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Mitigation of Landslide Disaster Management in Senggigi Tourism Area in West Lombok Regency

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Abstract

Landslides are a frequent occurrence in the wet tropics, particularly in the Senggigi area of West Lombok Regency. Following landslide incidents on February 6, 2021, near the Sheraton Hotel, Alberto Restaurant, and a road in Senggigi on November 12, 2021, mitigation efforts have become imperative. This research aims to identify the causal and influencing factors, assess their impacts, and propose mitigation strategies. Data is collected through questionnaires and interviews, followed by validity and reliability testing. Results indicate that soil type (20.945%) and high rainfall (23.776%) are significant factors contributing to landslides. Consequently, specialized attention from relevant agencies is needed to address soil issues in Senggigi effectively.

Keywords: Disaster, Landslide, Mitigation.

INTRODUCTION

Indonesia is one of the countries that has a vulnerability to hydrometeorological disasters, namely disasters caused by climate change and weather (Marengo et al., 2020; Turner, 2018). According to Law Number 24 of 2007, disasters are events or series of events that can threaten and disrupt the lives and livelihoods of the community. They can be caused by natural factors, non-natural factors, and also factors from humans themselves, which can directly cause human casualties, property losses, and psychological impacts. Disasters occur because of threats and vulnerabilities, and the community is not able to cope with them (Fan et al., 2019; Rosyida & Nurmasari, 2019; Uddin et al., 2021). Based on disaster events from the National Disaster Management Agency, landslides are deadly disasters because many victims have died from these disasters. A BNPB study states that 40.9 million Indonesians live in landslide-prone areas (BNPB, April 30, 2019).

Landslides pose a significant threat in tropical regions like the Senggigi tourist area. They not only result in loss of infrastructure, agricultural land, and human lives but also indirectly impede development and economic activities in the affected area and its vicinity (Erien, 2020; Guzzetti, 2021; Jakob, 2022; Nurwidyaningrum et al., 2022). The Senggigi Tourism Area in West Lombok Regency, Indonesia, is particularly prone to landslides, especially during the rainy season. This susceptibility is attributed to the geological features of the area, characterized by high morphology, faults, and fragile volcanic rocks, exacerbated by the region's wet tropical climate. Therefore, urgent mitigation efforts are imperative to minimize the adverse impacts of landslides.

So far, spatial and regional development have not paid attention to landslide disasters. The consequence is that the impact will continue to be sustainable if efforts are not made to minimize the risk of disasters (Alcántara-Ayala, 2021; Guzzetti et al., 2020; J. Zhang et al., 2024; X. Zhang et al., 2019). The Senggigi Tourism Area, West Lombok Regency is one area classified as frequent landslide disasters in West Nusa Tenggara Province. Several locations in the area experienced landslides, both in small dimensions and large dimensions, resulting in damage to infrastructure, houses, and facilities owned by residents, disruption of economic activities, and threatened the safety of residents. The causes of the landslide are slopes, morphology, geological conditions, spatial planning, and conversion of forests into food crops or plantations (Hidayat et al., 2019; Isnaini, 2019; Pecoraro et al., 2019; Perera et al., 2018; Ullah et al., 2020). A major landslide disaster occurred in the Sengigi Tourism Kawasa on February 6, 2021. The disaster occurred at 3 points: the first point around the Sheraton hotel, the second around Alberto Restaurant, and the third around the road in the Senggigi Tourism Area occurred on November 12, 2021. This is due to high rainfall that is long enough.

The Senggigi Tourism Area, located in West Lombok Regency, is characterized by its hilly terrain and steep slopes. While numerous initiatives have been undertaken by local governments, including collaboration with government agencies and universities, to minimize and prevent landslides, there is still a need for further research and innovation in this area. To advance risk reduction efforts and promote sustainable, safe development planning, conducting a comprehensive disaster risk analysis is imperative, particularly in disaster-prone regions like Senggigi. This research aims to identify causal factors of landslides, assess their impacts, and develop effective strategies to mitigate future risks and enhance resilience in the area.

