CHAPTER II

INDONESIA'S VULNERABILITY TOWARD VARIOUS NATURAL DISASTERS

Explanations in this chapter consists of four sub-titles; they are first the discussion about the understanding of natural disasters in general, next the classification of natural disasters, then some types of natural disasters that frequently occur in the world, and finally the impact of natural disasters.

Indonesia is an area identified as an area that is prone to natural disasters that are very diverse. The disaster resulted in suffering for the society like the human casualties, property loss or damage to the environment and the destruction of building that has been achieved, as well as other damages to facilities and infrastructure and public facilities and etc.

A. Definition of natural disasters

The phenomenon of natural disasters in Indonesia is a scientific event and no one can predict when a natural disaster will occur. A disaster is an event or series of events that threaten and disrupt the lives and livelihoods caused by both natural factors and human factors or non natural resulting in the emergence of human casualties, environmental damage, property loss, and psychological impact. Disaster caused by the event or series of events caused by nature which include

earthquakes, tsunamis, volcanic eruptions, floods, droughts, hurricanes, and landslides.[15]

A natural disaster is also related to human behavior. Aberrant human behavior and greed for natural resources which then can lead to an imbalance of the ecosystem. Theoretically, disasters classified into three types: first, natural disasters *(natural disaster),* such as earthquakes, landslides, floods, etc. Second, the disasters that are arising from anthropogenic (man made disaster), and the third, the conflicts and wars or combined disaster *(complex disaster).*[16]

The resulted loss depends on the ability to prevent or avoid the disasters and their durability. This understanding is related to the statement: "The disaster came when the threat of danger met with powerlessness". Thus, the activity of a dangerous nature will not be a natural disaster in areas without human helplessness, such as earthquakes in uninhabited areas. Consequently, the term "nature" is also contested because the event is not the only hazards or disasters without human involvement. The magnitude of potential losses also depend on the shape of the dangers of its own, ranging from fires, which threaten individual buildings, to a large meteor collision events that could potentially put an end to human civilization.

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[15] Lihat pasal I Undang-undang Republik Indonesia Nomor 24 Tahun 2007 tentang Penanggulangan Bencana

[16] Sarwidi, *"Sebab Akibat Bencana Alam Terhadap Masyarakat Indonesia".* Makalah disampaikan dalam Diskusi Terbatas IMPRESS. tanggal 26 Februari 2005.

However, in areas with high levels of danger *(hazard)* and has a higher susceptibility / *(vulnerability)* that will not give a great impact if there are humans who have the disaster resilience. The concept of disaster resilience is the valuation of system capabilities and infrastructures to detect prevention and deal with serious challenges that exist.

B. Natural Disaster classifications

Natural disaster, viewed from the causes can be divided into three types, namely: geological disasters, climatologically natural disaster, and extra-terrestrial natural disaster. Geological natural disasters are caused by forces emanating from the earth (endogenous force), for example, that earthquakes, volcanic eruptions, and tsunamis. Climatologically natural disaster is a natural disaster caused by wind and rain factors, such as floods, hurricanes, floods, hurricanes, droughts, forest fires caused by nature not human, soil movement or landslides as well as natural disasters. Although the main trigger of the climatologically factors is for example rain, but the symptoms initially started from the geological conditions (types and characteristics of the soil and rocks and so on).

There are some early symptoms of the natural disasters of geological and climatologically disasters related to morphological aspects of the earth that can be observed and studied before the advent of the main symptoms.

Extra-Terrestrial Natural disasters are natural disasters that occur in space, and related to the meteor impact. When there is blow of celestial objects on the earth's surface, this will cause tremendous natural disasters for the people of the earth.

