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Monographic issue

VIETNAM DISASTER RISK PROFILE

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Letter from the editors

The Emergency and Disaster Reports is a journal edited by the Unit for Research in Emergency and Disaster of the Department of Medicine of the University of Oviedo aimed to introduce research papers, monographic reviews and technical reports related to the fields of Medicine and Public Health in the contexts of emergency and disaster. Both situations are events that can deeply affect the health, the economy, the environment and the development of the affected populations.

The topics covered by the journal include a wide range of issues related to the different dimensions of the phenomena of emergency and disaster, ranging from the study of the risk factors, patterns of frequency and distribution, characteristics, impacts, prevention, preparedness, mitigation, response, humanitarian aid, standards of intervention, operative research, recovery, rehabilitation, resilience and policies, strategies and actions to address these phenomena from a risk reduction approach. In the last thirty years has been substantial progress in the above mentioned areas in part thanks to a better scientific knowledge of the subject. The aim of the journal is to contribute to this progress facilitating the dissemination of the results of research in this field.

This present monographic issue is dedicated to the Vietnam disaster risk profile.

The Vietnam is located on the Southeastern Asia, bordering the Gulf of Thailand, Gulf of Tonkin, and South Sea. It is bordered by China to the north, Laos and Cambodia to the west, and sea on the east, south and southeast. Vietnam possessing more than 3000 islands, including the large islands of Hoang Sa (Paracel Islands) and Truong Sa (Spratly Islands).

Due to geographically located, Vietnam is recognized one of the most disaster prone regions of the world, this country frequently faces to severity storm, occasional typhoons with extensive flooding, especially in the Mekong River. Besides that this rapidly developing country is not only highly exposed to a variety of other natural disasters but also impacted of technology disasters.

This disaster risk profile mapped out the overall hazard occurred in five decades (from 1964 to 2014) in Vietnam and its corresponding vulnerability due to geological, environmental and socio-economic factors.

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ABBREVIATIONS

AADMER: ASEAN Agreement on Disaster Management & Emergency Response

CARE: Cooperative for American Remittances to Europe

CCFSC: Central Committees for Flood and Storm Control

CRED: Centre for Research on the Epidemiology of Disasters

DRR: Disaster Risk Reduction

IFRC: International Federation of Red Cross and Red Crescent Societies

INGO: International Non-Government Organization

EMDAT: Emergency Events Database

GDP: Gross Domestic Product

GFDRR: Global Facility for Disaster Reduction and Recovery

HFA: Hyogo Framework for Action

MoH: Ministry of Health

OCHA: Office for the Coordination of Humanitarian Affairs

SCFSC: Steering Committees for Flood and Storm Control

UN: United Nations

UNDP: United Nations Development Programme

UNISDR: The United Nations Office for Disaster Risk Reduction

UNDRMT: United Nation Disaster Risk Management Team

1 INTRODUCTION

In recent years, the world has faced an increase in the frequency and severity of natural disaster. Due to geographically located, Vietnam is recognized one of the most disaster prone regions of the world¹, this country frequently faces to severity storm, occasional typhoons with extensive flooding, especially in the Mekong River delta (2,11). Besides that this rapidly developing country is not only highly exposed to a variety of other natural disasters but also impacted of technology disasters. According to sources from EMDAT, UNISDR, databases are analyzed to show consequences as well as frequency of disasters happened including natural and man-made disasters in Vietnam.

Furthermore, Vietnam has been listed one of the countries were alarmed about growth up of climate change which cause increasing catastrophic natural hazard.

To reduce impact of natural hazards, Vietnam Government's Policies have been issued to organize, introduce, monitor, follow, practice, and evaluate action in risk reduction and response to disaster.

Geography feature in Viet Nam

Vietnam is located on the Southeastern Asia, bordering the Gulf of Thailand, Gulf of Tonkin, and South Sea. It is bordered by China to the north, Laos and Cambodia to the west, and sea on the east, south and southeast. Vietnam possessing more than 3000 islands, including the large islands of Hoang Sa (Paracel Islands) and Truong Sa (Spratly Islands). The country has a total area of 331,210 square km and a long coastline 3,444km (excluded islands) (11).

The topography has a complex terrain including low, flat delta in south and north; central highlands; hilly, mountainous in far north and northwest and islands, with the "S – shaped" the largest onshore approximately 500km and the narrowest place nearly 50km (27)(Quang Binh Province, the central of Vietnam). Three fourths of the country is covered by mountains and hills, a rest is plain separated into many areas by hills and mountain. Vietnam has a high density of system river network about 2,360 rivers in which The Red River Delta (16, 700square km) in the north and Mekong River Delta (40,000 square km) in the South are the country's two biggest plains. Besides that, a chain of small deltas are located along the central coast, from the plains of the Ma River basin (Thanh Hoa) to Phan Thiet with a total area of 15,000 square km. Because mountain and hill are almost covered the way from the North to the South so it is difficult to transport between regions especially in the rainy season.

Occurred in both a tropical and a temperate zone, Vietnam is characterized by strong monsoon tropical type with high temperature and humidity. There is significant variation in climate between regions. The North regions located near the tropics are affected by monsoon significantly and endowed with a temperate climate with feature two typical seasons: the hot season is from May to October and the cold season is from November to coming April, average temperature fluctuates from 21°C to 27°C. Due to located near the equator, The South regions are mainly affected by southeast monsoon with heat and wetness around year and the difference in temperature between the two seasons is almost unnoticeable the average temperature about 26°C to 29°C. On general the average temperature in Vietnam ranges from 18°C to 29°C and the average rainfall is 1,680mm. (31)

Statement about climate on Vietnam report: “*Vietnam’s climate is favorable for tropical agricultural development but negatively influences on economic development in general and agriculture in particularly due to regular threats of storm, tropical low pressures, flood and other disasters.*”(1)

People

Population: 88.772.900, male: 43.907.200 (49, 46%) female: 44.865.700 (50, 54%).

Population density: 268(people/km²),

Population growth annual: 1(%) (2011)(Gapminder)

Key indicators: GDP per capital USD: 757 (2011)(Gapminder)

Life expectancy: 71 (2010) (Vietnam country profile)(1)

Mortality children under 1 year old: 15.8 (2010)

Mortality children under 5 years old: 23.8 (2010)

Population affected by natural disasters (average/year/million people): 19,794

World risk index: 34 (173)

Economic:

As know agricultural country, Vietnam were ranked 2nd on the world about rice export(13,23). Besides that, other famous agricultural products like: coffee, tea, contribute an enormous in economic development, base on Vietnam’s report 2004 “the export value of rice, aquatic products, coffee, cashew and other forest products surmounts up to 3 billion USD, making up 30% of the entire export turnover and over 50% of the share of agricultural production in GDP”.(3)

2 OBJECTIVE

The disaster profile in Vietnam was conducted with the following objectives:

- i) To determine the probability of hazards across different regions of Vietnam based on geological
- ii) To identify disasters occurred in five decades (from 1964 to 2014) including natural and technological disasters: types, time of occurred.
- iii) To assess the impacts of disasters on socio-economic factors, population's lives, health, ecological environment
- iv) To analysis the hazards and range of vulnerability factors
- v) To identify disaster prevention and response strategies implemented by government system (and community –based disaster risk management CBDRM)
- vi) To identify structure and characteristic of the emergency and disaster response framework in Vietnam

This analysis will help map out the overall hazard context of Vietnam and its corresponding vulnerability due to topographical, environmental and socio-economic factors.

3 METHODOLOGY

To analyse risk profile needs two key components: hazard assessment and vulnerability assessment.

To evaluate hazard: using databases sources such as: CRED-EMDAT, Relief web, Prevention.

To evaluate vulnerability: reviewing National Report, official website of Vietnam government like Central Committee for Flood and Storm Control, General Statistics Office, articles, books, reviews

Besides that other resources like webistes OCHA, UN, UNISDR or tools like Gapminder were used.

4 BACKGROUND AND CONTEXT

Located in the tropical monsoon area of the northwestern Pacific, Vietnam is well known as one of the most likely to disaster happen in the world. Period researched was included war for independent (1964 – 1975), so damages in that may be exaggerated.

Base on database source of CRED, EM-DAT, period from 1964 to 2014 more than 254 disasters occurred have caused 84,836,083 people affected including deaths (27,329 people), injured (15,422 people), homeless (4,766,345 people). It can be important seen that Vietnam has been suffered dramatically by natural disasters 189 natural disasters recorded nearly three times to technology disasters (65 events) and were root of 25,097 deaths (91,83% in total). Besides that the damages were calculated \$10,619,282 affected (80,054,316 people).

4.1 Natural disaster:

Vietnam is located in the tropical monsoon area, considered one of five storm hubs of Pacific Asia, and is regularly faced with various disasters such as: flood, flash flood, storm, storm surge, tropical depression, and inundation, whirlwind, coastline erosion, hail rain, drought, landslide, forest fire.

Due to different in geographic position and topographic condition, Vietnam is divided into eight areas prone-disaster including: North east and North west, Red River Delta, North central coast, South central coast, central highlands, North east south, Mekong river Delta, Coastal Economic Zone (table 4.1.2).

Trend of natural disasters occur: As can be seen from statement from the Report: Country Disaster Response Handbook (20), author expressed because of increasing significantly of climate change in Vietnam in recent years, hazard natural has intensified not only magnitude, frequency but also volatility such as rising rainfall events, very high frequency of floods and flash floods, seasonal river floods and coastal floods in almost regions of this country. And on the report of Government 2004 (1) also mentions that global climate change rose dramatically disaster events from late 1990s, and leading loss of live, livelihoods, and property.

In general, on the whole country catastrophe hazards natural occur heavily on water related disasters such as flood and flash flood or storm and drought. Moreover, each region in the country has suffered more different disasters such as: in the Northern mountain (the Red river) was subjected to extensive landslides, fire, silting, whirlwind, inundation as 80 percent areas is covered by hill and mountain's terrain combined; in the Coastal central provinces with narrow plains separated, sloping topography were subjected to salt penetration, whirlwind, inundation, fire, industrial and environmental hazard; in the Southern Delta (Mekong river) with large areas mangroves were enduring with whirlwinds, landslides, forest fires, sea water intrusion, prolonged deep inundation, river bank erosion; opposite to

above areas, in the Central high regions with almost mountain surrounding were faced to forest fires, landslides, whirlwinds and industrial and environmental hazard significantly. (Table 4.1.2)(1,2,3,15,20)

Table 4.1.1: disaster relative frequency in Vietnam can be classified as follows (source: The Government report documents on 2004)(1)

High	Medium	Low
Flood, Inundation	Hail rain	Earthquake
Typhoon, tropical depression	landslide	Accident (technology)
Flash flood	Forest fire	Frost
Tornado	Salt water intrusion	
Drought		

Table 4.1.2: Assessment of disaster severity in different geographic areas and in the coastal economic zone of Vietnam (source: Governmen report 2004)(1)

Very severe (++++)

Severe (+++)

Medium (++)

Light (+)

None(-)

Disaster	Geographic Areas and Economic Zones							
	North East and North West	Red River Delta	North Central Coast	South Central Coast	Central Highlands	North East South	Mekong River Delta	Coastal Economic Zone
Storm	+++	++++	++++	++++	++	+++	+++	++++
Flood	--	++++	++++	+++	+++	+++	+++++	++++
Flashflood	+++	--	+++	+++	+++	+++	+	+++
Whirlwind	++	++	++	++	+	++	++	++
Drought	+++	+	++	+++	++	+++	+	+++
Desertification	--	--	+	++	++	++	+	++
Saline intrusion	--	+	++	++	+	++	+++	++
Inundation	--	+++	++	++	--	++	+++	+++
Landslide	++	++	++	++		++	+++	++
Storm surge	--	++	++	++	++	++	+++	++
Fire	++	+	++	+++	--	+++	+++	+++
Industrial and environmental hazard	--	++			+++	+++		+++

Source: GOV 2004

Data analyze:

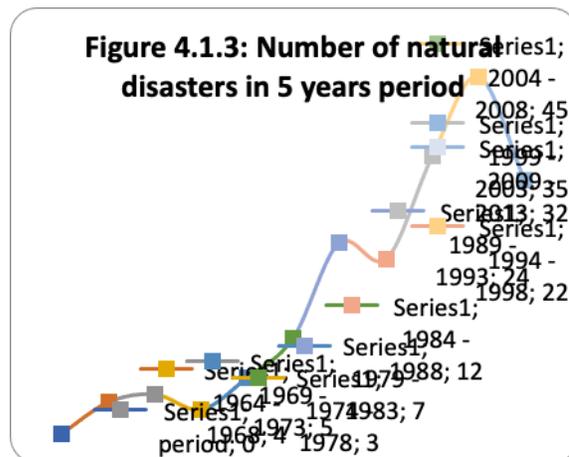
As be seen on data recorded on EM-DAT, in five decades, Vietnam has experience 189 natural disasters in which hydro-meteorological events such as flood, storm are the most of phenomenon happened 166 events taking about 87, 83% in all. Besides that the number of epidemic events takes about 10 incidents (5, 29% in total). Climatological events such as drought, wildfire have been recorded with a small number 6 events (3,17% in total) but have a trend to increase in recent years due to climate change. (figure 4.1.3)

Illustrated in figure 4.1.3, number of catastrophic natural hazard in Vietnam for each period indicated rising from 1979 and reach the top in period 2004 to 2008, from 2009 to 2013 it shows a light decrease.