METHODS

Data Analysis

This data processing is carried out by processing validation data (validity) and reality and determining the impact and disaster mitigation on research results.

1. **Analysis of Dominant Factors Causes and influences**

   This test is carried out by determining 1 most dominant factor from the causal factor variable from 18 variables and 1 most dominant factor from the influence factor variable from 5 variables that have been determined or from the results of processing respondent questionnaire data. As for how to determine it with the testing below:

   a. Validity Test

      This test is done by determining the values (Rxy, Rtable, and Validity Status). Where to determine Rxy by the CORREL Formula (average X1; average (Total)). For Rtotal in this study using 25 respondents with a formula where with a population of 20% value (N = 0.396)

After determining the average of 18 cause variables and 5 influence variables, researchers will take the highest average value, namely 1 cause variable and 1 influence variable. To determine the population of respondents, researchers took 25 respondents because it was known that population data on stakeholders in Lombok were:

1) Contractors 91 at 20% = 12 Respondents
2) Consultants 40 at 20% = 8 Respondents
3) Owner 23 at 20% = 5 Respondents

And if totaled from the stakeholder population, where 25 populations are found at 20%. To determine its Validity by comparing the value of N with the value of Rxy to find out its "Valid and Invalid."

b. Reliability Test

This test is carried out to determine the comparison between causal and influencing factors. If the causal factors outweigh the influence, then the study is said to be significant and vice versa.

This test is carried out by determining the values (Item Variance, Number of Item Variance, Total Variance, r11, and Reality). Where to determine the grain variant and the number of item variants. Where is the variant of the item with the formula (VAR block value X1) and for the number of grain variants that is (SUM block the average variance of the grain variant). And to determine the variance can be calculated by means (SUM average value (total)).

To determine "r11" that is by means ((number of questions/number of questions-1) multiplied (1- (number of item variances / total variance)). To determine Reliability by comparing the value of "r11" with the category of reliability coefficient.

c. Impact Caused by Landslides

The impact of this landslide can be determined after determining the causal factors. The impact caused by landslides in the research area can be determined by collecting data directly from the research location (the impact of landslides in the Senggigi area), which I will survey directly.

d. Disaster Management Mitigation

After testing or test results of validity and reliability, we can take 1 cause and 1 of the most dominant influences from the questionnaire that has been determined and has been processed. These 2 factors become a reference for disaster management or landslide disaster mitigation. After determining the mitigation, we can find out what factors cause landslides.

RESULTS AND DISCUSSION

Resource Person Data

Data collection in this study was obtained through the distribution of questionnaires to resource persons to obtain secondary data to be processed according to the purpose of the study. Secondary data distributed questionnaires to 35 (thirty-five) resource persons in accordance with the research objectives in which researchers took 35 respondents from a population of 20%, namely (contractors 110 in 20% = 21 respondents, Consultancy 40 in 20% = 8 respondents and 23 in 20% = 6 respondents) in which a total of 35 respondents in the population of 20%.

The resource persons in this study are those who are directly involved in the implementation of the procurement process of government construction goods/services and communities who have experience in the failure of the Senggigi landslide.

Work Experience

From the questionnaires that have been answered and collected, it can be seen that of the 35 respondents directly related to landslide disasters, they have experience or years of work in the following table:

Table 1. Respondent's Experience/Work Period

Experience	Total	%
5-10 Years	5	14,29
11-20 Years	7	20,00
21-30 Years	15	42,86
31 Years and Above	8	22,86
Total	35	100

Education Level

From the questionnaires that have been answered and collected, it can be seen that from 35 respondents, respondents who are directly related to landslide disasters with the following education levels, whose education level is Bachelor Starta one (S1) is 60% (21 people). The level of high school education is 40% (14 people) with the level of education as shown below.

Table 2. Respondent Education

Education	Total	%
SMA	14	40
S1	21	60
Total	35	100

Education Level

From the questionnaires that have been answered and collected, it can be seen that of the 35 respondents, respondents who were directly related to the landslide disaster had the following educational levels, with 60% (21 people) having a bachelor's degree (S1) and 40 having a high school education level. % (14 people) With education level as shown in the picture below.

