# Society Preparedness in Facing Landslides

## (A Case Study of Sagalaherang District Society, Subang, Indonesia)

M. Ruhimat
Department of Geography Education Faculty of Social Sciences Education
Universitas Pendidikan Indonesia
mamat_ruh@yahoo.co.id
mat.ruh61@gmail.com

**Abstract-Landslides are one of the events that are difficult to predict accurately. Morphology region, type, structure and texture of the soil, rainfall, vegetation density, as well as the behavior of the population in the use of land are a number of dynamic factors that could affect the occurrence of landslides. This research was conducted in Sagalaherang district, Subang. The district of Sagalaherang is physically located in areas of potential landslides. The awareness and readiness of local communities to deal with landslides is necessary to study. This study aims to determine the level of community preparedness in the face of landslides using index analysis the level of preparedness of UNESCO. The primary data obtained through observation and questionnaire as well as interviews with the community. The secondary data were obtained from a review of various documents and relevant literature. The samples of society were determined by proportional random sampling. Sagalaherang is one of the districts in Subang included in the prone category to landslides in the medium to high level. It has an average annual rainfall of over 2,700 mm/year. The geological conditions of Sagalaherang are volcanic materials from the eruption of the mount of Tangkuban Parahu and Sunda manifold breccia rocks. It has morphology hilly region, while for class slope is dominated by a class II to V. Based on the results, the level of community preparedness in the face of a landslide in the district Sagalaherang was categorized into a status of almost prepared. The society has to have knowledge and some steps to do when experiencing occurrences of landslides. However, the mobilization of resources for disaster management is still lacking. It is recommended to increase public knowledge and to conduct training activities for resource mobilization to face landslides, so that people come to in the prepared category.**

***Keywords: community preparedness, landslide***

## I. INTRODUCTION

There are a total of 18 districts and cities in West Java province categorized as potential areas of ground motion. The potential vulnerability of the ground movement ranges from low, medium to high. The majority of landslides occur in areas that have the potential vulnerability from medium to high. From 2010 to 2013, total fatalities due to landslides in West Java reached the number of 180 people (Directorate Volcanology and Mitigation, 2013). The frequency of landslides in West Java has a higher rate because the area is located in the volcanic area. The area has many active volcanoes which made of loose soil. Potential landslides that occur in an area depend on some aspects, including its land use, slope, and geological factors. The forest has been turned into some agricultural areas that contain lots of water so that the soil becomes loose significantly because there are no roots of the tree that bind the soil.

The district of Sagalaherang is located in Subang, West Java Province. It lies in a hilly area that has potential prone to landslides caused by the morphology of the region located in the hills, as well as by volcanic activity of Tangkuban Perahu Mountain. It has a medium to high level of vulnerability to land movement. The district has some villages that once were struck by landslides. Once, a landslide occurred in the district struck Tenggeragung village which resulted in one victim died. Then, in February 2010, a landslide occurred in Cileungsing village which resulted in two houses to collapse by landslides and dozens of other homes under threat of landslides. In December 2010, a landslide struck Tjikubang village and cause one house and one school building. Meanwhile, at the end of December 2012, another landslide occurred Cicadas village which claimed one death and seven others injured [1].

The vulnerability to landslides in Sagalaherang district still has less attention, so the mitigation efforts which are apparent to reduce the risk of danger of landslides are absence. Therefore, the community who settle in the area of potential landslides plays not only an important but also a decisive role. The activities of the community in utilizing the local environment can be a trigger and an inhibiting factor to the occurrence of landslides. Thus, the community preparedness needs to be measured to reduce the shock and to minimize the casualties when the landslides occur. The preparedness is the actions that enable governments, organizations, societies, communities and individuals to be able to respond to a disaster situation quickly and appropriately [2]. Preparedness has some parameters that can be measured, including knowledge and attitude, emergency planning, warning system, and resource mobilization capacity [3]. This means that the higher the index number, the higher the level of preparedness of the subject under study. The level of community preparedness is categorized into five categories, namely: Highly Prepared with the index value of 80 to 100, Prepared with an index value of 65 to 79, Almost Prepared with a score of 55 to 64, Less Prepared with a score of 40 to 54, Not Yet Prepared with an index value of less than 40 [3].