Table 4.1.5: Natural disasters in Vietnam from 1964 to 2014

Disaster subgroup	times occurred	Percentage
Wildfire	1	0.53%
Insect infestation	1	0.53%
Drought	5	2.65%
Epidemic	10	5.29%
Mass movement wet	6	3.17%
Flood	74	39.15%
Storm	92	48.68%

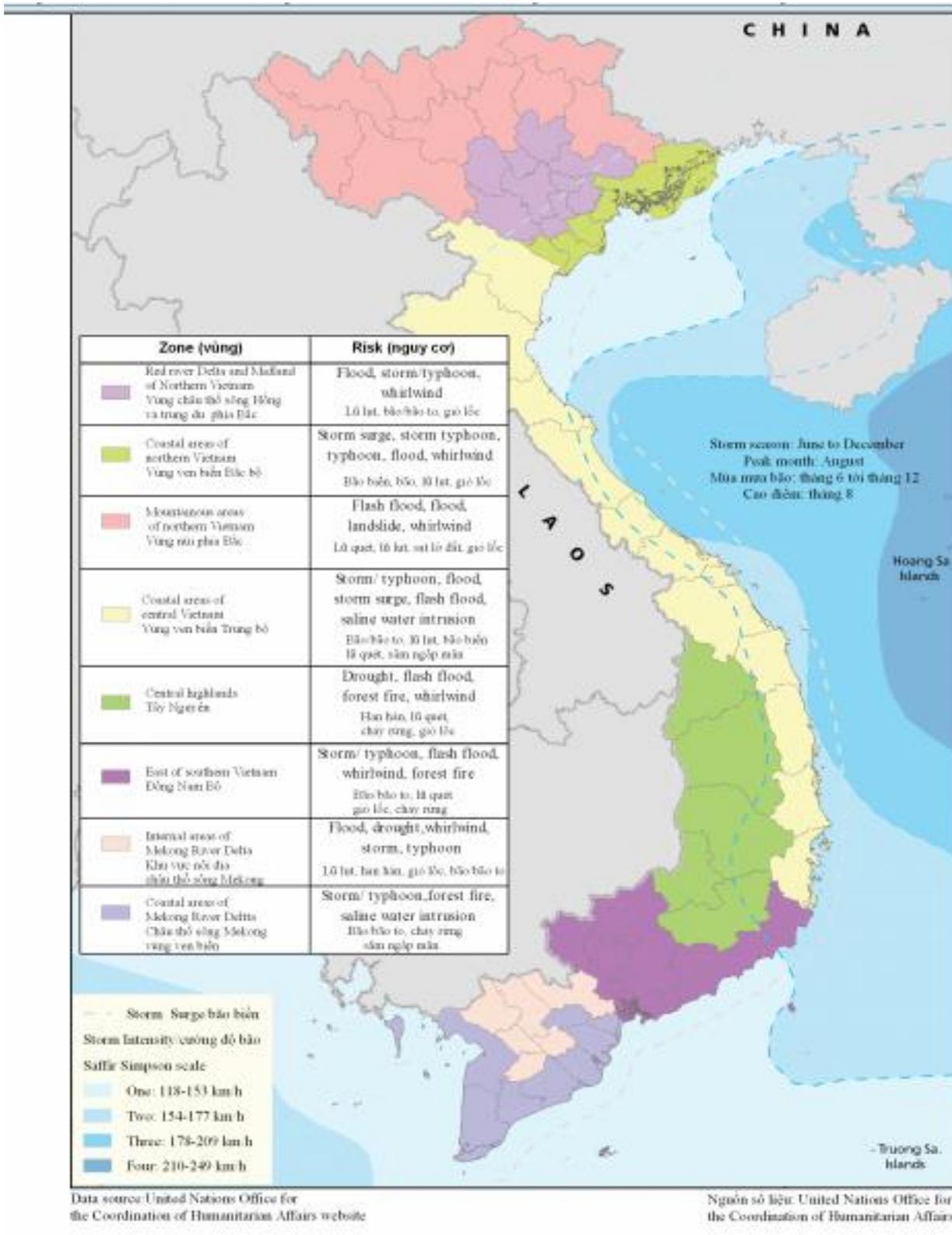
Figure 4.1.3: Number of natural disasters in 5 years period



Total	189	100%
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Figure 4.1.4: total affected of natural disaster from 1964 to 2014 (EMDAT)

Occurrence	Deaths	Injured	Affected	Homeless	Total affected	Total damage ('000\$)
189	25097	13702	80041355	4765815	84820872	10614782



Map 2: Natural Hazard Risks in Vietnam

Source: An atlas of communicable disease in Vietnam from 2000 to 2011, WHO, MoH, USAID.(2)

4.2 Technology disasters

Since the independent of the Vietnam Democratic Republic in 1975, so it seems that data about technological disaster before 1975 were not recorded, the analysis data were taken period from 1975 to 2014.

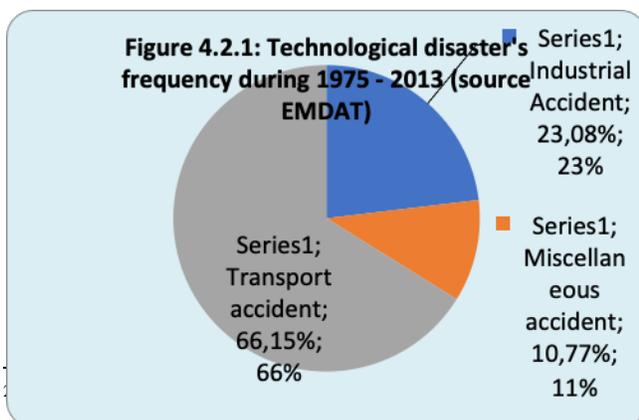
Although technology disasters were assessed less occurred than natural disasters (1), its effects are not minor. As can be seen in the figure 4.2 that frequency of technological disasters in Vietnam has grown up in recent years, and from 1975 to 2014, transport accident were recorded 43 events and industrial accident 15 events about 66.15% and 23.08% respectively (figure 4.2.1) (table 4.5). According to the Vietnam Labour Ministry estimated, there were 120,000-130,000 workplace accidents from 2005 to 2010, killing around 12,000 people. In other words, some 2,500 people, including innocent pedestrians passing construction sites, are killed every year.²

As small accidents happened frequently were not recorded so in reality damages are more likely high. From report of Paivi Hamalainen et al, (2006)(32) pointed out the fatality rate due to occupational accidents in Vietnam was 27.0 and accident rate was 20605.

As can be seen from the figure 4.2.2 peak of death happened in the period 1985 – 1994, while number of disasters reach a top with 28 events recorded in 1995 – 2004 and show a trend decrease in the period 2005 – 2014. Whilst number of events and deaths were rising down, number of people affected show an increasing trend (figure 4.2.3). Among technological hazards, transport accidents dominant risk in Vietnam (Figure 4.2.1)

The period 1985 – 1994 was the worst in terms of number of deaths with 769 people with only 12 events it means 64 killed/event, while 1995 – 2004 was the time when the number of events reach a top with 28 events in which transport accident 18 (64%).

Figure 4.2.1 shows that among technological hazards, transportation caused the largest number of deaths 1297 affected the largest population



<http://www.wsws.org/en/articles/2011/01/viet-j21.html>

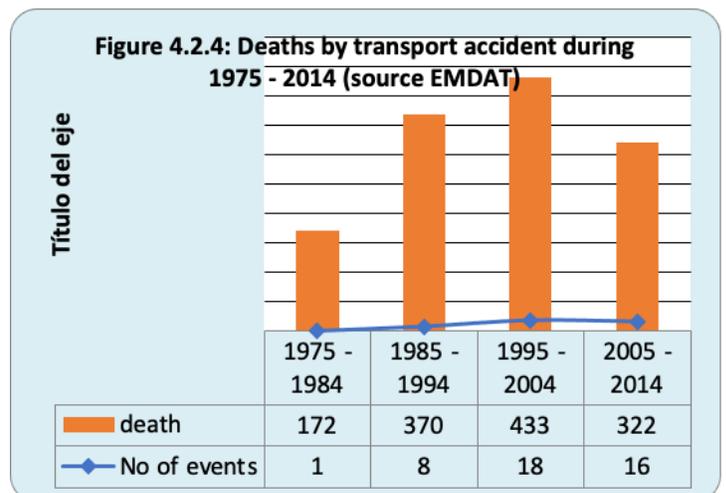
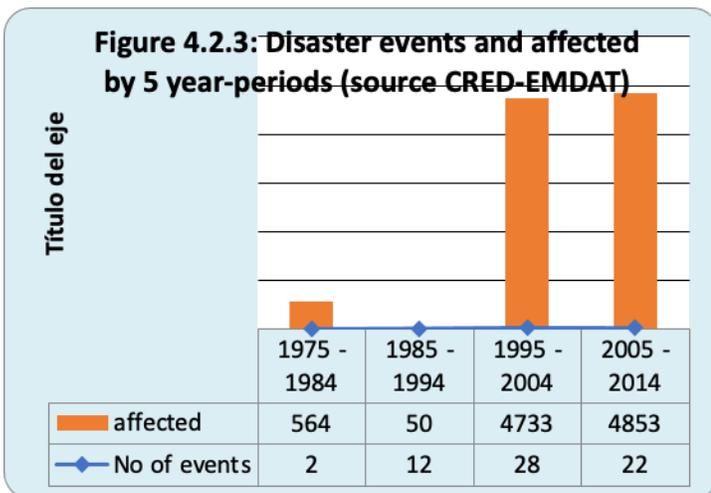
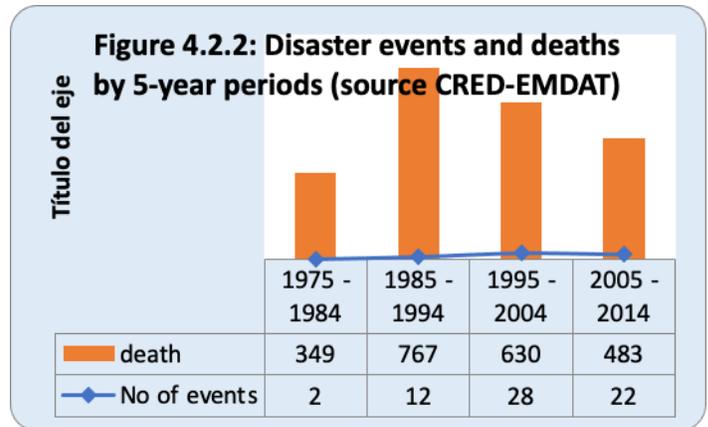


Figure 4.2.4: Total affected of technological disaster from 1964 to 2014 (EMDAT)

Occurrence	Deaths	Injured	Affected	Homeless	Total affected	Total damage ('000\$)
65	2232	1720	12961	530	15211	4500

4.3 General impact

It is clearly seen that disasters have been occurring all the seasons and every part of the country, its impact caused huge losses in terms of lives and assets, and destroying socioeconomic and cultural infrastructures, as well as natural environment. According to report of CCFSC 2005, SRV 2007, from 1995 to 2005 severity natural disasters have killed more than 7,500 people and “have seriously damaged assets, with losses estimated to be equivalent to about 1.5 percent of the country’s GDP. The disasters afflicting Vietnam have increased in terms of severity, as well as frequency”.(3)

Based on data on CRED, EM-DAT, the period from 1900 – 2014, the following natural disasters has been most catastrophic individually, is showing the top 10 natural disasters in the period of last 114

years. From consequence of top 10 natural disasters, storms are the dominant risk in Vietnam, followed by floods and third is drought for all indicators: death, affected and economic.

4.3.1 Consequence from top 10 natural disasters report in Viet Nam for the period 1900 to 2014 (database from EMDAT)

1) Affected people

Disaster	Date	No Killed
Storm	Sep-64	7000
Storm	2/11/1997	3682
Storm	26/09/1953	1000
Storm	23/10/1985	798
Storm	25/05/1989	751
Flood	25/10/1999	622
Epidemic	1/1/1964	598
Storm	24/07/1996	585
Storm	Sep-83	578
Flood	Jul-00	460
total		16074

2) Economic damage

Disaster	Date	No Total Affected
Storm	15/09/1980	9027174
Storm	23/07/1980	6624710
Flood	Jul-00	5000004
Storm	Oct-89	4635762
Flood	Aug-78	4079000
Flood	25/10/1999	3504412
Drought	Dec-97	3000000
Flood	7/9/1985	280000
Storm	6/9/1986	2502502
Storm	28/09/2009	2477315

3) Killed people

Disaster	Date	Damage (000 US\$)
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Storm	28/09/2009	785000
Storm	11/11/2013	734000
Storm	30/09/2013	663230
Storm	27/09/2006	624000
Flood	27/10/2008	479000
Storm	2/11/1997	470000
Storm	30/11/2006	456000
Drought	Dec-97	407000
Storm	24/07/1996	362000
Flood	10/11/2007	350000

“For some natural disasters (particularly floods and droughts) there is no exact day or month for the event, and for other disasters (particularly pre-1974) the available record of the disaster does not provide an exact day or month”

4.3.2 Consequence from top 10 technological disasters report in Viet Nam for the period 1900 to 2014 (database from EMDAT)

From the figure 4.2.2, it can be shown that the routinely of industrial accidents took about 23% less than transport crashes 64% but its damage caused more deaths than transport accident significantly.

Figure 4.3.2:

Disaster	Date	No Killed
Industrial Accident	Jun-91	300
Industrial Accident	1981	177
Transport Accident	4/4/1975	172
Transport Accident	8/3/1989	130
Industrial Accident	26/09/2007	64
Miscellaneous accident	29/10/2002	60
Transport Accident	14/02/2000	57
Transport accident	17/12/2010	53
Transport Accident	25/06/1988	50
Transport Accident	2/3/1998	50

Total affected people

Disaster	Date	No Total Affected
Miscellaneous accident	6/3/1967	5011
Industrial Accident	12/10/2013	4512
Industrial Accident	5/5/2003	3500
Industrial Accident	1981	564
Miscellaneous accident	6/6/2001	504
Industrial Accident	13/07/2004	400
Miscellaneous accident	29/10/2002	100
Industrial Accident	26/09/2007	80
Transport Accident	12/3/2005	70
Miscellaneous accident	2/5/2003	55

Economic damage costs

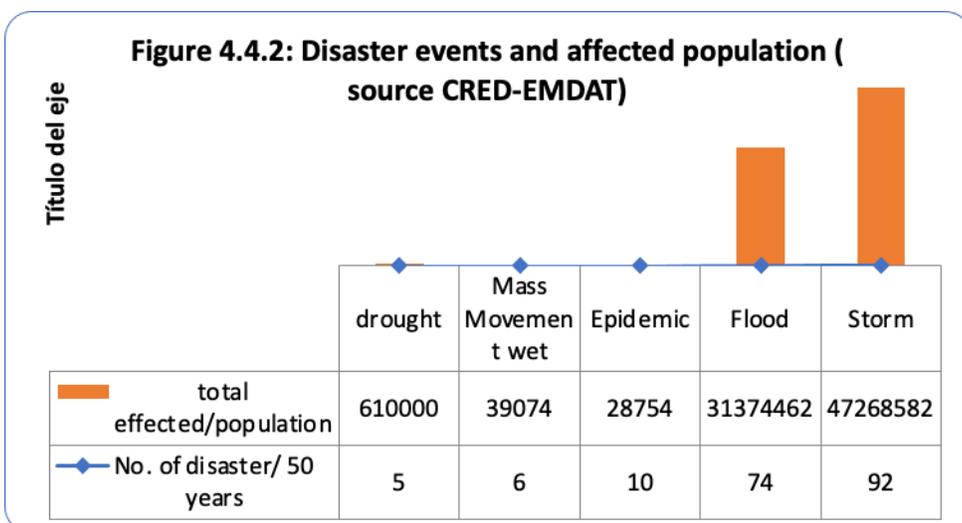
Disaster	Date	Damage (000 US\$)
Miscellaneous accident	29/10/2002	2000
Industrial Accident	26/09/2007	2000
Miscellaneous accident	6/3/1967	500

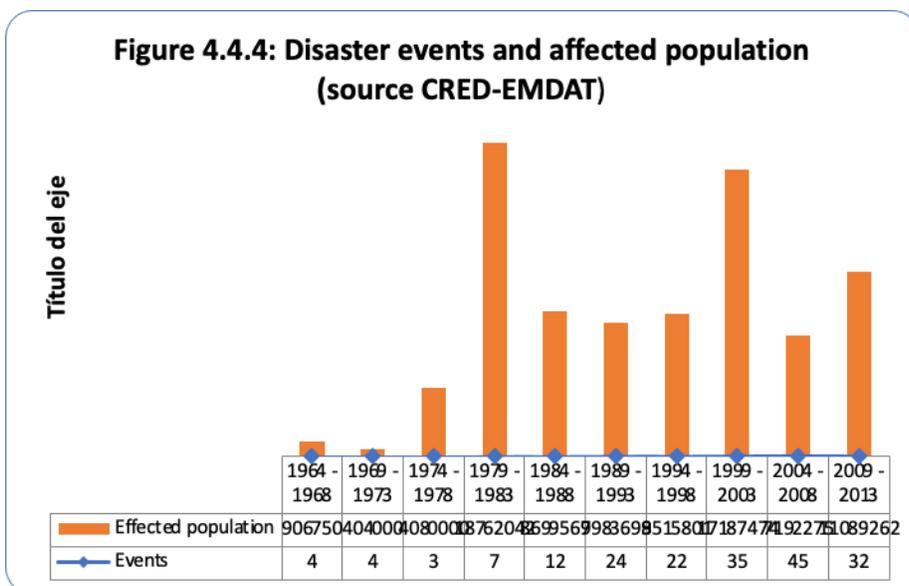
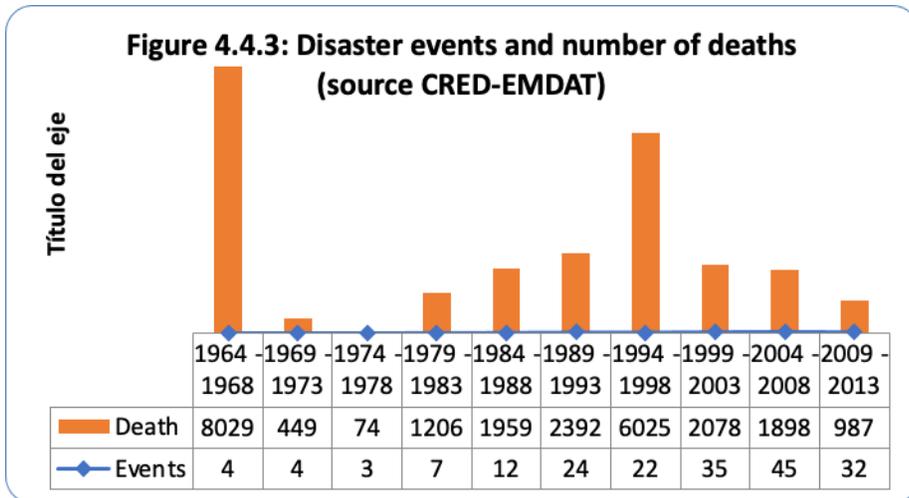
4.4 Impacts of natural disaster on human lives

Viet Nam is considered the most disaster prone countries of the world. Major disasters occur at least every decade and left behind severe consequence to people especial to the most vulnerability. According to table 4.1.2 shows more than 84,000,000 affected in which 25097 death. Most of them were influenced by storms 17959 people death and 47,268,582 affected, the 2nd killer disaster was flood, killing 5626 and affected 31,374,462 while 3rd was epidemics by killing 1182 and drought caused 610,000 people affected.

