417,784	16	68,090
Cambodia	181,040	15,135,169	15	2,890
Indonesia	1,910,930	249,865,631	868	9,260
Lao PDR	236,800	6,769,727	11	4,570
Malaysia	330,800	29,716,965	312	22,460
Myanmar	676,590	53,259,018	55(Estimate)	-
The Philippines	300,000	98,393,574	272	7,820
Singapore	716	5,399,200	298	76,850
Thailand	513,120	67,010,502	387	13,510
Vietnam	330,951	89,708,900	171	5,030

References:

The World Bank Data Bank website (2009, 2013): http://data.worldbank.org (Accessed: October 15, 2014)
Ministry of Foreign Affairs website (2014): http://www.mofa.go.jp (Accessed: October 15, 2014)

Contents

1. Introduction

The Pilot Study[1] has been implemented in the representative industrial agglomerated areas in Indonesia, the Philippines, and Vietnam among ASEAN Member States for the purpose of establishing the concept and the procedures of implementation of Area Business Continuity Management (Area BCM). Area Business Continuity Plans (Area BCP) for the pilot areas were formulated in the process of Area BCM.

Area BCM is defined as "a management process that helps to manage the risks of continuity and/or early recovery of businesses of an area in an emergency such as natural disasters that affect the entire area", and Area BCP as "a document set of procedures and information intended to promote continuity and/or early recovery of businesses of an area in an emergency such as natural disasters that affect the entire area.". The concept of Area BCM and its procedures for implementation are described in the guidebook[2] and its toolkits[3].

In the various stages of Area BCM, risk-informed decision making is the fundamental approach, as shown in Figure 1.1. To provide basic information, a GIS database was developed and GIS maps were prepared by summarizing information and data on natural disasters, disaster risks, important transport infrastructures and lifeline utilities, resources for disaster risk reduction, and others.

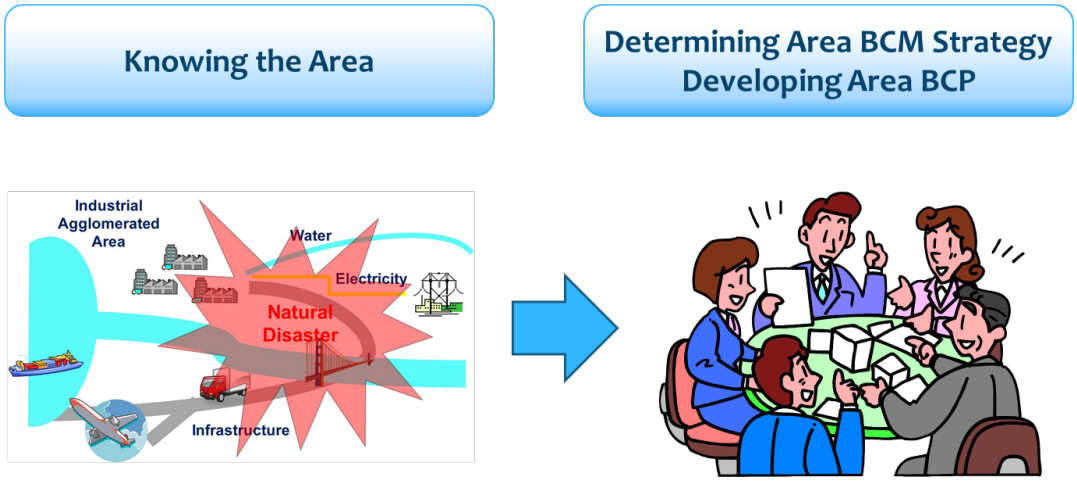


Figure 1.1 Risk-Informed Decision Making in Area BCM

[1] AHA Centre and JICA (2015): Final Report, "The Study on Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region".
[2] AHA Centre and JICA (2015): Main Volume, Tools for Area BCM, "Planning Guide for Area Business Continuity, ~ Area BCM Toolkits ~".
[3] AHA Centre and JICA (2015): Supplemental Volume, Tools for Area BCM, "Planning Guide for Area Business Continuity, ~ Area BCM Toolkits ~", Version 2.

Country reports were prepared for 10 ASEAN Member States, which provide, in addition to those contained in the database, more information on resources for disaster risk reduction of the countries. Risk profile reports, which contain detailed information of the pilot areas of the Study, were also prepared.

The country reports and risk profile reports, together with the GIS database, can be used as information sources for risk-informed decision making, not only for Area BCM, but also, as shown in Figure 1.2, for business continuity management (BCM) and disaster risk management of individual organizations, disaster risk management of the area, and planning of sustainable development of the area.

Since the database, country reports and risk profile reports for the Study were prepared with limited data and information, revisions by the national governments, local governments and/or national experts are necessary for further refinement and enrichment.

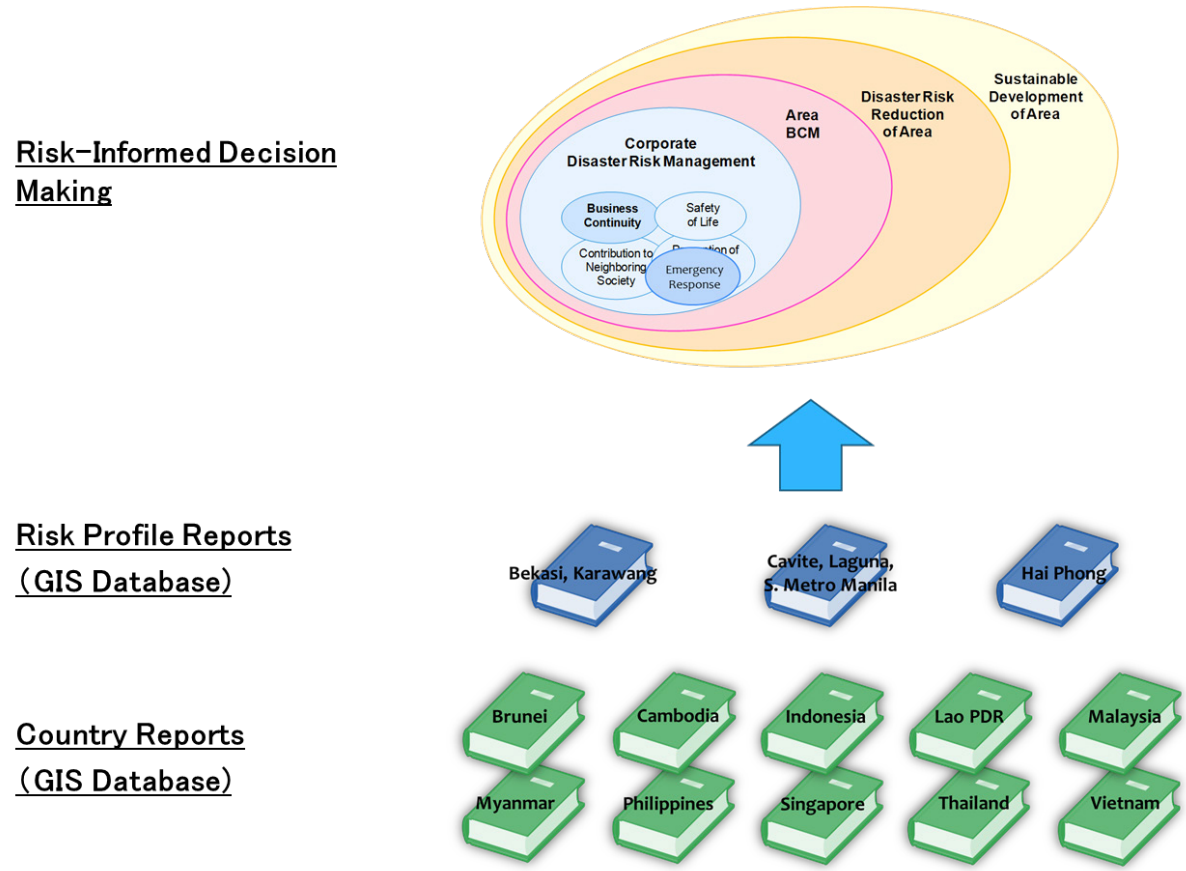


Figure 1.2 Utilization of GIS Database, Country Reports and Risk Profile Reports for Risk-informed Decision Making

2. GIS Database of ASEAN Member States

2.1 Overview of GIS Database

A GIS database was created using the information and data collected in the Study. The GIS database consists of the following 2 elements:

- Element 1: Database for ASEAN 10 countries
- Element 2: Database for the three pilot areas

Element 1 is the basic information from the country reports in this Study. One distinctive feature of Element 1 is the collection of past records of natural disasters including earthquakes, tsunamis, volcanos, floods, tropical cyclones and landslides. The records are presented in GIS maps. Overlaying infrastructures such as roads, railways, airports, ports, dams or power stations, and industrial agglomerated areas on these natural disaster layers in GIS can become important information for decision making in the process of Area BCM. Further, existing studies on natural disasters were summarized in formatted sheets, which were linked to the features on GIS maps.

Element 2 is a summary of information and data collected for the 3 pilot areas in Indonesia, the Philippines, and Vietnam. In workshops held in these 3 pilot areas, the compiled information and data were used for decision making in Area BCM and for preparation of Area BCP.

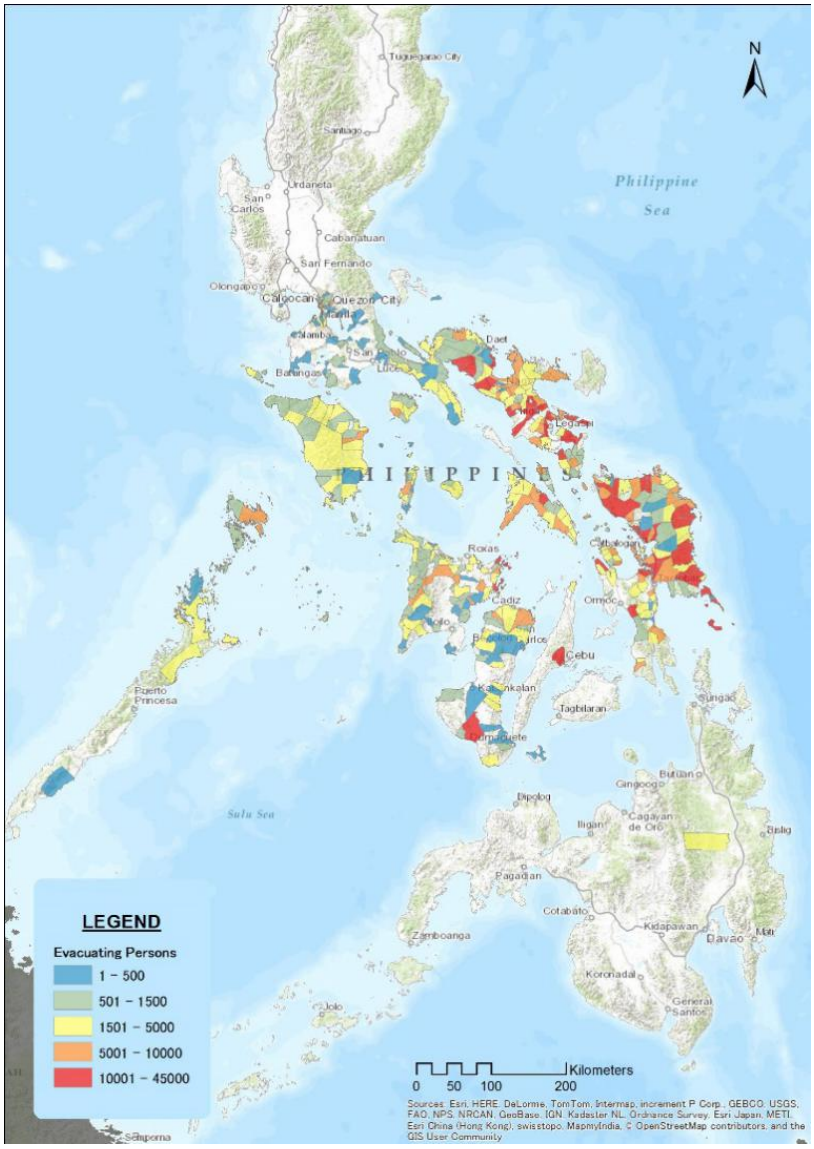
2.2 Provision of Database to AHA Centre

One of the important tasks of the Study was the transferring of the GIS database to the ASEAN Coordinating Centre for Humanitarian Assistance (AHA Centre). AHA Centre is an institution of the ASEAN Secretariat, whose main mission is coordination in response to disasters occurring in ASEAN Member States. Installation of equipment and various computer systems provided by the assistances of Japan-ASEAN Integration Fund (JAIF) and United States Agency for International Development (USAID) was completed in the operation room of AHA Centre. Discussions among concerned countries with the support of these equipment and computers have been conducted through real-time monitoring of disaster situations.

Various information collected in the ASEAN countries and in the pilot areas during the Study was provided to the AHA Centre, which is considered to enhance the capacity of AHA Centre, as the concept of Area BCM developed by this Study focuses on

information sharing among the stakeholders of the ASEAN countries, and risk-informed decision making by using a wide scope of information.

