

# STUDY OF LOCAL PEOPLE PERCEPTION RELATED TO LANDSLIDE HAZARD: A CASE OF TAWANGMANGU SUB-DISTRICT KARANGANYAR REGENCY INDONESIA

## *Studi Tentang Persepsi Masyarakat Lokal Terhadap Bencana Tanah Longsor: Kasus Di Kecamatan Tawangmangu Kabupaten Karanganyar Indonesia*

Heru Setiawan<sup>1</sup> dan Dyah R Hizbaron<sup>2</sup>

<sup>1</sup>) Researcher of Forestry Research Institute of Makassar

<sup>2</sup>) Lecturer of Geography Faculty, Gadjahmada University  
e-mail: hiero\_81@yahoo.com

### **ABSTRACT**

*In 2007, a series of landslides occurred at Tawangmangu, resulting in the collapse of several houses and the death of dozens of people. One essential pathway to reduce the vulnerability of communities goes through an increased preparedness. The present contribution aims to determine existing level of preparedness by analysing the people perception and knowledge of landslides. Survey method with random sampling technique was applied to assess the level of people perception and to analysis local people knowledge regarding with landslide. The number of respondents was spread proportionally across five sub-villages; Plalar, Guyon, Sodong, Salere and Ngledoksari. The respondents were interviewed using questionnaires with open and closed questions. Statistical analysis with multiple linear regressions was applied to identify the influencing factors of local people perception related to landslide. The result show that people in the area have good knowledge and perception about landslide. This condition is commonly influenced by age and education.*

**Keywords:** Landslide, people perception, Tawangmangu, disaster, hazard knowledge, vulnerability assessment

### **ABSTRAK**

*Bencana tanah longsor yang terjadi di Kecamatan Tawangmangu pada tahun 2007 mengakibatkan puluhan rumah roboh dan kematian. Analisis persepsi masyarakat terhadap longsor merupakan salah satu elemen yang penting untuk mengetahui kesiapsiagaan masyarakat dalam menghadapi bencana longsor yang akan terjadi di masa mendatang dan untuk meminimalkan dampak negatif yang timbul akibat bencana longsor. Untuk mengetahui tingkat persepsi dan pengetahuan masyarakat terhadap longsor digunakan metode survey dengan pengambilan responden yang dilakukan secara acak. Jumlah responden ditentukan secara proporsional dan tersebar di lima dusun yaitu Plalar, Guyon, Sodong, Salere and Ngledoksari. Wawancara terhadap responden dilakukan dengan menggunakan kuesioner dengan tipe pertanyaan terbuka dan tertutup. Data yang didapat selanjutnya dianalisis secara statistik dengan menggunakan metode regresi linear berganda untuk mengetahui faktor-faktor yang mempengaruhi tingkat persepsi masyarakat local terhadap longsor. Hasil pengamatan di lapangan menunjukkan bahwa secara umum masyarakat memiliki persepsi dan pengetahuan yang baik terhadap longsor. Kondisi tersebut dipengaruhi oleh umur dan pendidikan.*

**Kata kunci:** Longsor, persepsi masyarakat, Tawangmangu, bencana, pengetahuan bencana, penilaian kerentanan

## INTRODUCTION

One of hazard occurred frequently in Indonesia is landslide. Almost every place in Indonesia especially on mountainous area, landslide usually happened. Landslides commonly happen during rainy season between December and February. They bring extensive damages on property and cause losses of lives. According to the data that published by National Disaster Management Agency (BNPB, 2009), amount of dead people in 1998 until 2007 caused by landslide are 1,362 and the injured victims 315 people. Landslide has been considered as the top-five rank of most frequent disasters in Indonesia with the average events of 92 per year, after floods with 297 events per year, droughts with 156 events per year, fires with 147 events per year and typhoons with 110 events/ year (Karnawati et al, 2012).

Landslide can be triggered by several factors such as intense rainfall, earthquake shaking, water level change, storm waves or rapid stream erosion that cause a rapid increase in shear stress or decrease in shear strength of slope-forming materials (Dai *et al*, 2002). On the other hand, human activities have significant role for landslide occurrences for example undercutting of steep slopes for road construction and housing.

Tawangmangu is one of sub-district in Karanganyar regency, Central Java that susceptible to landslide. The two major of landslide events in 2007 in Tawangmangu has resulted 33 houses collapsed and 34 people died. The driving factors of the event were high intense rainfall, morphological condition, slope and land use change (Prawiradisastra, 2008). Based on these landslide events, the research related to the local people perception on landslide becomes important. By knowing the people perception about disaster, will be know how respond of people to survive and to cope from di-

saster in the future. The people perception about disaster and its negative impacts because of disaster will affected the ability of people to cope the disaster. Ability of people to deal with a disaster will reduce the negative impact which may be caused by the disaster (Sare, 2009). Community's perception is considered being fundamental for the behaviour towards risks and for the decision to take preventive measures (Rianto, 2009). Information on risk is important to reduce loses when disaster actually comes (Hizbaron, *et al.*, 2010). The general objective of this research is to analyse the local people's perception in relation to landslide. The more specific objectives are to analyze the factors that influence local community's perception of landslides.