Figure 4.4.3 and 4.4.4 demonstrate trend natural hazard happened and impacted in 5-years periods (1964 to 2014). As be seen that events reached a top in the period 2004 – 2008, in recent years 2009 – 2013 illustrated light decrease. Furthermore, it is apparent that number of deaths went downwards, the highest in the period 1964 -1968 with 8029 death, 4events, and average 2007 death/events. Whilst

volumes of people affected were fluctuating depend on each year.





4.5 Impacts of natural disasters on economy

After events happened, not only did its consequences act to human health, but impact to the countries economic especial in developing countries. According to Tran Huu Tuan about natural disaster consequences in Vietnam: “Disasters are the considered an obstacle to economic growth and sustainable development because they result in environmental degradation and they widen the poverty gap and increase the poverty rate in the population, especially in disaster-prone areas” (3) .

Annually Viet Nam coast is hit by typhoon cyclones which causing massive floods and flash floods, inundation associated especially in two largest plains Red River Delta and Mekong River Delta. The regular effect cause extensive and repeated damage to housing and infrastructures, interrupt schools time or destroy bridges as well as losses to agriculture, forestry, and fishery sector. These losses have a direct knock on effect on the capacity of the family and the community to develop and move beyond poverty such as: on agriculture major catastrophe natural happened affected harvest, quantity and

quality product, on aquaculture: fisheries fish and shrimp ponds were destroyed because of water over dyke systems and breakwaters; on infrastructure, many construction were swept such as schools, houses, workshops, many roads, bridges, and telecommunication systems. (1,3)

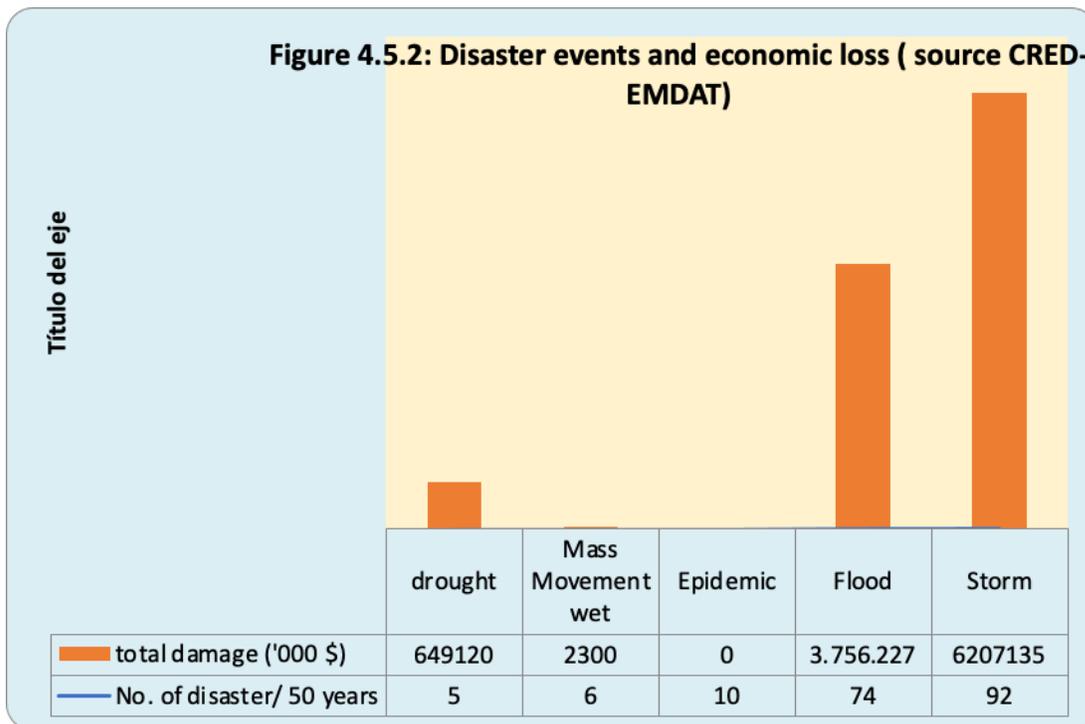
Besides that according to Tran Huu Tuan (3)in his paper also takes a view that Vietnam GDP structure is “20.3 percent for agriculture, forestry and fishery; 41.6 percent for industry and construction; and about 38 percent for services. Although the agriculture, forestry and fishery sector occupies the smallest share of the country’s GDP, it plays an important social security role, especially for the population that lives in rural areas”. As a result the harm caused by disasters impact strongly on vulnerable people whose livelihood depends on agriculture.

In a study of social vulnerability of a coastal Vietnam district, “Adger (1999) showed, among other factors, how this was affected by the increased regional autonomy, de-collectivization, and changes in land allocation systems over time and across different communes. Farmers in more hazard-prone ecosystems of Vietnam have been less well placed to take advantage of higher-yielding but less hazard-tolerant strains of rice” (3)

It can be summarized as living standards decline significantly because its affect on all aspects socioeconomic like: make slow down the process of hunger alleviation, prevent and postpone poverty reduction, especially in regions suffering a high frequency of disasters; cause high negative impact to development of educatio, especially in mountainous areas and the Mekong River Delta. Disasters also cause great problems for vulnerable people such as the elderly, disable, women and children.

Data analysis

As be shown on figure 4.5.2 over the period 1964 to 2004, total economic losses reported were 10,614,782,000 or 212,295,640/year, means 7% /year in total of export value of agricultural product. (Using data on Government report 2004 (1), the export value of agricultural product sum up 3 billion USD)



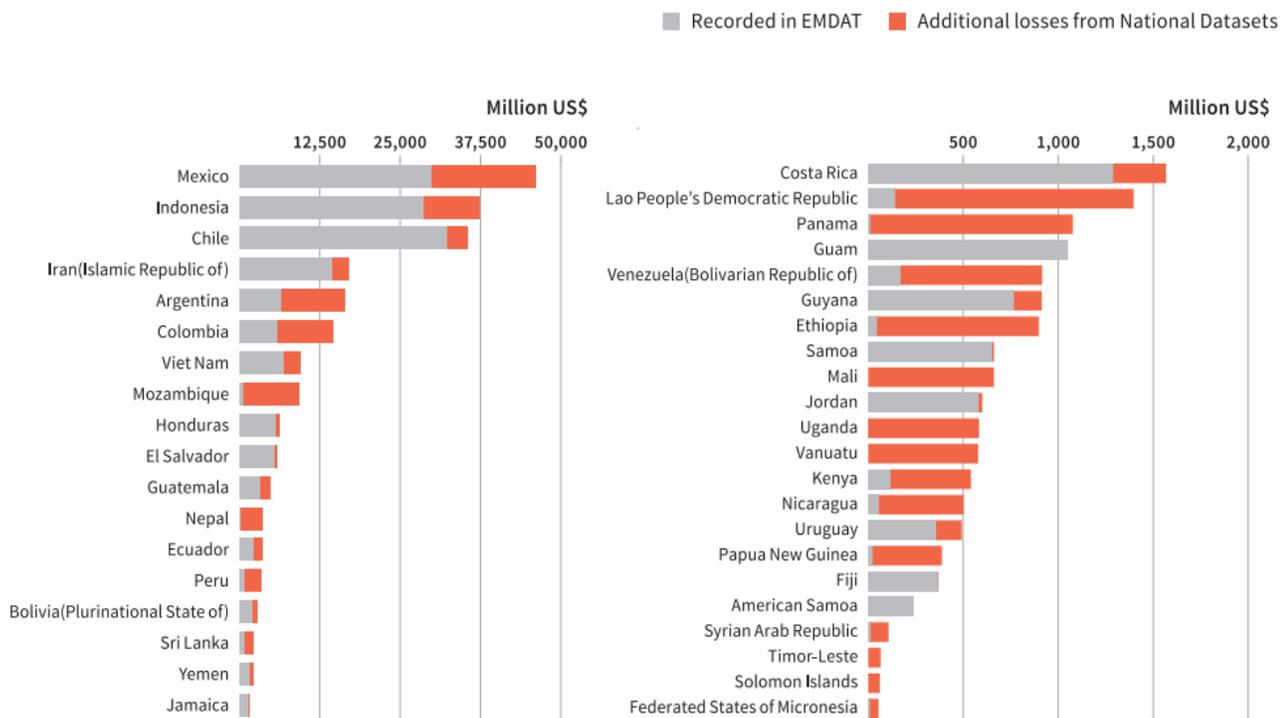
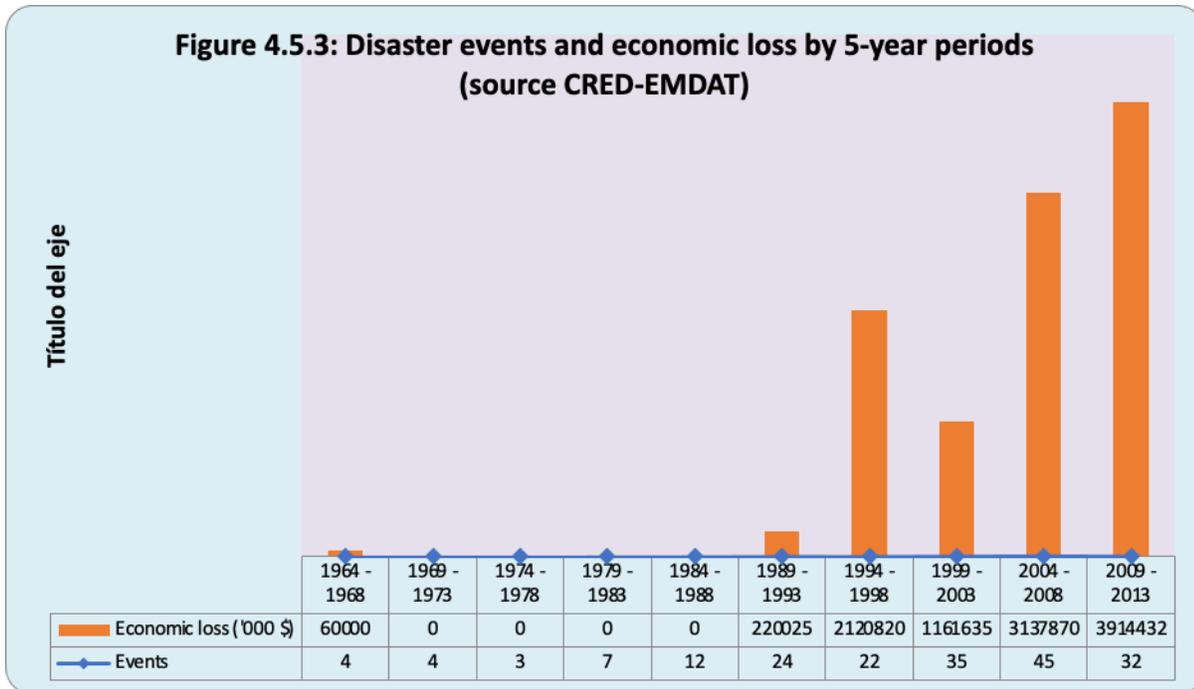


Figure 4.5.1: Direct economic losses in 40 countries as estimated from national global loss database, 1981 – 2011 (in million US\$) (GAP 2013 report)(35)

The impact on agricultural

It can be seen clearly that Vietnam is an agricultural country, so the impact of disaster to cultivation enormous. Annually the Viet Nam coast is hit by tropical storms and typhoons and associated flooding, at a rate of 4 to 6 a year or more, which are in effect almost regular disasters cause extensive and repeated damage to housing and infrastructure as well as losses to agriculture and fisheries. These losses have a direct knock on effect on the capacity of the family and the community to develop and move beyond poverty. Along with economic growth in Viet Nam the levels of economic loss climbed steadily since 1985, reaching over 700 million US \$ by 1996". (17)

These affects could be in "*growing periods, crop calendars and crop distribution, pest increases, and virus activity*" or "*floods and inundation cause losses of food stocks, as well as crops in the field. Drought and salt water intrusion during the dry season affect the summer rice crop*".(3)

5 DISASTER HAZARDS AND VULNERABILITY

“Disasters in the world produced by natural hazards are an increasing reality” and “Hazards always occur in the same areas, with varying severity and with varying frequency” (Glòria Furdada, Group RISKMAT. Dpt. Geodinàmica i Geofísica, Fac. de Geologia. Universitat de Barcelona)

Definite disaster base on UNISDR 2009 “Disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using their own resources.” Located in the tropical monsoon area of the Northwestern Pacific, Vietnam is occurred by a range of catastrophe natural disasters including floods and flash floods, tropical storms, droughts and landslid, in report of UNISDR 2009 (Global Assessment Report on Disaster Risk Reduction) ranks Vietnam the fourth in the global in terms of the absolute number of people exposed to floods, tenth to high winds from tropical cyclones, and sixteenth to droughts. Furthermore, natural disasters occur throughout the country in every part of this developing country and in every season of the year, not only causing enormous losses in terms of lives and assets but also destroying socioeconomic and cultural infrastructures, as well as the natural environment.

5.1 The hazards

Definition Hazard follow UNISDR “Hazard: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.”

