

## **DISASTER RISK INDEX IN SIMEULUE DISTRICT (Study Case: Disaster Prone Areas of Aceh Province)**

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### **ABSTRACT**

This study aims to: know the threats ,vulnerabilities and capacity in the research study and how is the disaster risk index of this area. The method of analysis used to define the results of the exploration problem is a descriptive study. To complement the descriptive explanation of some of the test that is : analyze the hazard,vulneribility and capacity do with make a table, map,disaster history and count Disaster Risk Index. From 8 regions in Simeulue are evenly distributed dissemination potential capacity. With an average score for the ability to anticipate threats of 1063, organizing ability and the ability of a solution of 889 monitoring and evaluation of 470. The region and the highest level of anticipation is East Simeulue and Alafan. From 8 regions in Simeulue are worrying spread of potential vulnerability. With an average score of between disaster index, variable economic conditions of 3843, the physical condition of the building has a score of 7848 and the condition of vulnerable 2880. Region and the highest level of vulnerability is Alafan and Salang. From 8 regions in Simeulue are evenly distributed dissemination potential capacity. With an average score for the ability to anticipate threats of 1063, organizing ability and the ability of a solution of 889 monitoring and evaluation of 470. The region and the highest level of anticipation is East Simeulue and Alafan. From the above calculations it can be concluded that the level of disaster risk is highest in Alafan and Salang.

Keywords: Disaster Risk , Proneness, Simeulue

### **Introduction**

Indonesia is a country with a highly potential for disaster . There are several potential disasters include natural disasters such as earthquakes, volcanic eruptions, floods, landslides, and others. Potential disasters in Indonesia can be classified into two main groups , namely the potential main hazard and the collateral hazard. The main potential hazards can be seen among others, on the map of potential earthquake in Indonesia, which indicates that Indonesia is a region with earthquake zones prone, landslide potential maps, maps of potential catastrophic volcanic eruptions, catastrophic potential map tsunami, flood potential maps and others. From the above indicators can be concluded that Indonesia has the potential major hazards (main hazard Potency) high. Certainly it is

very unfortunate for the country of Indonesia. Besides the high potential major hazards, Indonesia also has the potential collateral hazard potency (IDEP, 2007).

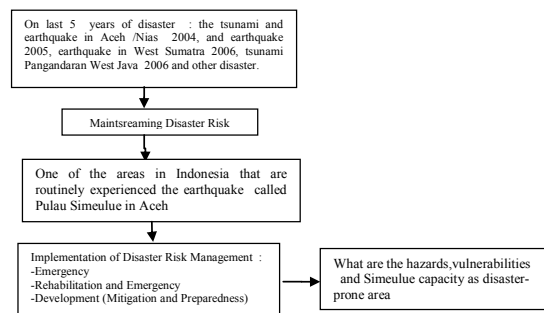
A disaster defined as a serious disruption and functioning of society, causing widespread human, material or environmental losses, which exceed the ability of an affected society to cope using only its own resources (EEA, 2006). Disaster is defined also as a serious disruption of the functioning of a society, causing widespread loss of human life in terms of material, economic or environmental and are beyond the ability of the society to cope using their own resources ( UNISDR, 2004). By UN definition (Cardona, 2005), the risk of losses is a function of three components: hazard, element at risk and vulnerability. In

the case of risk of human losses, the element at risk is the exposed population. The hazard occurrence refers to the frequency of returning period at a given magnitude, whereas the vulnerability is “the degree of loss to each element should a hazard of a given severity occur”(Blaikie et al., 1994).

Disaster Risk Reduction is a series of activities before, during and after a disaster is done to prevent, reduce, avoid, and recover from disasters. According to UNESCO/ISDR (2006), is a preparedness measures that enable governments, organizations, communities, and individuals to be able to respond a disaster situation quickly and appropriately. Included in the preparedness action is the preparation of disaster management plans, maintenance resources and personnel training. Preparedness activities focused on the development of plans to respond to disasters quickly and effectively. Preparedness, efforts are being made to anticipate disasters, through the appropriate steps to organizing and efficient, (Latif, 2008). Risk is the exposure to chance of loss. It is a combination of the probability of an event occurring and the significance of the consequence, known as impact, of the event occurring. The term "risk" comes from the early Italian "risicare" meaning to dare (Bernstein, 1996).