## RESEARCH METHOD

The study site is located in Tawangmangu Sub-district with cover areas 70.03 km<sup>2</sup> and altitude average 1,200 meters above sea level (BPS, 2011). The results of spatial data analysis related susceptibility to landslide show that most of area in the Tawangmangu Sub-districts categorized in medium susceptibility class was covering 2,674.888 Ha (Wati et al, 2010). This research was conducted on August till November 2012 (Figure 1).

This research applied simple random sampling method to take sample of respondents from the population. Type of research is survey method with the unit of analysis is the household and head of household was selected as a sample. Total households in study area are 1,411 households. According to Sugiyono (2007), the amount of respondent can be determined using formula:

$$S = \frac{N.P.Q.\lambda^2}{d^2(N-1) + P.Q.\lambda^2}$$

Where:

$\lambda^2$  = Error standard = 1

d = Standard deviation = 0.05

P = Q = Probability = 0.5

S = Total sample

N = Population

Base on Sugiyono (2007) formulation, the total minimum respondent that must be taken is 93 household. The respondents were distributed proportionally by considering the number of people in each sub-village. The amount of respondent is 14 respondents in Plalar Sub-village, 16 respondents in Guyon Sub-village, 25 respondents in Sodong Sub-village, 22 respondents in Selere Sub-village and 16 respondents in Ngledoksari Sub-village. The questionnaire with close and open ended questions used in order to collect

the primary data from household survey. The questions included close question with "agree" until "not agree" and open question to give opportunity for respondent to explore their opinion. The answer scored using *Linkert scale* as 5 if "fully agree" until 1 if "fully not agree" (Albaum, 1997). The data analysis process included several techniques, as follow: descriptive statistics analysis, linear regression analysis and chi-square analysis.

Some of equipments were used in this research; consist of Global Positioning System (GPS), recorder device, digital camera, printer, printed thematic map, printed satellite imageries, questionnaire sheet and list of question for interview, stationery. Software was applied for data analysis comprises Microsoft Office 2007 (Word, Excel) and SPSS 19 for statistical data processing.



Gambar 1. Research Location

## RESULT AND DISCUSSION

### Characteristic of Respondents

Totally, the amount of sample is 93 respondents consisted of 69% were men and 31% were women. The age of respondents is ranging from 23 to 82 years old, 41% respondents were between 23 and 39 years old, 45% were 40 to 59 years old and 13% were 61 years old or older. Based on the monthly income, 48% of the respondents reported monthly incomes lower than \$95 and 52% more than \$95. As regards level of education, 55% of respondents had attended elementary school or under, 23% junior high school, 17% senior high school and 5% had a university degree. Regarding the occupation type, at the time of data collection 46% of the sample were farmer, while 11% were trader and self-employed, 4% were civil servant, 20% were private employees and 18% have non-permanent occupation. The size of the surveyed households was dominated by the household with the 3 to 4 of family member (58%), followed by 5 to 6 member with 24% of respondents, 14% with 1-2 member and 4% with more than 6 member. Most of respondents have permanent building (70%), 17% semi permanent and 13% of respondent have non-permanent house. Regarding on the landslide experience, the majority of respondents (50%) experienced the landslide more than twice, while 24% respondents were twice and 26% respondent have once experienced in landslide.

### Local People's Perception to Landslide

Risk perception is characterized as the intuitive judgment of individuals and groups of risks in the context of limited and uncertain information (Slovic, 2000). Perceptions regarding the definition of landslides declared that most respondents (40%) answered mass of rock and soil that fallout. Deforestation is a major cause of the landslide chosen by 35% respondents, while the location of the

landslide occurred dominated in steep slopes area with 68% respondents. Type landslides that have occurred in the study area were Topple (47%). Losses caused by landslides consisting of physical and non-physical losses. Perception population regarding the major physical losses caused by landslides is house damage (71%), while the non-physical is trauma (66%).

The level of risk perception is derived by calculating the answer of respondents from the questionnaire. The result of calculation was categorized in three classes: Low, Moderate, and High. Cross tabulation between people perception and domicile of respondents (sub-village) was presented on the table 1.