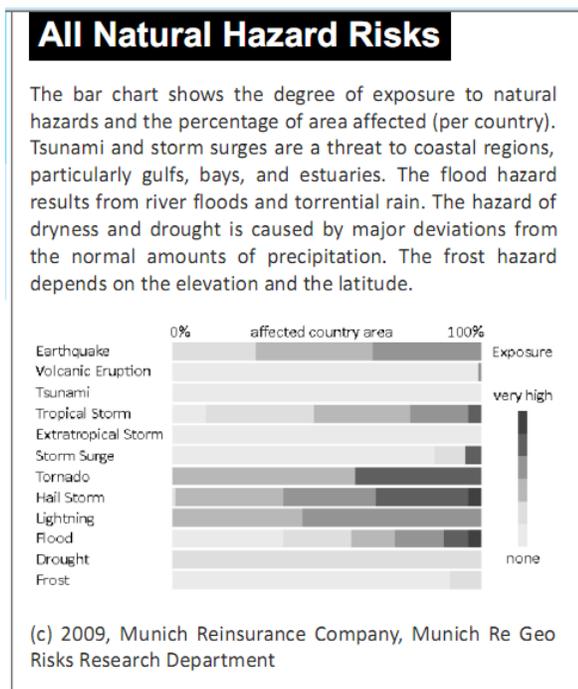


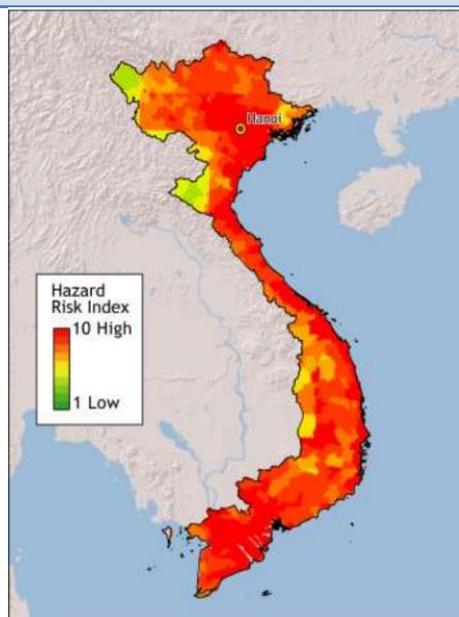
Figure 5.1.1: Natural hazard risks in Vietnam (Source: OCHA Regional Office for Asia Pacific, Viet Nam: natural hazard risks, issued 01 March 2011.)(36)

5.1.1 Floods (including flash floods and urban floods)

With a long coastline more than 3260 km and the river network has a total length of about 25,000 km concentrated into three rather clearly defined networks combined with diverse topography make Vietnam become high sensitive to flood. As shown front, in figures 4.1.1, every year Vietnam has faced to the most enormous damage causing by floods in human lives as well as socioeconomic. Moreover, the patterns of floods are not the same in each regions and seasons due to complicated terrain. “In hill or mountain areas, flash floods often occur in the hills, due to its steep slopes characteristic combined with heavy rain and unfavorable conditions for flood drainage. Flash floods can also occur due to rupture of small reservoirs or by landslides blocking the flow upstream”. (1,3.16,17)

Table 5.1.1.1: time flood appearance in each region (17)((<http://www.hymetdata.gov.vn/>) (14)

Regions	Start	End
The North	May – June	September – October
The Northern Central	June – July	October – November
The South Central	October	December
Highland	June	December
The South	July	December



Map 5.1: Risk of mortality by flood in Vietnam

Source: GFDRR Vulnerability, Risk Reduction, and Adaptation to Climate Change Vietnam, 2011.

Flood at each regions and case study:

In the Northern delta and midland: floods come from May to October. The result of affected by monsoon climate and combined terrain almost hill and mountain, floods often happen quickly.

Case study: The flash floods in 1998 were considered the most historical figure to the Northern Vietnam. For nearly three months (from August to October) more than 200 people were death, injured and missing, damage to thousand houses, schools, and infrastructure. On website glidenummer recoded codes:

The first one happened in August, flash flood and landslides, which took more than 100 people death and missing, was consequence of tropical storm Kammuri with heavy rains had happened before ([FF-2008-000128-VNM](#)) And then on September the second began with heavy rains triggered by tropical cyclone Hagupit caused flash floods and landslides in six provinces in northern Viet Nam, namely Lang Son, Son La, Bac Giang, Lao Cai, Quang Ninh, and Vinh Phuc where were the poor and widely deforested region. The floods left a total of 32 dead, five missing and 36 injured. Furthermore, 897 houses have collapsed and another 8,326 houses have been damaged or swept away by the flood([FF-2008-000173-VNM](#)). When people in this area did not have enough time to recover, the last flash flood happened in the end of October which affected to whole the Northern region, torrential and persistent rainfall caused widespread flooding in various parts of the North and the Central provinces of Vietnam, 89 killed, up to 183 houses collapsed and wased away while 180, 231 house heavy damaged, 15 classrooms collapsed. Moreover, not only did it cause massive damage to argiculture due the Autum – Winter harvest was on that time; but also on socioeconomic like: dyke eroded, embankment eroded, road damaged, communication poles collapsed, electric wire broken, power stations damaged.

Humanitarian response:

- Government: CCFSC alarmed to local governors as well as sent a request to Rescue Team to find and help local people. Steering Committee for Flood and Storm Control at provinces evacuated people, reinforce dykes, and conducted emergency relief for hard-hit areas. Vietnam Red Cross supported the local governors food and shelters.

(<http://www.ccfsc.gov.vn/resources/ccfsc/images/download/20081111%20Damage%20caused%20by%20flooding%20and%20heavy%20rain%20in%20northern%20provinces%20%20E.pdf>)

In the South Central Coast: Eights provinces and cities covered by hill, mountain, and long coast (12000km from Thanh Hoa province to Binh Thuan province) with minor plain so it is considered as undeveloped economic area as well as the most sensitive to catastrophe hydro-metrological hazard. Because short and steep characteristic of river system and river basins systems is generally hilly,

rainwater falling rapidly causing flash flood. Author Tran Huu Tuan described flood feature in this area: “This region is characterized by short and steep river systems with rapid flows. Dyke system in this region are inadequate or incomplete. Floods also spread across the flood plains, causing huge losses.”(3) Just four months from the September to December, on average 3, 4 events happen annually.

The catastrophic flood events in 1999 described “the greatest damage caused by natural disasters in the 20th century in Vietnam” overwhelming the Central Vietnam. In Glidenumber report, in 1999 two heavy rains made water level in river increase overcome historic flood levels for 100 years, killed 715, more than 1 million homes flooded, washed away thousands of homes and caused losses economic nearly 5,000 billion vietnamdong.(17)

Case study: Flooding in Central Provinces on November 2013 (UN Vietnam reported)(22)

And recently in 2013, affecting of storm 15th which derive from Typhoon Haiyan, the Central regions of Vietnam was inundated. There was a torrential rain with total rainfall of 401 to 973mm and strong winds happened from on the evening 14 to 17 November in the south central coastal areas, including Quang Nam, Quang Ngai, Da Nang, Phu Yen and Binh Dinh provinces. The highest levels were recorded in Quang Ngai province with 970 mm. As a consequence, the tropical depression and extensive flooding killed 42 people, 5 people missing, injured 66 people, and causing 414 house collapsed (more than a half in Binh Dinh province), thousands of house damaged, and economic such as damaged rice fields, dikes washed away.

Humanitarian response

- Government: In local regions, at the beginning people were alerted and evacuated from low-lying areas at risk by the Steering Committee of CCFSC and the National Committee for Search and Rescue, as the same time the CCFSC Steering Committee coordinated governances at local to monitor the evolution of the flooding situation, rainfall, as well as to direct the implementation of the relief activities.
- International agencies: Besides the response of local, International agencies supported the local government in preparedness, response and recover phase such as the UN Disaster Risk Management Team (UNDRMT) coordinated other humanitarian stakeholders, international NGOs monitored and support relief activities, Plan international, Save the Children, World Vision.

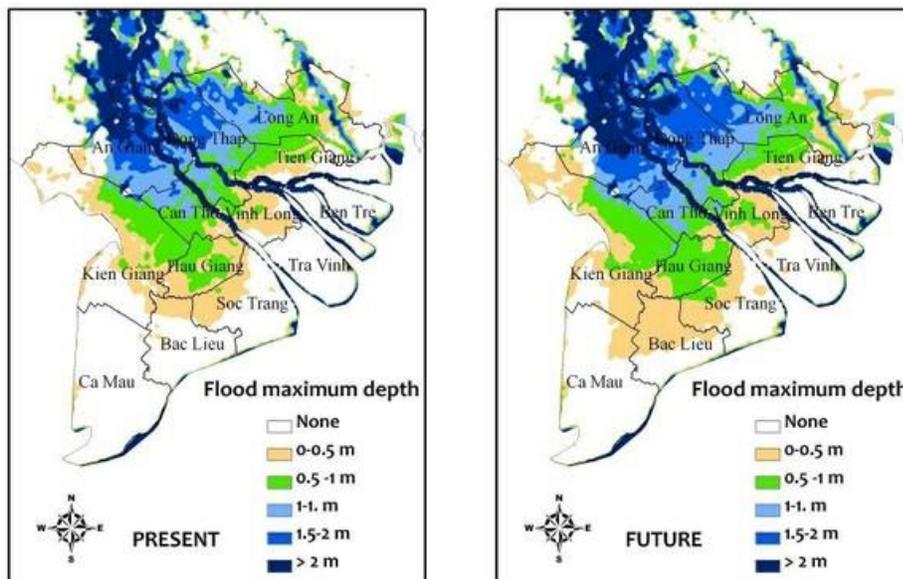
Key impact figures provided by CCFSC as of November 2013:

Fatalities	People Missing	People injured	Collapsed houses	Flooded/ Houses	Rice/Cash Crops	Fields Damaged
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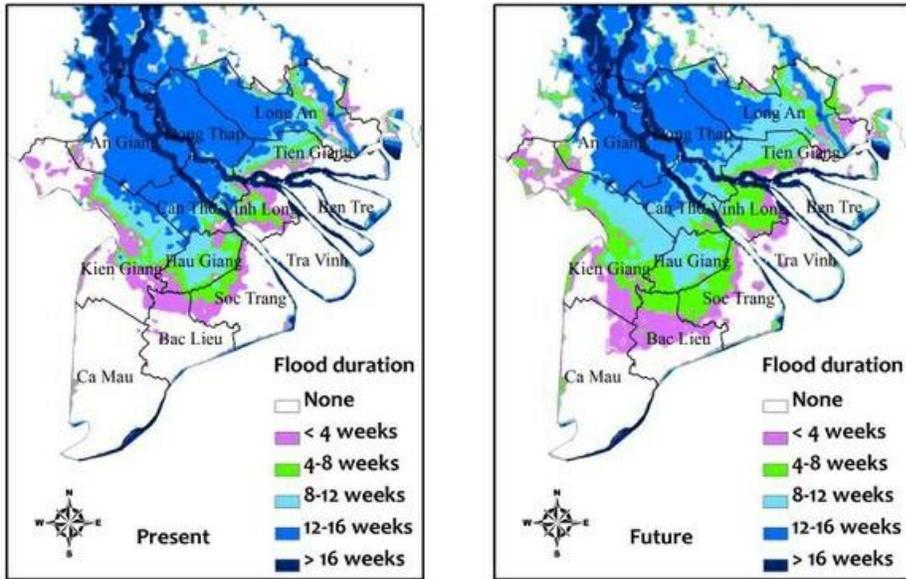
In the highland: beginning from June and lasting to December and opposite to the North and the Central figures are often taking a short. This hill area is prone to flash flood from the river upstream and trend in future this area will be the most damaged because of deforestation and landslides.

In Mekong River Delta: Events often start annually as early monsoon rains in June (phase 1st), gradually grow up to reach a peak in September (phase 2rd) (when level of water in Tien river over 4.2m) and decrease to the end December. “Flooding in Mekong delta is defined as riverine flooding, which is caused by upstream discharge, heavy rainfall in the Delta itself and variation in the tides of the East Sea and the Gulf of Thailand. (Wassmann et al. 2004)”.

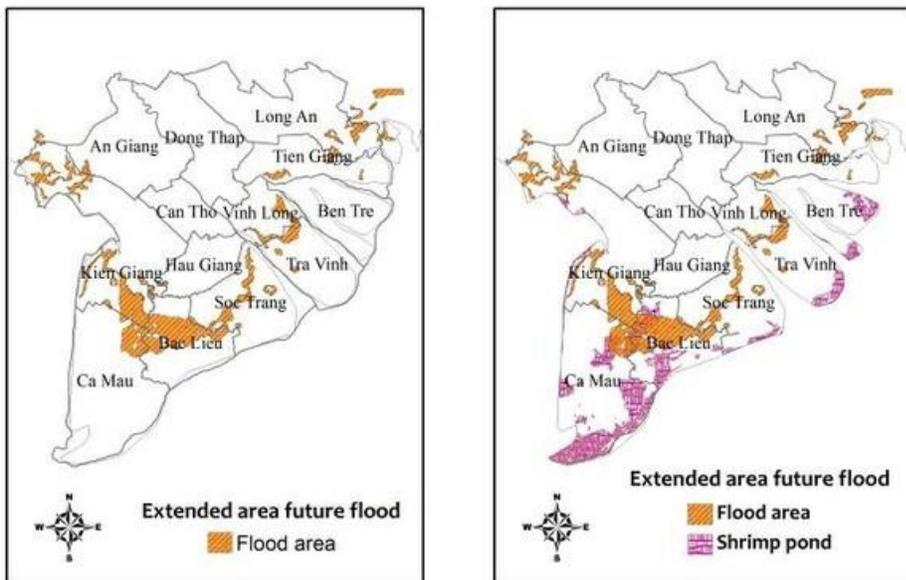
Desperately devastating floods were recorded in years 1994 (407 killed), 1995 (199 killed), 1996, flooding in three consecutive years 2000, 2001, 2002 took 1,044 human lives (one tenth of the total number of deaths in n15 years nationwide). Particularly, flooding in 2000 caused the highest damage to provinces frequently vulnerable in inundation in the Mekong delta.



Map 5.2: Estimated change in flooded area in Mekong Delta in the future, compare to the present day.(28)Source: Southeast Asia Regional Center, (http://startcc.iwlearn.org/project/copy7_of_hydro-agronomic-economic-model-for-mekong-river-basin-and-local-adaptation-in-thailand-model-development) (30)



Map 5.3: estimate change in the flooded duration in the Mekong Delta in the future, compared to the present day (30)



Map 5.4: estimated on extended future flood areas, potentially affecting the shrimp ponds located in the coastal areas of the delta. (30)

Reasons causing flood in Vietnam:

A flood is generally defined as an excess of the amount of discharged water compared to the drainage capacity. There are some reasons: all of which are caused by a combination of heavy precipitation and poor drainage.

- **Rainfall:** Flooding are caused by intense rainfall leading to exceed capacity of volume's water container or when flow exceeds the capacity of a river channel during the short period or combination with seasonal weather patterns.
- **Topography and tidal influences:** coastal areas where storm surge associated with a tropical cyclone leading to dykes broken and sea-level rise. In the South of Vietnam is affected by rising tidal.
- **Deforestation:** causes a lack of soil cohesion and erosion due to the human impact of change leading to the surface of the basin, reduce the possibility of drainage basins and the floodplains so directly or indirectly caused flood.

Characteristics

- **Flash floods** - large flow rate (combined with intense rain, often caused by storm), or occurs when the dam broken.
- **River flooding** - flows up and down slowly, usually seasonal floodwaters up on us River (river flooding on the Central may differ from flooding in other areas)
- **Flooding from the sea** - There is currently associated with storms and storm surges.

The dominant factor affecting the level of flooding include: depth of flooding, flooding time, speed flow, flood intensity up, and the frequency of occurrence of floods.

Methodology for flood:

- Depend on knowledge of time occurrence and seasonal weather patterns of each regions as well as capacity of the basin and flood discharge capacity of the river. (Capacity of cover surface characteristics of basin, flood discharge capacity of the basin and flood discharge capacity of river)
- Flood maps and surveys about geography nearby areas or above are taken to forecast.
- **Warning system:** to regular flood. To flash flood with happens quickly and unpredictable.

