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Spatial Distribution Analysis of Disaster-Vulnerable Groups in Bantul Regency, Yogyakarta

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Abstract

This study aims to analyze the spatial distribution of the population of disaster-vulnerable groups in Bantul Regency in 2022. This study used secondary data from the Central Statistics Agency (BPS) with data on infants, toddlers, children, pregnant or breastfeeding mothers, people with disabilities, and the elderly. The collected data is then processed to determine the density intervals of high, medium, and low vulnerable groups. The study results are presented as a spatial distribution map of the density of vulnerable groups. The results showed that areas with a high density of vulnerable groups were in Kasihan and Piyungan sub-districts. Sites with a moderate density of vulnerable groups are in the Banguntapan, Sewon, Bantul, Jetis, and Imogiri sub-districts. Meanwhile, areas with low density of vulnerable groups are in Sedayu, Pajangan, Pleret, Dlingo, Pandak, Bambanglipuro, Srandakan, Pundong, and Sanden Districts. Mapping the spatial distribution of vulnerable group density can determine areas in Bantul Regency classified as highly vulnerable group density to be prioritized first, then medium to low vulnerable group density. Thus, this research can be helpful for Bantul Regency policymakers in carrying out earthquake disaster risk reduction programs for vulnerable groups referring to the results of spatial distribution maps, and it is hoped that this research can be implemented for other regions in Indonesia.

Keywords: Spatial Distribution, Disaster-Vulnerable Groups, Bantul Regency.

INTRODUCTION

Indonesia, as a country located at the meeting of three active plates of the world, namely the Indo-Australian, Eurasian, and Pacific plates, is in the path *of the Ring of Fire* and geographically located on the equator, needs to be aware of the threat of earthquakes, tsunamis, volcanic eruptions, and hydrometeorological disasters (Astuti et al., 2021; Pambudi, 2018; Syukri et al., 2021). One of the most frequent disasters in Indonesia is earthquakes (Rosyida and Nurmasari, 2019). Yogyakarta Special Region (DIY) is one of the provinces in Indonesia that has experienced several major earthquake events (Efendi et al., 2019). The largest earthquake with the most damage and fatalities on May 27, 2006 (Wibowo et al., 2021).

Bantul Regency is the area with the most severe damage, and this is because Bantul Regency is near the active subduction zone of the southern part of Java Island from the Indo-Australian Plate and Eurasian Plate regions (Hidayati et al., 2022). Based on data from the National Development Planning Agency (Bappenas), the damage that occurred in Bantul Regency due to the May 27, 2006 earthquake suffered severe damage, 26,045 units of buildings were severely damaged, 29,582 units of buildings were moderately damaged, and 24,262 units of buildings were slightly damaged. The fatalities reached 4,121, and the injuries reached 12,026 (Bappenas, 2006).

The earthquake hazard in Bantul Regency is further exacerbated by the low capacity of the community and the high vulnerability of the community (Oktari et al., 2021; Wahyuningtyas et al., 2020; Choirunnisa and Giyarsih, 2018). Community groups that are at high risk of being affected by disasters because they are in situations and conditions that cannot prepare themselves to face disaster threats

are vulnerable groups (Pahleviannur and Hafida, 2022; Kuran et al., 2020; Benevolenza and DeRigne, 2019). According to Undang-Undang Republik Indonesia Nomor 24 Tahun 2007 tentang Penanggulangan Bencana, vulnerable groups consist of 1) infants, toddlers, and children; 2) pregnant or breastfeeding mothers; 3) persons with disabilities; and 4) elderly people.

Problems caused by the influence of geographical location and past events are further exacerbated by the current population of vulnerable groups in Bantul Regency, which is based on data from the Central Agency of Statistics Indonesia (BPS) in 2022, as many as 42% of the total population of Bantul Regency are vulnerable groups. This is by research Hizbaron et al. (2022); Puspitotanti and Karmilah (2022), that the higher the number of vulnerable populations, the higher the vulnerability of an area.