So it is important to understand more the natural disaster types can be seen on the following table:[17]

Table 1. Natural Disaster Types

Natural Disaster Types	**Examples**
Geological natural disaster	Earthquake, tsunami, volcanic eruption, landslide, ground subsidence
Climatological natural disaster	Flood, flash flood, tornado/hurricane/tropical storm, drought, forest fire (not caused by humans)
Extra-terrestrial natural disaster	Meteorite fall-out from outer space
Natural disaster caused by human behavior	Forest fire, landslide, water pollution
Natural disaster caused by human behavior and natural phenomena	Forest fire, landslide, flood caused by forest denudation

[17] Capacity Building in Local Communities (accessed March, 20,2012); available from : http://www.gitews.org/tsunami-kit/en/E5/further_resources/Disaster%20Awareness%20in%20Primary%20School%20Module%20-%20Tsunami.pdf

C. Various Natural Disaster

Natural disasters in recent years often occur in Indonesia. It requires knowledge and understanding of the types of natural disasters that are common in Indonesia.

1. Earthquakes

Earthquakes are caused by the release of elastic strain energy in rocks lithosphere. The greater energy releases the more powerful earthquake. There are many ways that the government take in order to anticipate such disasters by establishing the Meteorology, Climatology and Geophysics Agency (BMKG). An earthquake occurs because of sudden shifts in the earth's crust across a fault.The displacement of a fault and motion of the earth's crust may release energy. Earthquake may occur in land and under the sea. Earthquake that occurs under the sea, may caused tsunami.

In addition, the government makes another attempt to anticipate the disaster by making an earthquake hazard map, conducting education and training on natural disasters, and forming a natural disaster coordination body. The Government also provides information to the public about the steps in anticipating the earthquake disasters such as making a house or building standards, preparing family members to deal with emergencies and alert setting up groups in the community

In the recent years natural disasters frequently occur in Indonesia. One of them was the earthquake that occurred on the island of Alor in October 24-November 15, 2004 (7.3 Richter scale), Nabire on 6 February 2004

with the 6.9 Richter scale and 26 November 2004 with 6.4 Richter scale (6.4) which caused casualties and loss of property of large enough population. Else, the earthquake occurred on December 26th, 2004 with epicenter off the west coast with the NAD Province on the 8.9Richter scale. The earthquake had triggered tsunami waves that impact is felt in 11 countries in Asia with an estimated death toll of no less than 80,000 inhabitants. While one earthquake that occurred in Yogyakarta and surrounding areas in recent years, with a magnitude that is not too large, namely about 5.9 Righter scale, but enough to make the ruins a few houses and buildings.

Nias and Simeleu were grieving due to the aftershocks that were not less devastating, the tsunami in March 2005. Then following, the earthquake occurred in Yogyakarta on May 27, 2006. An earthquake measuring of 5.9 on the Richter scale has killed 3.098 people. Additionally, in October 2010 there were three successive natural disasters occurred, namely; floods In Wasior, Papua that was claimed to cause victims as many as 100 people, and the earthquake and tsunami in Mentawai with 431 fatalities.[18]

[18](accessed March, 22,2012); available from : http://green.kompasiana.com/iklim/2011/09/18/saatnya-indonesia-belajar-%E2%80%9Cshippaigaku%E2%80%9D-dari-negeri-sakura-atasi-bencana/

2. Tsunami

"Tsunami" originates from the Japanese word of "tsu" which means harbor, and "nami" which means wave. Thus by word, "tsunami" means: harbor wave". In the fact,a brief description of tsunami is "series of travelling waves most commonly generated by vertical displacement of the sea floor associated with earthquakes below or near the ocean floor that cause a huge amount if sea water to be displaced abruptly".

Tsunami waves may originate from three sources: earthquakes, volcanic eruptions,landslide all undersea, and meteor falling. The velocity of tsunami waves may reach 800 km/hour in the deep sea, but tends to slow down when approaching coastal areas although they are still quite fast (50km/hour) while the height is increasing as it reach coastal.

The impact of Tsunami will be much depending on the strength of the wave. Tsunami wave can destroys buildings and carries away people, cars, and other belonging.

