Hazard analysis and social vulnerability to predict the loss population is affected by natural disaster of landslides in the Pesisir Selatan District of West Sumatra

Triyatno¹*, Isril Berd², Idris³ and Viola Putra³
¹Graduate Program of Environmental Science, Universitas Negeri Padang, Indonesia
²Lecturer of Fakultas Teknologi Pertanian, Universitas Andalas, Indonesia
³Lecturer Faculty of Economic, Universitas Negeri Padang, Indonesia

*triyatno@fis.unp.ac.id

Abstract. Pesisir Selatan District is one of the areas in West Sumatra that often experiences natural disasters of landslides. Natural disasters of landslides that occur in this area often cause losses in the form of property or human lives and disruption of road access to other areas. The aims of this research were to analyze the hazard of landslides based on land characteristics, analyze the carrying capacity of the region based on landslide hazards, analyze social vulnerability, and analyze prediction of Population loss. The method used in this study is a survey method with a geomorphological approach. Data used in the form of primary data and secondary data. The technical analysis used is in the form of scoring to analyze landslide hazards and GIS used to analyze the carrying capacity of the region, vulnerability, and exposed populations. The results showed that the hazard of landslides in the study area was divided into three, namely low, medium, and high hazards. The hazard of low landslides is generally found in plain areas near the coast. This area is formed due to the results of sedimentation processes from both rivers and the sea. The hazard of moderate landslides is generally found in hilly areas, and the hazard of high landslides is generally found in hilly or mountainous areas. The hazard of landslides is caused by physical characteristics in the form of high rainfall, steep slopes to very steep slope, high rock weathering. Social vulnerability in the research area is divided into two parts, namely low and medium. Low social vulnerability is caused by the ratio of male population more than female population, ratio of vulnerable groups, ratio of poor Population, and a ratio of disabled Population. Social vulnerability is being caused by a greater number of female populations, ratios of vulnerable groups, and disabled Population. The prediction of population loss found in the Lakitan Tengah area is in Lengayang Subdistrict, which is 11,869 Population.

1. Introduction
The West Sumatra region is an area that has the potential to be hit by natural disasters in the form of earthquakes, tsunamis, volcanic eruptions, floods, flash floods, landslides and coastal abrasions. The potential for disasters in the West Sumatra region is due to the fact that this region is located on the west coast of Sumatra Island and crosses the equator, causing this area to have high rainfall, weathered rock conditions, regional morphology from the plains to the mountains. The occurrence of natural disasters from year to year tends to increase both in number and intensity so that losses incurred by an
event of natural disasters tend to increase also from the following year, both property losses and human lives.

The West Sumatra region that has the potential for natural disasters is the Pesisir Selatan District. The Pesisir Selatan District area often experiences natural disasters such as coastal abrasion, floods, flash floods, and landslides. The potential for natural disasters in the region of the Pesisir Selatan District is largely determined by physical conditions such as geology, geomorphology, hydrology, soil conditions, land use and land cover. Natural disaster occurrences of landslides in the Pesisir Selatan Regency often occur during the rainy season, high rainfall and supported by easily weathered rocks and thick soil solum cause this area has considerable potential for landslides to occur.

The natural disaster occurrence of landslides that occurred in the Pesisir Selatan District has caused many losses in the form of disruption of transportation routes, loss of property and loss of human life. The high impact of losses caused by natural disasters of landslides in this region is mostly caused by cutting slopes for road construction or settlements. Settlement patterns in this area generally fall on the plain or in mountainous areas such as those found in the Painan and Bayang Utara regions. The aims of this article are to analyze the landslide hazard, carrying capacity of regions based on landslide hazard levels to predict social vulnerability and population loss which can result in high loss of property and human lives.