The GIS database provided to the AHA Centre by this Study was formulated for Area BCM; that refers to mitigation and prevention measures before the disaster occurs. It can also be used as a part of emergency response operations. In fact, during the emergency response operation to counter typhoon no. 22 (Hagupit) which landed on the Philippines in early December, 2014, information from some parts of this GIS databases were utilized in order to present evacuation status (Figure 2.1).



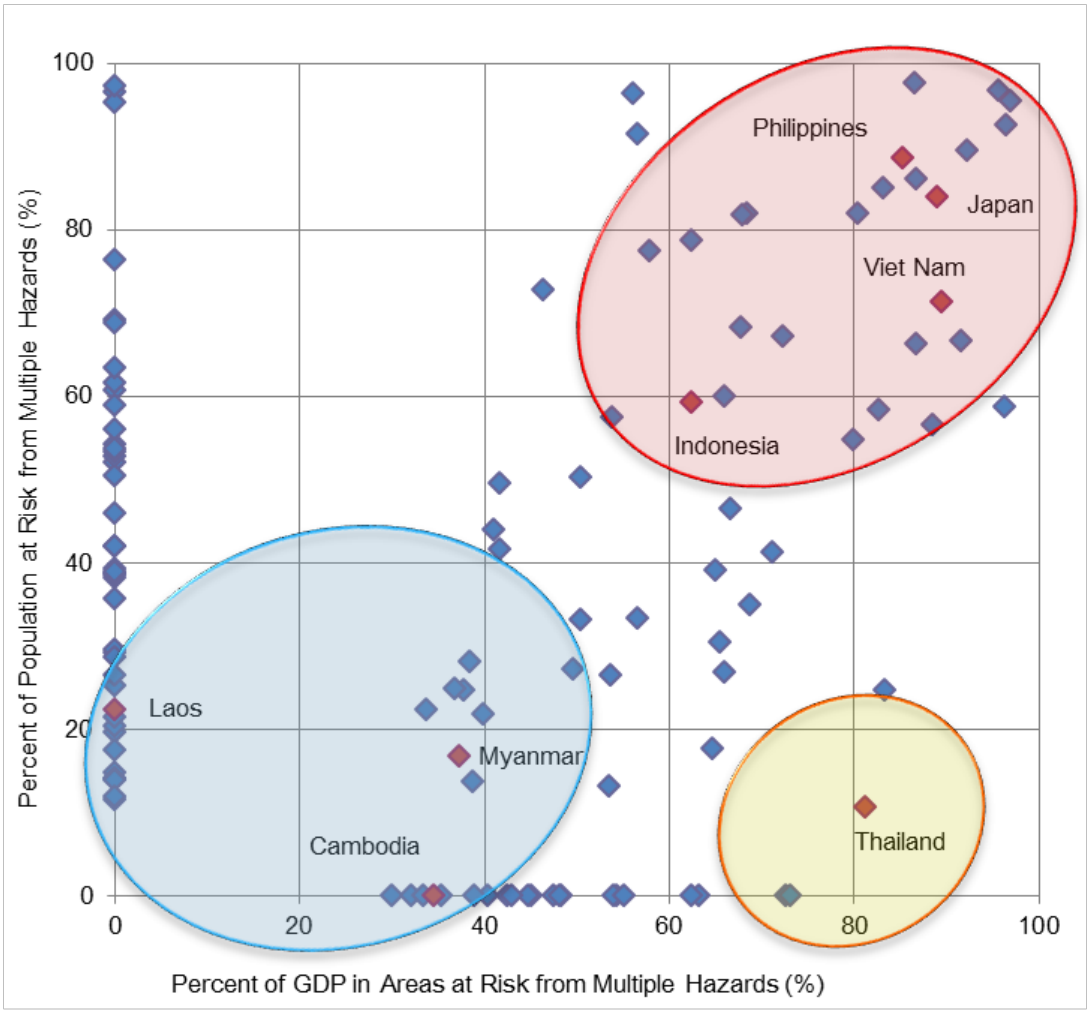
Note: An example of utilization of the GIS database (Input to Excel was conducted separately)

Figure 2.1 Distribution of Evacuees on December 10, 2014, 6AM

3. Information of the Regional Level

The GIS database and mapping have advantage to locate summarize information on natural disasters, industrial parks, transport infrastructures, lifeline utilities, resources for disaster risk reduction, and others in the ASEAN regional level. In addition to the map showing the relative risk of the country such as in Figure 3.1, by using the information plotted on the maps and superimposing the information, the stakeholders will be able to discuss risks of the countries and/or areas for their decision makings, such as investment.

Examples of the maps of the regional level are given in Figure 3.2 to 3.9.



Note: Prepared by the Study Team used information from Natural Disaster Hotspots, Global Risk Analysis, The World Bank, 2005.

