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RESEARCH ARTICLE

Analysis of Factors Causing Erosion and Flooding in Manleuana Village, Dom Aleixo District, Dili Regency

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ABSTRACT

Erosion is a major cause of land damage and degradation. Erosion is the moment of land shifting, ultimately leading to flooding or overflowing water in an area. Erosion and flooding cause physical, social, and economic losses. Many people are unaware of the factors that cause erosion and flooding, so they are unaware of the importance of maintaining the land they use for daily activities. This ultimately leads to erosion and flooding in the areas they occupy. The purpose of this study was to determine the factors causing erosion and flooding, identify and determine which factors control and influence erosion and flooding in Manleuana Village, Dom Aleixo District, Dili Regency. The research method used in this study was a descriptive qualitative method using primary and secondary data to identify the factors causing erosion and flooding in Manleuana Village, Dom Aleixo District, Dili Regency. Based on the research results, the factors causing erosion were identified with scores ranging from 77.07% to 92.18%, with agreement to strong agreement categories for several factors, including climate (rainfall density), topography, vegetation, and human behaviour. The factors causing flooding, based on scores ranging from 69.7% to 86.18%, with agreement to strong agreement categories for seven factors and seventeen variables, were: river conditions, particularly river capacity; drainage conditions, particularly drainage capacity; soil conditions, particularly soil infiltration; flood discharge, particularly heavy flow and normal discharge; river capacity or drainage, particularly erosion and sedimentation; watershed characteristics (watershed width), watershed shape, topography, morphometric, geology, vegetation; and finally, human actions in terms of land use and indiscriminate waste disposal within the area; and the planning, monitoring, and maintenance systems for dams and drainage systems. The analysis shows that relevant ministerial agencies and the community have identified several issues and developed plans to prevent future erosion and flooding in Manleuana Village, Dom Aleixo District, Dili Regency, due to heavy rainfall.

INTRODUCTION

Timor-Leste is a country with two seasons: rainy and dry. During the dry season, the land experiences drought, and during the rainy season, Dili, in particular, experiences natural disasters such as erosion and flooding every year.

Erosion is a major cause of land damage or degradation. Kartasoeptra (2005) states that erosion is the process of soil washing away, transporting, or moving soil from one place to another, by the force of water and wind, either naturally or as a result of human actions.

Continuous erosion can cause numerous problems and damage to the land itself. Generally, the causes of erosion are determined by several factors, such as climate (rainfall intensity), topography (land slope), soil characteristics, vegetation, and human activities or actions.

Flooding is a natural phenomenon related to human activities or actions, which cause flooding. Flooding itself can occur due to several factors, such as climate (rain intensity), river conditions, drainage conditions, upstream conditions, agricultural conditions, and tidal fluctuations. The potential threat of flooding is due to damaged rivers, damaged water catchment areas, violations of regional spatial planning, lack of integrated development planning, and a lack of community discipline.

Dili Regency, as a city within Timor-Leste, has led to massive urbanization in the city. The rapid growth of the population in Dili has led to increased demand for basic and secondary needs. In other words, there have been significant changes in land use in urban spatial planning, activities to meet the increasing needs of the community in the economic, social, and environmental dimensions. This results in excessive natural exploration, uncontrolled land use changes, and reduced environmental capacity. The multiplier effect of these activities results in natural disasters such as erosion and flooding. Population growth can be said to increase built-up land and reduce green open space. Green open spaces are highly effective water reservoirs. In certain areas, rainwater becomes groundwater, which is retained by abundant vegetation, significantly reducing surface runoff. The retained groundwater then filters into water reservoirs or reservoirs within the soil, such as the no-groundwater zone. Within the soil zone, the water becomes soil water, and within the groundwater zone, the water becomes

groundwater in unconfined and confined aquifers. In 2021, erosion and flooding occurred in Manleuana Village, Dom-Aleixo District, Dili Regency. Manleuana Village consists of 10 hamlets with a total population of 18,076 people in 2023, comprising 9,045 women, 9,031 men, and 3,463 families. In 2021, disasters such as erosion and flooding also occurred, damaging domestic infrastructure, including homes, and non-domestic infrastructure, such as roads, in Manleuana Village. Therefore, this study was conducted to identify the factors causing erosion and flooding and to mitigate them in the area through integrated and appropriate management.

METHODOLOGY

Research methodology

Research methodology is a scientific method used to achieve a goal. It is a scientific way to obtain data for scientific purposes and uses (Sugyono, 2011:2). Methods play a crucial role in research studies, collecting data and information, and solving problems encountered by researchers to achieve a goal and use it. This is similar to the activities of searching, registering, formulating, and analysing data to complete a report. According to David H. Penny, research methodology is systematic thinking about various problems, the solution of which requires the collection and interpretation of facts.