Simeulue island is categorized as prone since they often experience an earthquake and tsunami, the Regional Disaster Management Agency (BPBD) Simeulue District has strong earthquake and tsunami occurred in 1907. Furthermore, on November 2, 2002 an earthquake reaching 9.3 on the Richter Scale (SR), December 26, 2004 reached 9.1 magnitude and tsunami reached 30 meters, March 3, 2005 earthquake reaching 9.1 magnitude, February 20, 2008, 5 April 2009, August 18, 2009 and December 19, 2009. On January 16, 2011 an earthquake of 5.9 magnitude, January 18, 2011 the power of the SR 5.7, 5 April 2010 with the strength of 7.2 Richter. On October 17, 2011 in Simeulue earthquake occurred again with a magnitude of 5.2 SR and January 11, 2012 with a strength of 7.1 SR and April 2012 with a strength of 8.5 Richter. On October 5, 2010 a cyclone hit West Teupah Subdistrict 5 and damaging homes and on March 30, 2011 back hurricanes in Central Simeulue and damaging three

houses. So it can be concluded that these districts are areas that are prone to disasters. From the description of the history of this disaster Simeulue included in disaster-prone areas (TDMRC : Tsunami and Disaster Mitigation Research Center Syah Kuala University, 2011) and have been socialized in Aceh Province.



Graph 1. The background of this study

Based on research Silbert, M, 2011, noted the importance of economic development to reduce vulnerability to disasters. Vulnerability analysis should take into account vulnerable groups such as women, the poor, and small island in developing countries. Based on the background, that is Simeulue proneness, the history of disaster and implemented policies and respect to disaster risk management, so the main problem of this research : What are the threats hazards, vulnerability and capacity in the study area and how is the disaster risk index of this area.

### Research Methodology

The Research was done on June 2012-June 2013. The research location is determined by purposive sampling (Sudjana, 1988) the disaster prone areas in the province of Aceh, Simeulue. Collecting data do in three ways, literature study, questionnaire and field observation. The method of analysis used to define the results of the exploration problem is a descriptive study. To complement the descriptive explanation of some of the test that is : analyze the hazard, vulnerability and capacity do with make a table, disaster history and Disaster Risk Index with the formula :

$$Disaster\ Risk\ (DR) = \frac{Hazard\ (H) \times\ Vulnerability\ (V)}{Capability\ (C)}$$

Sample amount was determined using Taro Yamane’s formula

(in Israel, 1992), as follows:

$$n = \frac{N}{1 + N(e)^2}$$

n = sample amount;

N = population amount;

e = confidence level – 10 %

### RESULT AND DISCUSSION

Based on Disaster Management Act to calculate the level of risk of Disaster Risk, it can be seen from three variables, namely, the threat (Hazard), Vulnerability and Capability. The vulnerability of a community is Determined by the level of disaster risk. Disaster risk is a function of the threat to the state of vulnerable, which can be changed by the existence of ability. By using this formula then when there are no vulnerabilities and threats, risks resulting value is 0, but on the contrary if a region has a value of more than 100 disaster risk, this means that the region has a high risk of disaster. With the model as follows:

$$Disaster\ Risk\ (DR) = \frac{Hazard\ (H) \times\ Vulnerability\ (V)}{Capability\ (C)}$$

In this study, researchers lowered these variables into a few factors and sub-factors in order to obtain the weighted value of each variable threats, vulnerabilities and capabilities. The following diagram decrease variables into a few factors based on a review of studies and the results of focus group discussions in Simeulue community.

### 3.1 Value Threat

Threats are rare or extreme events of the environment due to human activity or natural because that adversely affect human life, property or activity to the level that caused the disaster (UNDP, 2009). Simeulue island consists of more than 40 islands located in the Indian Ocean and in the outer islands of Sumatera. From the observation and data analysis of the obtained multiple threat picture in this disaster-prone areas. Value is calculated through observation researchers threat while in the study by determining the location of impact and the weight of values were then calculated by multiplying the frequency of occurrence. Value threats in Simeulue district can be seen in Table 3.1.