Figure 3.1 Natural Disaster Risks of ASEAN Countries

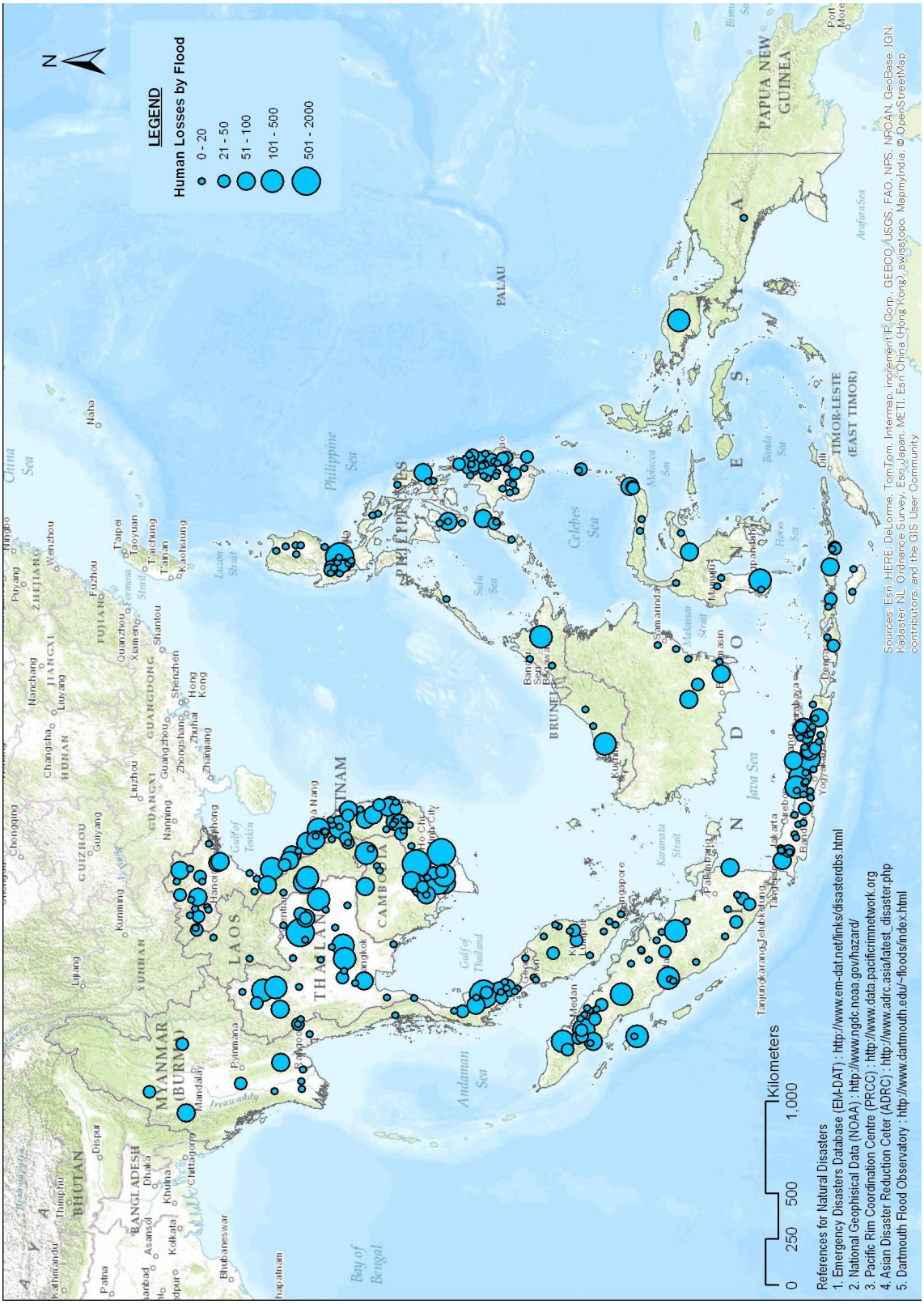


Figure 3.2 Distribution of Flood Disasters in ASEAN Region: Human Losses

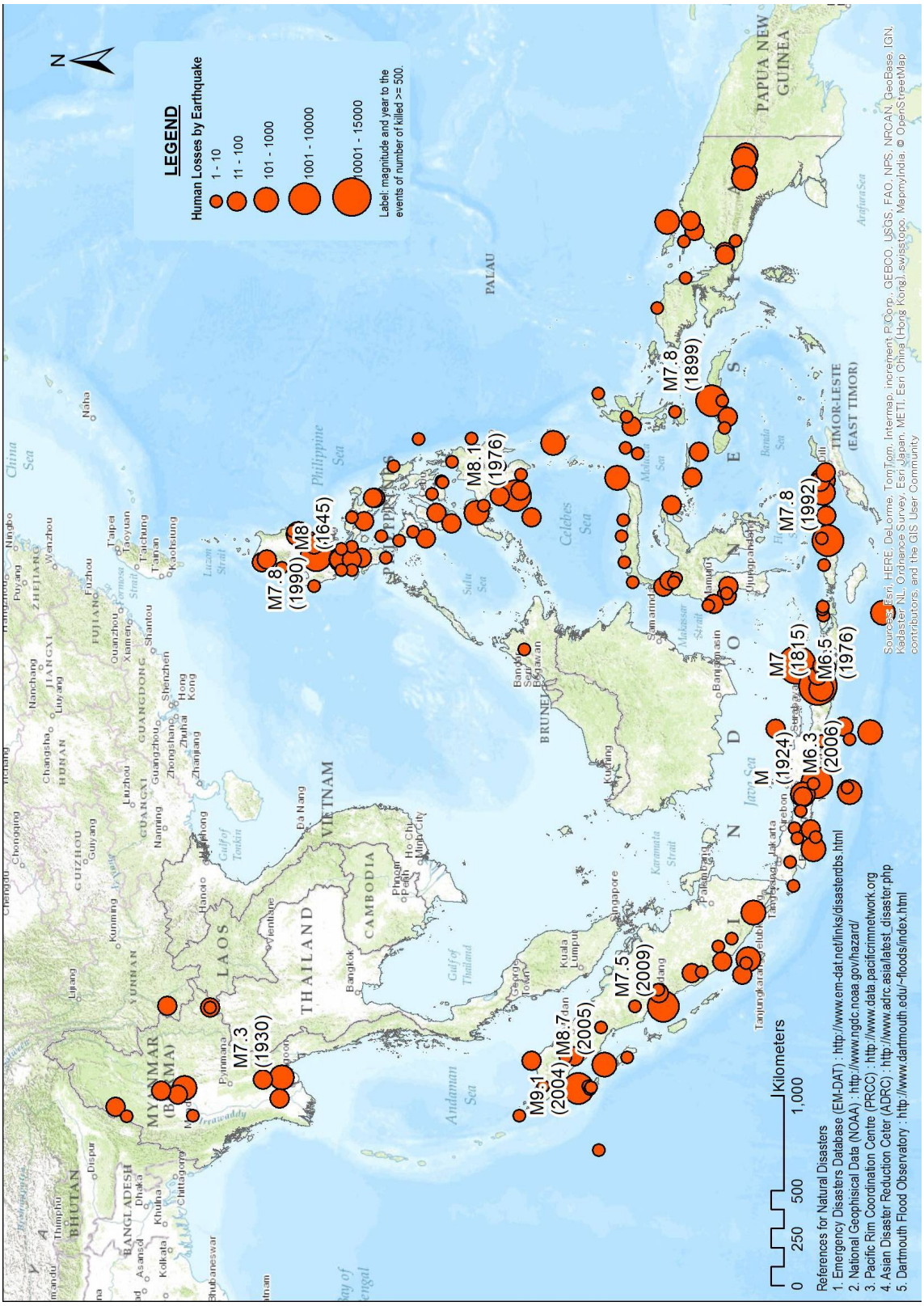


Figure 3.3 Distribution of Earthquake Disasters in ASEAN Region: Human Losses

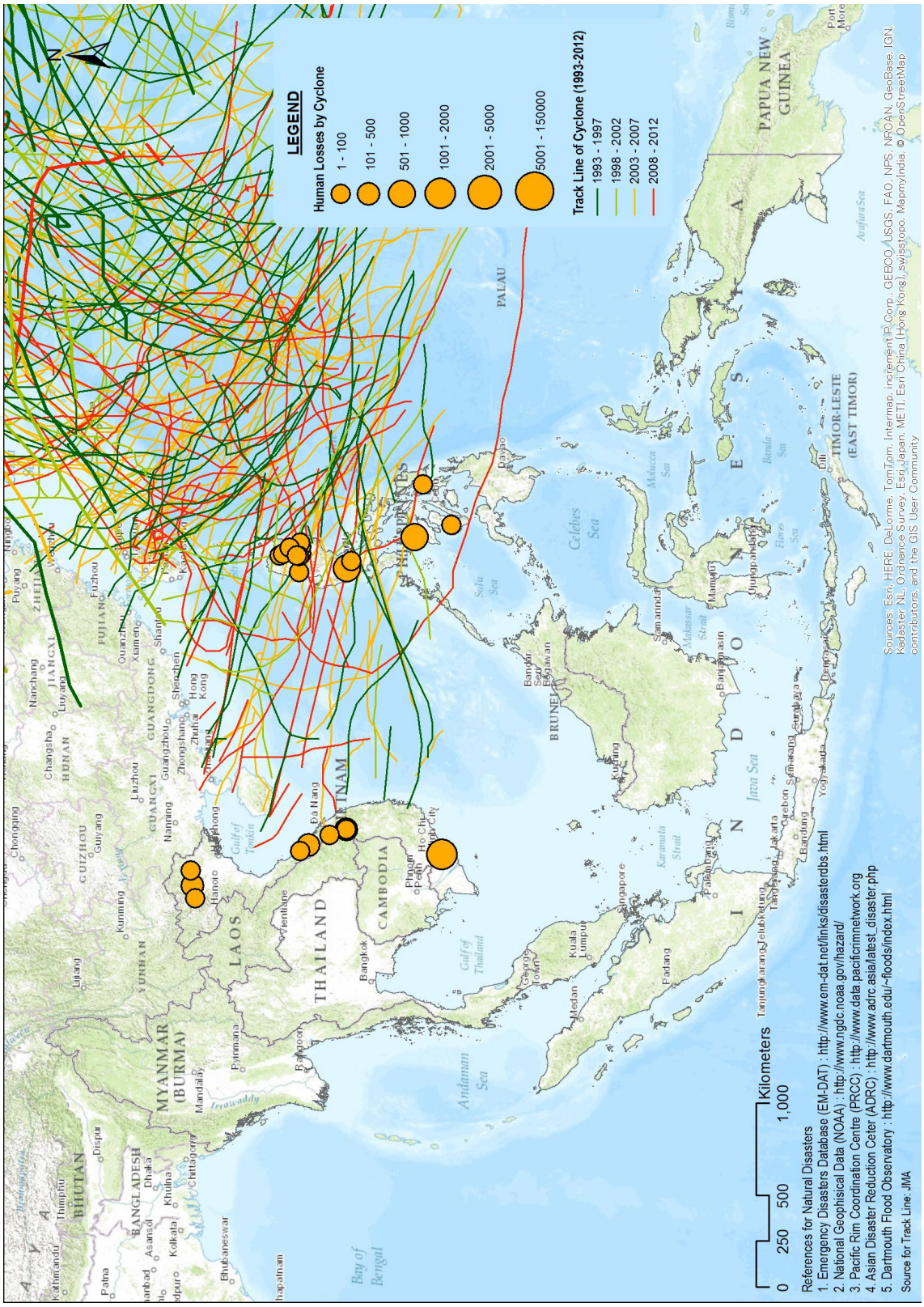


Figure 3.4 Distribution of Cyclone Disasters in ASEAN Region: Track lines and Human Losses