## II. LAND SLIDE

A landslide is a displacement of the slope forming materials in the form of rocks, debris material, soil, or mixture materials, that move down or out the slopes. It is a form of erosion that is characterized by a mass movement of land in a relatively large volume. It is a mass movement

of soil or rocks with the obliquity of the original position, so that it parts from a solid mass because of the gravity influence, with the type of rotational and translational motion forms. A landslide can be divided into six types which include translational slides, rotational landslides, block movements, rock falls, creeping soil, and the flow of material destruction. Translational and rotational slides are the most common types of landslides in Indonesia. The deadliest landslide type which destructs properties, objects and casualties is the flow of material destruction. It occurs because the landslide can cover a large distance that can reach hundreds or even thousands of meters, especially in the area of the river basins and in the area around volcanoes. The speed of this type of landslide is strongly influenced by the slope, volume and water pressure, as well as the type of material. There are some factors that influence the occurrence of landslides and erosion, which include natural and human factors. The main natural factors are climate, soil characteristics, the nature of material, elevation and slope, even a tsunami. Meanwhile, the human factor is human action that can accelerate the erosion and landslides [4].

Rainfall is an element of a climate which plays its role in the landslide. The rain which infiltrates into the soil and is saturated in the soil determines the occurrence of landslides. The intensity of rainfall determines the size of erosion, while landslides are determined by the saturated soil condition by the rain and the collapse of friction glide. The annual rainfalls of more than 2,000 mm mostly occur in most parts of Indonesia. In addition, the type of soil is also one of the influential factors to the occurrence of landslides. Each type of soil has a level of sensitivity to the different landslides. The solum depth, textures, and structures of the soil determine the size of surface runoff water and the rate of soil saturation by water. In the soil with deep solum (> 90 cm), loose structure and dense land cover, most of the rain water infiltrates into the ground and only a small portion that becomes surface runoff water. Instead, in the soil with shallow solum, solid structure, and less dense land cover, only a small portion of rainwater infiltrates and mostly becomes surface runoff. The nature of the soil material is determined by the origin of rocks and mineralogical composition that affect the sensitivity of landslides.

In mountain areas, soil parent material is dominated by volcanic, sedimentary, and metamorphic solid rock. The soil that is formed from sedimentary rocks, mainly stone clay, stone or clay calcareous marl and limestone, is relatively sensitive to landslides. Volcanic rocks are generally resistant to landslides. One characteristic of land which is sensitive to landslide is the existence of the land cracks with more than 2 cm wide and more than 50 cm deep during the dry season. The land has the properties to expand in wet conditions and to contract in dry conditions, caused by the high content of clay mineral type 2: 1 as seen on the ground Grumusol. At a certain depth of the Podsolic or the Mediterranean soil, there is accumulation of clay that in water saturated conditions can also function as the glide plane in the landslide.

Landslides often occur in the hilly and mountainous, especially on sandy soils (Regosol or Psamment), Andosol (Andisols), shallow rocky (Litosol or Entisols), and shallow ground calcareous (Renzina or Mollisols), in the region of undulating mainly on the ground Podsolic (Ultisols), the Mediterranean (Alfisols), and Grumusol (Vertisols) formed from the parent rock stone clay, marl and limestone with a high clay content.

Based on the height, land is differentiated by medium land (350-700 m above sea level) and the high land (> 700 m asl). Altitude is closely related to the types of commodities in order to maintain environmental sustainability. National Land Agency establishes land at altitudes above 1000 m above sea level and slopes> 45% as the limited business area and is preferred as protected areas. While the Ministry of Forestry set a land with an altitude> 2000 m above sea level and / or slope> 40% as a protected area. Slopes or the slope of the land is one of the factors triggering landslides. The steeper the slope is, the greater the volume and speed of runoff that could potentially cause mudslides. In addition to the steepness, the slope length also determines the magnitude of the landslide. The longer the field slope is, the greater the landslide occurs. The class of slope consists of flat 0-3%, ramps or wavy 3-8%, slightly crooked or wavy 8-15%, sloping or hilly 15-30%, somewhat steep 30-45%, steep 45-65% and very steep >65% (Arsyad, 1989) [5].

Human factors are human actions that can cause or accelerate the occurrence of landslides. Actions by humans that can cause landslides include deforestation that reduces rainfall infiltration so that it increases the runoff. The surface flow or run off should not be left great because it will affect the amount of erosion, which in turn will also affect the occurrence of eroded soil. In the regions of Europa, Asia and America, for example, gully erosion might be the most important natural geomorphic hazard (Inolonita, Michael A. Fullen, 2015) [6]. Inappropriate conservation technique on agricultural lands will trigger landslides. Therefore, it is necessary to give the knowledge to the society and at the same time encouraging their attitude so that their interaction with the environment will not cause the acceleration of landslides.

## III. Research Method

The study used descriptive method by using survey technique. The subjects of the study were householders, and the samples were 80 householders. The samples were selected using proportional random sampling. The instruments used in the study were interview guides. The parameters used to investigate the householders' level of preparedness in facing landslides were (1) knowledge of the disaster, (2) an emergency response plan, (3) the warning of disasters, and (4) resource mobilization.