The high population of vulnerable groups in Bantul Regency and earthquake-prone areas results in higher vulnerability (Humaedi et al., 2020; Kim and Gim, 2020; Ahmad and Afzal, 2019). The high number of vulnerable groups in earthquake-prone areas results in the potential for more casualties (He et al., 2021; Safitri, 2021). The earthquake vulnerability map of Bantul Regency is presented in Figure 1

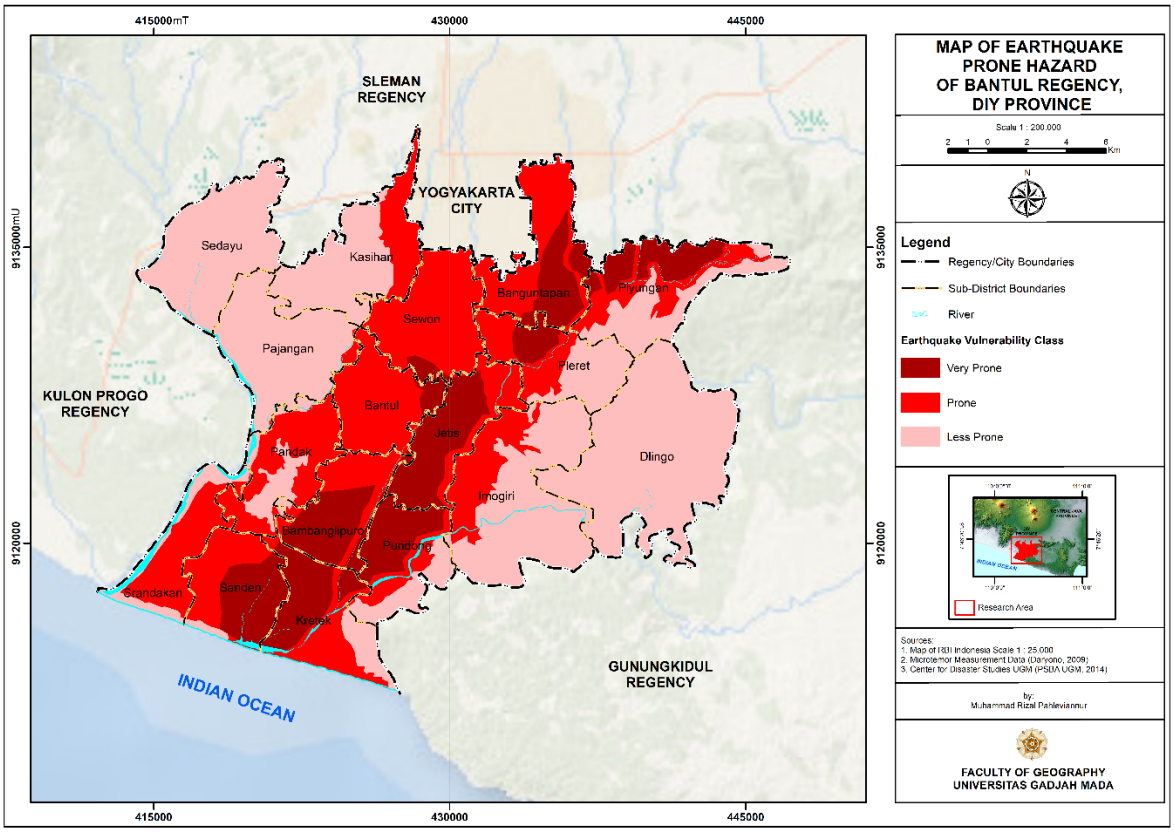

Figure 1. Map of Earthquake Prone Hazard of Bantul Regency, DIY Province

Vulnerability to vulnerable groups can be minimized through inclusive disaster risk reduction priorities. According to Wahana Visi Indonesia (WVI), who have carried out special assessments on the needs of vulnerable groups, there is a priority to meet the needs of vulnerable groups in disaster risk reduction. These priorities include access, participation, regulation, systems, and stigma (Wahana Visi Indonesia, 2022). Vulnerable groups who have access, decision-making opportunities, good data collection, involvement in activities, and changes in perspectives that are equal in disaster risk reduction will have resilience in facing disaster threats (Cabello et al., 2021; Chisty et al., 2021; Hasan et al., 2019).