This research was conducted in Manleuana Village, Dom-Aleixu District, Dili Regency, for one month to determine the factors causing erosion and flooding in the area. This study used tools and materials such as a GPS, a measuring tape, a Sunto compass, complete stationery, a calculator, a camera, and a map of the area.

Several important factors were used to determine the factors causing erosion and flooding. In general, erosion is determined by climate, topography, soil characteristics, vegetation cover, and land use (Wischmeier and Smith, 1978; Shwab et al., 1981; Hudson, 1995; Arsiad 2010; Asdak 2012). Formulas such as climate, topography, soil characteristics, vegetation cover, and land use are used to calculate the total erosion rate.

The erosion process consists of three sequential steps: detachment, transportation, and sedimentation. Rainwater erosion is caused by the kinetic energy of water falling on the ground surface (Asda, 2014). The kinetic energy (KE) is 1/2 MV, where M is the mass of water and v is the speed of the falling water. The magnitude of this kinetic energy can be used to determine the erosion process itself. The method of measuring and predicting

erosion, to determine the level of erosion hazard (TBE) can be calculated by comparing the level of erosion in a land unit and the effective soil depth in that land unit. In this case, the erosion level is calculated by calculating the estimated average annual soil loss due to layer and gully erosion calculated using the formula proposed by Wisehmeir and Smith (1978), namely the Universal Soil Loss Equation (USLE) such as A = R x K x LS x C x P. Where R is the average annual rainfall erosivity (usually expressed as rainfall impact energy (MJ/ha) multiplied by the maximum rainfall intensity for 30 minutes (mm/hour), K is the soil erodibility index (tons x ha x hours) divided by (ha x mega joules x mm), LS is the slope length and steepness index, C is the crop management index, and P is the soil conservation effort.

Flood analysis is based on the facts and conditions of unstable river water discharge. For example, it is based on the calculation of the ratio of maximum and minimum average river flow in a watershed. Furthermore, it can also be analysed based on data on flood frequency in the watershed. Several social factors or conditions that allow land or forest to be pressured by the population, thus becoming a problem, include high population numbers and growth, low education levels, community livelihoods, high unemployment rates, and low health levels, including the population's age composition. These factors tend to lead to a very high dependence on land availability. Their livelihoods tend to be highly dependent on land, whether owned or available. Within the Region. Therefore, to practically analyse the extent of population pressure on land in the watershed area, it can be determined by considering the area of agricultural land within the watershed and the number of farmers in the watershed and several sub-watersheds. The formula used to determine population pressure on land is: IKL = A/P, where IKL is the land availability index, A is the area of agricultural land in the watershed (ha), and P is the number of farming families within the watershed (KK).

This type of research is descriptive (Nazir, 1988) because this study will describe information and collect data on the factors causing erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency.

The objects of this research are the population and a sample of that population. Sugyono (2014: 61) states that a population is a generalized area consisting of objects or subjects possessing certain qualities and characteristics determined by the researcher to be studied and then conclusions drawn from, where the sample is a subset of the population

and its characteristics. Therefore, In this research on the analysis of factors causing erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency, the object used is the population affected by erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency, and will use 41 affected populations as samples. The following table shows the total population and total families affected by erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency.

Table No. 4 Total Population and Total Households Affected by Erosion and Flooding in Manleuana Village, Dom-Aleixu District, Dili Regency.

Village	No.	Sub. Village	HH	Women	Men	HH Affected
Manleuana	1	Badiak	278	817	724	65
	2	Efaca	340	798	783	26
	3	Lemocari	628	1724	1807	76
	4	Lisibutak	482	1284	1278	97
	5	Lau-lora	443	1092	1184	139
	6	Mauc	167	440	430	52
	7	Mane-mesak	476	1206	1173	51
	8	Manleuana	166	392	372	48
	9	Mundu Perdidu	128	363	362	36
	10	Ramelau	335	915	932	56
	Total		3443	9031	9045	646