2. Methodology
This type of research is in the form of quantitative research using a geomorphological approach [1, 2, 3, 4]. The method used in this study is a survey method to analyze the level of hazard of landslides. Landslide hazard levels were analyzed based on geomorphological units in the form of land units and social vulnerability of landslides obtained by analyzing satellite images in the form of Ikonos images to see the distribution of settlements found in areas that have potential or hazard of landslides [1, 5, 6, 7].

The type of data used in this study is primary data and secondary data. Primary data in the form of data obtained directly in the field are in the form of data on land characteristics, namely geological, geomorphological, soil, hydrology and land use conditions [8, 9, 10], Data The secondary data used in this study is population data obtained from BPS data of the Pesisir Selatan District in Figures, basic maps of a 1:250,000 scale geological map, 1:250,000 scale geomorphological maps, 1:150,000 scale maps, scale land use maps 1:250,000.

The stages of research carried out in the form of pre-field stages, field stages, and post-field stages. The details of the activities carried out in this study are as follows;

2.1. Pre-field stage
Activities carried out in the pre-field stage in the form of preparation of data needed in the field in the form of literature studies on the hazard and social vulnerability of landslides of natural disasters, preparing basic maps for guidance in the field, and determining sample points for field data collection. Analyzing satellite imagery in the form of an Ikonos image to determine the distribution of residential settlements in areas that have the potential for landslides.

2.2. Field stage
The activities carried out at the field stage were in the form of matching sample point maps with actual conditions in the field, and continued with field data collection in the form of land characteristics data that included geological, geomorphological, soil, hydrological and land use data. Taking documentation of research in areas that have the potential for natural disaster landslides.

2.3. Post-field stage
The activities carried out in the post-field stage are to classify field data, tabulate field data, analyze field data, and produce map results and research reports.
3. Data analysis
To determine the hazard of landslides that occurred in the study area, a formula was formulated by [1, 3, 11] as follows;

\[ I = \frac{c - b}{k} \] ................................. (1)

Information;
I: large range of class intervals
b: lowest number
c: highest number
k: number of classes desired

Based on the formula above, the interval of the landslide hazard class in the study area is as follows;

\[ I = \frac{56 - 14}{3} = \frac{42}{3} = 14 \] ................................. (2)

Information:
the highest number of physical characteristics determining landslide hazards 56 (c)
number of lowest physical characteristics determinant of landslide hazard 14 (b)
desired number of classes 3 (k)

To determine the social vulnerability of natural disasters, landslides in the Pesisir Selatan District area use a formula that refers to Perka No. 2 BNPB 2012, in DDRI 2013 as follows;

\[
K_s = 0.6 \times \left( \frac{0.01 \times RJK + 0.1 \times RK + 0.1 \times RPC + 0.1 \times KR}{\log(\frac{KP}{0.01})} \right) 
\] ................................. (3)

Information:
Ks: social vulnerability
KP: population density
RJK: sex ratio
RPC: ratio of disabled population
KR: vulnerable group

To determine the number of loss population, based on analysis of landslide hazard data, social vulnerability of the community, and population.

4. Result and Discussion
Hazard of landslides is an event that often occurs during the rainy season and usually occurs in areas that have a slope of more than 15% with weathered material on it [12, 5, 13, 14]. The hazard of landslides that occur in the Pesisir Selatan District is a natural process of slope evolution towards common levels [15, 12, 14]. The hazard of landslides that occur in Pesisir Selatan district can be seen from the characteristics of the land in the form of geological, geomorphological, soil, hydrological and land use conditions [15, 16]. For more details on the characteristics of the land in the research area can be seen in the following Table 1, Table 2, Table 3.
### Table 1. Land Characteristics for Landslides Natural Disasters Pesisir Selatan District