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One solution to meet the need for earthquake disaster risk reduction for vulnerable groups in Bantul Regency is to conduct spatial distribution mapping. Mapping is carried out to be able to determine the spatial.

Distribution of areas with a high density of vulnerable groups so they can be prioritized first in meeting the need to reduce earthquake disaster risk. Previous studies on disaster-prone groups focused more on social aspects (Fallah-Aliabadi et al., 2022; Annisa and Setyowati, 2019). No research on disaster-prone groups has been reviewed using a geographical approach. Thus, this study aims to determine and analyze the spatial distribution of disaster-prone groups in Bantul Regency to be prioritized in meeting earthquake risk reduction needs.

RESEARCH METHODS

Data on disaster-vulnerable groups is sourced from data from the Central Agency of Statistics Indonesia (BPS) for each sub-district in Bantul Regency in the 2022 Figures. Vulnerable groups consist of infants, toddlers, children, pregnant or breastfeeding mothers, people with disabilities, and the elderly. Age limits for vulnerable groups are presented in Table 1.

Table 1. Age Formulation of Vulnerable Groups

Vulnerable Group	Age Group
Infants, Toddlers, Children	0 – 18 Years
Pregnant or Breastfeeding Mothers	-
Person with Disabilities	-
Elderly People	≥ 60 Years

This secondary data study aims to analyze the spatial distribution of disaster-vulnerable groups in Bantul District, DIY Province, in 2022. Data on the number of vulnerable groups are then processed to determine the low, moderate, and high-density intervals presented in Table 2. Presentation of final data to show spatial distribution using maps.

Table 2. Density Class

Density Class	Interval
Low	6471 – 25000
Moderate	25001 – 43530
High	43531 – 62058

Source: Data Processing, 2023

RESULTS AND DISCUSSION

Vulnerable group data represents the number of people classified as disaster-vulnerable groups in Bantul Regency in 2022. Spatial distribution in the form of maps can make it easier for readers to see and understand the distribution of areas with high, moderate, and low densities of vulnerable groups. The spatial distribution map of disaster-prone groups in Bantul District can be used for further spatial analysis. Data on the population of disaster-prone groups in Bantul District in 2022 are presented in Table 3 and visualized in the spatial distribution map in Figure 2.

Table 3. The population of Disaster-Vulnerable Groups in Bantul Regency in 2022

Sub-Districts	Infants, Toddlers, Children	Pregnant or Breastfeeding Mothers	Person with Disabilities	Elderly People	Total	Density Class
Kasihan	29602	359	174	14027	44162	High
Banguntapan	28567	864	41	8665	38137	Moderate
Sedayu	13460	276	83	7463	21282	Low
Piyungan	12128	259	135	49536	62058	High
Sewon	28442	515	136	13920	43013	Moderate
Pajangan	10270	201	58	5448	15977	Low
Pleret	4470	394	39	1568	6471	Low
Bantul	18005	201	113	9785	28104	Moderate
Dlingo	10466	312	70	7030	17878	Low
Jetis	16348	322	139	8818	25627	Moderate
Pandak	10342	256	137	5456	16191	Low
Imogiri	17744	342	128	10594	28808	Moderate
Bambanglipuro	10993	181	96	7240	18510	Low
Srandakan	8141	183	69	5710	14103	Low
Pundong	9464	206	63	6226	15959	Low
Sanden	5802	146	208	4325	10481	Low

Source: Central Agency of Statistics Indonesia (BPS), 2022

Infants, toddlers, and children are among the vulnerable groups. The highest number of infants, toddlers, and children is in Kasihan District, with 29602 people. Three sub-districts in Bantul Regency have many infants, toddlers, and children of more than 25000 people. In addition to Kasihan District, two sub-districts with many infants, toddlers, and children in Bantul Regency are Banguntapan District, with 28567 people, and Sewon District, with 28442 people. Meanwhile, the sub-district with the lowest number of infants, toddlers, and children is Pleret District, which is 4470 people. Two sub-districts in Bantul Regency have a low number of infants, toddlers, and children with a low number of less than 5000 people. In addition to Pleret District, the sub-district with a relatively low number of infants, toddlers, and children is Sanden District with 5802 people.