The sampling technique in this study used the total number of families affected by erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency, the total number of families affected by erosion and flooding was 646 families. From the total number of families affected by erosion and flooding, the researcher took a sample of 41 from a percentage of 15%. The formula used to determine the total sample from (Taro Yamane Formula or Slovin Ridwan (2010) is, N = n / (n. 〖d〗 ^2 + 1). so that the total sampling is 41 families. The data collection technique was carried out secondarily obtained from the Manleuana village office and literature synthesis, as well as primary data obtained directly from the results of field observations. The analysis technique used to analyze the factors causing erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency, was an analysis using the Likert scale method using a questionnaire. From the Literature Synthesis, it was found that there were 5 factors causing erosion, namely, climate, soil, regional shape or topography, land cover vegetation, and human activities. As well as the factors causing flooding, 14 internal

factors causing flooding were obtained consisting of river capacity, drainage capacity, soil infiltration, water flow height, normal discharge, water runoff, sedimentation erosion, watershed area, watershed shape, topography, morphometric, geology and vegetation. In addition, there were 7 external factors causing flooding consisting of rainfall intensity, land use, waste disposal behaviour, slum areas, flood control system planning, dam and drainage maintenance. Based on the five factors causing erosion and the 21 factors causing flooding, the factors that cause erosion and flooding in Manleuana Village, Dom- Aleixu District, Dili Regency will be determined. using the Likert scale analysis method to determine the factors causing erosion and flooding so that it can be used to carry out handling and management applications for erosion and flooding in an integrated and appropriate manner.

RESULT AND DISCUSSION

General description of Manleuana Village, Dom-Aleixu District, Dili Regency.

General description of the research area of Manleuana Village, Dom-Aleixu District, Dili Regency, has an area of 7.2 km2, which includes 10 hamlets, namely Badiak, Efaca, Lemocari, Lisbutak, Laulora, Mauc, Mane-mesak, Manleuana, Mundu Perdidu and Ramelau Hamlets. The administrative boundaries of Manleuana Village, Dom-Aleixu District, Dili Regency are as follows:

- East : Bairro Pite Village
- West : Aileu Municipality
- North : Likisa Municipality
- South : Fomentu Sub-Village

The satellite map of the research location can be seen as follows:

Figure no. 1. Map of the research location of Manleuana Village, Dom-Aleixu District, Dili Regency.

B. General description of Manleuana Village, Dom-Aleixu District, Dili Regency.

C. General description of the research area of Manleuana Village, Dom-Aleixu District, Dili Regency, has an area of 7.2 km2, which includes 10 hamlets, namely Badiak, Efaca, Lemocari, Lisbutak, Laulora, Mauc, Mane-mesak, Manleuana, Mundu Perdidu and Ramelau Hamlets. The administrative boundaries of Manleuana Village, Dom- Aleixu District, Dili Regency are as follows:Analisis Erosi Dan Banjir Di Desa Manleuana, Kecamatan Dom-Aleixu, Kabupaten Dili.

This analysis used five factors: climate, topography or landform, soil characteristics, vegetation cover, and human activity, as causes of erosion. For flooding, 10 external factors were used: rainfall, river conditions, drainage conditions, soil conditions, flood discharge, watershed characteristics, topography, morphometric, geology, and vegetation. For internal factors, four factors were used: human behaviour, slum areas, flood control system planning, and watershed and drainage maintenance.

These factors were obtained from a literature review and used as input for the analysis of the causes of erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency, using a Likert scale analysis. This analysis was conducted based on responses obtained from questionnaires distributed to families affected by erosion and flooding.

Based on the questionnaire results and the results of scoring interpretation, the cause of erosion, such as climate, received a score of 89.76 present from 41 respondents.

The soil characteristics factor received a score of 79.02 present. And based on direct observations in the field, the land area in the research area is prone to erosion due to the lack of organic material, high weathering levels, lack of vegetation that binds aggregates or soil. Other influential observation results are the slope gradient, and its lithology such as clay, because of this, when heavy and long rain with high rainfall intensity can cause erosion due to the load given by rainwater to the soil, while the infiltration capacity of the soil is lacking and results in the load and the emergence of erosion whose path follows the existing slope gradient.

Figure 2: Soil Horizon
Figure 2: Soil Horizon in Manleuana Village, Dom-Aleixu District, Dili Regency.
Source: Researcher (elevation 174.64 masl)

The human behaviour factor received a score of 77.07 present, based on the observation results, it was also found that human behaviour is one of the factors that can accelerate the erosion process because bad human behaviour is a negative factor in land degradation, but humans also play an important role in preventing erosion.

Figure 3: Human behaviour in land use in Manleuana Village, Dom-Aleixu District, Dili Regency. Source: Researcher 2023

Topographic factors scored 91.46 present, socioeconomic and sociocultural factors scored 83.66 present, reforestation and mitigation factors scored 77.56 present, and cross-sectorial involvement factors scored 81.46 present, out of a total of 41 households. The following table shows the interpretation of erosion scores at intervals.