No	Variabel	Tolak Ukur		Bobot	Frekuensi dan Penilaian Skor Dampak															
		Antisipasi	dampak		Teupah Selatan		Simeulue Timur		Teupah Barat		Simeulue Tengah		Teluk Dalam		Salang		Simeulue Barat		Alafan	
					f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor
1	Tsunami	1	8	9	1	72	0	0	1	72	0	0	1	72	0	0	1	72	1	72
2	Gempa Bumi	5	9	9	12	972	15	1215	13	1053	12	972	12	972	12	972	13	1053	14	1134
3	Kebakaran	4	5	5	5	125	8	200	4	100	4	100	4	100	4	100	5	125	5	125
4	Longsor	5	3	3	1	9	1	9	1	9	2	18	2	18	1	9	1	9	4	36
5	Angin Topan	5	4	3	1	12	1	12	2	24	0	0	0	0	1	12	1	12	2	24

Tabel 3.1. Frequency and Threat Assessment Scores

From the above results, we can conclude that from 8 regions in Simeulue are evenly spread of potential threats. With above average scores index disasters, earthquakes pose a threat variables with the highest frequency, as many as 103. Then fires, landslides, hurricanes and tsunamis, respectively 39, 13, 8 and 1. Scores

for each indicator that the tsunami disaster threat of 360, Earthquake of 8343, amounting to 975 fires, landslides and hurricanes by 117 by 96.

And the region which is the highest threat level are Alafan and Simeulue East. This is

because the region as the capital of Simeulue East sub-district is a densely populated area. At the time of the earthquake is easy there is a risk of fire because the stove fell, candles and fall short of current flow occurs. Triggers Another fire building construction material of wood. Mitigation of earthquake made hereditary society is making a house with basic materials so that the board is not too risky when the earthquake happened but on the other hand is more combustible material than brick building material.

Position Simeulue is near the line of the meeting between the Indian plate. Australian and Eurasian plates. Sumatera island arc and the western section is part of the Eurasian plate. While the other plate is under the Indian Ocean. Limit the collision of two plates can be observed in the form of lines deep ocean trenches to the west of Sumatera to the Andaman Islands. In the collision region, the Indian Plate under Sumatera menjam 50 " 60 cm / rock mass above referred to as the contact area of a subduction zone / penunjaman. The highly risk index is Alafan than the other, this was due to the earthquake epicentrum point located at coordinates 3.316 ° North latitude and 95.854 ° East line, with a

depth of 30 kilometers and approximately 250 kilometers south of Banda Aceh and  $\pm$  50 km from Alafan region so that the vibrations are stronger than other regions.

### 3.2 . Value Vulnerability

According to the Ministry of Research and Technology of the Republic of Indonesia, the vulnerability is a condition of a community or society that leads or has an inability in the face of threats. Society is said to have vulnerabilities if they are not able to anticipate and survive a threat. The vulnerability arises because the pressure acts of individual or community.

The forms of vulnerabilities that exist in society seen from indicators of economic conditions, the physical condition of the building and the condition of the vulnerable population. Susceptibility values calculated through observation while on-site research study by determining the impact and value weights are then calculated by multiplying the frequency of occurrence. The value threats in Simeulue district can be seen in Table 4.

This would be a situation faced by people with potentially disaster areas in Simeulue district can be seen in Table 4

No	Variabel	Tolak Ukur		Bobot	Frekuensi dan Penilaian Skor Dampak															
		Antisipasi	dampak		Teupah Selatan		Simeulue Timur		Teupah Barat		Simeulue Tengah		Teluk Dalam		Salang		Simeulue Barat		Alafan	
					f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor
1	Kondisi Ekonomi	3	7	9	15	945	10	630	6	378	5	315	4	252	6	378	7	441	8	504
2	Kondisi Fisik Bangunan	4	8	9	30	2160	15	1080	9	648	7	504	12	864	11	792	13	936	12	864
3	Kondisi Penduduk Rentan	3	8	8	7	448	5	320	8	512	4	256	5	320	7	448	4	256	5	320

Tabel 3.2. Frequency and Vulnerability Assessment Scores

From the above results, we can conclude that from 8 regions in Simeulue are worrying spread of potential vulnerability. With an average score of between disaster index, variable economic conditions of 3843, the physical condition of the building has a score of 7848 and the condition of vulnerable pensusuk 2880. Region and the highest level of vulnerability is Alafan and Salang.

Subdistrict Alafan is the most vulnerable region from other regions . Physically this area directly facing the Indian Ocean with no

obstacles. Alafan region includes areas that have economic resources low and limited access to transportation either by land or sea. Land access many disconnected because a lot of damaged roads and bridges , the network exit is also very limited because there is no port, so that when disaster strikes the area is extremely vulnerable to food aid, medicines and other. Access to communication and electric lighting is also inadequate in this area because there is no telecommunication networks and information that goes into this region.