Cross tabulation is a summary of the data presented in table form. On the table 1, it can be seen that totally, 43 respondents (46%) have moderate level of risk perception, 44 respondents have high level (47%) and only 6 respondents (6%) that have low level of perception. On the low level was scattered in Plalar Sub-village 1 respondent, Salere 3 respondents, Sodong and Ngledoksari have the same number with 1 respondent. People who have moderate level spread across Guyon Sub-village 11 respondents, Plalar 6 respondents, Salere 11 respondents, 9 respondents in Ngledoksari and 6 respondents in Sodong Sub-village. Population with a high level of perception amounted to 44 respondents with a composition in Guyon Sub-village 5 respondents, Plalar 7 respondents, Salere 8 respondents, 18 respondents in Sodong and 6 respondents in Ngledoksari.

The chi-square test is used to assess the degree of relationship between the level of perception ((high, moderate, low) and the domicile of respondent. Null hypothesis (H0) stated that there is no differences level of perception in five sub-villages and alter-

native hypothesis (Ha) stated that there is a differences level of perception in five sub-villages. The decision making was determined by looking at the ratio between the value of calculated chi-square and the value of chi-square table. Null hypothesis is accepted if the value of calculated chi-square is less than the value of chi-square table and the opposite, null hypothesis is rejected if the value of calculated chi-square is greater than the value of chi-square table.

Base on the Table 2 can be seen that value of calculated chi-square was 12.911 and chi-square table is 15.507. Because of the value of calculated chi-square (12.911) less than the value of chi-square table (15.507),

null hypothesis is accepted, meaning that there was no differences level of people's perception in five sub-villages or there was no correlation between the level of people perceptions and the domicile of respondents (sub-village).

### Influencing Factors of People Perception

Westen and Kingma (2011) mentioned that the level of risk perception depend on their personal situation, cultural and religious background, social background, economic level, political background, level of awareness, media exposure, other risks and risk reduction situation. Before conducting an analysis of factors that influence perception, the first thing to do is analysis to the

Tabel 1. Cross Tabulation Between People Perception and Domicile of Respondents

Count		Sub_village					Total
		Guyon	Plalar	Salere	Sodong	Ngledoksari	
People_perception	Low	0	1	3	1	1	6
	Moderate	11	6	11	6	9	43
	High	5	7	8	18	6	44
<b>Total</b>		<b>16</b>	<b>14</b>	<b>22</b>	<b>25</b>	<b>16</b>	<b>93</b>

Sumber: primary data analysis

Tabel 2. The result of chi-square tests of people perception using SPSS

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.911 <sup>a</sup>	8	.115
Likelihood Ratio	13.616	8	.092
Linear-by-Linear Association	.682	1	.409
N of Valid Cases	93		

a. 5 cells (33.3%) have expected count less than 5. The minimum expected count is .90.

Sumber: primary data analysis

factors that have correlation with the level of community's perception related to landslide. Social economic characteristic of respondents preassumed has correlations with the level of landslide perception of local community. Independent factors of respondents comprise age, gender, education, household size, occupation, income, building type and people experience to the landslide.

Correlation analysis was conducted using SPSS Software. The null hypothesis stated that independent variables (age, gender, education, occupation, income, household size, building type and landslide experience) do not have a correlation with the dependent variable (community's perception). Decision-making is based on the null hypothesis that will be accepted if the value of Sig. (1-tailed) > 0.05. The results of correlation analysis are presented in the Table 3.

The null hypothesis used in this analysis is independent variables (age, gender, education, occupation, income, household size, building type and landslide experience) do not have a correlation with the dependent variable (people perception). Probability value (*P-value*) was used 0.05. Decision-making is based on the null hypothesis that

will be accepted if the value of *Sig. (1-tailed)* > 0.05. From calculations process using SPSS software (see Table 3) can be seen that there are five variables that have a *sig. (1-tailed)* < 0.05, those are age, education, occupation, income, household size and building type. It can be concluded that the variables that have a correlation with the local people perception are age, education, occupation, income, household size and building type.

The final output of the multiple linear regression analysis is coefficients table. Coefficients tested the influence of one by one independent variables with the dependence factor (the level of people perception) using *T-test*. The null hypothesis stated that partially the independent variables not have significant influence with the level of people perception (dependent variables). A method for decision-making is done using a probability value (*P-value*) 0.05. If the significance value > 0.05, null hypothesis is accepted.

Base on the Table 4 can be seen there are only two variables that have significant influence to the people perception, that are age and education. Findings from this study indicated that two predictor variables, age and education, have a significant influence

Tabel 3. Correlation Test of People Perception Using SPSS

<b>Correlations</b>	
<b>Independent variable</b>	<b>Sig. (1-tailed)</b>
Age	.000*
Gender	.080
Education	.000*
Occupation	.003*
Income	.000*
household size	.048*
Building_type	.000*
Landslide_exp	.235

Sumber: primary data analysis

with the variation of local people perception to landslide.