| No | Location                  | Slope (%) | Relief/Topography | Slope Shape | Slope Length (m) | Altitude Relief (m) | Soil Texture | Soil Permeability cm / hour | Depth soil (cm) | Structure Rock | Structure Level Weathering Rock | Depth weathering Rock (cm) | Groundwater Spring | Groundwater Depth ground water (cm) |
|----|---------------------------|-----------|-------------------|-------------|------------------|---------------------|--------------|----------------------------|----------------|----------------|----------------------------------|----------------------|-------------------|----------------------------------|
| 1  | Mauro Sri Tapan           | 95        | Ir                | 203         | 78               | ld                  | ld           | 15.3                      | 2.10           | Mr             | S                               | 2.35                 | A                 | 501                                             |
| 2  | Padang                    | 2         | Dr                | 63          | 5                | lp                  | lp           | 18.9                      | 39             | Dt             | R                               | 60                   | Ta                | 160                                             |
| 3  | Ampulu Tapan              | 98        | Ir                | 98          | 2                | lh                  | lh           | 31.4                      | 73             | Mr             | R                               | 142                  | A                 | 53                                              |
| 4  | Bukit Suburung Batu Br. Kapas | 30    | Ir                | 144         | 96               | lb                  | lb           | 23.9                      | 40             | Mr             | R                               | 81                   | A                 | 87                                              |
| 5  | Bukit Tuai Br. Kapas      | 63        | Dt                | 134         | 83               | lp                  | lp           | 35.9                      | 22             | Mr             | R                               | 33                   | A                 | 76                                              |
| 6  | Kampung Jambak Br. Kapas  | 2         | Dt                | 57          | 3                | ld                  | ld           | 29.8                      | 25             | Dta            | R                               | 93                   | Ta                | 145                                             |
| 7  | Bukit Pulai               | 98        | Ir                | 141         | 88               | ld                  | ld           | 38.5                      | 31             | Mr             | R                               | 46                   | Ta                | 63                                              |
| 8  | Bukit Timbulkin Painan    | 54        | Ir                | 132         | 73               | ld                  | ld           | 15.1                      | 27             | Msf            | K                               | 59                   | A                 | 68                                              |
| 9  | Bukit Vila Painan         | 99        | Ir                | 133         | 86               | lp                  | lp           | 25.7                      | 81             | Msf            | K                               | 141                  | A                 | 165                                             |
| 10 | Bukit Gunung Paar Baru    | 35        | Ir                | 93          | 91               | ld                  | ld           | 13.0                      | 13             | Mr             | R                               | 130                  | Ta                | 143                                             |
| 11 | Sibingkeh                 | 48        | Ck                | 15          | 95               | ld                  | ld           | 13.8                      | 117            | Mr             | S                               | 126                  | Ta                | 166                                             |
| 12 | Sibingkeh                 | 99        | Ir                | 80          | 98               | lp                  | lp           | 29.3                      | 30             | Mr             | S                               | 84                   | A                 | 30                                              |
| 13 | Kerto Pulai, tanusan      | 85        | Ir                | 153         | 76               | lp                  | lp           | 31.4                      | 48             | Mr             | S                               | 78                   | A                 | 142                                             |

Source: Results of Field Measurement and Data Analysis in 20018

Information:

D = data
H = scor

Slope shape
Ir = irregular
Dr = plain
Ck = concave

Land use
Sbl = scrub bush
Ld = farm
Kc = mixed farm
Pm = settlement
Ht = forest
Sw = paddy field