Vulnerability

Residential placements in areas affected by flooding easy:

- Residential located in the flood-prone
- The surface of land decreases permeable to water (due to erosion or concrete)
- Buildings and infrastructure without flood resilience
- Infrastructure in high flood risk areas, especially in Mekong river, bamboo-bridge.
- Storage of food, food, plants and animals are not protected

- Vessels were not equipped with life jackets, celebrities appropriate;
- Lack of resources and skills needed to cope with the floods (eg rescue equipment households on the river in flood rescue skills, the ability to swim).

The harmful effects typical

Floods can cause adverse effects on human lives as well as socioeconomic. According to Vietnam Red Cross death caused by floods took 44% in total death by disasters.

- Human impact: Damage mainly due to the drowning; injured by the floods are common. Floods have the potential to increase the level of infectious diseases (such as malaria, diarrhea, infections caused by viruses);
- Loss of equipment: Buildings, school, and infrastructure can be washed away, collapsed, or be soaked or damaged by objects floating in the floodwaters bump into. Where saturated soil can occur landslides. Damage in the river valley usually greater than the open ground. The assets of the household may be damaged, lost;
- Water Supply: Flooding can cause pollution or contamination of surface water wells and underground aquifers leading no clean water.
- Damaged to harvest season, stockpile food, threatening to food security at local
- Exposure secondary displacement diseases, viral diseases, causing landslides

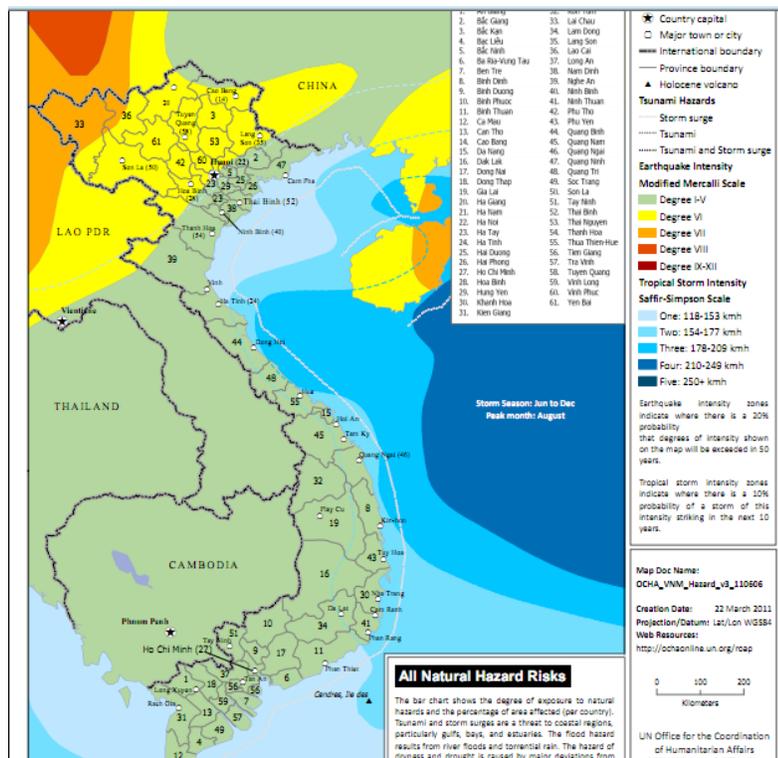
5.1.2 Storm

Hazardous weather events related to hydro-meteorological besides heavy rains and strong winds during monsoons, tropical cyclones or tropical storms hit Vietnam regularly. Most of them origin from the Northeast Pacific, on an average about 30 storms each year of which Vietnam is hitting about 4 to 6³ storms annually. Tropical cyclones and hurricanes occur more frequently in the Northern and Central coastal region than the Southern base on author Handbook Technical of Disaster Risk Management and Adaptation to Climate Change in Vietnam in fifty years (1954 – 2006), there were totally 380 typhoons and tropical depressions in vietnam, of which 31% hit the North, 36% to the Northern Central and Middle Central Part and 33% to the South Central and the South. When typhoon's landfalls usually accompany with strong wind, high tide and heavy rain, thus resulting in heavy and long rains, floods leading to damage vegetation, houses, communication, systems, roads and bridges. It is estimated that up to 80-90% of Vietnam's population are affected by typhoons. (7,16,17)

According figure 4.4.2, in the past five decades there have been 92 severe storm events which altogether killed 17959 and more than 47 million people affected, and caused a total economic loss of \$ 6 billion. Base on Vietnam Red Cross in 2003, 41% death due to disaster caused by storm.

³ Sach kte

For example: Typhoon Linda in 1997 was an overwhelming storm which killed nearly 3,000 people in the Mekong Delta provinces; Linda was considered as the most devastating disaster for Vietnam in the twentieth century.



Map 5.5: Natural Hazard Risks in Vietnam
 Source: OCHA Regional Office for Asia Pacific, March 2011

Reasons causing hurricanes and tropical cyclones in Vietnam

When the water temperature exceeds 26°C, a mixture of heat and moisture forms a region depression in the sea. Wind direction rotate around the deep low pressure, the pressure drops rapidly under direction in mind. This low pressure combine trade winds are pushed along the grooves. A low pressure area will become a hurricane when wind speeds reach level 11 on a scale from 103 to wind Beaufort10 or 119km /h.(17)

Methodology for wind and surge hazards

Cyclones are classified according to wind speeds in their circulation and these classifications vary from country to country. In Vietnam, Beaufort Wind Scale is used as tool to evaluate. Beaufort Wind Scale (source : <http://www.spc.noaa.gov/faq/tornado/beaufort.html>)

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land

0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-19 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (18-25 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	High waves (23-32 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (29-41 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (37-52 ft) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

Characteristics

When the hurricane hit land, damaging winds will accompany floods and landslides (not to mention heavy rain and storm surges). The phenomenon of reduced air pressure in the storm can make current local sea level rise, but its consequences are severe flooding coastal areas sea.

For the estimation of surge for Maldives, the following factors have been considered:

- Landfalling cyclones (numbers)
- Intensity (highest wind speed/central pressure)
- Bearing of tracks
- Average speed of movement
- Radius of maximum wind
- Bathymetry

Vulnerability

The specific factors that contribute to vulnerability to damage by floods:

- People living in the lowland or coastal areas are influenced directly of hurricane,
- People living in the neighbour area are influenced indirectly due to heavy rainfall, landslides or flooding.
- The communication or warning system is still weaknesses, cannot provide information in time and exactly.
- The material of building is inappropriate or poor quality or the constructor built for a long time.
- Vessels are not equipped with lifebuoys/ life jackets/ Radio life-saving appliances.
- Lack of public awareness about threats from the storms.
- Vulnerability of building varies, based on their material of construction.

The harmful effects typical

- Humane lives: Fragments blown apart in the storm, houses collapsed or were swept away by flood waters can cause death or injured.
- Epidemic: infectious disease such as: cholera, pneumonia.
- Food security: Disaster risk may increase due to flooding (flood watch in part) and there was not enough food reserve real or not get food. Strong wind and rain storm can damage to crops,

plants and food reserves, agricultural land contaminated by salt water occurs when the storm surges, cattle killed, damage fishery and trees were uprooted;

- Water supply: Groundwater or items containing water storage can be flood waters box infection
- Houses, constructions, infrastructures are damaged or collapses.
- Energy, information and logistics wind storm can break, pour column, power lines, lines of communication, information and disruptive power.
- Traffic could be interrupted paragraph, town or city can be isolated;
- Indirect hazards - floods, storm surges and landslides.

5.1.3 Droughts

Besides impacts of storms and floods, annually, in the dry season, from December to April Vietnam confronts with drought status which is a normal part of the climate for virtually all regions. Drought is defined: “Unlike aridity, this refers to a semi-permanent condition of low precipitation (desert regions), drought results from the accumulated effect of deficient precipitation over a prolonged period of time. Here “deficient” refers to values being less than the expected or long-term average value at a particular location. Ultimately, drought refers to a condition of an insufficient supply of water necessary to meet demand, both being highly location-specific”(F). Drought is a slow-onset hazard, and it is difficult to recognize when it begins and when it ends (Wilhite, 2000)(4). In Vietnam, the start of a drought is defined as the time when total of rainfall in a year is less than 80% of the annual rainfall or when there is no rain or less than 1.0 mm of rain within a 14-day period. In recent years, drought period starts earlier and ends later.

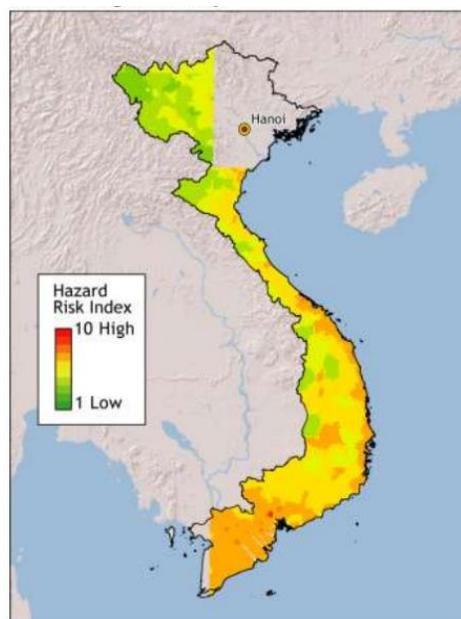
It is considered that drought is the third-ranked disaster with respect to its impact on the socioeconomic conditions of Vietnam (after storms and floods). For example: the severe events in 1998 were widespread, particularly in the Central, Highlands region, the South East and the Mekong Delta, affected 11 crops and causing major losses like more than 3.1 million people affected, a total economic losses estimated of around 500 billion, (around 37 million dollars)(GTZ, ADPC and MRC, nd). Moreover drought had negative effect in agriculture and forestry and resulted in depleted reservoirs, increased groundwater pumping, interruptions of public water supplies, and reduced recreational opportunities and tourism revenues. Environmental and social impacts were significant, particularly the tremendous increase in forest and ranges fires, soil erosion, and effects on fish and wildlife populations.

Source: Droughts in Asian Monsoon Region Chapter 8 Drought Risk Management in Vietnam Huy Nguyen, Rajib Shaw (4)

Table 5.1.3.1: Drought events in Vietnam from 1952 - 2005

Region	Years of Drought		
	Winter–spring season	Summer season	Summer–autumn season
Mountainous area in the north	1988, 1990, 1991, 1993, 1994, 1996, 1998	1988, 1990, 1991, 1992, 1993, 1998	
Red River Delta	1960, 1961, 1963, 1964, 1986, 1987, 1988, 1991, 1992, 2004, 2005	1987, 1990, 1998	
North central region	1991, 1992, 1993, 1994, 1996	1982, 1983, 1984, 1988, 1992, 1993, 1995, 1998	1991, 1992, 1993, 1994, 1995, 1996, 1998, 2004
South central region	1977, 1978, 1983, 1984, 1993, 1998, 2002, 2004, 2005	1983, 1993, 1994, 1997, 1998, 2000, 2004, 2005	1952, 1969, 1970, 1971, 1977, 1978, 1983, 1982, 1984, 1985, 1993, 1998, 2000, 2001, 2002, 2004, 2005
Central highlands	1994, 1995, 1996, 1997, 1998	1997, 1998, 2001, 2002, 2004, 2005	1983, 1988, 1993, 1995, 1997, 1998
Southeast region	1987, 1988, 1990, 1992, 1994, 1997, 1998	1988, 1990, 1992, 1997, 1998	1988, 1990, 1992, 1998
Mekong River Delta	1989, 1992, 1993, 1998, 2004	1981, 1983, 1984, 1985, 1987, 1992, 1994, 1998, 2004	1981, 1982, 1988, 1992, 1997, 1998

Source: Hieu (2002), Hoc (2002), Shaw et al. (2007) and Tinh (2006).



Map 5.6: Risk of drought mortality

(Source: GFDRR climate change country profile in Vietnam, April 2011)

Reasons causing:

- Direct: lack of rain for a long time,
- Or exploited and using underground water inappropriate
- Or quantity of water evaporated from the river more than rain
- Or due to human activities that cause of the change in the surface coating and surface soil layer (example: mining excessive groundwater, deforestation).

Characteristics

- Water deficient temporarily leads to reduce the moisture abnormally.
- Meteorological drought due to no rain or lack of rain.
- Hydrological drought
- Agricultural drought is the impact of meteorological and hydrological drought, focusing on precipitation shortages, effect to other factors: the formation of irrigation systems, due to the ability to maintain soil moisture, rain and by the time behavioral adaptation to drought farmers

Methodology for drought

As drought occurred abnormally, in Vietnam, a plenty of indexes are used to monitor, forecast and assess the drought process. It is a typically a single number that assimilates individual or a combination of different types of data that measure certain drought types for a given period based on a single type or a combination of historical data like the Palmer Drought Severity Index, the Crop Moisture Index, the Standardized Precipitation Index (SPI) and Surface Water Supply Index (SWSI), and Dry Index

Vulnerability

The specific vulnerability factors given below (17)

- Located in drylands where drought phenomenon increase scarcity of water.
- Farming on the unfertilizer land or degraded arable land
- Lack of inputs for farming to improve productivity
- Lack of water resources management system
- Lack of seed and food reserves
- The region depends on other weather systems for water resources
- The area has a low amount of moisture in the soil
- Lack of allocating resources to mitigate the threat of drought.

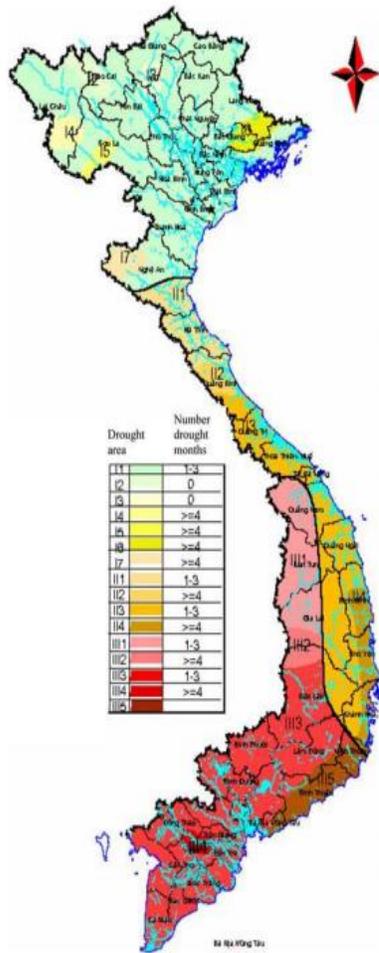
Factors contributing to Vulnerability (17)

- Effected by climate change
- Impacts of El Niño-related phenomenon crises
- Economic of Vietnam almost agricultural and impact on crop/harvest
- Lack of drought forecasting and early warning to people to storage water
- Lack of establishing plan and management of water-resource systems
- Unsustainable

The harmful effects typical

Drought can cause adverse effects as follows:

- To human life: There is not enough water for drinking, cooking, and personal hygiene
- To “affect agriculture in terms of growing periods, crop calendars and crop distribution, pest increases, and virus activity”(3). Cultivation: Reduce the quantity and quality of crops and plants leading to food security issues. Additional aquaculture economic rises down. Moreover, livestock such as cattle, pigs can be sold or if drought occurs in the long run, they can die from thirst or disease.
- The economic consequence: reducing the income of farmers, reducing costs for the agricultural activities; food price increases of raw materials (eg: rice), increased inflation, increased disease due to malnutrition or disease due to hygiene, especially for vulnerability objective such as children and the elderly.
- When the water flow in the river decreased, the area near the sea may suffer effects of saltwater intrusion and salinization.