The respond of two significant predictor variable (age and education) to the regression can be seen on the value of *Unstandardized Beta Coefficients*. Constant coefficient have a positive value (2.314) which states that assuming the absence of predictor variables, the level of people perception tends an increase. Regression coefficient for age variable is negative (-.178), meaning that by assuming the absence of other independent variable, the increasing of age level will be followed by the decline of perception level. The young people tend to have higher level of perception than elderly people. Regression coefficient for education variable is positive (.313), meaning that by assuming the absence of other independent variable, the increasing of education level will be followed by the raise of perception level. The people with high level education tend to have higher level of perception than people who have low level education.

## CONCLUSIONS

Community's perception related with landslide in Tawangmangu dominated in high and moderate level. Totally, 46% respondents have moderate level of risk perception, 47% have high level and only 6% respondents that have low level. The variables that have a relationship with the perception are age, education, occupation, income, household size and building type. Age and education are two factors that have significant role which influence the level of local community's perception to landslide.

## ACKNOWLEDGEMENT

I would like to give my great full thanks to Drs. N.C. (Nanette) Kingma and Dr. C.J. (Cees) van Westen as my excellent supervisors. Great thanks are consigned to all of respondents in Tawangmangu for kind cooperation and comfortable condition during fieldwork in Tawangmangu.

Tabel 4. Coefficients Test of People Perception Using SPSS

Model	Coefficients <sup>a</sup>		t	Sig.	
	Unstandardized Coefficients				Standardized Coefficients
	B	Std. Error			Beta
(Constant)	2.314	.359		6.443	.000
Age	-.178	.044	-.346	-4.074	.000*
Gender	-.097	.107	-.074	-.912	.364
Education	.313	.061	.478	5.128	.000*
Occupation	.001	.029	.003	.034	.973
Income	.175	.103	.143	1.688	.095
Household_size	.007	.059	.008	.112	.911
Building_type	.030	.086	.035	.348	.729
Landslide_exp	-.034	.053	-.047	-.655	.514

a. Dependent Variable: People\_perception

Sumber: primary data analysis

## REFERENCES

- Albaum, G. 1997. *The Linkert Scale Revisited: An Alternate Version*. Journal of the Market Research Society; Apr 1997; 39, 2; ABI/INFORM Global pg. 331
- BNPB (National Disaster Management Agency). 2009. *Indonesian Disaster Data and Information*. Retrieved 21st May, 2012. <http://dibi.bnpb.go.id/>
- BPS (Centre of Statistic Bureau) of Karanganyar Regency. 2011. *Karanganyar dalam angka 2011*. Badan Pusat Statistik Kabupaten Karanganyar
- Dai, F.C. Lee, C.F. Ngai, Y.Y. 2002. *Landslide Risk Assessment and Management: An Overview*, Engineering Geology 64:65–87
- Hizbaron, D.R., Hadmoko, D.S., Samodra, G., Dalimunthe, S.A., Sartohadi, J. 2010. Review of Vulnerability, Risk and Rockfall Danger Prone Zoning in Kulonprogo, Yogyakarta. *Forum Geografi*. Vol 24, No. 2 Dec 2010.
- Karnawati, D. Syamsul, M. Teuku, F. Wahyu, W. 2012. *Development of Socio-Technical Approach for Landslide Mitigation and Risk Reduction Program in Indonesia*. [www.seed-net.org/download/C1-1\\_Paper3.pdf](http://www.seed-net.org/download/C1-1_Paper3.pdf). Accessed on 24 January 2013
- Prawiradisastra, S. 2008. *Analisis morfologi dan geologi bencana tanah longsor di Desa Ledoksari Kabupaten Karanganyar*. Jurnal sains dan teknologi Indonesia Vol. 10 No. 2 Agustus 2008 Hlm.84-89
- Rianto, T. 2009. *Spatial Analysis of Volcanic Risk Perception Case Study in Local Community at Merapi Volcano Dangerous Zones*, ITC, International Institute of Geoscience and Earth Observation, MSc Thesis, Enschede, The Netherlands
- Sare, M. Y. W. 2009. *Tingkat kerentanan dan kapasitas masyarakat lokal terhadap bencana tanah longsor di Kecamatan Kokap Kabupaten Kulon Progo*. Thesis Program Sekolah Pascasarjana Universitas Gadjahmada
- Slovic P. 2000. *The perception of risk*, 1st edn. Earthscan publications Ltd. London. England
- Sugiyono. 2007. *Metode Penelitian Kuantitatif dan Research Development*. Alfabeta, Bandung
- Westen, V. N.C. Kingma. 2011. *Guide Book Session 7: Disaster Risk Management*. Twente University - ITC School on Disaster Geo-information Management. Enschede. Netherland
- Wati, S.E. T, Hastuta, S, Widjojo, F, Pinem. 2010. *Landslide Susceptibility Mapping with Heuristic Approach in Mountainous Area; A Case Study in Tawangmangu Sub District, Central Java, Indonesia*. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Science, Volume XXXVIII, Part 8, Kyoto Japan