Table Interprets Score Erosion Based on Interval

No.	Factor	Presents %	Category
1	Climate	89.76	Strongly agree
2	Characteristic land	79.02	Agree
3	Human behaviour	77.07	Strongly agree
4	Topography	91.46	Strongly agree
5	Social Economy culture	83.66	Strongly agree
6	Greening and Mitigation	77.56	Agree
7	Cross-Sectorial Engagement	81.46	Strongly agree

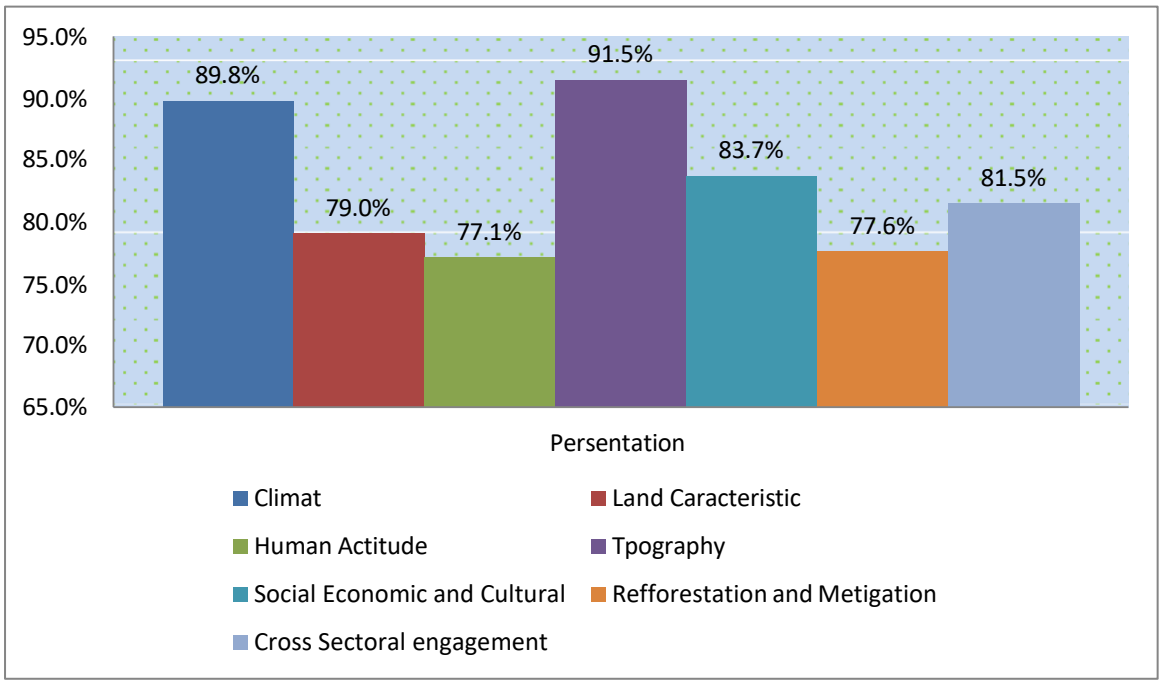


Figure Nú.24. Graphic Diagram Interpretation of scores erosion base on interval

Figure 3: Condition of the River Coordinate -8.584862S/120.543759E, 109.27 meters above sea level Source: Researcher 2023

For the causes of flooding itself, from the results of the questionnaire and the results of determining the interpretation of the scoring, the factors causing flooding such as river condition factors with their variables, namely river capacity, got a score of 74 percent from 41 families, drainage condition factors with their variables, namely river conditions or river capacity, got a score of 69.75 present, soil condition factors with their variables, namely soil infiltration, got a score of 76.59 present, irrigation discharge factors with their variables such as river flow and normal discharge got a score of 86.16 present, river capacity or drainage factors with their variables such as erosion and sedimentation got a score of 84.23 present, watershed characteristic factors with their variables such as watershed width, watershed shape, topography, morphometric, zoology and vegetation got a score of 75.03 present.

Gambar No.4 Bagian kiri sedimentasi di drainase, bagian kanan pembuangan sampah sembarangan di dalam sungai oleh masyarak yang tinggal di datarang banjir
Sumber : Peneliti 2023