### Table 2. Land Characteristics Scorr for Landslides Natural Disasters Pesisir Selatan District

| No | Location                  | Slope (%) | Relief/Topography | Slope Shape | Slope Length (m) | Altitude Relief (m) | Soil Texture | Soil Permeability cm / hour | Depth soil (cm) | Structure Layer Rock | Structure Level Weathering Rock | Depth weathering Rock (cm) | Groundwater Spring | Groundwater Depth ground water (cm) |
|----|---------------------------|-----------|-------------------|-------------|------------------|---------------------|--------------|----------------------------|----------------|----------------------|----------------------------------|----------------------|-------------------|----------------------------------|
| 1  | Mauro Sri Tapan           | 4         | 4                 | 3            | 4                | 4                   | 4            | 4                          | 3              | 4                    | 4                               | 4                    | 4                 | 1                                               |
| 2  | Padang                    | 1         | 1                 | 2            | 1                | 4                   | 4            | 2                          | 1              | 2                    | 2                               | 2                    | 1                 | 2                                               |
| 3  | Ampulu Tapan              | 4         | 4                 | 3            | 4                | 4                   | 4            | 4                          | 3              | 4                    | 2                               | 3                    | 4                 | 4                                               |
| 4  | Bukit Suburung Batu Br. Kapas | 3       | 4                 | 3            | 3                | 4                   | 4            | 4                          | 2              | 2                    | 2                               | 2                    | 4                 | 4                                               |
| 5  | Bukit Tuai Br. Kapas      | 4         | 1                 | 3            | 3                | 4                   | 4            | 1                          | 4              | 2                    | 2                               | 1                    | 4                 | 4                                               |
| 6  | Kampung Jambak Br. Kapas  | 1         | 1                 | 2            | 1                | 4                   | 4            | 1                          | 1              | 2                    | 2                               | 1                    | 4                 | 4                                               |
| 7  | Bukit Pulai               | 4         | 4                 | 3            | 3                | 4                   | 4            | 2                          | 4              | 2                    | 2                               | 1                    | 4                 | 4                                               |
| 8  | Bukit Timbulkin Painan    | 4         | 4                 | 3            | 3                | 4                   | 4            | 3                          | 2              | 3                    | 2                               | 3                    | 4                 | 4                                               |
| 9  | Bukit Gunung Paar Baru    | 3         | 4                 | 3            | 3                | 4                   | 4            | 1                          | 4              | 2                    | 3                               | 1                    | 4                 | 4                                               |

Source: Results of Field Measurement and Data Analysis in 2018
Table 3. Land Characteristics of Pesisir Selatan District

| No | Location                      | Land use | Rain fall mm/month | Landslide Hazard |
|----|-------------------------------|----------|-------------------|------------------|
|    |                               | D H      | D H               |                  |
| 1  | Muaro Siri Tapan              | Sbl 2    | 48 4              | 48 High          |
| 2  | Padang Kejai Tapan            | Ld 2     | 38 3              | 28 Low           |
| 3  | Ampalu Tapan                  | Kc 2     | 40 3              | 45 High          |
| 4  | Bukit Subarang Batu           | Sbl 2    | 45 4              |                  |
|    | Bt. Kapas                     |          |                   |                  |
| 5  | Bukit Tuiak Bt.kapas          | Ht 1     | 40 3              | 39 Medium        |
| 6  | Kampung Jambak                | Sw 3     | 35 3              | 27 Low           |
|    | Bt.Kapas                      |          |                   |                  |
| 7  | Bukit Pulai                   | Kc 2     | 40 3              | 27 Low           |
| 8  | Bukit Pincuran Boga Painan    | Kc 2     | 44 3              | 43 High          |
| 9  | Bukit Timbulun                | Pm 4     | 48 4              | 48 High          |
|    | Painan                        |          |                   |                  |
| 10 | Bukit Vila Painan             | Kc 2     | 46 4              | 46 High          |
| 11 | Bukit Gaung, Pasar Baru       | Kc 2     | 39 3              | 38 Medium        |
|    |                               |          |                   |                  |
| 12 | Sibingkeh                     | Ht 1     | 41 3              | 40 Medium        |
| 13 | Siguntur                      | Ht 1     | 46 4              | 46 High          |
| 14 | Koto Pulai, tarusan           | Pm 4     | 49 4              | 49 High          |

Source: Results of Field Measurement and Data Analysis in 2018

Based on the table above the hazard of landslides that occur in the study area can be divided into several parts, namely; high, medium and low. The hazard of landslides in this study area is determined by the characteristics of the land in the form of weathered geological conditions and rock structures that follow the slope direction and the weathering depth of rocks more than 100 cm. The morphometry of the slopes of the study area starts from 0% - 45% with slope lengths varying from 53 m to 203 m, this causes the shape of slopes that vary from flat to irregular or irregular which can cause the amount of water that can be accommodated in the slope segment which has a concave shape [13, 17, 18]. Land use in the study area is in the form of shrubs, mix farm, rice fields, forests and settlements, this variation in land use causes the hazard of landslides in the study area to also vary such as in residential areas that cut slopes to establish buildings. Slope cutting activity causes the amount of water that enters the soil, causing increased mass of soil mass [14, 17, 19].