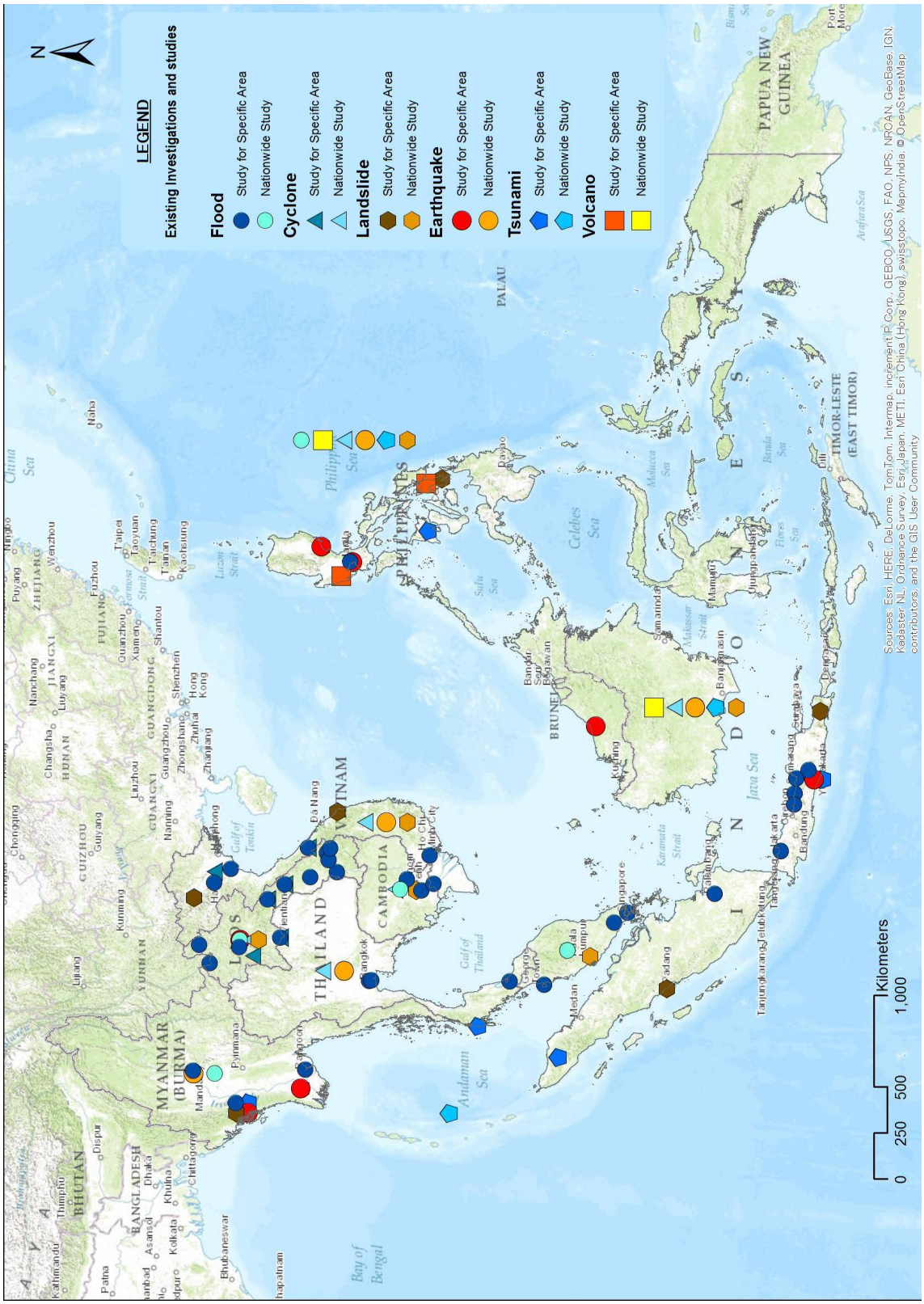


Figure 3.5 Locations of Existing Investigations and Studies in ASEAN Region

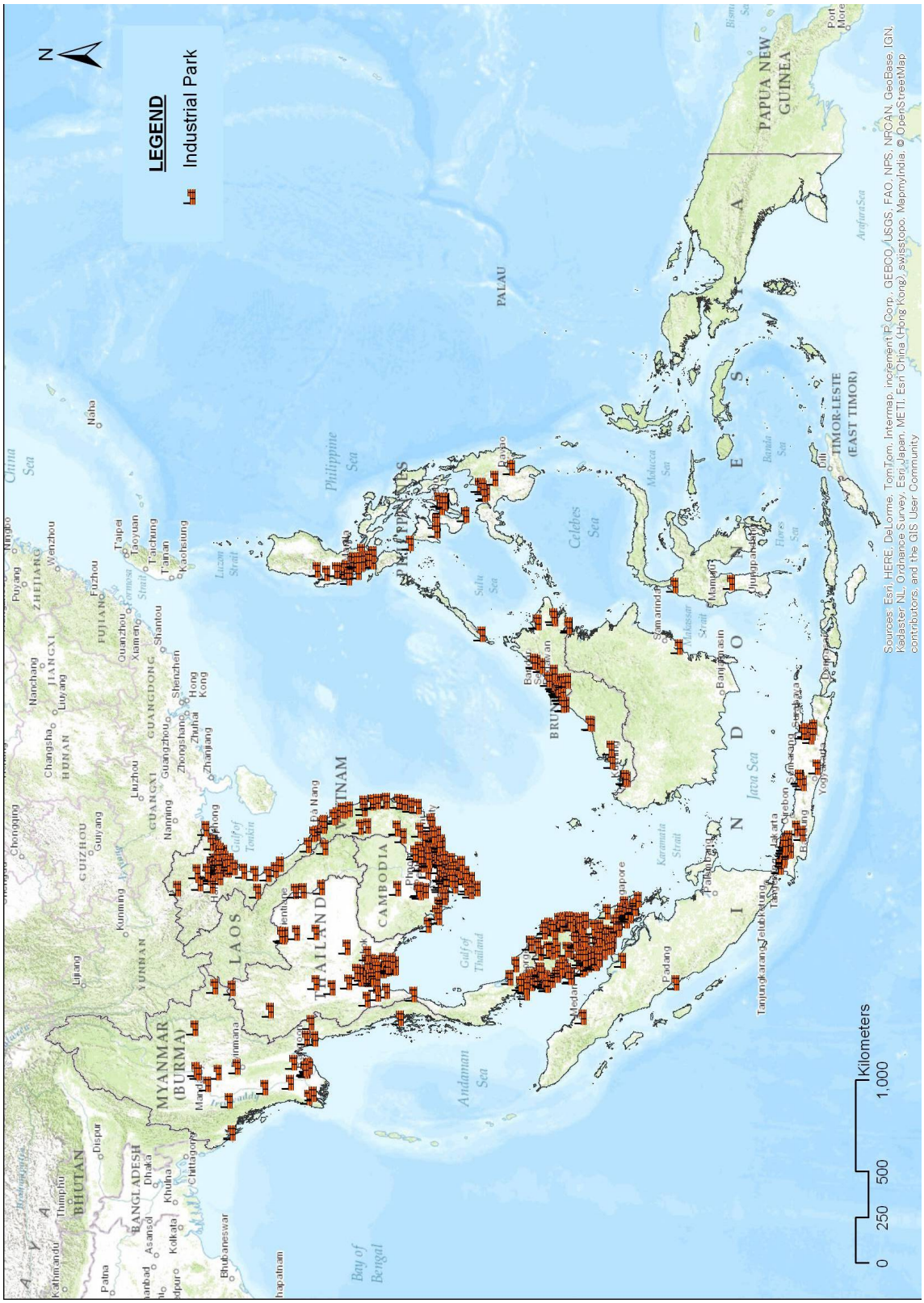


Figure 3.6 Distribution of Industrial Parks in ASEAN Region

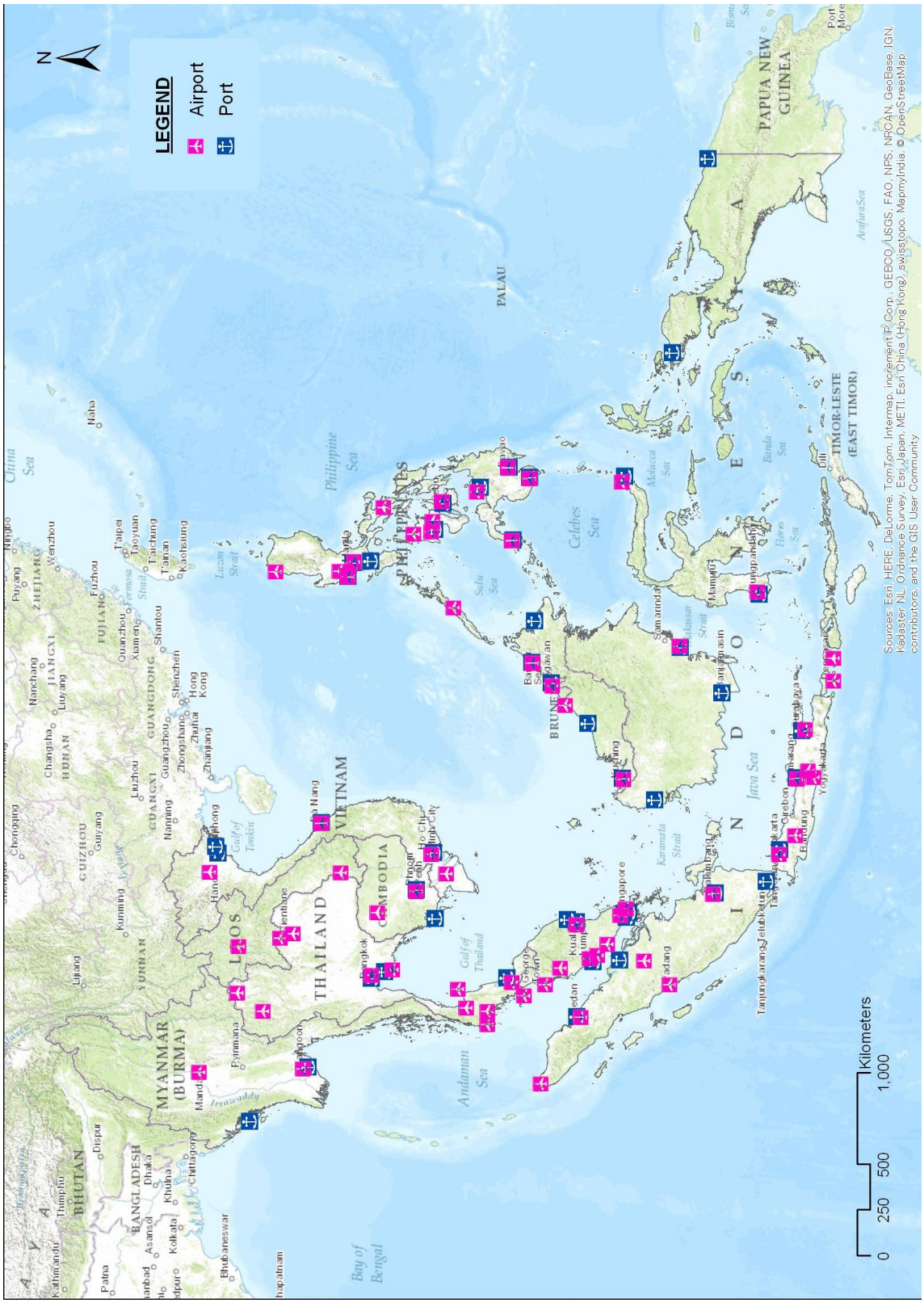


Figure 3.7 Distribution of Major Sea Ports and Air Ports in ASEAN Region

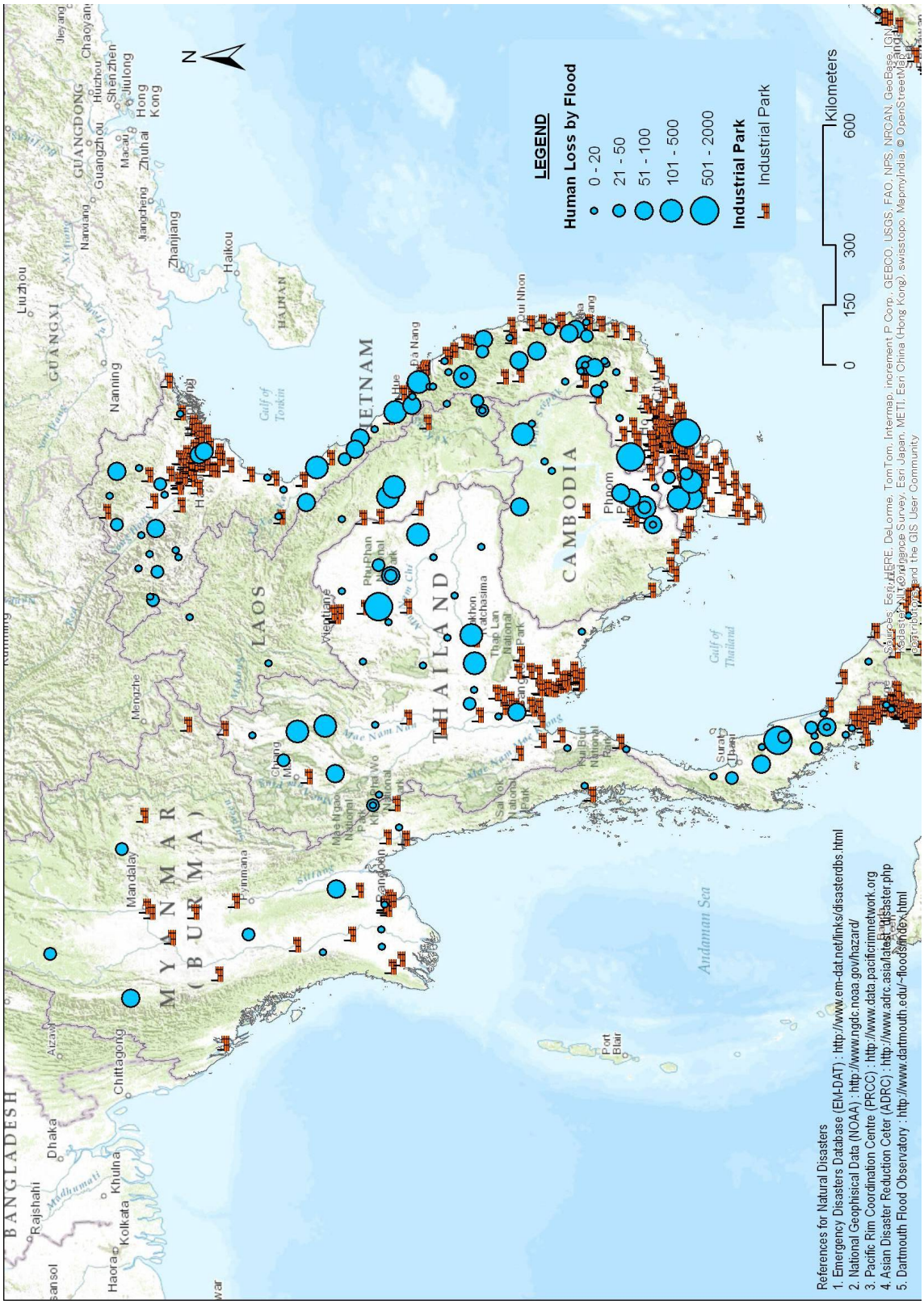


Figure 3.8 Distribution of Industrial Parks and Flood Disasters (Human Losses) in the Indochinese Peninsula

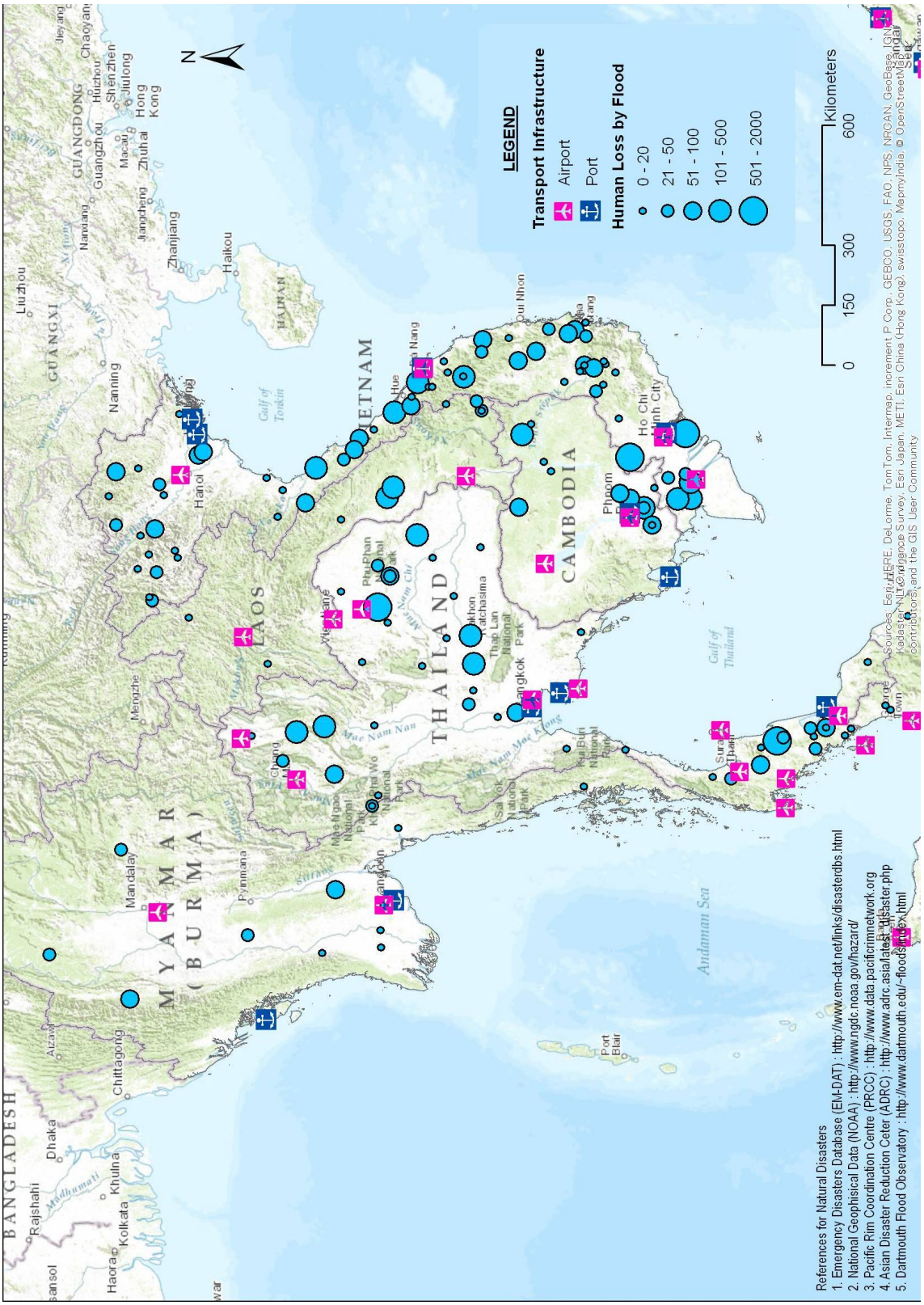


Figure 3.9 Distribution of Major Sea Ports and Air Ports, and Flood Disasters (Human Losses) in the Indochinese Peninsula

4. Information on Countries

4.1 Overview of Country Reports

The first version of country reports were prepared for 10 ASEAN Member States, which give information on natural disaster risks of the respective countries, industrial parks, major traffic infrastructures and lifeline utilities, and legislative systems relating to disaster management and business continuity.

The country reports are considered as reference documents for individuals and organizations who are wishing to integrate disaster risk information into their decisions: such as investment to the country, 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 of the reports are also useful for planning and implementing disaster risk management of individual organizations, disaster risk management of the area, and sustainable development of the 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 reports were prepared with limited data and information from public domain, mainly through the internet, a revision by national experts is required for further refinement and enrichment.

A list of the country reports and related documents prepared by the Study from AHA Centre and JICA is provided in Appendix 1. An example of the contents of the country report is attached in Appendix 2.

4.2 Information of the Country Level

For each country the following information and data are collected and compiled in the country report:

- Predominant hazards
- Natural disaster risk
- Industrial parks
- Transport infrastructures and lifeline utilities
- Legislative systems
- Current status of BCP implementation

The data with location information of natural disaster risk, industrial parks, and transport infrastructures, lifeline utilities, and others were used to construct the GIS database. A sample GIS map is shown in Figure 4.1 where locations of flood disasters in the Philippines are plotted.

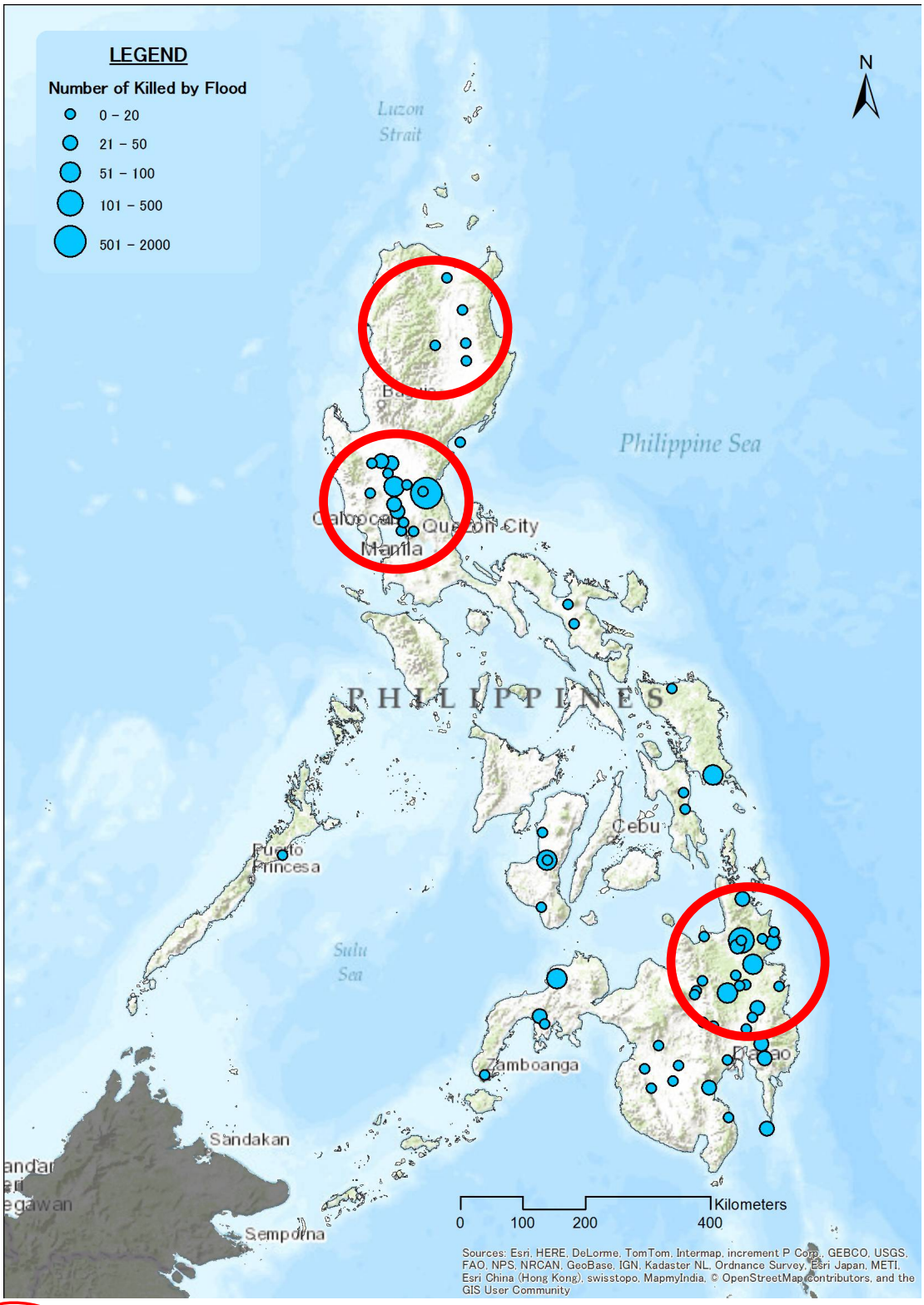
Predominant Hazards

In the Study, the hazard and risk assessments were carried out based on the collected information from the existing database, documents and public information through internet.