Table 3. Respondent's Education

Education	Total	%
Senior High School	14	40
Bachelor	21	60
Total	35	100

Job (job title on the project)

From the questionnaires that have been answered and collected, it can be seen that of the 35 respondents who were directly related to the landslide disaster, they worked as CONTRACTORS (10) 28,57%, PUPR STAFF (12) 34,29%, CONSULTANTS (6) 17,14%, BASARNAS (4) 11,43%, and PSDA (3) 8,57%.

Table 4. Respondent's Occupation/Position

Respondents	Total	%
Contractor	10	28,57
PUPR Staff	12	34,29
Consultant	6	17,14
Basarna	4	11,43
PSDA PU	3	8,57
Total	35	100

Validity Test

To test whether the variable used is valid or not with the validity test, pearson compares the calculated r value with the table r. if the value of the r count is more than the r table, then it is declared 'valid', and if the value of the r count is less than the r table, then it is declared 'invalid'. Where N = 25 at 5% significance in the distribution of the r value of the significance table, the table r value is 0.396.

Reliability Test

In reliability testing, Cronbach's Alpha value of the cause of the landslide was obtained at 1.04, and the effect of the landslide was obtained at 0.01. Where the value is greater than 0.01, the research instrument used is declared feasible so that the data obtained can be used in factor analysis.

Factor Analysis of the Causes and Effects of the Senggigi Landslide

Using descriptive statistical method analysis, the results of the analysis are used to determine the most dominant cause and influence factors.

Based on the results of the analysis of the causes and influence factors of landslide disasters, the percentage of each variable is calculated, and researchers take the 5 highest cause variables and 1 highest influence variable. The researchers explained the results of 5 causative factors and 1 of the most dominant influence factors.

Causative Factors

The type of soil obtained a percentage of 20.945% of the total assessment score from respondents. Factors in carrying out work can affect work productivity. Of the 25 respondents stated were 8 very influential. 13 respondents stated very influential, 2 stated medium influence, and 2 stated little influence.

The use of wrong land planning (irregular) obtained a percentage of 20.534% of the total assessment score from respondents in carrying out work can affect work productivity. Of the 25 respondents, 6 were very influential. As many as 14 respondents stated very influential, 4 respondents stated medium influence, and 1 respondent stated little influence.

The additional burden on the slope obtained a percentage of 20.329% of the total assessment score from respondents in carrying out work can affect work productivity. Of the 25 respondents stated, 11 were very influential. As many as 7 respondents stated very influential, 3 stated medium influence and 4 stated little influence.

Erosion or erosion on the soil obtained a percentage of 19.302% of the total assessment score from respondents in carrying out work can affect work productivity. Of the 25 respondents stated, 7 were very influential. As many as 10 respondents stated very influential, 4 stated medium influence and 4 stated little influence.

Forest burning obtained a percentage of 18.891% of the total assessment score from respondents in carrying out work, which can affect work productivity. Of the 25 respondents, 7 were very influential. As many as 8 respondents stated very influential, 5 stated medium influence and 5 stated little influence.

Factors of influence

High rainfall obtained a percentage of 23.776% of the total assessment score from respondents in carrying out work, which can affect work productivity. Of the 25 respondents stated there were 6 very influential. 16 respondents stated very influential, 2 stated medium influence and 1 stated little influence.

CONCLUSION

The research report on the causal factors influencing landslide disasters in Senggigi highlights significant findings. Analysis using EXEL software revealed that soil type and high rainfall are primary factors contributing to landslides in the Senggigi tourism area, with soil type accounting for 20.945% and high rainfall for 23.776% of the occurrences. These factors have direct impacts on local communities and infrastructure, necessitating mitigation measures. Recommendations include increased awareness and regulation regarding building on susceptible soil types and implementing strategies such as reforestation to mitigate the effects of high rainfall, emphasizing the importance of proactive measures in disaster preparedness and management.