The hazard of landslides in the study area can be divided by three classes, namely low, medium and high. The hazard of low landslides is generally found in plain areas located near the coast or alluvial plains. This area is generally formed due to the sedimentation process resulting from the erosion process in the upstream section. The hazard of low landslides is generally found in hilly areas that have slopes of 25% - 45% and spread almost everywhere throughout the study area while the hazard level of high landslides is generally found in areas that have slopes of more than 45% and in areas that have experienced rock weathering levels go on. In the slope segment there are generally springs which trigger landslides. For more details, see the following table 4.
| Subdistrict          | Village                  | Percentage of Low Hazard Area | Percentage of medium Hazard Area | Percentage of high Hazard Area |
|----------------------|--------------------------|------------------------------|---------------------------------|-------------------------------|
| Basa Ampek Balai Tapan | Ampang Tulak Tapan | 49.38                        | 31.76                           | 18.86                         |
| Basa Ampek Balai Tapan | Batang Arah Tapan   | 77.73                        | 21.28                           | 0.99                          |
| Basa Ampek Balai Tapan | Binjai Tapan           | 61.91                        | 36.97                           | 1.11                          |
| Basa Ampek Balai Tapan | Kebun Tapan            | 99.62                        | 0.36                            | 0.02                          |
| Batang Kapas IV Koto Hilie |                | 35.11                        | 56.72                           | 8.17                          |
| Batang Kapas IV Koto Mudiek |               | 17.27                        | 56.02                           | 26.71                         |
| Batang Kapas Koto Nan Duo IV |            | 59.93                        | 36.62                           | 3.44                          |
| Batang Kapas Koto Nan Tigo IV |          | 64.12                        | 32.13                           | 3.75                          |
| Bayang Gurun Panjang |                           | 67.16                        | 18.14                           | 14.70                         |
| Bayang Koto Barakap |                               | 47.34                        | 46.04                           | 6.62                          |
| IV Nagari Bayang Utara | Koto Ranah           | 7.02                         | 61.04                           | 31.93                         |
| IV Jurai Bungo Pasang Salido |         | 37.46                        | 37.22                           | 25.31                         |
| IV Jurai Lempo       |                           | 22.39                        | 53.23                           | 24.38                         |
| Koto XI Tarusan Ampang Pulai |          | 68.64                        | 24.99                           | 6.36                          |
| Koto XI Tarusan Barung Barung Balantai |   | 16.02                        | 70.28                           | 13.69                         |
| Koto XI Tarusan Barung Barung Balantai Selatan | | 24.4                         | 64.75                           | 10.86                         |
| Koto XI Tarusan Batu Hampar |               | 67.18                        | 26.41                           | 6.41                          |
| Koto XI Tarusan Duku |                                | 20.52                        | 64.50                           | 14.98                         |
| Koto XI Tarusan Kapuh |                                | 73.53                        | 15.28                           | 11.19                         |
| Koto XI Tarusan Kapuh Utara |            | 64.18                        | 30.02                           | 5.80                          |
| Lengayang Kambang   |                           | 21.98                        | 54.27                           | 23.75                         |
| Lengayang Kambang Timur |                  | 15.06                        | 60.77                           | 24.18                         |
| Lengayang Kambang Utara |                | 22.65                        | 65.53                           | 11.82                         |
| Lengayang Lakitan Tengah |               | 24.22                        | 61.52                           | 14.26                         |
| Linggo Sari Baganti Aie Haji |            | 41.48                        | 52.92                           | 5.60                          |
| Linggo Sari Baganti Lagan Hilir Punggasan | | 80.09                        | 19.67                           | 0.24                          |
| Linggo Sari Baganti Lagan Mudik Punggasan | | 43.01                        | 53.11                           | 3.88                          |
| Pancung Soal Inderapura Selatan |           | 38.6                         | 37.07                           | 24.34                         |
| Pancung Soal Inderapura timur |            | 49                           | 33.66                           | 17.35                         |
| Pancung Soal Inderapura utara |            | 40.4                         | 47.50                           | 12.10                         |
| Pancung Soal Kudo-kudo inderapura |         | 99.21                        | 0.79                            | 0.00                          |
| Sutera Amping parak |                                | 91.49                        | 7.04                            | 1.47                          |
| Sutera Amping parak timur |                       | 46.23                        | 47.81                           | 5.96                          |