The records of natural disasters that have affected the countries are classified based on the impact and frequency of occurrence in Figure 4.2. Both "damage amount" and "number of deaths" are used to express the impact, and "number of disasters occurred between 1983 and 2012" is used to represent the frequency of occurrence.

Figure 4.2 can be used to see the relative level of risk of natural hazards in the countries according to their impacts and frequency of occurrence. The summary of assessment is shown in Table 4.1. Descriptions of each hazard are given in "Natural Disaster Risk" of the country reports.

Please note that the figures were prepared by the available existing information, and not all information relating to the impacts of disasters were included. Further collection of information and discussion among experts of each country will be necessary to improve on the information represented in Figure 4.2.



: 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.glidenumber.net/glide/public/search/search.jsp.

Figure 4.1 Locations of Flood Disasters in the Philippines: Human Losses

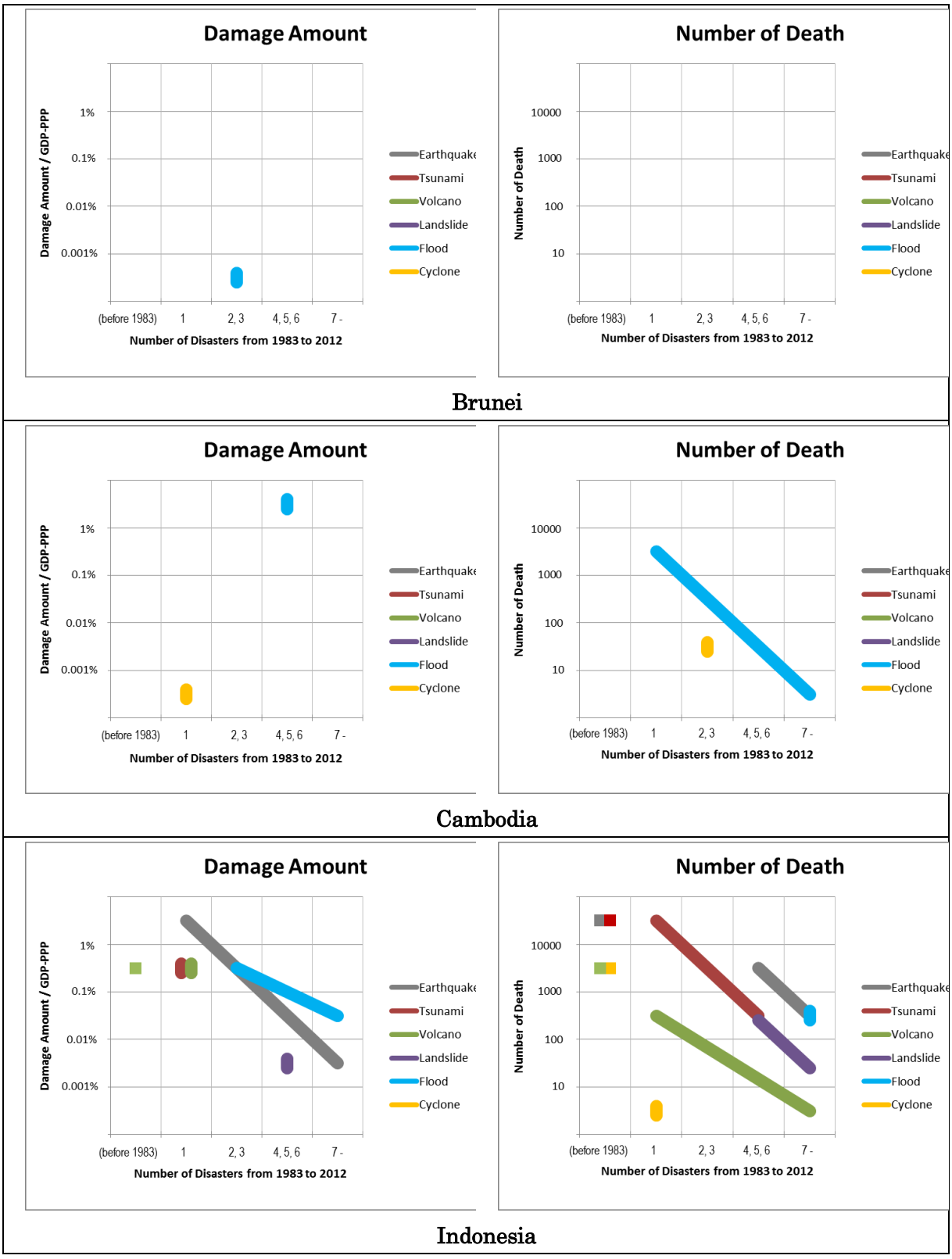


Figure 4.2 (1 of 3) Result of Hazard and Risk Assessment

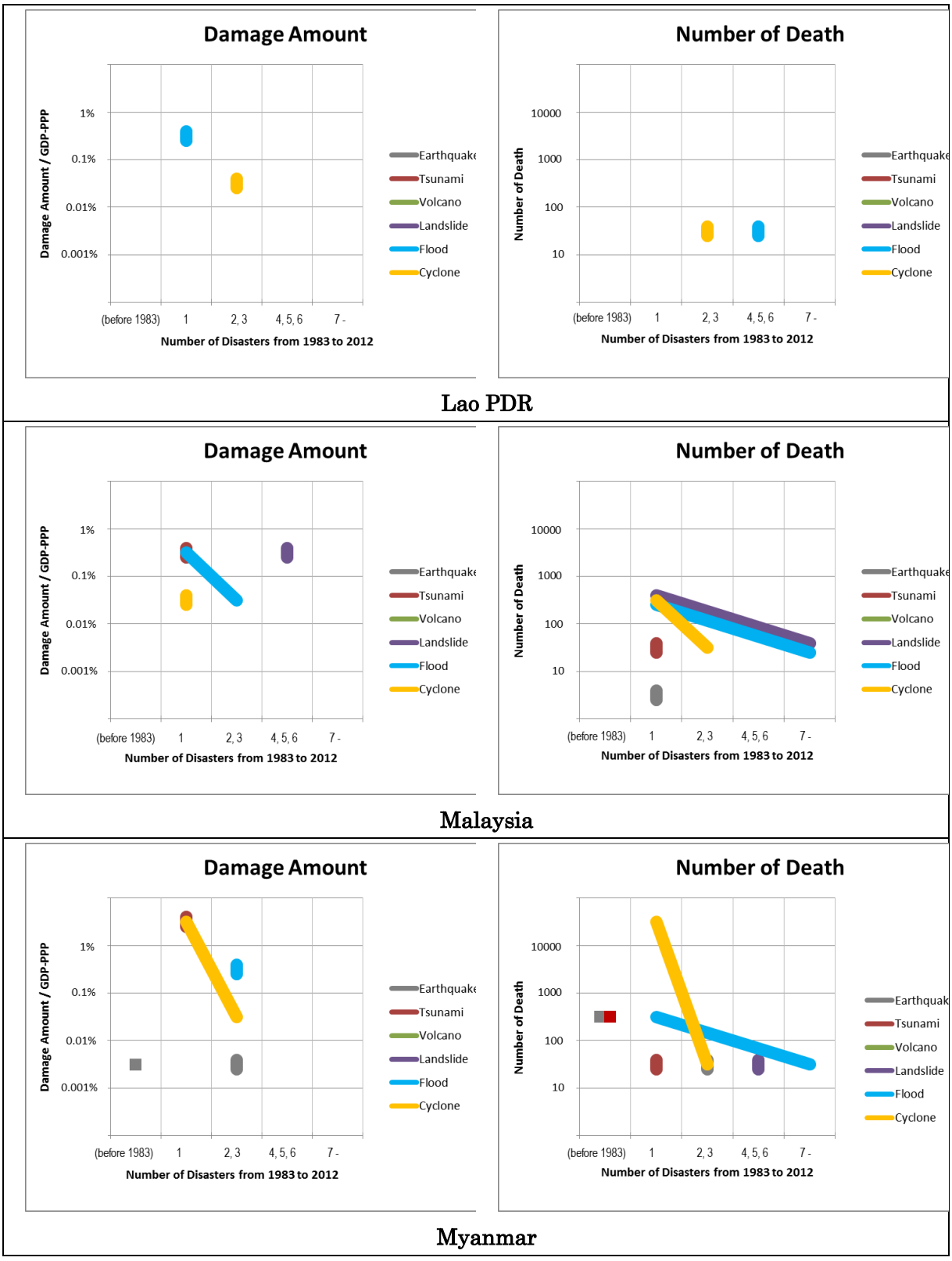


Figure 4.2 (2 of 3) Result of Hazard and Risk Assessment

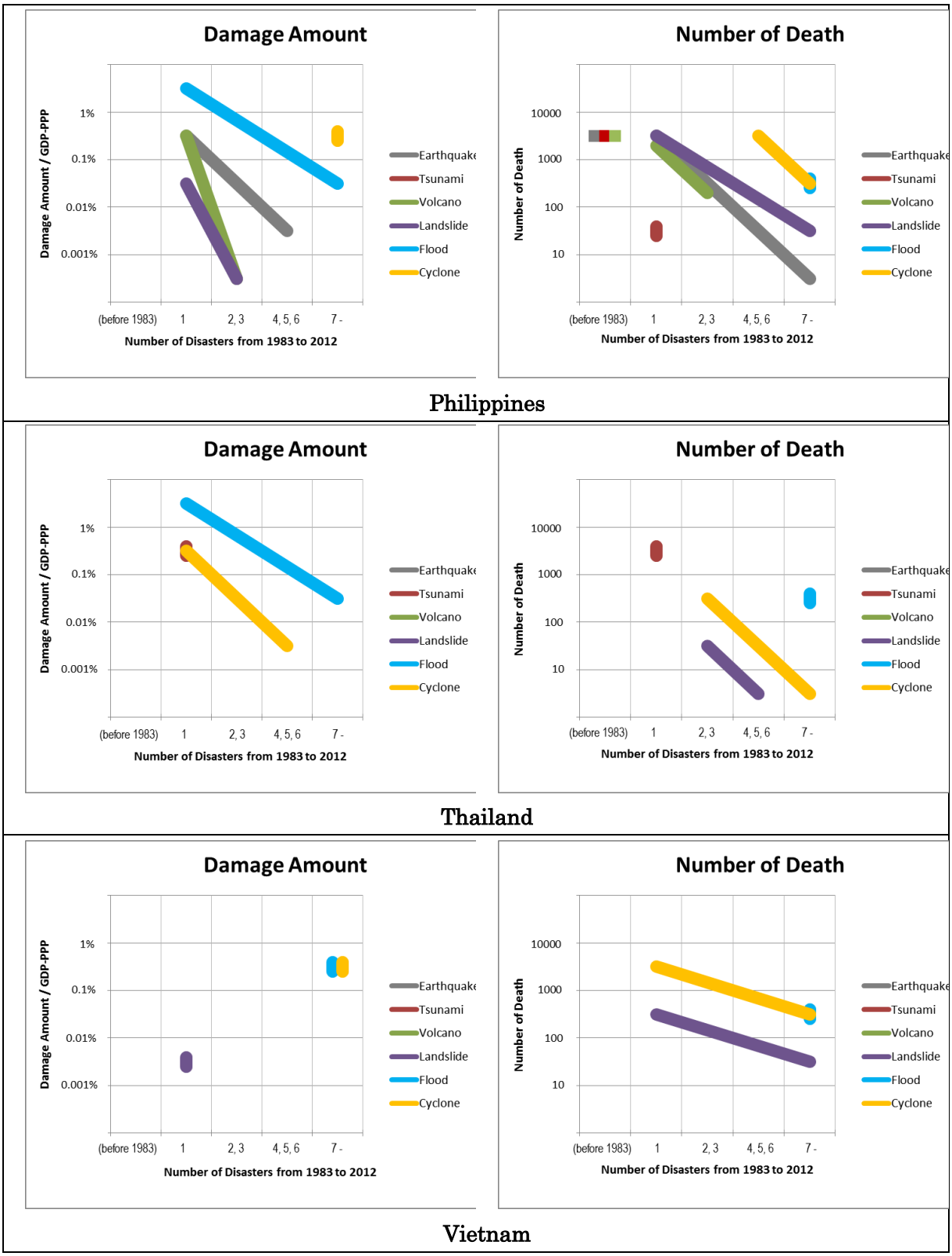


Figure 4.2 (3 of 3) Result of Hazard and Risk Assessment

Table 4.1 Summary of Hazard and Risk Assessment (Review from Disasters between 1983 and 2012)