Map 5.7: Spatial Areas of Drought in Vietnam – Average Data from 1960 to 2005. Source: (3)

Region	Total Area (ha)	Area Affected (ha)	Area Died (ha)			Cost (Billion VND) ^a
			Rice	Summer crop	Winter vegetables	
North central	739,804	107,880	6,612			21.8
Red River Delta	526,869	32,578				9
Central coastal provinces	628,999	122,139	3,922	74,613	469	68.0
Central highlands	127,403	147,646	33,464	7,421		22.3
Southeast		26,361		5,176	477	22.3
Mekong Delta		276,656	7,775	231	3,032	34.0

Source: Data from General Department of Hydro-meteorology.

^aIn 1998, 1 USD = 15,000 VND.

Figure 5.1.3.2: Economic loss caused by Drought in 1998. Source: (4)

5.1.4 Landslide

Although landslides have less attention than meteorological catastrophe natural disaster, landslides is a type of threat to Vietnam, it happens regular and widely on very region cause most significant effects to human lives especial in highland area. Due to its mountainous terrain, several rivers and their tributaries criss-cross the region. Landslides are triggered by various phenomena such as floods, earthquake...the severity of these landslide types depend on rainfall intensity, spatial distribution of rainfall, topography and surface conditions

Landslide caused by external factors (water) or internal factors (geological changes) and human activities (unplanned mineral exploitation or construction); included phenomenon erosion in rivers which is the most popular and causes remarkable losses of human lives and destroy houses, fields; coastal erosion which leads to sea intrusion and causes lost land as well as destroys environment; landslides and slopes which most impact to human lives; land subsidence. Erosion occurs due to side effects external (eg flow), due to the impact inside (geohazards) and due to human activities people like deforestation, mining or construction unplanned. Landslides often are associated with debris flows or lead to flash flooding.

Reason causing

- Landslide is the movement of rocks beneath the slope. This phenomena is considered as a result of (or a combination of) the occurrence of natural geological shocks (e.g: earthquakes), due to weathering phenomenon, or due to changes in soil moisture, or by the service transfer of protective structures at the foot of the slopes, or by construction on slope, or by the occurrence of weathered surface slopes and by the impact of human change the direction of flow or structure of the slope.

Characteristics

- Landslide vary with the type of soil movement, for example, it can be described as form "rock waterfall or stream." Landslides can also be secondary effects of the battle strong storms, heavy rain or earthquakes. Landslides occur more than geological phenomena other.

Predictability

- Landslides could be predicted through the data of geology, geomorphology, hydrology, climate and coating made material. Field observations also may indicate early signs of landslide slopes such as wound cracks in the ground.

Vulnerability

The specific factors that contribute to vulnerability to damage due to landslides

- Constructors were built on the slopes, on soft ground or on top of a cliff;
- Constructors were built at the foot of the slope or
- Process of roads, communication lines construction in the mountains
- Construction of the burial ground with the old pipe;
- Lack of understanding of the danger of landslides;
- Excessive exploitation of natural resources, deforestation in the basin.
- The harmful effects typical
- Loss of material: Anything located on the slopes will be destroyed. Rock be buried roads and cut communication lines, waterways. The impact not directly may include loss of productivity in agriculture, forests and floods.

5.1.5 Whirlwind

The frequency of appearance and the impact of the whirlwind in Vietnam factors are difficult to assess because of no clearly technical definition .According to author of Handbook Technical of Disaster Risk Management and Adaptation to Climate Change in Vietnam (14), although the data in the report regardless two distinct phenomena and factors cyclone, but the figures show that nearly all the territory of Vietnam are likely to occur but sometimes occur more routinely in mountainous and midland than lowlands. This demonstrates the high terrain (hills) have contributed to the impact thundercloud development particularly strong increase the number of attacks, whirlwind. In the period from 1993-1998, with 235 matches, whirlwind is recognized, they have claimed the lives of 234 people; do 1,841 people were injured; toppling, damaged houses 90.00; estimated losses can reach every hundred billion.

Characteristics

- Large tornadoes: a large tornado (such as hoses) are formed from the filtering characteristics match particularly strong (thunderstorms tornado was rated as the most powerful level) or from other strong storms. At storm started creating turbulent, it interacts with the wind at high latitudes, creating a vortex.
- Small tornadoes: When local wind started swirling motion on the ground, vortices produce out. Vortices move along the ground and the wind was originally formed to push it away. The vortices rolling objects such as dust, sand or snow as it moves on the ground and therefore it can be observed as a normal condition

- Small tornadoes are formed by the mass movement of hot air when the air mass is replaced by the block colder air and form columns of small size wind swirling motion in the below of a "hot zone". The small tornadoes often do not exist long time; wind created by the tornado was not sustained and the a small tornado encounter obstacles (eg buildings, homes, trees ...).

Predictability

- It is hard to predict tornadoes. The occurrence of tornadoes especially difficult to forecast. Gust vortices often observed even when it formed. Thus the cyclone early warning vortex hardly realizable, however can apply preventive measures to minimize the damage caused by a tornado. The specific factors that contribute to vulnerability to damage by cyclone

Vulnerability: factors contribute to vulnerability status

- The size (small), material, age and storey height of construction,
- Lack of life jacket for boat.
- Lack of community awareness of dangers caused by tornadoes.

The harmful effects:

- Human lives: The piece blown apart in a tornado or collapsed house can cause death or injury.
- Constructors: damaged or destroyed by winds in a tornado.
- Agriculture: harvest, livestock could be damaged by strong wind and rain during a tornado
- Energy, information and logistics were destroyed or interrupted.

5.1.6 Tsunami

Due to its long coastline and located in the Pacific prone-tsunami, Vietnam has been recognized as potential areas. And base on Vu Thanh Ca⁴, in Vietnam there is no recorded tsunami information in the past up to now because of no tsunami observation system in Vietnam. However, the UN program coordination Group on Natural disasters and emergencies (2011) pointed out that part of the Vietnamese coast can potentially be affected by a tsunami, though the probability of a tsunami event is relatively low. Many possible tsunami scenarios have been suggested by the author Takahito Mikami and Tomoyuki Takabatake in their paper⁵: (8,9,10,17)

⁴ Vu Thanh Ca , 2013, Tsunami hazard in Vietnam,

⁵ Takahito Mikami and Tomoyuki Takabatake, 2013

- Manila trench is considered the most dangerous because this fault can generate tsunamis that can attack Vietnam's shore.
- The Ryukyu trench
- Fault at 1090 E -110 E: activate from the southern part of Hai Nam Island and hit south-central Vietnam.
- The northern part of the Philippines and the southern part of Taiwan
- The western part of the East Sea and the middle part of the Vietnamese coast

And author also mentioned tsunami vulnerability in the Vietnamese Coast such as long areas of Low-Lying Grounds especial in two largest deltas: the Red River and the Mekong Deltas, moreover lack of past experience makes local people unable to response when disaster happens, as well as undeveloped Tsunami mitigation measures.

5.1.7 Epidemics

Located in the tropical monsoon area makes Vietnam is prone to communicable disease such as avian influenza A/H5N1, Severe Acute Respiratory Distress Syndrome, vibrio cholera, dengue fever, viral encephalitis, malaria...One of this, the burden of dengue fever has been a public health problem for many decades.(2)

Reason causing:

- Unsanitary conditions especially vector bone diseases, for example: houseflies act an supplementary vectors by contaminating food after feeding on exposed human faeces cause cholera
- Poverty and under-nutrition.
- Crowded population: will increase the speed of spread to diseases which are likely to spread through the respiratory tract like ARD, SARD.
- Climate: create favorable conditions for the development of diseases such as That standing water creates an ideal breeding ground for mosquitoes, which transmit dengue fever. As a result, dengue fever incidents in the city have been on the rise, with particularly high caseloads in the raining season

Characteristics:

- Quickly spread of epidemic due to crowed population and increase incident of disease.
- Serious infectious diseases such as meals, dengue could cause high mortality.

- Lack of surveillance in rural, high land where the most vulnerability.
- Risk of social and economic disruption.

Prevention:

- Community health education about diseases: Board of information at local about prevention disease, educate in school, media.
- Improve health care systems
- Forecast probability epidemic base on record history
- Ensure all children immunize
- Treat contaminated water source

Vulnerability:

- Poverty
- Under-nutrition
- Lack of immunization such as measles (outbreak occur in 2014 killed more than 150 children, and approximate 4000 cases)(report of MoH date 3/5/2014)
- Contaminated water
- Lack of health care system to vulnerability area.

5.2 *Vulnerability*

The combination of threatening of catastrophe natural hazard and vulnerability traits make risk. Base on definition of UNISDR “Hazards always occur in the same areas, with varying severity and with varying frequency” and define of vulnerability is the characteristics and circumstances of a community, system or asset that make it susceptible to damaging effects of a hazard. It means that disadvantage factors of economic, social, cultural, environmental impacts to community and worsen community’s damages. Vulnerability itself is the result of the impact that a hazard capable of causing, resistant to the adverse effects and capacity prevention, response and recovery for influences on. Status vulnerable expression in many fields, derived from elements of the physical, social, economic, and environmental. Examples of these factors include: poverty, climate change, hazard-prone community, livelihood, community access, weaknesses in ability public alert, lack of disaster’s knowledge in community...

Vulnerability indicators such as the number of disaster events, deaths, affected population and economic losses have been plotted against hazard types as well as for 5-years intervals covering the 50-

year period 1964 – 2014, Vietnam has experienced 189 natural and 65 technological disasters which took 27329 deaths, caused damage to nearly 85 million people and loss of more than 10 billion USA.

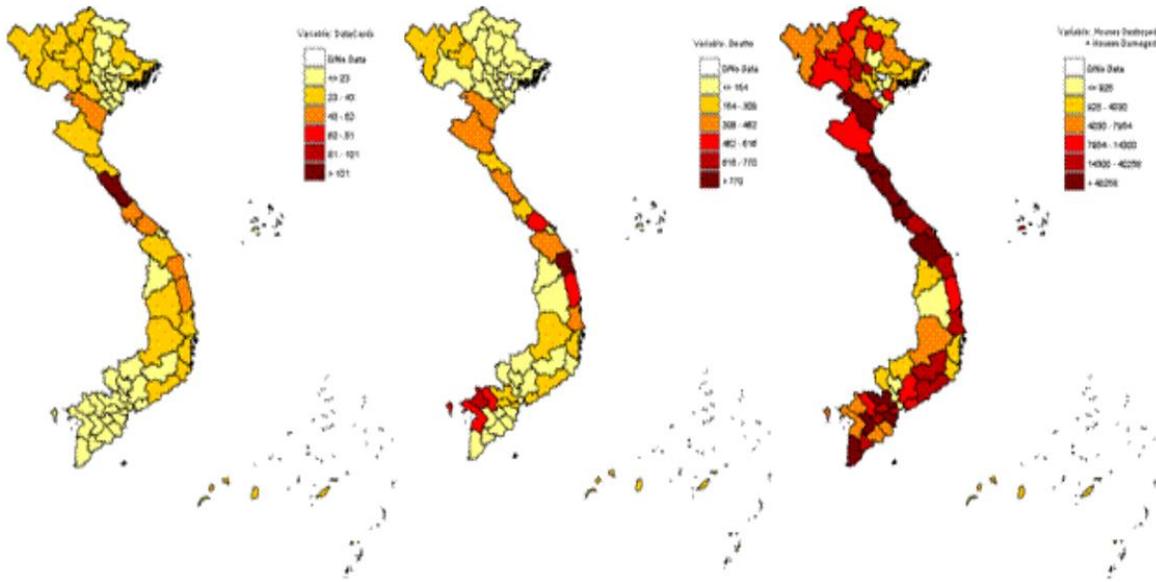
Among natural hazards, storms caused the largest number of death with 17,957 and affected the largest population 47 million people and cause the highest economic loss 6 billion USA (58% in total loss by all disasters).

The period 1964 – 1968 was the worst in terms of number of deaths with 8029 people, while 1979 – 1983 was the worst in term of affected population 18762042 people and 2009 – 2013 economic loss four billions caused mainly by the storms in 2013 and floods in 2010

Storms are the dominant risk in Vietnam with an economic 6, 2 billions USA followed by floods 3,7 USA billion and drought 6,5 million USA

Table 5.2: damage assessment caused by disasters for the 10 recent years^{⊗1)}

Item	Unit	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
People killed	No	508	399	1,243	3,083	434	901	775	629	389	186	7,375
House collapsed	No	7,302	11,043	96,927	111,037	12,171	52,585	12,253	10,503	9,802	4,487	395,202
Rice fields submerged	Ha	658,676	198,439	927,506	641,393	103,422	131,267	655,403	132,755	46,490	209,764	4,692,313
Shrimp, fish poll broken	Ha	6,364	120	4,761	34,619	215	1,419	2,877	1,002	310	10,581	65,955
Ship sunk, damaged	Unit	43	1,117	1,017	3,008	231	845	109	2,033	26	183	11,764
Area of forest fire	Ha	8,322	9,648	12,758	1,361	14,812	1,139	850	1,845	15,548	1,402	115,664
Total	Bil.V ND	2,850	1,129	7,998	7,730	1,459	5,427	5,098	3,370	1,958	1,589	40,835



(a)

(b)

(c)

Map...: Spatial distribution (a): of reports for all disaster types

(b): of death for all disaster types

(c) : of houses destroyed and damaged for all disaster types

(source: A preliminary analysis of flood and storm disaster data in Vietnam, March 2011)(37)

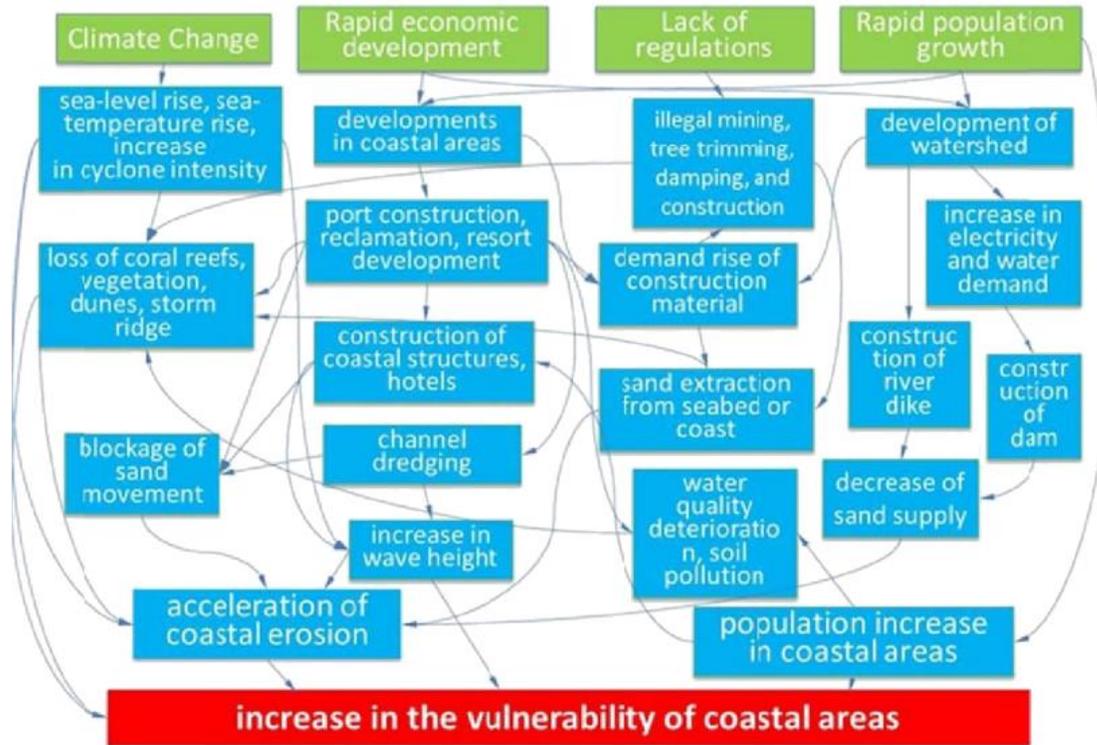


Figure 5.2.1: factors leading to the vulnerability of coastal areas

Source: Hiroshi Takagi, Nguyen Danh Thao, Miguel Esteban, TranThu Tam, Hanne Louise Knaepen, Lilian Yamamoto, Coastal Disaster Risk in Southern Vietnam: Problems of Coastal Development and the Need for Better Coastal Planning, paper, 2013. (5)

Base on the figure 5.2.1, the fact sheets for the map about factors linking together. The figure illustrate some of the principal driving forces of catastrophe natural disaster, ranging from climate change and rapid economic development, to lack of regulation and rapid population growth. Base on the map, some factors shown in this section the relationship is two-way, with the factor being both a cause and a consequence of vulnerability.