Source: Data Analysis in 2018
Based on the table above the percentage of the area that has a low, medium and high landslide hazard varies, this is caused by several factors including slope, soil characteristics, geology, morphology and land use. The highest percentage of landslide hazards is highest in the Bayang Utara area, which is 92.98% of the total area. This shows that the Bayang Utara area has a topography in the form of mountains and hills that have a slope of more than 45%, and have areas that have the potential for landslides only around 7.02% of the total area. Areas that have low landslide hazards are found in the Tapan Kubu area, which are 99.62% of the area and Kudo-Kudo Inderapura is 99.21% of the total area. This area is a plain area which is mostly in the form of sediment, for more details can be seen in the following picture.

![Landslide Hazard Map Pesisir Selatan District West Sumatera](image)

**Figure 1.** Landslide Hazard Map Pesisir Selatan District West Sumatera

Social vulnerability shows the level of social fragility of a community in the event of a natural disaster in the form of a landslide. The social vulnerability of the study area was seen from the percentage of population density, sex ratio, ratio of vulnerable groups, poor population, and ratio of disabled population. For more details, see the following table 5.
### Table 5. Social Vulnerability and Prediction Population loss of Landslide Hazards in Pesisir Selatan District

| Subdistrict | Village | Sex Ratio | Percentage of Vulnerable Groups | Percentage of Poor Population | Social Vulnerability | Social class vulnerability | Amount of moderate Population loss Prediction | Amount of high Population loss Prediction | Total of Population loss Prediction |
|-------------|---------|-----------|---------------------------------|-------------------------------|----------------------|--------------------------|---------------------------------------------|------------------------------------------|--------------------------------------|
| Basso Ampek Buluh Tapan | Ampung Tekah Tapan | 1.02 | 0.23 | 0.1 | 0.01 | 15.57 | Low | 8 | 3 | 11 |
| Basso Ampek Buluh Tapan | Batang Arul Tapan | 0.99 | 0.14 | 0.07 | 0.01 | 42.57 | Medium | 255 | 421 | 676 |
| Basso Ampek Buluh Tapan | Binga Tapan | 0.96 | 0.2 | 0.09 | 0.01 | 31.94 | Low | 132 | - | 132 |
| Basso Ampek Buluh Tapan | Koto Tapan | 0.99 | 0.25 | 0.11 | 0.01 | 0.14 | Low | - | - | - |
| Butang Kapat | Koto Hilse | 0.97 | 0.12 | 0.07 | 0.00 | 46.25 | Medium | 876 | 314 | 1,190 |
| Butang Kapat | Koto Medrek | 0.95 | 0.11 | 0.06 | 0.00 | 40.80 | Medium | 246 | 270 | 516 |
| Butang Kapat | Koto Non | 0.97 | 0.25 | 0.13 | 0.01 | 43.18 | Medium | 423 | 318 | 740 |
| Butang Kapat | Koto Non | 0.99 | 0.46 | 0.19 | 0.01 | 36.48 | Medium | 73 | 191 | 264 |