Country	Impact of Hazards
Brunei	Only 3 slight disasters by flood are recorded in the last 30 years, but no one was killed by these events. No other disasters are recorded.
Cambodia	Several disasters by flood with more than 100 dead or more than 1% damage amount of GDP are recorded. If smaller disasters are included, the flood disaster with loss of life occurred every 2 years in average. The disasters by cyclone are recorded but the impact is smaller than flood.
Indonesia	The disasters from all 6 hazards are recorded, just as in the Philippines. Tsunami caused the largest impact with respect to the number of deaths. The largest damage was caused by the 2004 Indian Ocean Tsunami, in addition to 7 tsunamis that caused more than 1000 deaths after the 17th century. The numbers of deaths by earthquakes is less than that of tsunamis but are more frequently occurred. 7 earthquakes caused more than 1000 deaths after 19th century. The numbers of deaths by flood in one event is less than that of tsunami or earthquake, but occur more frequently. The amount of damage by flood is larger than earthquake as events occur every several years. The impacts by volcano and cyclone are small in the last 30 years but events with more than 1000 deaths are recorded before 1983.
Lao PDR	The disasters by flood and cyclone are recorded. The impacts of floods and cyclones with respect to the number of deaths are the same but floods are more frequent.
Malaysia	The impacts by landslide and flood are in the same level in the view of death. The maximum number of deaths by cyclone is same as that of landslides and floods, but frequency is low. The only damage by tsunami was that caused by the 2004 Indian Ocean Tsunami and no older events are recorded.
Myanmar	The impact by Cyclone Nargis in 2008 is far greater than the rest with respect to the number of deaths (about 140,000), and 3 other cyclones caused more than 1000 deaths in the 20th century. The numbers of deaths by floods is less than that of cyclones, but are more frequent. The amount of damage from the 2004 Indian Ocean Tsunami is large; however no tsunamis and earthquakes having caused more than 1000 deaths are recorded. .
Philippines	The disasters from all 6 hazards are recorded, just as in Indonesia. The most influential hazard is cyclone. Five to six cyclone disasters causing death occurred every year on average. With respect to the amount of damage, cyclones bring the largest impact, also. Earthquake, volcanoes and landslides also caused at least one disaster with more than 1000 death in last 30 years. The number of death in one flood disaster is smaller but is more frequent. The impact of flood with respect to the amount of damage is after that of cyclones. The impact of tsunami in last 30 years is not large, however more than 4000 were killed by the 1976 Mindanao Tsunami.
Singapore	No disasters causing any amount of damage or deaths are recorded.
Thailand	The largest human loss in last 30 years was caused by the 2004 Indian Ocean Tsunami, but there is no record of any events on a similar scale to that of 2004 even in historical

	period. Floods are very frequent and their impact is the largest with respect to the amount of damage. The next greatest impact from cyclones.
Vietnam	The impact of cyclones is the largest with respect to the number of deaths, followed by floods. The impacts of cyclone and flood are in the same level with respect to the amount of damage.

Natural Disaster Risk

The following information is summarized in the country reports for floods, earthquakes, tsunamis, volcanoes, cyclones and other meteorological hazards, and landslides.

- Risks
- Background of hazards
- Responses by the country
- Sources of hazard and risk information
- Studies on hazard and/or risk assessment
- References for data and further reading

Regarding "Responses by the Country", when information is available, descriptions on "provision of disaster management information", "early warning and transmitting information", and "preparedness and education" are provided.

Industrial Parks

The information on industrial parks was collected by the Study. The location and basic information of 1,316 industrial parks in the ASEAN region were collected (1st Step). Selecting 210 comparatively large industrial parks, additional information on developer, developing situations and currently operating Japanese companies were studied (2nd Step). 51 industrial parks were selected in the pilot areas in Indonesia, the Philippines, and Vietnam, and more detailed information such as a list of operating companies, transport infrastructures and lifeline utilities were collected (3rd Step).

Table 4.2 Number of Industrial Parks Studied

Country	1st Step Basic Survey	2nd Step Intermediate Survey	3rd Step Detailed Survey
Brunei	21	5	2
Cambodia	22	5	2
Indonesia	66	27	12
Lao PDR	10	5	2
Malaysia	364	35	4
Myanmar	49	10	1
Philippines	280	35	17
Singapore	74	20	1
Thailand	84	25	3

Vietnam	346	43	7
Total	1,316	210	51

Collected information on the industrial parks is compiled as follows:

- Distribution of Industrial parks in the country
- Historical evolution of industrial parks
- Recent trends and Japanese investment
- Risks of natural hazards
- General investment risk of the country (attached to Appendix 4 of the country report)

For a first look at the risks of natural hazards to industrial parks and individual enterprises, it is useful to superimpose a location of interest on the distribution maps of natural disasters, such as Figures 4.3, where the locations of earthquake disasters and industrial parks are shown for Metropolitan Manila and Calabarzon of the Philippines.

Hazard and risk assessments are required to grasp more detailed information on the risks on the industrial parks.

Transport Infrastructure and Lifeline Utilities

Transport infrastructures and lifeline utilities of the country are described as follows:

- Overview of transport infrastructure
- Overview of lifeline utilities
- Natural disasters and infrastructure

As for transport infrastructures, information on major facilities or systems of roads, railways, seaports, and airports are collected, compiled, and mapped. The targets of lifeline utilities are electricity, water supply, sewer system, gas and communications. The main facilities, supply capacity and diffusion rates, and others are compiled.

The transport infrastructures and lifeline utilities are crucial for the business continuity of enterprises. It is important to know their risks to natural disasters. For the first glance of the risks, it is useful to superimpose locations of transport infrastructures and lifeline utilities on the distribution maps of natural disasters, as shown in Figure 4.4. Hazard and risk assessments are required to grasp more detailed information on the risks on transport infrastructures and lifeline utilities.

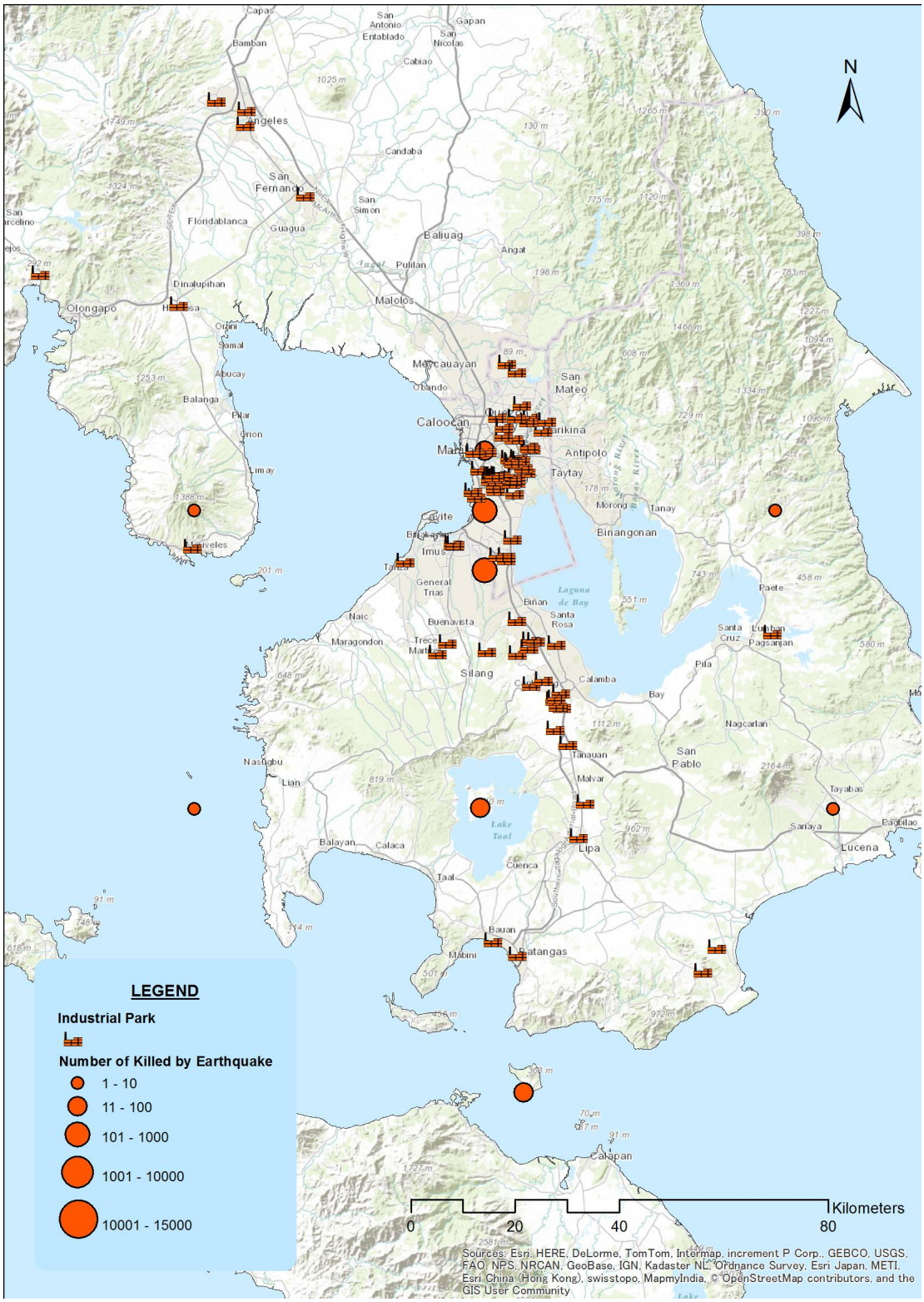


Figure 4.3 Industrial Parks and Earthquake Disasters: Metropolitan Manila and Calabarzon

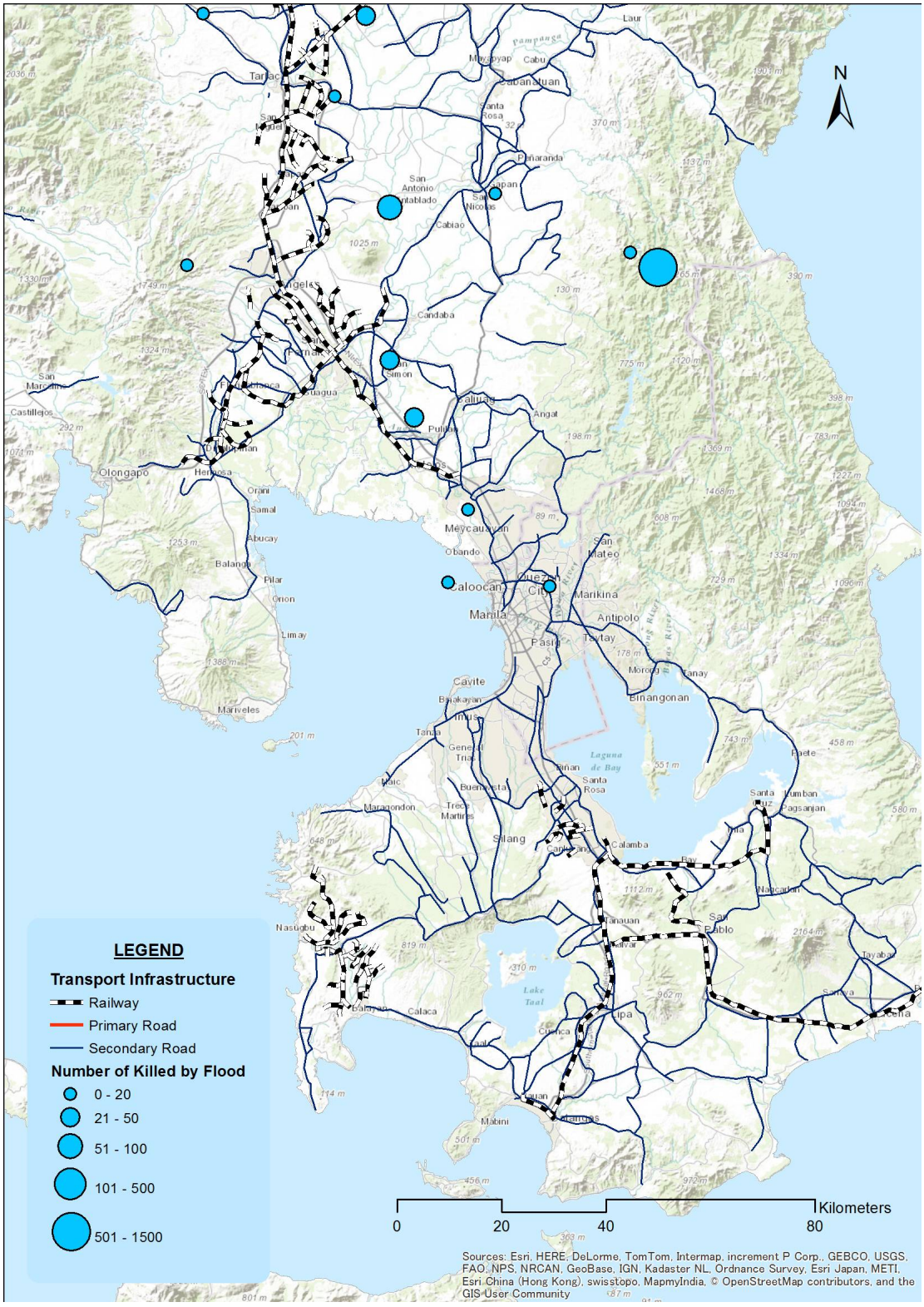


Figure 4.4 Flood Disasters and Major Road and Railway Networks: Metropolitan Manila and Calabarzon

Legislative Systems

The information on laws, regulations, and plans of the following areas were collected and compiled.