## IV. Results

To measure disaster preparedness, there are three main target groups that should be considered, namely the community/household, group or bureaucratic apparatus and education unit [3]. One part that becomes stakeholder in level of preparedness in the face landslides in Sagalaherang district is households or communities. Households are stakeholders who play an important role in efforts to increase community preparedness because the household is the foundation of public life. The following will discuss the household level of preparedness in the face landslides in Sagalaherang district based on four parameters above.

## V. KNOWLEDGE OF DISASTER

In measuring the respondents' knowledge about landslides, there are several indicators that are used. The indicators are derived from the questions related to disaster, the cause of the disaster, the types of disaster, the signs of landslides and the characteristics of buildings that are resistant to landslides, the actions undertaken when the landslide occurred, and knowledge of resources landslides. Knowledge of household respondents on their understanding on disasters is one of the important things that determines for the process of determining the index of community preparedness for disasters. Knowledge of the community/household on disaster is revealed by several indicators, namely the cause of the disaster, the types of natural disasters, the signs of landslides, the traits or characteristics of the building in anticipation of landslides, and the resources to gain knowledge about landslides.

The average results showed a score of 97%, meaning that the level of knowledge of the disaster on households can be categorized as prepared category. The results of this study would be good news for households in Sagalaherang district because most people already have a high readiness in the face landslides. Knowledge of disasters that households obtained is from various sources of information, one of which is television. Their news about the event or occurrence of landslides that occurred in various parts of Indonesia has added the insight and knowledge for households. In addition to getting information about events of landslides from the television media, households also know the information from the radio. However, some more efforts are still required to make the public gain more knowledge of the disaster and more tangible insight. One way to add information regarding disaster is by establishing an information center that can be accessed by the general public, especially information related to disasters, particularly landslides

## VI. EMERGENCY RESPONSE PLAN

Another parameter used to determine the level of preparedness of households in the Sagalaherang district is the Emergency Response Plan (ERP). In answering questions about an emergency response plan by households, some components asked to the respondents were a number of actions to be taken in the face landslides, the preparation of drugs, and self-rescue or understand the evacuation route map in the event of landslides. The responses were added up, and then searched for their mean/average. The results showed an average score of 62%, meaning that the readiness of households in terms of emergency response plans is in the category of almost prepared. These results are far different from the of respondents' knowledge on disaster. The knowledge of households is not directly proportional to the emergency response plan. It can be seen from the description of the emergency response plan owned by households, such as the plan of actions to be taken when the landslide occurred, such as running toward the open field to evacuate to a safe place. In the future, the readiness of emergency response plans of the components of households should receive serious attention, namely the need to increase the readiness of the various efforts, such as simulation and training.

## VII. DISASTER WARNING SYSTEMS

The indicator used to determine the community's understanding of the disaster warning is the knowledge of both traditional and technology-based disaster warning systems, the actions taken when hearing their disaster warning, and the sources of information about disaster warning obtained by the public. The average results of households' landslide warning system were 53%. This can be interpreted that households are included in the category of poorly prepared. The highest score was in the indicator hills away or run off into the open, and the lowest score was inability to coordinate and utilize information through the media or radio and television communications. The data showed a tendency that the type of alert used by the households is still simple ways. As a result, to this, in the future it is necessary to conduct socialization about the utilization of various communication media effectively.

## VIII. HUMAN RESOURCE MOBILIZATION

Mobilization of human resources within the family is part of the action in the face of disaster preparedness and plays a very important to prepare members of the household to do the right thing in the face of possible disasters. The indicators for resource mobilization are the respondent's participation in the meetings/seminars/training, and vigilance in the face of disaster. The results showed that the mean score of the respondent's readiness to face the possibility of disaster from the aspect of resource mobilization was 63% indicating the category of almost prepared. This type of training that has been followed related to disaster management was first aid on accidents, which was 75%. Meanwhile, the lowest score was in life insurance/property, which is 30%. This means that in terms of insurance, only a small proportion of respondents had prepared. Life insurance and savings needs to be disseminated to the respondents, as one important part of the face of the possibility of disaster.

## IX. CONCLUSIONS

There are four parameters of readiness of households or communities facing disaster which include knowledge of disaster, emergency response plan, disaster warning system, and human resource mobilization. The average results showed a tendency as follows: knowledge disaster domestic stakeholders were in the category of prepared. An emergency response plan was in the category of almost prepared. Disaster warning system was in the category of less prepared, and for resource mobilization was in the category of almost prepared. This study is to measure the readiness of the components of the households. For further research, it is suggested to examine the readiness of the elements of the bureaucracy and education units.

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