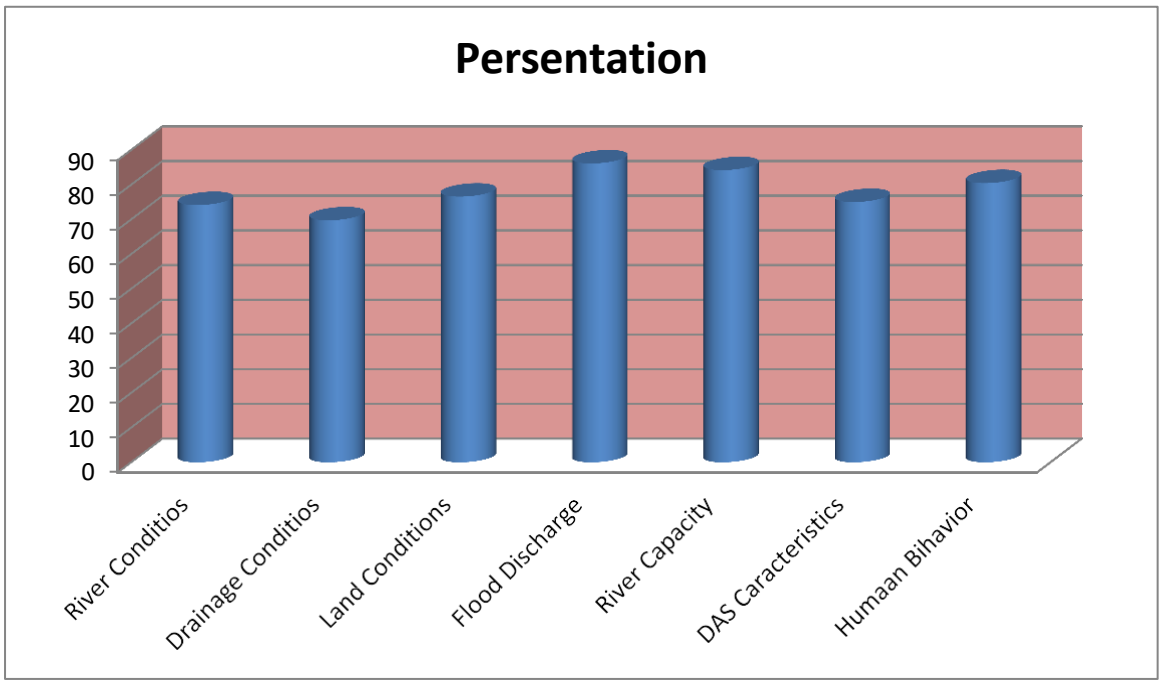
Figure No. 5: Communities living in floodplains but already within the river basin.
Source: Researcher 2023

The final factor, human behaviour in land use, such as dumping waste in slum areas, the planning, monitoring, and maintenance system for Check DAM irrigation, and drainage, received a score of 84.49 present. The following table interprets the flood scores.

Flood Score Interpretation Table Based on Interval

No.	Factor Indicators	Presents %	Category
1	River Conditions	74.15	Agree
2	Drainage Conditions	69.76	Agree

3	Soil Conditions	76.59	Agree
4	Flood Discharge	86.16	Strongly Agree
5	River Capacity	84.23	Strongly Agree
6	Watershed Characteristics	75.03	Agree
7	Human Behaviour	80.49	Strongly Agree



Picture No.25 Graphic Diagram Interpretation of flood score based on interval

picture No.19.the population's house is in the river and the garbage is thrown into the river.

Sources: Researcher 2023

Picture Now.20. Different types of garbage in the river Sources : Researcher 2023

CONCLUSION

A. Based on the results of the research, several conclusions can be drawn according to the interpretation of interval scoring regarding the factors causing erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency, we can draw the following conclusions:

B. 1. Factors causing erosion based on the interpretation of the scoring interval obtained 77.07 percent to 92.4 percent so categorized as agree to strongly agree for five factors such as rainfall (rainfall intensity), soil characteristics, topography, vegetation and human behavior.

C. 2. Factors causing floods based on interval scoring obtained 69.7 percent to 86.18 present which is categorized as agree to strongly agree for for seven factors with its variables totalling 17 variable factors. Such as river condition factor with variables such as river capacity, drainage condition factor with variables such as drainage capacity, soil condition factor with variables such as soil infiltration, flood discharge factor with variables such as high flood flow and normal discharge, river or drainage capacity factor with variables such as erosion and sedimentation, the shape of the river flow area, topography, morphometric, geology, vegetation and lastly human behaviour factors with its variables such as land use, waste disposal behaviour, slum areas, flood control planning system, DAM check selection, irrigation and drainage.

D. Based on the results of this analysis, relevant government bodies or institutions with the local communities can identify and conduct planning to address erosion and flooding in Manleuana Village, Dom-Aleixu District, Dili Regency, based on the causing factors of erosion and flooding in the area. This means that overall there are some ways from local governments and relevant institutions to answer and address erosion and flooding according to the factors that cause erosion and flooding, but not yet effective and good and some also not running**.**

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