5.2.1 Climate change

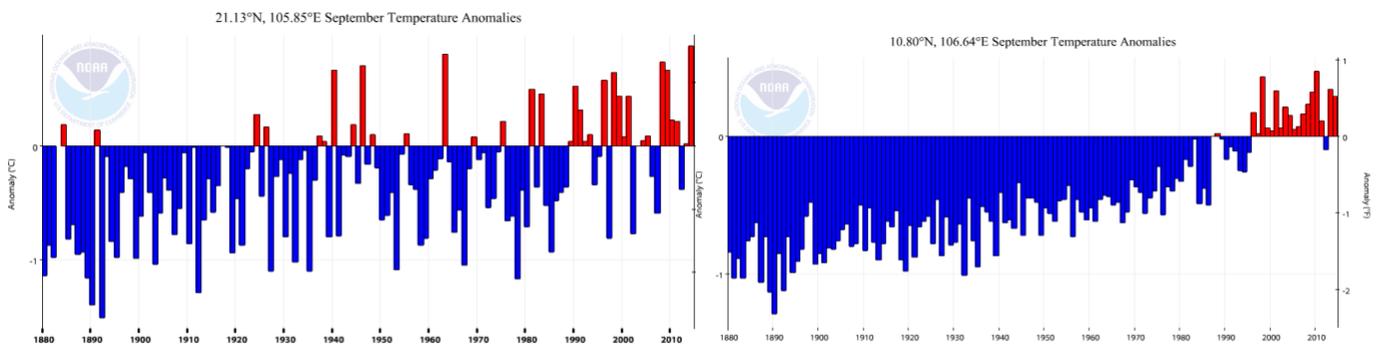
According to GFDRR 2011, rising temperature and sea level have been warming in Vietnam. Mean annual temperature has increased by 0.4°C since 1960, with the rate of increase more rapid in the dry seasons (November, December, January and February, March, April) and more intense in the southern parts of the country. And climate change's effects will high exposure to floods and storms, and the fact that two of its most important economic sectors are located in coastal lowlands and deltas such as industry and agriculture. Vietnam was ranked 23th for climate change vulnerability by Maplecroft Index 2012 and "listed by the World Bank as one of the five countries that will be worst-affected by climate change" (1,15,17,31). Furthermore "the frequency of tropical cyclones operating in the East Sea

has been observed to have decreased over the past several decades, although the frequency of tropical cyclones that affect Vietnam has increased by 0,43 event per decade in the past 50 years. Higher-intensity typhoons are noted to be occurring more frequently. ” (1)

“Regarding sea level change along the coast, observations show that average sea level has decreased by 0.2cm per year (1965-2006) at Hon Dau station, by 0.260 cm per year (1978 – 2006) at Son Tra station, and has increased by 0.398 cm per year (1981 – 2006) at Vung Tau station” (15)

CLIMATE FUTURE AT A GLANCE		
At a Glance ²⁵		
Temperature	Mean annual temperature will increase, with some suggesting greater increases in the southern zones	▲ 1 °C to 2.0°C by 2050
Rainfall	Annual average rainfall will increase Relatively large increase in winter rainfall expected Proportion of rainfall falling in heavy events, particularly in northern regions	▲▲
Extremes	Heat waves	▲▲ +2-14% by 2090
	Cold waves	▲▲ +100-180%
	Run-off	▲▲ -20-40%
	Sea level	▲▲ +7% by 2050 ▲▲ +28-33cm

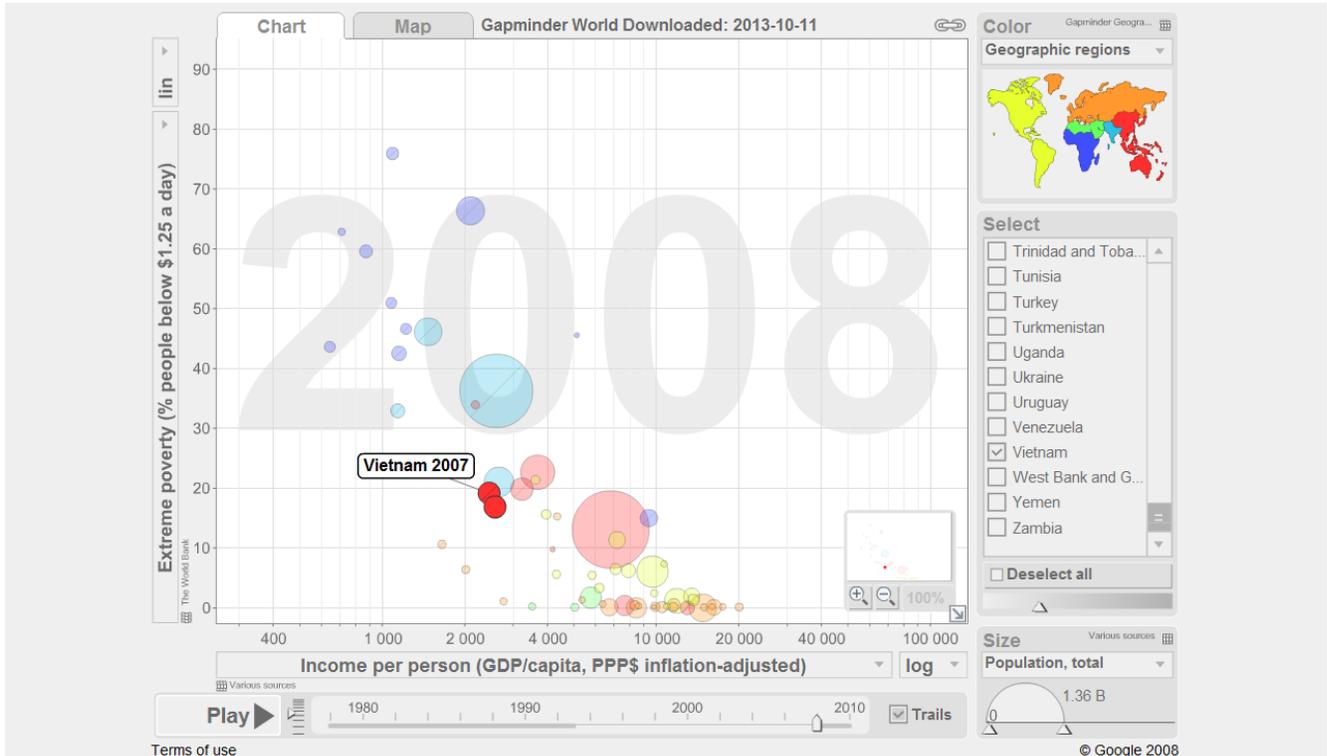
The rising temperature in the North and South (source: <http://www.noaa.gov/climate.html>)(26)



5.2.2 Poverty

The most important factor to vulnerability is poverty which is a factor being both a cause and a consequence. As Tran Huu Tuan the poor have less chance to tackle damages due “they have fewer assets, almost no insurance and less diversified sources of income. A disaster can push them into a downward spiral of destitution ” (3) moreover almost the poor in Vietnam are living on agriculture, all their income comes from the field so as serious disasters occurred could destroy harvest completely; push them to more and more impoverished. Another factor that poverty is a factor drive the poor living in the most natural disasters such as end of hill, lowland or near rivers or on the river (in Mekong Delta areas) although they were warning that these areas are dangerous as level water rising. The result of rapid economic development as well as climate change lead to enlarge the poverty gap in which the poor has less chance to recovery, mitigate after disasters.

In 2012 population in Vietnam about 9 million, population density 265 people per km square. And (1) twenty-seven percent live in urban areas, and the poverty rate for the whole country is 14.8 percent, though this varies across localities.(8). Gapminder world 2012: Vietnam



5.2.3 Lack of regulations

Problems about regulations were mentioned significantly in researches about vulnerability in Vietnam. Such as: based on author Takagi 2012(4) due to lack of strong regulations, “*private investment, such as the building of jetties by hotel owners, can cause significant coastal erosion in other areas, often inhabited by poorer members of the community*”. Or Huy Nguyen (3) mentions that absence policies and activities in drought management interdisciplinary department.

Listed below from GFDRR in Vietnam about policies in risk disaster reduce

- “There is lack of synchronized planning and coordination among ministries and sectors, and insufficient attention is given to the integration of natural hazard and climate risk issues within local and sectoral socio-economic development programs
- Institutional mandates are not clearly defined; overlaps need to be reduced.
- Stringent regulations are needed to discourage construction in zones that are at-risk of inundation, flash floods, storms, sea surges, and landslides,

- Penalties need to be enforced for actions in contravention of existing environmental policies that could increase vulnerability e.g., destruction of mangrove forests.
- Incentives need to be provided to households and the private sector for purchasing disaster-related insurance.”

5.2.4 Rapid urbanization

Urbanization is an issue which developing countries have faced as its growth of economic is almost concentrated in the big city. In Vietnam from 1995, after economic reforming, there had a population shifts from rural to urban areas for economic opportunities. Population density in the big cities such as Ho Chi Minh City, Ha Noi, Da Nang are higher significant than the others. It is result to increase at risk from the impacts of climate related natural hazards including flooding in urban areas due need of building infrastructures did not meet such as a lack of drainage; or epidemic diseases spreading quickly. So population growth in cities combined with socio-economic factors increase climate risks.

6 DISASTER RISK REDUCTION PLAN IN VIET NAM

Disaster prevention and response strategies implemented by the authorities

6.1 Organizational framework

- The Central Committee for Flood and Storm Control

This organization plays an important role in monitor, response, direct operation, recovery, mitigation and preparation of government.

Role: Observing and investigating the establishment and implementation of the annual flood and storm preparedness solution plans.

Issuing mandates on mobilizing labor force, equipment, ect. to in time respond to pressing situations which are over the local authorization

Instructing localities to overcome consequences caused by floods and storms

Organizing summing up workshops on disaster preparedness and mitigation to propagate experiences, lessons, and advanced technologies in disaster preparedness and mitigation in local and sectors”

The members of central committee including members of Ministries: Agriculture and Rural Development; Natural Resources and Environment; Police; Planning and Investment; Finance; Industry and Trade; Education and Training; Information and Communications; Culture, Sports

and Tourism; Construction; Transportation; Health; Science and Technology; Foreign Affairs; Labour – Invalids and Social Affairs; Vietnam National Broadcast; Voice of Vietnam

For examples about roles have been identified for various Ministries under NDRRP:

- *Ministry of Agriculture and Rural Development (MARD)*: is a governmental agency performing state management functions in the fields of agriculture, forestry, salt production, irrigation / water services and rural development nationwide, including state management functions with regard to delivery of public service and management of the State's ownership of rural state owned enterprises in accordance with legal documents such as integration of risk reduction in planning and implementation of building dikes, lakes to prevent floods and supply water in dry season; integration of drainage water in rural areas.

Units under MARD: support and participate role in part

Water and Sewerage Department: is charge of flood prevention measures, implement prevention and against damage caused by water such as drought, flooding, inundation, invasive salinity, erosion, water resources polluted in irrigation systems; troubleshooting works irrigation; monitor, update on the status of rain, storm, flood to response the rising water.

Center for Prevention and Mitigation of Natural Disasters: is charge of disaster risk management with two missions: disaster mangerment and support technology in prevention, mitigation and response disaster.

Department of Dyke Management and Flood Prevention: monitor, planning, building, maintaince dykes and dams

- *Ministry of Public Health*: coordinate with MARD in response disaster; build up national health disaster management plan; develop an emergency preparedness plan within the health sector; monitor and surveillance epidemic diseases
- *Ministry of Finance*: planning the budget allocationfor communicable disease prevention and control
- *Ministry of Natural Resource and Environment*: integration of forecast, warming and inform about disaster in time;ensuring pollution prevention and control in service of communicable disease prevention
- *Ministry of Education*: integration National Plans in Response Disaster in school; ensure the dissemination of education and information on communicable diseases prevention and

control to the population; build up and develop community-based disaster risk management program

- *Ministry of National Defence*: coordinate with MoH in rescue and recovery operations to prevent disease infection
- *Research and rescue national committee*: coordinate with Steering Committee for Flood Prevention, local government, ministries to build up plan about forces, means and implementation of search and rescue in time effectly.

- ***People’s committees of all levels establish the Committees for Flood and Storm Control at each level (1)***

Role: helping the equivalent People’s Committee to build and instruct the implementation of flood and storm measures in the territory

Organizing dyke protection, flood and storm preparedness and mitigation, and protecting local socio-economic areas

Overcoming flood aftermath

- ***“Ministries and central sectors establish Sector Committees for Flood and Storm Control (1)***

Role: building and implementing flood and storm preparedness and mitigation, protecting people, physical and technical materials under the sector’s management

Managing contingency materials and equipment in supporting to flood and storm preparedness and mitigation under the sector’s management function

In time supply materials, equipment, technologies, ect. to affected areas in emergency situations and support flood and storm aftermath overcoming, following the mobilizing mandates of the Central Committee for Flood and Storm Control

Drawing out experiences in flood, inundation, and storm preparedness and mitigation and propagate them to localities and units in the sector” (1)

- “Since the effect of the Decree No. 168/HDBT, which stipulated the functions, responsibilities, and organization of the Steering Committees for Flood and Storm Control from the central to grassroots levels, the organization of disaster preparedness and mitigation in general and flood and storm preparedness and mitigation in particular were strengthened. The effectiveness of the Steering agencies was consolidated to in time respond to disaster situation and development. A part from establishing flood and storm control agencies at levels, sectors, and localities, steering agencies for flood and storm control should also be established at key works and locations to actively respond to flood and storm development which can cause problems in these areas. Flood and storm

preparedness and mitigation actively implemented in three stages: response preparation, response, and aftermath overcoming, actively helped to mitigate damage and losses and quickly stabilized people's lives and restored production." (1)

6.1.1 Policies

Policies were authorized by Prime Minister to response, recovery, mitigation and preparation disasters like (1)

- Land policy and land use management: "the Law had regulations on managing land for construction of residences in avoiding disaster-prone areas and using land in the scope of flood and storm prevention works, specially in the riverbed for flood release to ensure smooth flood release and reduce danger for the dyke system"
- Policies for forest planting, protecting and forest management and exploitation
- Policies on managing natural resources and exploitation management
- Water resources management policy
- Policy on environmental protection, sustainable development, and environmental management
- Policies for flood diversion and retention and dredging riverbed for flood release
- Policy for disaster aftermath overcoming in disaster-prone areas
- Policies for living-with-flood areas
- Community awareness raising and community-based disaster risk management (CBDRM) inside

6.1.2 National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020

National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020 was issued on 16 November 2007, this is considered guideline to Hyogo Action 2005 – 2015 as well as key policy document for mainstreaming and integration of disaster risk reduction within national, sectoral and provincial socio-economic development planning frameworks. This framework mainly focuses on water-related disasters. The Government of Vietnam's 2007 The National Strategy for Natural Disaster, Prevention, Response and Mitigation to 2020, which outlines Vietnam's main disaster risk management objectives and the National Target Program (NTP) form the overarching policy framework for disaster risk management and climate change adaptation activities. The CCFSC's main mandate is to translate this strategy into action. Other decrees and laws are also complementary. The government of Vietnam has priorities disaster preparedness, recognizing that the most cost-effective measures to mitigate flood related disasters are often non-structural. These measures include flood mapping, river flood warning

systems, television-based disaster information and warning systems, training at all government and grassroots levels on disaster preparedness, and reforestation of certain areas. Land use and development have also been addressed through government regulations.(3,15,34)

Outlines Vietnam's main disaster risk management objectives and the National Target Program (NTP) form the overarching policy framework for disaster risk management and climate change adaptation activities.