- Legislative systems for disaster management
- Regulations and standards for business continuity management
- Legislative systems for environment and pollution control
- Legislative systems for development including land use, rivers and building codes

Regulations, standards and guidelines for business continuity management are summarized in Table 4.3. The Study could not identify those of Brunei, Cambodia, Laos, Myanmar and Vietnam.

Table 4.3 Regulations, Standards or Guidelines for BCM/BCP

Country	Laws / Regulations	Supervisory Authority	Category
Indonesia	Regulation No. 9/15/PBI/2007	Bank of Indonesia	*Regulation*
	Regulation No. 6/8/PBI/2004	Bank of Indonesia	*Regulation*
	Indonesia BCP	Bank Indonesia (Central Bank)	*Regulation*
	Manual: business continuity planning, 2011	International Labour Organization	*Guideline*
Malaysia	MS (Malaysia Standards) 1970, Business Continuity Management Framework, 2007	Technical Committee on Business Continuity Management	*Standard*
	Guidelines on Management of IT Environment, 2004, Bank Negara Malaysia	Central Bank of Malaysia	*Guideline*
	Guidelines on Business Continuity Management, 2008, Bank Negara Malaysia	Central Bank of Malaysia	*Guideline*
Philippines	Circular No. 268 (Philippines Central Bank)	Monetary Board	*Regulation*
	Circular No. 269 (Philippines Central Bank)	Monetary Board	*Regulation*
	Circular No. 542 (Philippines Central Bank)	Monetary Board	*Regulation*
	Manila Bank BCP	Bank of Central Philippines (Local Central Bank)	*Guideline*
Singapore	Singapore Standard 540:2008 (SPRING: Singapore productivity and innovation)	Business Continuity Management Technical Committee	*Standard*
	Singapore Standard 507:2004 (SPRING: Singapore productivity and innovation)	SPRING Singapore, Ministry of Trade and Industry	*Standard*
	MAS Business Continuity Management Guidelines, June 2003	Monetary authority of Singapore	*Guideline*
	MAS Consultation Paper On Business Continuity Planning (BCP) Guidelines, 2003	Monetary authority of Singapore	*Guideline*
	Guidelines for Company Emergency Response Plan	Ministry of Home Affairs, SCDF	*Guideline*
	Business Continuity Management Requirements for SGX members	Singapore Exchange	*Guideline*
Thailand	TIS 22301-2553, Business Continuity Management Systems	Thai Industrial Standards Institute (TISI)	*Standard*
	118/2550 - Policy on BCM and BCP for Financial Institutions	Bank of Thailand	*Guideline*

Implementation of BCP

When available, the following information was collected and described in the country reports:

- Major natural disasters and awareness of BCP
- Current status of BCP implementation
- Efforts on promoting BCP implementation
- Problems facing for Implementation of BCP

Information on the current status of BCP implementation includes descriptions on "implementation of BCP in enterprises", "implementation of BCP in foreign capital companies and Japanese companies", and "implementation of BCP in operators of lifeline utilities". Efforts on promoting BCP implementation include "regulations and guidelines for BCP implementation", and "efforts on disseminating and increasing awareness of BCP in the private sector".

5. Information on Target Areas

5.1 Overview of Risk Profile Reports

The first version of risk profile reports were prepared for the pilot areas of the Study, namely:

- Indonesia: An industrial agglomerated area distributed over Karawang regency, Bekasi regency, Kota Bekasi, and the surrounding area,
- The Philippines: An industrial agglomerated area distributed over Cavite state, Laguna state, the southern part of Metro Manila, and the surrounding area, and
- Vietnam: An industrial agglomerated area distributed in Haiphong city, and the surrounding area.

The reports were considered as reference documents for individuals and organizations who are wishing to integrate disaster risk information into their decisions: such as investment to an area, preparation of a business continuity plan (BCP) or disaster management plan of their organization, preparation of an Area Business Continuity Plan (Area BCP) for their area, and simply understanding natural disaster risks of their area. Information in the reports is also useful for planning and implementing the disaster risk management of individual organizations, the disaster risk management of an area, and the sustainable development of an area.

Hazard and risk assessments were also carried out to provide further information for risk-informed decision making.

Since the risk profile reports for the pilot areas were prepared with limited data and information, a revision by local administrations, operators of transport infrastructure and lifeline utilities, and universities of the areas is necessary for further improvement. For a new area in other parts of ASEAN countries, it is recommended that a risk profile report be prepared by the national government and/or local government who administer the area.

A list of the risk profile reports and related documents prepared by the project of AHA Centre and JICA is provided in Appendix 1. An example of the contents of risk profile report is shown in Appendix 3.

5.2 Information of the Target Area

In the risk profile reports for the pilot areas, the following information and data were collected, compiled, and mapped.

- Disaster Risks of the Pilot Area
- Natural Hazards in the Pilot Area
- Profile of the Pilot Area

Disaster Risks of the Pilot Area

The hazard and risk assessments were carried out as a part of Area BCM implementation. The purpose of hazard and risk assessments is to set the premise for creating a disaster scenario, which describes the situation of enterprises, local administration, transport infrastructures, and lifeline utilities.

The hazards of interest, which is related to the local business activity, are not necessarily limited to one. The hazard assessment in this Study was carried out in three pilot areas for several hazards as shown in Table 5.1.

Table 5.1 Hazard Assessments in the Pilot Areas

Pilot Area	Earthquake	Tsunami	Flood	Storm Surge
Bekasi, Karawang (Indonesia)	4	1	4	-
Cavite, Laguna and South of Metro Manila (Philippines)	4	7	4	-
Haiphong (Vietnam)	4	8	4	12

Note: Figures in the table refer to the number of simulation cases

All the results of hazard assessment are included in the risk profile reports. The results of hazard assessment for the probability of once in 200 years (except tsunami) are shown in Table 5.2.

Table 5.2 Results of hazard assessment for the probability of once in 200 years

Bekasi, Karawang (Indonesia)	
Earthquake	7 - 8 in MMI scale
Tsunami	Wave height is less than 0.3 meter in Jakarta supposing the probability of once in 1,000 years or less
Flood	Inundation depth is 4 meter maximum. Duration is more than 2 weeks.
Cavite, Laguna and Southern Part of Metropolitan Manila (Philippines)	
Earthquake	8 - 9 in MMI scale. Liquefaction probability is high along Manila Bay.
Tsunami	Wave height at the nearest seashore from CEZ is 1 meter which indicates the probability of once every 100 to 600+ years.

Flood	Inundation depth along Manila Bay is 2 meters maximum. Duration is several days. Inundation area along Laguna de Bay is limited.
Haiphong (Vietnam)	
Earthquake	5 - 6 in MMI scale
Tsunami	Wave height is 1 - 2 meters which indicates the probability of once in 1,000+ years.
Flood	Inundation depth is less than 1 meter. Duration is several days.
Storm Surge	Inundation depth is 5 meters maximum.

Figures 5.1 and 5.2 show the collected information of the pilot area in the Philippines, and the results of hazard assessment for an earthquake, respectively.

Predominant hazards can be decided by using the collected information on the disasters. The risk assessment was carried out by superimposing the distribution of collected transport infrastructures and lifeline utilities over the seismic intensity map or inundation map which are the results of hazard assessment.

For tsunamis, floods and storm surges, the facilities in the inundated area are assumed to be under water and considered to be fundamentally damaged. As the extent of damage is affected by the type, structure and condition of the facilities, the data regarding past disasters in the area is the most important; however, as it was not available in the pilot area, the risk was assessed based on the disaster information in other areas.

For earthquakes, the extent of damage can be estimated based on the intensity of seismic motion at the point where facilities are located, and the seismic capacity of the facilities. The relation between the damage of typical facilities and the intensity of seismic motion is proposed as the damage function based on past disaster records. ATC-13[4], ATC-25[5] and Hazus[6] are made based on disasters in U.S.A. and are popularly used. The extent of damage and the necessary time to recover were estimated based on the existing damage function.

[4] ATC, 1985, ATC-13: Earthquake Damage Evaluation Data for California, Federal Emergency Management Agency, Applied Technology Council, California, U.S.A.

[5] ATC, 1991, ATC-25: Seismic Vulnerability and Impact of Disruption on Lifelines in the Conterminous United States, Federal Emergency Management Agency, Applied Technology Council, California, U.S.A.

[6] FEMA, 2011, Hazus -MH 2.1, Multi-hazard Loss Estimation Methodology, Earthquake Model.

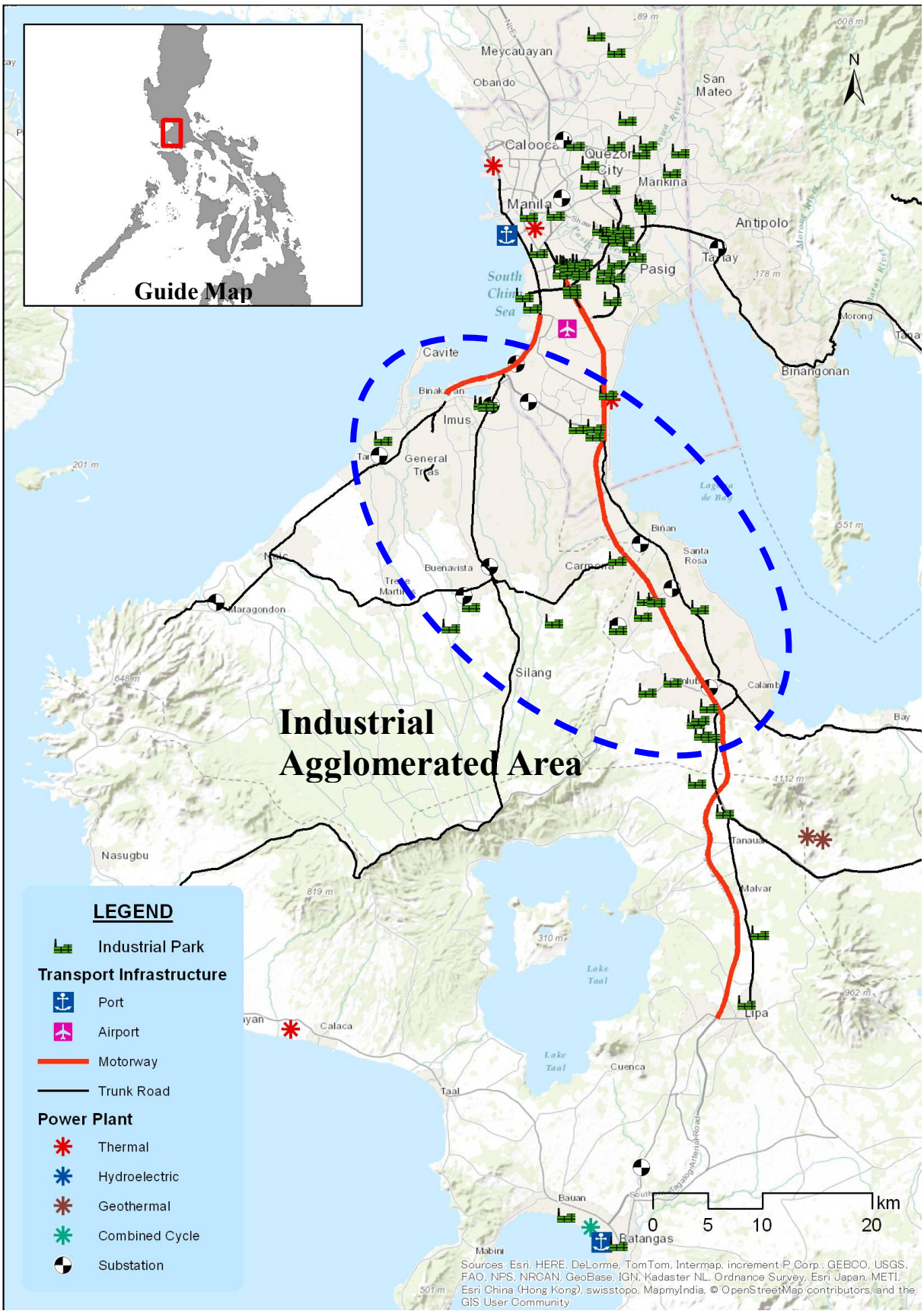


Figure 5.1 Collected Information for the Pilot Area in the Philippines (Cavite, Laguna, and the Southern Part of Metropolitan Manila)

Figure 5.2 Seismic Intensity for the probability of a once in 200 years Earthquake (Cavite, Laguna, and the Southern Part of Metropolitan Manila in the Philippines)

Figure 5.3 is the summary of risk assessment in the pilot area. The figures can be used to see the relative level of the risk of natural hazards in the countries according to their impacts and frequency of occurrence. The highest disaster risk by natural hazard in regard to business continuity in Bekasi and Karawang area is flood; earthquake is the highest in Cavite, Laguna and the southern part of Metro Manila area; storm surge and flood due to typhoon are most serious in Haiphong.