Tsunami disaster has proved to cost many victims and wealth property as the example of the biggest tsunami on 26 December that hit Aceh with the wave length reached 10 meters and caused 79.940 victims[19]. There were also refugees as many as tsunami victims and earth quake especially in Indonesia with more or less 500.00 people died. It was noted

[19] (accessed March, 22,2012); available from: http://karodalnet.blogspot.com/2009/03/inilah-daftar-tsunami-di-indonesia.html

that 446.212 from total of refugees caused by tsunami was the Aceh refugees.[20]

In March 2011 in Japan there was tsunami that caused many loss about 120 million dollar. This recent data from Japan police shows that there were already 10.000 people died because of the disaster.[21]

Tsunami can be described as a sea wave with long-period which evoked by a disturbance impulsive which occurs on the medium of sea. In addition to the transient nature, the tsunami also can be no dispersive, meaning that the wave phase velocity is independent of wavelength.

The Government has applied preparation steps to anticipate disasters such as Tsunami by using the Tsunami Education Park development in Aceh in 2008. In the park, there is a tsunami simulator to demonstrate the resistance of the tsunami, the construction of retaining walls and construction of a tsunami evacuation sites completed with facilities and infrastructure.

3. Landslide

A landslide is the shifting of a large quantity of soil, comprising soil, rocks, and a variety of material moving down the mountainside or steep terrain with loose soil, especially during a heavy rainfall. Landslides

[20] Jawahir Thontowi, *"Urgensi Peraturan Hukum Bagi Bencana Alam"*, dalam Hukum dan Bencana Alam, (Yogyakarta, JICA-FH UII, 2003).
[21](accessed March, 22,2012); available from: http://www.voanews.com/indonesia/news/PBB-2011-Tahun-Termahal-dalam-Bencana-Alam-137615133.html

are one of the natural phenomena of uncontrolled dangers as a potential hazard to human safety. Landslides often occur due to the deforestation and other human activities.

The main cause of landslides can be blamed on occurrences such as intense rainfall,geological and topographical conditions, as well as triggered by irresponsible human deeds. In short, a landslide may occur due to heavy rainfall, steep terrain, thick and soft soil with unstable rocks, ground shaking, depleting water supply in a lake or dam,increased burden from buildings, erosion, cliff material deposits, and an old landslide.

The government has set up steps of preparation to anticipate landslide or volcanic mapping landslide-prone hills, by making regulations to prohibit the residential development without considering the safety of the environment. The government promotes reforestation in anticipation of the natural disasters, and builds a variety of infrastructure security such as drainage.

4. Flood

Extreme natural phenomena in the form of prolonged rain and human activity are the two things that cause flood. In addition, the most significant cause of flood is the excessive rainfall. The melting of snow for the case in the United States that have 4 seasons is also another major causing flood.

In addition to human activities such as deforestation, the increasingly dense settlement also has the flood potential due to settlement and compaction of the soil that does not allow rainwater to seep into the ground.

5. Volcanic eruption

The volcanic eruptions can have bad impact for the lives of humans, plants, and animals resulted in an existing magma in the volcano erupted out as lava, which could result in fire, rain of dust, toxic gases, tsunami waves if the mountain is located on the sea floor and earthquakes happen.

Conducting evacuation of people around the volcano is the government's mitigation efforts. However, sometimes the effort is facing a dilemma, one of the example is that volcanologist experts must decide whether the volcano will erupt or not. If the early symptoms of a volcanic eruption is so convincing, the volcanologist experts decided to immediately inform the local government officials to evacuate residents.

In addition to evacuation, a mitigation effort by the government is to divert the lava flow to keep flowing in the lines moving away from residential areas. Although it is dangerous, but more people live and make a living on the slopes of the volcano because the volcanic ash contains minerals that nourish the soil, making it great for agriculture.

6. Windstorm/Hurricane

Geographically, the coastal areas and small islands in Indonesia are quite susceptible against windstorm disasters. A windstorm can reach a velocity of 200 km/hour with wind speeds of up to 200 kg/m2 which makes it powerful enough to tear down buildings and trees.

Windstorms often occur in Indonesia, for instance *angin bohorok* in North Sumatra,*angin puting beliung* in Bengkulu and South Sulawesi, *angin gending* and *cleret tahun* in East Java, and *angin lesus* in Central Java.