| Buyang | Gunan Panjang | 0.91 | 0.27 | 0.11 | 0.02 | 41.81 | Medium | 320 | 280 | 600 |
| Buyang | Buyang | 0.91 | 0.2 | 0.09 | 0.01 | 20.81 | Low | 24 | - | 24 |
| IV Nagari Buyang Utara | Koto Ranah | 0.89 | 0.54 | 0.33 | 0.05 | 38.24 | Medium | 90 | 254 | 344 |
| IV Jvari | Buyang Siallo | 0.94 | 0.53 | 0.14 | 0.03 | 37.11 | Medium | 199 | 92 | 292 |
| IV Jvari | Lempo | 0.96 | 0.16 | 0.06 | 0.01 | 54.36 | Medium | 1,827 | 2,307 | 4,134 |
| Koto XI Tarusan | Mampung Pulu | 1.03 | 0.07 | 0.03 | 0.00 | 52.88 | Medium | 1,403 | 1,891 | 3,294 |
| Koto XI Tarusan | Buyang | 0.96 | 0.2 | 0.08 | 0.01 | 51.48 | Medium | 2,516 | 136 | 2,652 |
| Koto XI Tarusan | Buyang | 0.9 | 0.23 | 0.09 | 0.01 | 31.79 | Low | 129 | - | 129 |
| Koto XI Tarusan | Barong | 0.92 | 0.26 | 0.1 | 0.01 | 0.13 | Low | - | - | - |
| Koto XI Tarusan | Koto | 0.93 | 0.1 | 0.05 | 0.01 | 45.77 | Medium | 651 | 456 | 1,107 |
| Koto XI Tarusan | Pula | 0.93 | 0.16 | 0.07 | 0.01 | 38.21 | Medium | 81 | 265 | 346 |
| Koto XI Tarusan | Koto | 1 | 0.5 | 0.17 | 0.03 | 28.07 | Low | - | 72 | 72 |
| Lenggayang | Kambang | 0.93 | 0.23 | 0.11 | 0.01 | 54.30 | Medium | 889 | 3,200 | 4,089 |
| Lenggayang | Kambang | 0.94 | 0.15 | 0.08 | 0.01 | 57.90 | Medium | 1,572 | 5,540 | 7,112 |
| Lenggayang | Kambang | 0.94 | 0.16 | 0.08 | 0.01 | 55.68 | Medium | 1,543 | 3,517 | 5,060 |
| Lenggayang | Koto | 1.02 | 0.37 | 0.17 | 0.01 | 61.27 | Medium | 2,394 | 9,475 | 11,869 |
| Linggo Sari Bugantii | Air Haji | 0.96 | 0.64 | 0.24 | 0.01 | 36.55 | Medium | 197 | 69 | 266 |
| Linggo Sari Bugantii | Lago Ilir Punggasan | 0.99 | 0.63 | 0.24 | 0.01 | 0.19 | Low | - | - | - |
| Linggo Sari Bugantii | Lago Ilir Punggasan | 0.98 | 0.93 | 0.29 | 0.01 | 35.48 | Medium | 224 | - | 224 |
| Pancung Soal | Indrapura Siallo | 1.01 | 0.02 | 0.08 | 0.01 | 46.58 | Medium | 420 | 833 | 1,252 |
| Pancung Soal | Indrapura Siallo | 1 | 0.01 | 0.05 | 0.00 | 33.33 | Low | 115 | 49 | 164 |
| Pancung Soal | Koto-Koto Indrapura Siallo | 0.99 | 0.02 | 0.03 | 0.01 | 42.52 | Medium | 485 | 187 | 672 |
| Satra | Amping pasak | 0.98 | 0.27 | 0.13 | 0.01 | 32.89 | Low | 14 | 138 | 153 |
| Satra | Amping pasak | 1.04 | 0.6 | 0.22 | 0.01 | 44.21 | Medium | 393 | 467 | 861 |

Source: Data Analysis in 20018
Based on the table above the highest percentage of sex ratios is found in the Ampiang Parak Timur which is 1.04 area and Inderapura Timur which is 1.02, indicating that in this area the male population is more than the female population. The ratio of the percentage of male population and the smallest percentage is found in the Barung-Barung Balantai Selatan area, which is 0.9, which means that in this area there are more female residents, this is if a landslide occurs, this area must be priority in action mitigation.