Pregnant or breastfeeding mothers are one of the disaster-prone groups. The highest number of pregnant or breastfeeding mothers is in Banguntapan District, with 864 people. Two sub-districts in Bantul Regency have a high number of pregnant or breastfeeding mothers more than 500 people. In addition to Banguntapan District, the district with many pregnant or breastfeeding mothers is Sewon District, with 515 people. Meanwhile, the sub-district with the lowest number of pregnant or breastfeeding mothers is the Sanden sub-district, which amounts to 146 people. Three sub-districts in Bantul Regency have a low number of pregnant or breastfeeding mothers with a low number of less than 200 people. In addition to Sanden District, districts with few pregnant or breastfeeding mothers are Bambanglipuro District, with 181 people, and Srandakan District, with 183 people.

People with disabilities are one of the disaster-prone groups. The highest number of people with disabilities is in the Sanden sub-district, with 208 people. Two sub-districts in Bantul Regency have a high number of people with disabilities, more than 150 people. In addition to Sanden District, the district with many people with disabilities is Kasihan District, with 174 people. Meanwhile, the sub-district with the lowest number of people with

disabilities is the Pleret sub-district, which has 39 people. Two sub-districts in Bantul Regency have a low number of people with disabilities, with a low number of less than 50 people. In addition to Pleret District, the sub-district with a few people with disabilities is Banguntapan District, with 41 people.

The elderly are one of the disaster-prone groups. The highest number of elderly people is in Piyungan District, with 49536 people. Piyungan District is the only sub-district with the highest number of elderly people and the farthest gap between sub-districts in Bantul Regency. Meanwhile, the sub-district with the lowest number of elderly people is the Pleret sub-district, which amounts to 1568 people.

A high number of vulnerable groups correlates to the vulnerability of a region. Areas with many vulnerable groups are vulnerable to disasters (Panjaitan et al., 2023; Hizbaron et al., 2022; Smith et al., 2022). Vulnerability becomes an obstacle for groups vulnerable to disasters because they are in a period of development that does not have good knowledge and understanding, physical limitations, and age factors (Akash et al., 2023; Isia et al., 2023). Infants, toddlers, and children are vulnerable groups in a development period that does not know and understand disasters. Please note that children include Senior High School (SMA) level students. Disaster risk reduction for infants, toddlers, and children needs to be supported by families and the environment, including schools (Burkhart and Ievers-Landis, 2023; Mulianingsih and Hardati, 2022; Pahleviannur and Hafida, 2020). Families are expected to be able to protect infants and toddlers to reduce the risk of disasters. Children as students are expected to have disaster risk reduction programs implemented in the curriculum, subjects, and extracurriculars to provide knowledge and preparedness in disaster risk reduction.

Pregnant or breastfeeding mothers are vulnerable groups because they have physical limitations that can hinder movement (Hirani et al., 2023; Hossain et al., 2023). Pregnant or breastfeeding mothers rarely participate in socialization and disaster risk reduction training activities. Pregnant or breastfeeding mothers are also expected to be involved in socialization and training on disaster risk reduction, so they have knowledge and understanding of disasters.

People with disabilities are a disaster-prone group because they have physical limitations from birth or accidents. Different types of people with disabilities need specific policies that explain each disability in disaster risk reduction. Special Schools (SLB) and disability assistants must also be involved in inclusive disaster socialization and simulation activities to have special knowledge and understanding of inclusive disaster risk reduction (Lillywhite and Wolbring, 2022; Sheehy et al., 2022).

Elderly people are a vulnerable group because they are based on age factors and physical limitations. Age factors cause physical and thinking skills to decrease, making them vulnerable to disasters. Elderly people need family support to reduce the risk of disasters (Van Orden et al., 2021). Elderly people must also be involved in various activities such as socialization and disaster simulation to adapt to disasters.

A spatial distribution map of the density of vulnerable groups is obtained based on the summation results of each vulnerable group. Areas classified as high density of vulnerable groups are shown in red. Areas classified as moderately vulnerable group density are shown in yellow. Areas classified as low-density of vulnerable groups are shown in green. A spatial distribution map of the density of vulnerable groups is presented in Figure 2.