Natural disaster types and their initial symptoms can be seen in table 2

Table 2. Disaster Types and their Initial Symptoms :[22]

Disaster Types	Initial Symptoms
Flood	High intensity of rainfall, for long periods,rise in river water levels as recorded by the observation post
Flash Flood	Barren mountainous area, avalanche prone rocks, high intensity of rainfall, long periods of rainfall, upstream damming up

[22] (accessed March, 20,2012); available from: Capacity Building in Local Communities http://www.gitews.org/tsunamikit/en/E5/further_resources/Disaster%20Awareness%20in%20Primary%20School%20Module%20-%20Tsunami.pdf

Landslide/Avalanche	High intensity of rainfall, for long periods, land fissures at upper slopes, water seeping like new springs, slanting electric poles, trees and buildings
Volcanic Eruption	Rise in crater temperature, change in chemical composition of water and steam/gas in crater, lava fallout, slight tremor, forest animals fleeing down mountainsides
Tsunami	Earthquake, depleting sea water level, animals fleeing to higher grounds
Earthquake	Increased frequency and amplitude on seismograph, change in animal behavior (usually quiet)

D. The impact of natural disaster

According to Epidemiology Disaster Research Centre *(CRED)* and the International Strategy for Disaster Reduction of the United Nations, United Nations International strategy for Disaster Reduction (UN-ISDR), natural disasters such as earthquakes and large tsunamis in Japan led to record losses hit to 366 billion dollars (285 billion Euros), as many as 29,782,302 people were killed in the disasters last year. Storms and floods accounted for 70

percent of the earthquake disaster, but they are the biggest killer.[23] Data released by the research center of Epidemiology of Disasters (CRED) and the International Strategy for Disaster reduction of the United Nations United Nations International strategy for Disaster Reduction (UN-ISDR), show the earthquake claimed 20,943 people were killed and most of them are the Japanese population. The earthquake and tsunami disaster that triggered a nuclear power plant in Fukushima in March was also the most expensive disaster, causing damage valued at 210 billion U.S. dollars.

The increasing numbers of refugees have a major impact on social stability, economics, politics, and national security. The most vital sector in a country that affected is the sector of the economy by releasing huge funds to rehabilitate the buildings destroyed by the disaster and funds to help disaster victims.

Tsunami and earthquake in Aceh and Yogyakarta have a big impact that covers all aspects of society, both in areas that are directly affected or indirectly affected by the tsunami. In addition, natural disasters also cause psychological disturbances because of family loss, property, poverty, health threats, and vulnerability due to living in refugee camps. Most of the communities that are directly affected, hoped the assistances from the government. Tsunami and earthquake that left hundreds of thousands of lives have been victimized and hundreds of thousands of refugees who have

[23](accessed March, 23,2012);available from: http://www.antaranews.com/berita/293428/pbb-kerugian-akibat-bencana-2011-capai-366-miliar-dolar

struggled to overcome the loss of family and their property, as well as the thinking on how to continue his life.

Disasters that have occurred should be managed immediately by the government of Indonesia since the disaster has caused many casualties and destroyed some public facilities. The government must immediately establish an emergency response situation. Emergency response is a series of activities that are carried out immediately at the time of the disaster to deal with the negative impact, which includes rescue and evacuation of casualties, property, fulfillment of basic needs, protection, management of refugees, rescue, and recovery facilities and infrastructure. Coordinated government assistances are given by the Minister of Social Welfare, Social Minister and the Health Minister in the form of food aids or food, medicine and tents to set up camps for refugees or citizens who survived the disaster, whose houses were destroyed by the tsunami.

The enormity of the tsunami experienced by Aceh and Yogyakarta people attract the attention and sympathy of the whole power of the country to work together to provide help to restore the life and economy of these areas. Aids for tsunami victims from the community in various regions in Indonesia who moved are given to provide relief to victims of disaster. Assistance from the community such as food and clothes that are still worth taking are deliberately donated to help the victims. However, the assistance given by the government and society is not enough because of the high number of victims or refugees resulting from the disaster.

Attention from the government is very limited in providing the aids and evacuation for the disaster victims. Lack of coordination from the local government also because of the uneven assistance provided for all victims of the disaster makes many refugees still have not received assistance. Besides the issue of aid distribution, there is a concern that the government should immediately restore the post-disaster areas to reconstruct the devastated buildings.