

Community Preparedness in Dealing with Landslides

Mamat Ruhimat

*Department of Geography Education Faculty of Social Science Education, Universitas Pendidikan Indonesia
mamatrulhimat@upi.edu*

Keywords: Community Preparedness, Landslides.

Abstract: Landslides are one of natural disaster that difficult to be predicted accurately. Communities that living in a landslide-prone area has to have preparedness to deal with it. This research was conducted in Sagalaherang subdistrict, Subang district, West Java. Sagalaherang subdistrict physically located in a landslide-prone area. This research aims to determine preparedness level of community to deal with landslides using index of preparedness level analysis from UNESCO. Primary data were obtained through field observation and questionnaires and interviews with the people. Secondary data were obtained from a review of various relevant document and literature. Community sample were determined with proportional random sampling. Sagalaherang is one of subdistrict in Subang district that categorized as prone to landslides in the medium to high level, has average rainfall above 2.700 mm/year. Geological condition of Sagalaherang was volcanic material that resulted from volcanic eruption of Tangkuban Parahu with breksi rock types. The morphology were hilly, slope class were dominated with class II – V. Level of community preparedness in dealing with landslides in Sagalaherang subdistrict is categorized as nearly prepared. Communities has knowledge's, and a number of steps that has to be done if landslides occurred. It was still lack in resources mobilization of disaster management. It recommended to increase knowledge's of community and conducting trainings of resources mobilization to deal with landslides, until communities get into well prepared categorize.

1 INTRODUCTION

A total of 18 districts and cities in West Java province were included to the list of area that has land movement potential. The potential for soil movement varies from low to medium to high. Majority of landslide disasters that occurred in areas with potential of land movement in moderate to high. From 2010 to 2013 the number of landslide victims in West Java has been reached 180 people (Directorate of Volcanology and Disaster Mitigation, 2013). Frequency of landslides in West Java has a higher potential because it lies in the volcanic region and has a wavy morphology. Landslides depend on many aspects, such as land use, slope, and geological factors, even the behavior of the population in using land.

Sagalaherang subdistrict that located in Subang district in area of West Java are located in hilly area, that was an area that has potential to landslides that caused by its morphology which was hilly area, or the volcanic activities of Tangkuban Parahu. Sagalaherang subdistrict in Subang district was one

of area that has medium to high of land movement level. Landslides occurred in Sagalaherang subdistrict has struck Tenggeragung, Sagalaherang village, the incident causing death of one person. After that, landslides occurred in Cileungsing, Sagalaherang Kaler village, in February 2010 resulted in two houses owned by residents crashed carried away by landslides, and dozens other houses are under threat of landslides, it also occurred in Cikubang, Sagalaherang Kaler village in December 2010, the community has been startled by landslides that fall on one house and one elementary school, meanwhile for landslides that occurred in the late of December 2012, in Panaruban, Cicadas village that causing death of one person and other seven people were injured (news.okezone, 21 April 2007). Landslide vulnerabilities in Sagalaherang subdistrict was still lack of attention, so there is not any real mitigation efforts to decrease the risks of the danger of landslides. Community that lives in area that has landslide potential plays an important role, even very decisive. People activities in using their land could be a triggering or inhibiting factor of landslides. The

preparedness of community needs to be measured, so that when landslide occurs, it won't make any shock and the victims could be minimalized. Preparedness are the actions that allows government, organizations, peoples, communities, and individual to be able in dealing with disaster situation quickly and appropriately (Carter, 1991). Preparedness has some parameters that can be measured which is: knowledge and attitude, emergency planning, warning system, and resource mobilization capacity (LIPI, UNESCO, 2006). This means that the higher index number, the level of subject preparedness that has been studied are also higher. Level of community preparedness are categorized into five, namely: very prepared with index value 80 – 100, prepared with index value 65 – 79, nearly prepared with index value 55 – 64, less prepared with index value 40 – 54, not prepared yet with index value less of 40 (LIPI-UNESCO, 2006).