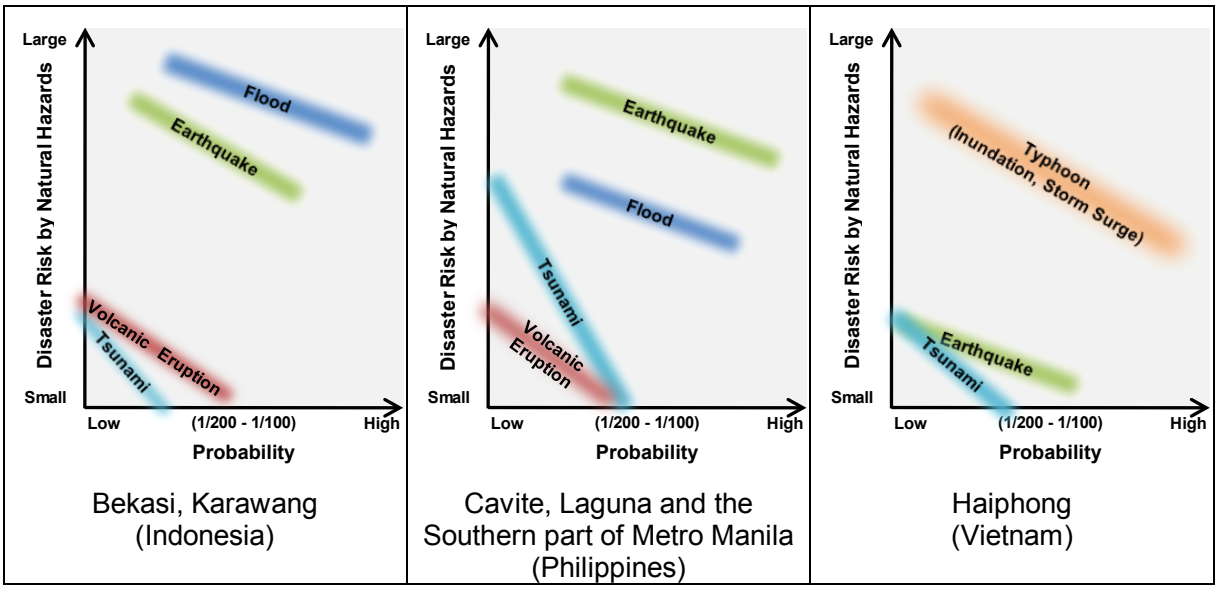


Figure 5.3 Summary of Risk Assessment

Natural Hazards in the Pilot Area

Brief descriptions of natural hazards experienced or expected in and around the pilot areas are given here. Natural hazards described are floods, cyclones and other hydrometeorological hazards, storm surges, earthquakes, tsunamis, volcanoes, and landslides. An example is shown in Figure 5.4 where locations of natural hazards are plotted for the pilot area in the Philippines.

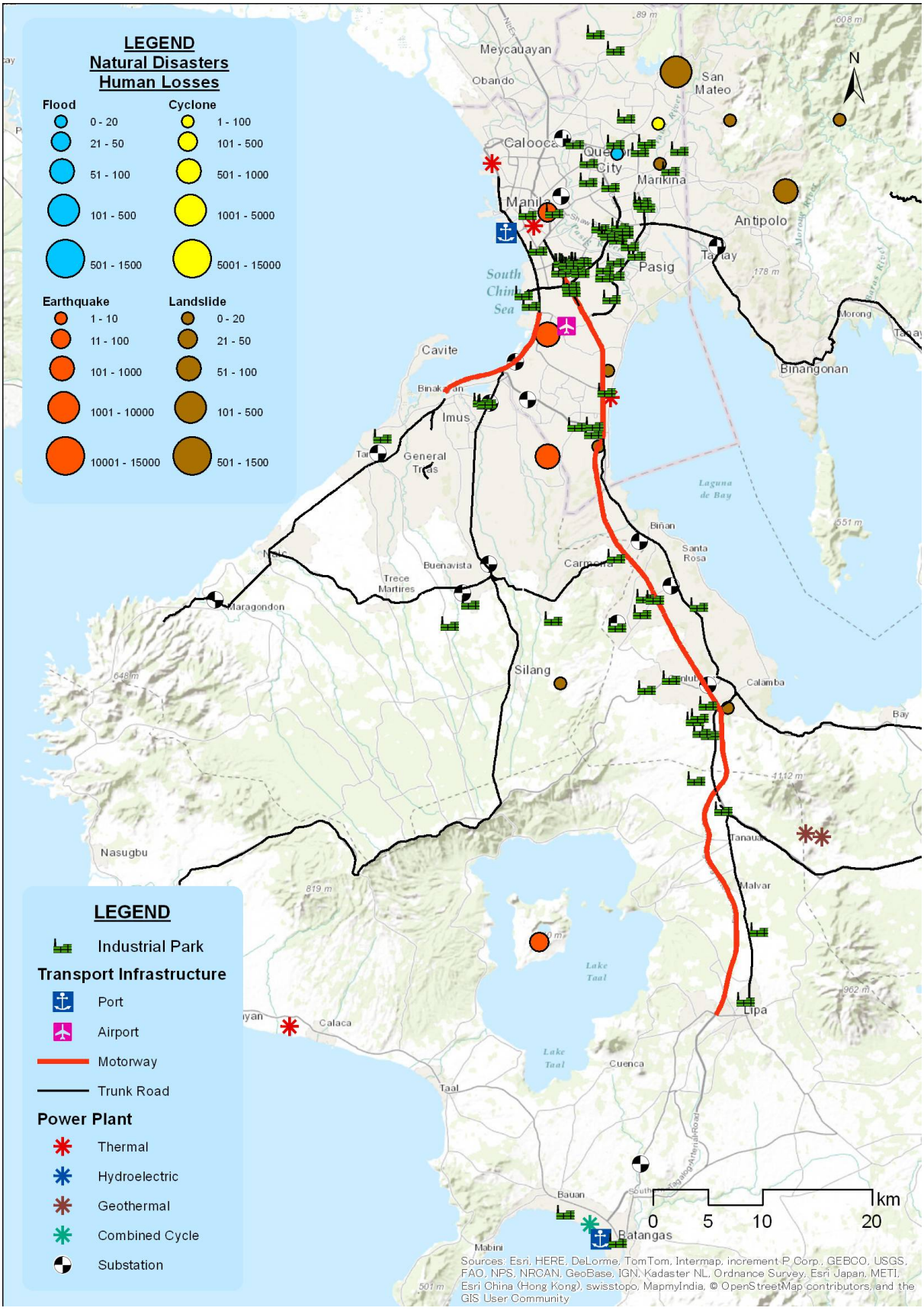


Figure 5.4 Locations of Natural Disasters in the Pilot Area of the Philippines (Cavite, Laguna, and the Southern Part of Metropolitan Manila)

Profile of the Pilot Area

In the risk profile compiles reports of the following information:

- Outline of the Pilot Area
- Outline of Local Authorities
- Present State of Industrial Agglomerated Areas
- Transport Infrastructure Conditions
- Lifeline Facilities and Public Services
- Economic Relations with Neighboring Regions and Japan
- Current status of implementation of BCP
- Current status of disaster risk management

The table of contents of risk profile repot is attached in Appendix 3.

6. Conclusions

"Risk-informed decision making" is the fundamental approach used for Area BCM. Selection of critical natural disasters seriously affecting the area, development of disaster scenarios, specifying bottlenecks of the area in case of disaster, review of Area BCM strategy, selection of measures, and others are advised to be conducted based on risk information such as the hazard situations, disaster risks, social infrastructures, and disaster management systems and their capacity.

Similarly, the approach is important for planning and implementing BCM and disaster management of individual organizations, disaster risk management of the area, and sustainable development of the area.

On the other hand, one of the major issues of implementing Area BCM is how the stakeholders can have access to hazard and risk information as well as technical and scientific methods for hazard and risk assessments. This is a big challenge for the private sector, especially for SMEs. It is indispensable that hazard and risk information be displayed simply for easy understanding and easy application to decision makings.

In order to fulfill the gap of risk information, it is beneficial to have a portal site that provides information sources for planning mitigation and prevention measures, emergency responses, and rehabilitation and reconstruction. Such information can be used not only for Area BCM, but also for BCMs of individual organizations and disaster risk reduction planning of local governments. It is the responsibility of the national government or local government to prepare the portal site. This is a separate approach for them from the promotion of Area BCM.

The country reports and risk profile reports prepared by the study were the very first versions of the portal site for the countries and the pilot areas, respectively. It is expected that responsible organizations of the countries and the pilot areas will improve and revise those reports with information that is local and more detailed.

In the future, it is expected that the risk information would be opened to the public through, for example, WebGIS for wider usage by broader range of users.

Appendix 1 References

Final Report

AHA Centre and JICA (2015): Final Report, "The Study on Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region", March 2015.

Guidebook and Toolkits

AHA Centre and JICA (2015): Main Volume, Tools for Area BCM, "Planning Guide for Area Business Continuity, ~ Area BCM Toolkits ~", Version 2, March 2015.

AHA Centre and JICA (2015): Supplemental Volume, Tools for Area BCM, "Planning Guide for Area Business Continuity, ~ Area BCM Toolkits ~", Version 2, March 2015.

Toolkits in Supplemental Volume

AHA Centre and JICA (2015): Area Business Continuity Plan (Area BCP), Version 2, Karawang and Bekasi, West Java, Indonesia, March 2015.

AHA Centre and JICA (2015): Area Business Continuity Plan (Area BCP), Version 2, Cavite, Laguna and the Sothern Part of Metro Manila, the Philippines, March 2015.

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Country Report

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AHA Centre and JICA (2015): Country Report, Indonesia, March 2015.

AHA Centre and JICA (2015): Country Report, Laos, March 2015.

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AHA Centre and JICA (2015): Country Report, Vietnam, March 2015.

Report for the Pilot Areas

AHA Centre and JICA (2015): Risk Profile Report ~ Bekasi and Karawang of Indonesia ~, February 2015.

AHA Centre and JICA (2015): Risk Profile Report ~ Cavite, Laguna and Southern Part of Metro Manila of the Philippines ~, February 2015.

AHA Centre and JICA (2015): Risk Profile Report ~ Hai Phong of Viet Nam ~, February 2015.

International Disaster Database

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.glidenumber.net/glide/public/search/search.jsp.

National Oceanic and Atmospheric Administration (NOAA), National Geophysical Data Center (NGDC): http://ngdc.noaa.gov/hazard/hazards.shtml

Asian Disaster Reduction Center (ADRC), Disaster Information:
http://www.adrc.asia/latest/index.php

Global Disaster Alert and Coordination System (GDACS):
http://www.gdacs.org/resources.aspx.

Global Risk Data Platform:
http://preview.grid.unep.ch/index.php?preview=home&lang=eng.

Appendix 2 Contents of Country Report

(ex. the Philippines)

Appendix 3 Contents of Risk Profile Report

Chapter 1 Disaster Risks of the Pilot Area

1.1 Overview
1.2 Identification of Predominant Hazards
1.3 Disaster Risk for Storm Surges and Floods
1.4 Hazard and Risk Information Sources

Chapter 2 Natural Hazards in the Pilot Area

2.1 Floods
2.2 Typhoons/Meteorological Hazards
2.3 Storm Surges
2.4 Earthquakes
2.5 Tsunamis
2.6 Volcanoes

Chapter 3 Outline of Natural Hazard Assessments

3.1 Seismic Hazard Assessment
3.2 Tsunami Hazard Assessment
3.3 Flood Hazard Assessment
3.4 Storm Surge Assessment

Chapter 4 Profile of the Pilot Area

4.1 Outline of the Pilot Area
4.2 Outline of Local Authorities
4.3 Present State of Industrial Agglomerated Area
4.4 Transport Infrastructure Conditions
4.5 Lifeline Facilities and Public Services
4.6 Economic Relations with Neighboring Regions and Japan
4.7 BCP Implementation Conditions
4.8 Current State of Disaster Risk Management

Appendix Details of Natural Hazard Assessments

A.1 Seismic Hazard Assessment
A.2 Tsunami Hazard Assessment
A.3 Flood Hazard Assessment
A.4 Storm Surge Assessment

(ex. Hai Phong, Vietnam)