The second highest vulnerable region is the District Salang because this area is not hilly like many other areas. So they have to run far enough to reach the hill. But when the 2004 tsunami happened community can still save themselves for the hills, because the distance to the area is still quite safe. Results interview mentioned that knowledge has been acquired to save themselves from generation to generation, to save himself and family members, do not remember the others but continue to run to reach the hill.

**3.3. Rated Capacity**

Ability is a combination of strength and existing resources within a community, social

or organization that DAPT reduces the level of risk or the impact of disasters (ISDR, 2002). Existing capabilities in an environment can not be separated from the power of the parties therein (Ministry of Research and Technology of the Republic of Indonesia). From the observation and data analysis of the obtained several images in capacity of disaster-prone areas. Rated capacity is calculated through observation while on-site research study by determining the impact and value weights are then calculated by multiplying the frequency of occurrence. Rated capacity in Simeulue district can be seen in Table 5.

No	Variabel	Tolak Ukur		Bobot	Frekuensi dan Penilaian Skor Dampak															
		Antisipasi	hasil		Teupah Selatan		Simeulue Timur		Teupah Barat		Simeulue Tengah		Teluk Dalam		Salang		Simeulue Barat		Alafan	
					f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor	f	Skor
1	Kemampuan Antisipasi Ancaman	7	9	7	17	1071	19	1197	18	1134	17	1071	15	945	15	945	16	1008	18	1134
2	Kemampuan Mengorganisir Solusi	5	8	7	16	896	18	1008	14	784	15	840	15	840	15	840	16	896	18	1008
3	Kemampuan Pengawasan & Evaluasi	7	8	5	12	480	12	480	11	440	12	480	11	440	12	480	13	520	11	440

Table 3.3. Frequency and Capacity Assessment Scores

From the above results, we can conclude that from 8 regions in Simeulue are evenly distributed dissemination potential capacity. With an average score for the ability to anticipate threats of 1063, organizing ability and the ability of a solution of 889 monitoring and evaluation of 470. Region and the highest level of anticipation is East Simeulue and Alafan.

Alafan have a high threat to the community in managing the risk of tsunami and earthquakes should be to greater capacity, such as in anticipation, community organizing, monitoring and evaluation. Although this indicator is to adopt disaster risk management system from the outside, but this indicator has been applied to the public, for example, people have been able to anticipate early on in the event of an earthquake and tsunami. When an earthquake is high then the village elders (customary village head and dean) immediately ascertain whether a tsunami through the receding sea water and dry well. If such symptoms occur they immediately announced to go up into the hills. For monitoring indicators and the solution is usually done by the village elders to ensure that all citizens have gone up a hilltop and

traditional elders have been able to make further plans after they were evacuated, for example, a search team go to the forest and fine food sources for people who evacuated in the Mount and Security team to ensure that the condition of the village safe.

East Simeulue community is high capacity region because after the 2004 tsunami many NGOs are in, so local knowledge is getting applied and coupled simulation, in addition to the preparedness is further enhanced by the presence of an early warning system of the community in the form of wind chimes that have been applied.

At the time of the 2004 tsunami eastern Simeulue relatively safer, harmful effects in an earthquake collapsed many houses but communities in Simeulue Timur has the capacity to anticipate the event of an earthquake with the development board.