2 LANDSLIDES

Landslides are a movement of slope forming material in the form of rocks, debris material, soil, or mixture materials, move down or off the slopes. Landslides was a form of erosion that indicated by transportation or movement of soil mass which occurs at some point in a relatively large volume. Landslides are the movement of soil/rocks mass with tilted direction from original position, so it was being apart from solid mass, because of gravity with rotation and translation movement types. The slides it can be divided into six types, namely: translation slides, rotation slides, block movement, stone ruins, soil creep, and debris material flow. Translation and rotation slides are the most common in Indonesia.

Landslide types that took a lot of victims of property, objects, and human life is debris material flow, because it can go through far enough which is hundred or even thousand meters, especially in watershed area around volcanoes. This landslide speed were influenced by slopes, water volume and pressure, and the material types. Factors that influence to the occurrence of landslides and erosion are nature and human factors. The main nature factor are climate, soil characteristics, main material, elevation, and slopes, even tsunami, human factor is all of human activity that accelerate the occurrence of erosion and landslides (Elliason, 2013). Rainfall is one of climate element which has the big role to landslide occurrence. Rainwaters that infiltrated into soil and saturated the soil determines landslides. Rain intensity determines the level of erosion, meanwhile landslides were determined by soil saturated

condition by rainwaters and the collapse of slide friction. Annual rain fall >2.000 mm/year occurs in most parts of Indonesia. Soil types was also a factor that influencing landslide occurrence. Every soil types has different level of sensitivity to landslides. The depth or solum, texture, and soil structure determines the quantity of surface runoff water and saturation rate of the soil by water. On soil with deep solum (>90cm), loose structure and dense land cover, most of the rain water were infiltrated into the ground and only a small part that being the surface runoff water. Conversely, in soil with shallow solum, solid structure, and less density of land cover, only small percentage of rain water that infiltrated and most of them are being the surface runoff water.

Characteristics of soil parent material is determined by the source of rock and composition of mineralogy that affects the landslide sensitivity. In a mountainous area, soil material is dominated with strong rocks from volcanic rocks, sedimentary, and metamorphic rocks. Soils that formed by sedimentary rocks, especially clay, calcareous limestone or marl and limestone, are relatively sensitive to landslides. Volcanic rocks generally are landslides resistant. One of characteristics of landslide-sensitive soil is the width of soil fracture is >2 cm and the depth is >50 cm in dry season. The soil could expand in wet condition and shrink in dry condition, which was caused by the high content of clay mineral type 2:1 as seen on Grumusol soil. At certain depths of Podsollic or Mediteranic soil there is a clay accumulation which in saturated water condition can also function as a glide field in landslide occurrence. Landslides are common in hilly and mountainous areas, especially in sandy soils (Regosol or Psamment), Andosol (Andisols), shallow rocky soil (Litosol or Entisols), and calcareous shallow soil (Renzina or Mollisols), in wavy regions especially on Podsollic soil (Ultisols), Mediterranean (Alfisols), and Grumusol (Vertisols) that formed from the main rocks of clay stone, marl and limestone with a high clay content. The altitude of land based on height were divided into medium plains (350 – 700 m above sea level) and high plains (>700 m above sea level). Elevation is closely related with the types of commodity that suitable to preserving the environment. National Land Agency set the land on elevation above 1.000 m above sea level and slopes >45% as a restricted business area and prioritized as protected forest areas. While Ministry of Forestry set the land with the elevation above >2.000 m above sea level and/or slopes >40% as protected areas. Grade or land slopes is one of trigger factor of landslides. When slope are steeper, the volume and speed of runoff would be increased