The percentage ratio of the highest vulnerable groups in the Punggasan Langan Mudik area in Linggo Sari Baganti District is 0.93, indicating that this area has a population that is less than 12 years old and a population of more than 60 years old, which causes this area to be more vulnerable in the event of a natural disaster landslides. The highest percentage ratio of poor Population is found in the Koto Ranah area of Bayang Utara District which is 0.33, this indicates that this area has more poor Population than other regions. The high rate of poverty in this area is due to the fact that some Population depend on agricultural and forest products. The percentage ratio of the disabled population in the study area is very small, ranging from 0.00 to 0.05, this indicates that in terms of the disabled population the study area does not have a high value. This means that if a natural disaster occurs, landslides in the research area do not cause a burden to the community, especially when they carry out the evacuation process.

The level of social vulnerability in the research area can be divided into two parts, namely low and medium social vulnerability. The level of social vulnerability is generally found in regions that have a low percentage ratio of male and female population, namely the male population is less than the female population and has a high percentage ratio of vulnerable groups of more than 0.1, this is shows that in this area the population is less than 12 years and more than 60 years is higher and the percentage ratio of the poor is higher. Low social vulnerability in the study area shows a greater male and female population ratio, namely the male population is greater than the female population and has a lower ratio of vulnerable groups and has a smaller ratio of poor Population.

The Population loss is a prediction of the number of Population living in the area who have the hazard of moderate and high landslides. The highest prediction of Population loss is in the Lakitan Tengah of Lengayang District, which is 11,869 Population, because most residents choose a place to live in a hilly area that has a hazard of moderate and high landslides. In general, Population in this area have livelihoods as farmers, so they are closer to going to work in the landfarm or paddy fields. Population who live in this area generally choose a place to stay near the hilly foot area by cutting slopes. The Population loss prediction to landslide hazards in the lowest research area is 0 Population, this means that in areas that have a moderate and high landslide hazard there are no residents. In this area generally in the form of forests or mixed farm, the community generally lives in the plains area.

5. Conclusion
Based on the description on landslide hazards in the study area, some conclusions can be drawn as follows;
1. The landslide hazard in the study area can be divided into three parts, namely the hazard of low, medium and high landslides. This difference in the level of landslide hazard is caused by the physical characteristics of an area in the form of; geological conditions, morphology, soil, hydrology, and land use,
2. The level of social vulnerability in the research area can be divided into two parts, namely low and medium. Low social vulnerability is generally found in regions that have a higher percentage ratio of males than females, the composition of vulnerable groups that are low or have few vulnerable groups, and the ratio of the percentage of disabled Population is small and has a small ratio of poor Population,
3. The highest number of settlements in the Lakitan Tengah area is 11,869 Population and the lowest is 0 in the Lagungg Hilir Punggasan, Batu Hampar and Tapan Kubu areas.
6. Suggestion
Based on the description above about the landslide hazards in the area of Pesisir Selatan District to reduce the impact of losses that will be caused by a landslide natural disaster event, the suggestions that can be taken are as follows;
1. to reduce the hazard of landslides in this area, it should be noted that the causes of landslides are in the form of physical characteristics of the area.
2. to reduce the hazards of landslides in this area it is necessary to increase the social vulnerability of the community, especially in areas of high landslide hazards that have residents,
3. to reduce the number of Population loss to the research area, there should be a regulation on land use for settlements, especially in areas that have the hazard of moderate and high landslide.

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