The National Strategy addresses both general and region-specific measures for disaster preparedness, response, and mitigation. General measures include:

- Consolidation of the system of law, policy making, and organizational structures
- Development of human resources and social mobilization
- Increasing financial resources
- Raising related to disaster prevention, response, and mitigation
- Ensuring the effectiveness of dyke, reservoir, and dam systems
- Enhancing search and rescue capacities and
- Promoting international cooperation and integration. Specific measures are proposed for different regions

6.1.3 Progress towards HFA 2005 – 2015

Vietnam has signed the commitment to achieve the HFA goals by 2015.

Outcome

“Area 1: the National Strategy on Disaster Prevention, Response, Mitigation (2007) (National DRM strategy) was developed as a key policy document and within the current reporting period, the Government of Vietnam has made considerable progress with respect to the mainstreaming and integration of disaster risk reduction within national, sectoral and provincial socio-economic development planning frameworks”(29)

“Area 2: Decision 76/2009 QD/TT was passed strengthening the function and organization of the Central Committee for Search and Rescue and at lower levels. Besides that, Vietnam launched Vinasat 1 in April 2008 to assist with improving the accuracy of weather forecasting and the country's ability to prepare for major storm events, in particular typhoons. up to now the Gov issued Decision 264/2006/QD-TT instructing the Geophysical Institute to establish earthquake and tsunami gauging stations for early warning”.(29)

“Area 3: the stated goals for Vietnam for the period 2007 -09 under goal 3 did not particularly address the key intended issue for this HFA goal area. Therefore in this section, progress towards vietnam’s stated goal is also augmented by a brief summary of progress towards the HFA goal area 3 which is intended to focus on ensuring that DRR measures are included in post-disaster recovery and reconstruction” (29)

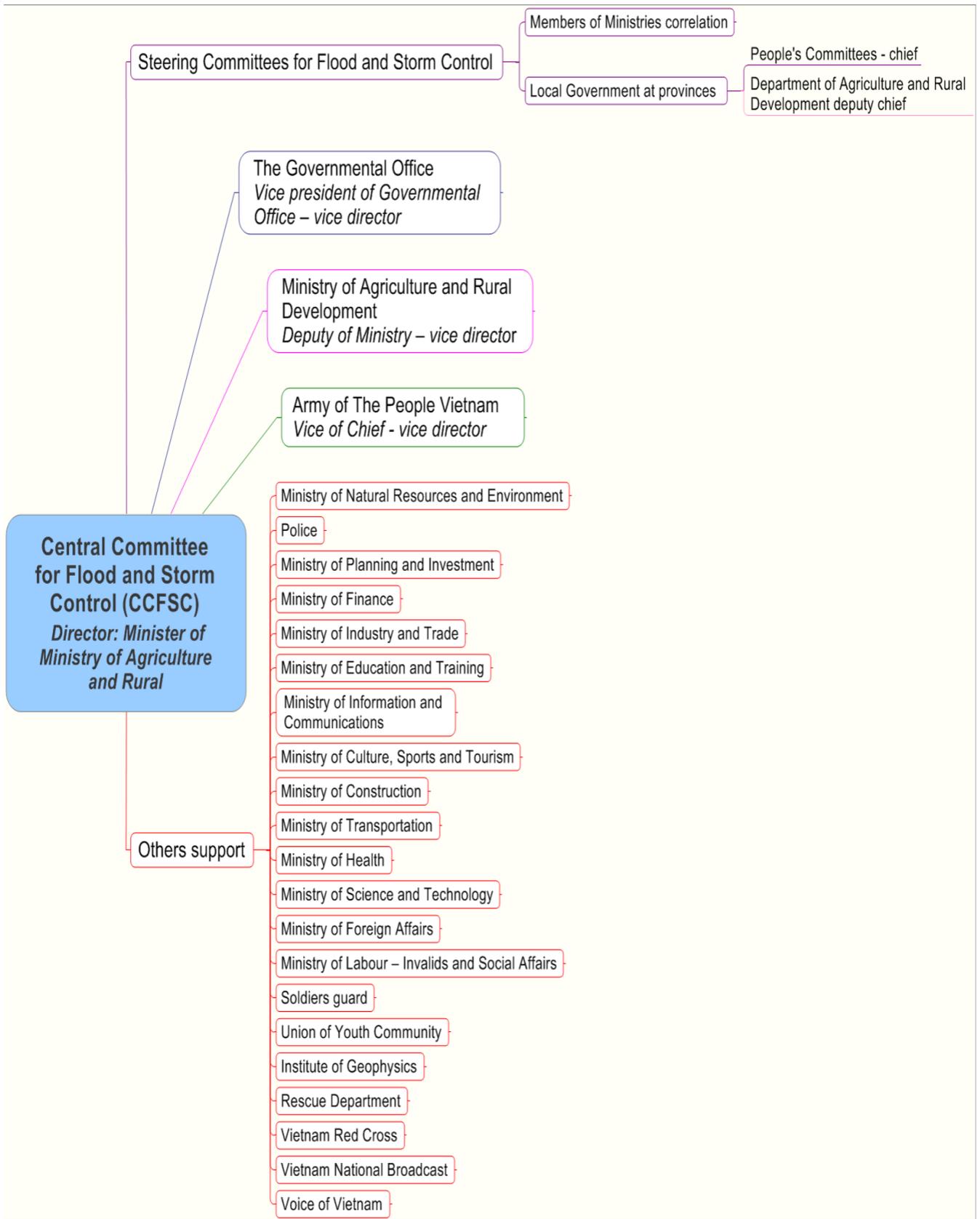
6.2 Structure and characteristics of the emergency and disaster response

Government

- CCFSC is the main office who takes responsibility to determine the emergency preparedness and response activities which is focuses heavily on water related disasters at the National level and the local level as well as coordinate with Ministries, International Non-Organizations. The direct of CCFSC in Ministry of Agriculture and Rural Development (MARD). In each province/city has its own Steering Committees for Flood and Storm Control (SCFSC) will be in charge in commune levels
- So when emergency case is declared, base on kind, size, predicted damage of hazard, CCFSC will give a decision to CFSC and Province Governors who monitor and report reality status to CCFSC as same as conduct actions to protect people such as:
 - o widely to inform people and regularly updated situation
 - o inform the fishing boats seeking safe shelter
 - o warn people about the disaster and guide shelter, evacuation if needed
 - o the police, the army set up the rapid response teams, surveillance and ensure the safety of people
 - o medical team in emergency ready
 - o the youth organizations, the volunteers rather in the most vulnerability areas like crowded population, prone-areas, dykes, dams to response in time or consolidate dykes, houses, avoid falling trees, pour threatening people
 - o the local red cross was mobilized
- In case the emergency is beyond the capacity of provincial management, CCFSC will coordinate sources outside to support local.
- To evaluate emergency status, Prime Minister authorized Decision about Detail Provisions on Disaster Risk Level on 15th August 2014.
- Four ready factors: “Operator, force, means supplies, logistics” at each provinces/city(17)

International Non-Government Organization in Vietnam

- INGO in Vietnam like: Disaster Management Working Group including WHO, Oxfam, UNDP, Red Cross/IFRC, CARE...have been taken part in Community-based disaster risk reduce intervention in Vietnam through their plan and actions in all preparation, response, recovery, mitigation, prevention phases.(17,15,31)



Structure and characteristics of the emergency and disaster response

7 DISCUSSION

It is clearly to see that with huge catastrophe damages which are recognized widely by media broadcast will take pay more peoples's attention than minor disasters. So people may not notice the danger of regularly disasters which become harsher and harsher due to climate change. Flood in the Northern 2010 could be taken an example, civilian living in that areas used to face with floods by their experiences in past so when the huge flood had happened, they became to passive to response and three floods happened incessan made the poor in the northern highland more difficult to relief. And the South has same situation. Mekong delta is warmed as the most prone-floods disaster in Vietnam, it appears that people living there are not significantly aware of the vulnerability of their situation or event they may not realize the extend of the risk to their livelihood.

About economic: Abnormally severe flash flooding is likely to damage infrastructure and productive capacity, as well as directly reduce output, particularly by destroying standing crops and by disrupting economic and social activity. In low and middle-income countries, accumulated losses from small-scale, highly frequent and localized disaster events approach the magnitude of those from major disasters. Decrease vulnerability of agriculture: according to World Bank in their report suggest that *“farmers in more hazard-prone ecosystems of Bangladesh, Vietnam, and other South and Southeast Asian countries have been less well placed to take advantage of higher yielding but less hazard-tolerant strains of rice (Catling 1994;Hossain, Bose, and Chowdhury 2001). Similarly, some combination of greater incidence of natural hazards and (related) higher incidence of poverty can influence the choice of location of investments. In Vietnam, for instance, this choice is contributing to widening regional disparities, as some more hazard-prone regions have received disproportionately small shares of both private and public investment and external assistance (Benson 1997c).”*

To reduce damage Vietnam need improving the forecast and warning system especial for monsoon season, when often there is more rain, typhoons and floods, an accurate forecast will support disaster management and well-prepared plan.

8 CONCLUSION

As known as a “bed-storm” in Asia areas, catastrophe natural disasters in Vietnam almost are hydro meteorological like storm surge, flood, or climate drought, landslide, fire, tornadoes

For five decades, from 1964 to 2014, Vietnam has experienced 189 natural and 65 technological disasters which took 27329 deaths, caused damage to nearly 85 million people and loss of more than 10 billion USA.

Among natural hazards, storms caused the largest number of death with 17,957 and affected the largest population 47 milion people and cause the highest economic loss 6 billion USA (58% in total loss by all disasters).

The period 1964 – 1968 was the worst in terms of number of deaths with 8029 people, while 1979 – 1983 was the worst in term of affected population 18762042 people and 2009 – 2013 economic loss four billions caused mainly by the storms in 2013 and floods in 2010

Storms are the dominant risk in Vietnam with an economic 6,2 billions USA followed by floods 3,7 USA billion and drought 6,5 million USA.

To techonology disaster, peak of death happened in the period 1985 – 1994, and show a trend decrease in the period 2005 – 2014. Whilst number of events and deaths were rising down, number of people affected show an increasing trend. Among techonological hazards, transport accidents dominant risk in Vietnam.

The reasons which increase vulnerability of natural hazards in Vietnam are matix of elements such as: climate change, poverty, lack of regulars and rapid population growth, in which all factors could be the reason or consequence of each other.

To support prevention and mitigation disaster, Primer Ministry was issued policies as well as National Stragery, National Program such as The Government of Vietnam’s National Strategy for Natural Disaster Prevention Response and Mitigation to 2020; Community-based Disaster Risk Management Program (or Decision 1002) for around 6,000 communes at risks in Vietnam until 2020, the National Target Programme to respond to Climate Change 2010 – 2015. Besides that, Vietnam also pacticipates actively other international and regional commitments such as Hyogo Framework for Action (HFA) and ASEAN Agreement on Disaster Management & Emergency Response (AADMER).

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Annex 1 Summarized Table of Technological Disasters in Viet Nam from 1900 to 2014

		# of Events	Killed	Total Affected	Damage (000 US\$)
Drought	Drought	5	-	6110000	649120
	ave. per event		-	1222000	129824
Epidemic	Unspecified	1	16	83	-
	ave. per event		16	83	-
	Bacterial Infectious Diseases	1	598	10848	-
	ave. per event		598	10848	-
	Parasitic Infectious Diseases	1	200	-	-
	ave. per event		200	-	-
	Viral Infectious Diseases	7	368	17823	-
	ave. per event		52.6	2546.1	-
Flood	Unspecified	7	836	1150175	13400
	ave. per event		119.4	164310.7	1914.3
	Flash flood	10	377	893428	201700
	ave. per event		37.7	89342.8	20170
	General flood	51	3609	24977543	2792127
	ave. per event		70.8	489755.7	54747.6
	Storm surge/coastal flood	6	804	4353316	749000
	ave. per event		134	725552.7	124833.3
Insect infestation	Unspecified	1	-	-	-
	ave. per event		-	-	-
Mass movement wet	Avalanche	1	200	38000	-
	ave. per event		200	38000	-
	Landslide	5	130	1074	2300
	ave. per event		26	214.8	460
Storm	Unspecified	9	298	36780	1035
	ave. per event		33.1	4086.7	115
	Local storm	8	160	4513	10100
	ave. per event		20	564.1	1262.5

	Tropical cyclone	77	18557	47227289	6196000
	ave. per event		241	613341.4	80467.5
Wildfire	Forest fire	1	-	-	-
	ave. per event		-	-	-

Annex 2: Summarized Table of Technological Disasters in Viet Nam from 1900 to 2014

		# of Events	Killed	Total Affected	Damage (000 US\$)
Industrial Accident	Collapse	6	453	80	2000
	ave. per event		75.5	13.3	333.3
	Explosion	5	114	4600	-
	ave. per event		22.8	920	-
	Fire	2	18	3521	-
	ave. per event		9	1760.5	-
	Poisoning	2	177	964	-
	ave. per event		88.5	482	-
Miscellaneous accident	Collapse	1	29	-	-
	ave. per event		29	-	-
	Explosion	3	47	559	-
	ave. per event		15.7	186.3	-
	Fire	2	63	5111	2500
	ave. per event		31.5	2555.5	1250
	Other	1	24	-	-
	ave. per event		24	-	-
Transport Accident	Air	5	253	-	-
	ave. per event		50.6	-	-
	Rail	2	25	76	-
	ave. per event		12.5	38	-
	Road	19	455	225	-
	ave. per event		23.9	11.8	-
	Water	17	574	75	-
	ave. per event		33.8	4.4	-
		65	2648.8	21182.8	6083.3

Annex 3: A list of communicable diseases that need to be reported weekly (source: Atlas of communicable diseases in Vietnam from 2000 to 2011)

No	Name of Disease	Group	Code by ICD-10
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1.	Cholera	A	A00
2.	Typhoid	B	A01
3.	Dengue	B	A90/A91
4.	Viral Encephalitis	B	A83
5.	Malaria	B	B50
6.	Hand, Foot, and Mouth disease	B	B08.4
7.	Meningococcal Meningitis	B	A39
8.	Measles	B	B05
9.	Influenza A (H5N1)	A	J09
10.	Severe respiratory infection caused by virus	A	
11.	Dangerous emerging disease with unknown pathogen	A	