and has potential to causing landslides. Beside steepness, the length of slope also determine the magnitude of landslides, the longer the slope, the greater landslide would be. Slope class consists of flat (0 – 3 %), ramps or choppy 3 – 8 %, slightly slanted or wavy 8 – 15 %, slanted or hilly 15 – 30 %, slightly steep 30 – 45 %, steep 45 – 65 % and very steep above 65 % (Arsyad, 1989). Human factor, are the action of human that causing or makes the landslides occurrence going faster. The action that causing landslides are deforestation which decreasing groundwater infiltration so it will increase runoff. Surface flow or runoff should not be high, because it will affect the erosion, and in the end it also will affect to the landslide occurrence. In the less regions of Europa, Asia and America for example, gully erosion might be the most important geomorphic natural hazard (Inolonita, Michael A. Fullen, 2015). Improper conservation technique in farming land will trigger landslides. The causes of landslide including active and passive factors (Cook and Doornkamp, 1994). Passive factor controls the landslide occurrence, meanwhile the active factor was the trigger of landslides. Therefore, to every habitant should be given knowledge's and planting the attitudes so that the interaction with environment will not causing the acceleration of landslide occurrence.

3 METHOD

Research method that used was descriptive. This research uses survey techniques. Community that became sample of research are the heads of household. The number of samples was 80 people. Sampling technique uses proportional random sampling. The tools of research was interview guidelines. Parameters that used to observe household preparedness level in dealing with landslides are: (1) knowledge of disaster, (2) emergency response plan, (3) disaster warning, and (4) resources mobilization.

4 RESULTS AND DISCUSSION

In measuring the preparedness to deal with disaster, there was three main groups that should be considered, they are community/households, apparatus group or bureaucracy and education units (UNESCO, 2006). One of the stakeholders in preparedness level to deal with landslides of Sagalaherang subdistrict is the households or community. Households is a stakeholder that holds

big role in addition to increase the community preparedness, because it was an initial foundation in social life. These are the level of household preparedness in dealing with landslides in Sagalaherang subdistrict based on the above 4 parameters as follows.

4.1 Knowledge of Disaster

In studying the knowledge of respondent about landslides used some indicators that lowered in some questions related to the causes of disaster occurrence, types of disaster, signs of landslide occurrence and signs of building that resistant to landslides, the actions that should be done when landslide occurs and knowledge of landslide information sources. Knowledge of household respondents about the understanding of disaster was one of important thing that determine for a process to determining index of community preparedness in dealing with disaster. Knowledge of community/households about disaster, were revealed through some indicators, namely the causes of disaster, types of natural disaster, signs of landslide, signs or characteristics of building to anticipate landslides, and information sources to get the knowledge of landslides.

The average of this research results showed score of 97%. This means level of knowledge about disaster of household respondents can be categorized as prepared. This results exactly is a good news to the households in Sagalaherang subdistrict, because most of them has a high preparedness in dealing with landslides. Knowledge of disaster that the household respondents already have was obtained from various information sources, one of them is television. Reports about any occurrences or landslides that occurs in various region in Indonesia on the TV, adding the insight and knowledge for the household respondents. Besides television, the household respondents also get the information from radio. But it still needs some more effort to make the community getting more knowledge about disaster, one of them is with adding information about disaster such as founding an information source that can be accessed by population especially related with disaster, especially landslides.

4.2 Emergency Response Plan

The next parameter that used to determine the level of household preparedness in Sagalaherang subdistrict is Emergency Response Plan. In answering the questions of emergency response plan by household respondents, components that has been questioned to the household respondents are a number of actions that should be done in dealing with landslides,

prepare the medicines, and a place to rescue themselves or understanding evacuation maps when the landslide occurs. Respondent answers were summed up, then search the average. Results of this research showed that its average was 62%. This means preparedness of household respondents in emergency response plan is categorized as nearly prepared. The results of this research on the emergency response plan are very different from the ownership of disaster knowledge. Knowledge of household respondents is not directly proportional with the emergency response plan. It can be seen from the description of the emergency response plan which is owned by the household respondents, like a plan of action to do when the landslide occurred that is go to the open field to evacuate themselves to a safe place. In the future, specifically for the preparedness of the emergency response plan of the household respondent component should receive a very serious attention, which need for increased preparedness by various acts, such as simulation and/or training.