REFERENCES

Alcántara-Ayala, I. (2021). Integrated landslide disaster risk management (ILDRiM): the challenge to avoid the construction of new disaster risk. Environmental Hazards, 20(3), 323–344.

Erien, S. W. (2020). Strategi Pemerintah Kota Padang Dalam Pengembangan Pariwisata Berbasis Mitigasi Bencana.

Fan, X., Xu, Q., Liu, J., Subramanian, S. S., He, C., Zhu, X., & Zhou, L. (2019). Successful early warning and emergency response of a disastrous rockslide in Guizhou province, China. Landslides, 16, 2445–2457.

Guzzetti, F. (2021). On the prediction of landslides and their consequences. Understanding and Reducing Landslide Disaster Risk: Volume 1 Sendai Landslide Partnerships and Kyoto Landslide Commitment 5th, 3–32.

Guzzetti, F., Gariano, S. L., Peruccacci, S., Brunetti, M. T., Marchesini, I., Rossi, M., & Melillo, M. (2020). Geographical landslide early warning systems. Earth-Science Reviews, 200, 102973.

Hidayat, R., Sutanto, S. J., Hidayah, A., Ridwan, B., & Mulyana, A. (2019). Development of a landslide early warning system in Indonesia. Geosciences, 9(10), 451.

Isnaini, R. (2019). Analisis bencana tanah longsor di wilayah Jawa Tengah. Islamic Management and Empowerment Journal, 1(2), 144–145.

Jakob, M. (2022). Landslides in a changing climate. In Landslide hazards, risks, and disasters (pp. 505–579). Elsevier.

Marengo, J. A., Alves, L. M., Ambrizzi, T., Young, A., Barreto, N. J. C., & Ramos, A. M. (2020). Trends in extreme rainfall and hydrogeometeorological disasters in the Metropolitan Area of São Paulo: a review. Annals of the New York Academy of Sciences, 1472(1), 5–20.

Nurwidyaningrum, D., Sari, T. W., Sudardja, H., & binti Impak, S. (2022). Analisis Jenis Longsoran Pada Daerah Wisata Berlereng Tajam, Banten. Prosiding Seminar Nasional Teknik Sipil, 2, 1–8.

Pecoraro, G., Calvello, M., & Piciullo, L. (2019). Monitoring strategies for local landslide early warning systems. Landslides, 16, 213–231.

Perera, E. N. C., Jayawardana, D. T., Jayasinghe, P., Bandara, R. M. S., & Alahakoon, N. (2018). Direct impacts of landslides on socio-economic systems: a case study from Aranayake, Sri Lanka. Geoenvironmental Disasters, 5, 1–12.

Rosyida, A., & Nurmasari, R. (2019). Analisis Perbandingan Dampak Kejadian Bencana Hidrometeorologi dan Geologi di Indonesia Dilihat Dari Jumlah Korban (Studi: Data Kejadian Bencana Indonesia 2018). Jurnal Dialog Dan Penanggulangan Bencana, 10(1), 12–21.

Turner, A. K. (2018). Social and environmental impacts of landslides. Innovative Infrastructure Solutions, 3, 1–25.

Uddin, M. S., Haque, C. E., Khan, M. N., Doberstein, B., & Cox, R. S. (2021). "Disasters threaten livelihoods, and people cope, adapt and make transformational changes": Community resilience and livelihoods reconstruction in coastal communities of Bangladesh. International Journal of Disaster Risk Reduction, 63, 102444.

Ullah, S., Khan, M. U., & Rehman, G. (2020). A brief review of the slope stability analysis methods. Geol. Behav, 4(2), 73–77.

Zhang, J., Tang, H., Li, C., Gong, W., Zhou, B., & Zhang, Y. (2024). Deformation stage division and early warning of landslides based on the statistical characteristics of landslide kinematic features. Landslides, 1–19.

Zhang, X., Song, J., Peng, J., & Wu, J. (2019). Landslides-oriented urban disaster resilience assessment—A case study in ShenZhen, China. Science of the Total Environment, 661, 95–106.