**3.4. Disaster Risk Index**

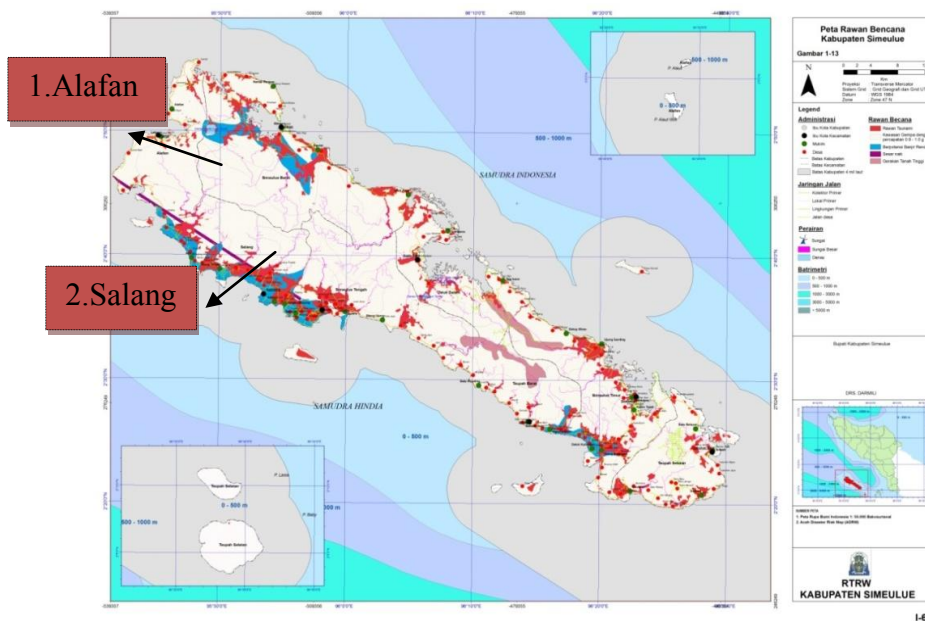
By using this formula then when there are no vulnerabilities and threats, risks resulting value is 0., But on the contrary if a region has a value of more than 100 disaster risk, this means that the region has a high risk of

disaster. Results obtained from observation through interviews and focus group discussions, grouped by the disaster areas in Simeulue District can be seen in table 6.

No	District	Research Variable			Disaster risk index
		Threats	Vulnerabilities	Capacity	
1	Teupah Selatan	1190	1688	2447	82
2	Simeulue Timur	1436	1618	2685	87
3	Teupah Barat	1258	1538	2358	82
4	Simeulue Tengah	1090	1075	2391	49
5	Teluk Dalam	1162	1436	2225	75
6	Salang	1093	2030	2265	98
7	Simeulue Barat	1271	1633	2424	86
8	Alafan	1391	3553	2582	191

Table 3.4. Main Analysis Disaster Risk Index

The figure was obtained from the conversion of the value set by the Disaster Management Act is equal to 100. From the above calculations it can be concluded that the level of disaster risk is highest in Alafan and Salang. The same thing was concluded by Bappeda Simeulue, 2012 in mapping disaster risk index Simeulue island with a GIS (Geographic Information System), that the District Alafan and Salang are the most risk areas on the island.



Graph 2. Main Analysis Disaster Risk Indeks 2013

Alafan and Salang is the highly risk index area than the other, this was due to the earthquake epicentrum point located at coordinates 3.316 ° North latitude and 95.854 ° BujurTimur, with a depth of 30 kilometers and approximately 250 kilometers south of Banda Aceh and ± 50 km from Alafan region so that the vibrations are stronger than other regions.

Alafan Physically is an area directly facing the Indian Ocean with no obstacles. Alafan region includes areas that have economic resources low and limited access to transportation either by land or sea. Land access many disconnected because a lot of damaged roads and bridges, the network exit is also very limited because there is no port, so that when disaster strikes the area is extremely

vulnerable to food aid, medicines and other. Access to communication and electric lighting is also ineffective in this area because there is no telecommunication networks and information that goes into this region, it make difficult to communicate out of the island of Simeulue. Salang is the second highly risk cause there is no close hill around for evacuated place. The people must be run for 30 minute to reach the hill.

### 3.5. Conclusion

From 8 regions in Simeulue are evenly distributed dissemination potential capacity. With an average score for the ability to anticipate threats of 1063, organizing ability and the ability of a solution of 889 monitoring and evaluation of 470. Region and the highest level of anticipation is East Simeulue and Alafan. From 8 regions in Simeulue are worrying spread of potential vulnerability. With an average score of between disaster index, variable economic conditions of 3843, the physical condition of the building has a score of 7848, and the condition of vulnerable 2880. Region and the highest level of vulnerability is Alafan and Salang. From 8 regions in Simeulue are evenly distributed dissemination potential capacity. With an average score for the ability to anticipate threats of 1063, organizing ability and the ability of a solution of 889 monitoring and evaluation of 470. Region and the highest level of anticipation is East Simeulue and Alafan. From the above calculations it can be concluded that the level of disaster risk is highest in Alafan and Salang. It can be seen from the disaster risk index Alafan shown 191 score and Salang area 98 score.

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