4.3 System of Disaster Warning

Indicator that used to determine the understanding of community in disaster warning are knowledge of disaster warning system traditionally or based on technology and the action that should be done when hearing the warning of disaster, also an information source that obtained by community. The average of household respondent answers about landslide warning system was 53%. This means that household is categorized as less prepared. The highest score was in indicator of stay away from hills/cliffs and/or run to the open place, and the lowest score was in can not coordinate yet and/or utilizing the information through communication media of radio and television. That means the types of warning that has been used by household respondent still using such simple methods. Based on that tendency, in the future it seems need to do a socialization of utilizing various communication media effectively. Area that has landslide potential, should be mitigate to minimizing the effects. Landslide mitigation can be done in two main aspects that is physical condition of nature and vegetation, then mitigation for humankind in social (Nursa'ban, 2010).

4.4 Resources Mobilization

Human resources mobilization in families is a part of preparedness act in dealing with disaster and plays a big role to prepare household members to do right act in dealing with possibility of disaster occurrence. Resources mobilization indicator is the participation

respondents to the meeting/seminar/training, and vigilance in dealing with disaster. Research results showed that the average score of respondent preparedness in dealing with disaster that seen from the aspect of resources mobilization was 63%. Score 63% is categorized as nearly prepared. Types of training that has been participated related with handling disaster is the first aid of accident which was 75%. While the lowest score is on the life/property insurances which was 30%. This means that from insurance side, only small percentage of respondents that has been prepared. Life insurance and saving should be socialized to the respondents, as an important part in facing the possibility of disaster occurrence.

5 CONCLUSIONS

Four parameters of household or community preparedness in dealing with disaster is knowledge of disaster, emergency response plan, system of disaster warning, and resources mobilization. The averages of research results showed these tendency: Knowledge of disaster on household stakeholders is in prepared categorize. Emergency response plan is in nearly prepared categorize. System of disaster warning is in less prepared categorize, and for resources mobilization is in nearly prepared categorize. This research is only measuring the preparedness from household component. In the future at similar research, it recommended to studying the component of bureaucracy and education units preparedness.

REFERENCES

- Arsyad., 1989. *Konservasi Tanah dan Air*. Bogor: Institut Pertanian Bogor Press.
- Carter, N., 1991. *Disaster Management: a disaster manager's handbook*. Manila: Asian Development Bank.
- Cook, R.U., Doornkamp, J.C., 1994. *Geomorphology in Environmental Management-and New Introduction*. Amsterdam: Elsevier.
- Direktorat Vulkanologi dan Mitigasi Bencana, 2013
- Elliason Jonas, Sigbjornsson Ragnar, 2013. Assessing the Risk of Landslide-Generated Tsunamis, Using Translatory, Wave Theory, *International Journal of Earthquake Engineering and Hazard Mitigation*, 1 (1).
- Ionlonita, Michael A. Fullen, 2015. Gully Erosion as a natural and human-induced Hazard. *The Journal of the International Society for the Prevention and Mitigation of Natural Hazard*, 79.
- LIPI – UNESCO. 2006. Pengembangan Framework untuk Mengukur Kesiapan Masyarakat Terhadap Bencana Alam.

- Nashrulloh A., 2007. Longsor Subang Satu Orang Tewas. Okezone (online) halaman 2. Tersedia: <http://news.okezone.com>
- Nursa'ban, M., 2010. Identifikasi Kerentanan dan Sebaran Longsor Lahan Sebagai Upaya Mitigasi Bencana di Kecamatan Bener Kabupaten Purworejo. *Gea Jurnal Pendidikan Geografi*. 10 (2).