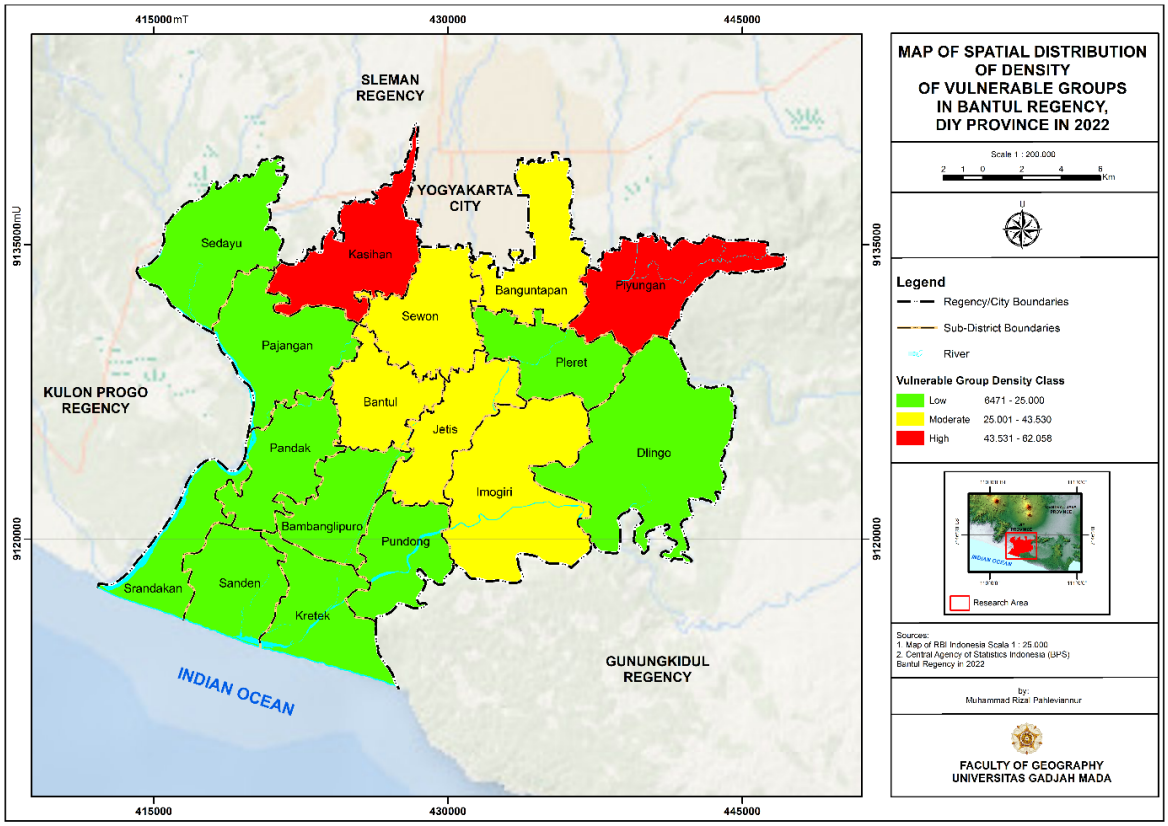

Figure 2. Map of Spatial Distribution of Density of Vulnerable Groups in Bantul Regency, DIY Province in 2022

Areas with a high density of vulnerable groups are in Kasihan and Piyungan sub-districts. Kasihan District is classified as an area with a high density of vulnerable groups because it has the highest number of infants, toddlers, and children in Bantul Regency. In addition, Kasihan District is classified as an area with a high density of vulnerable groups because the number of people belonging to vulnerable groups is relatively high. Piyungan District is classified as an area with a high density of vulnerable groups because it has the highest number of elderly people in Bantul Regency. In addition, Piyungan District is classified as an area with a high density of vulnerable groups because the number of people belonging to vulnerable groups is relatively high. Areas with a moderate density of vulnerable groups are in the Banguntapan, Sewon, Bantul, Jetis, and Imogiri sub-districts. Meanwhile, areas with low density of vulnerable groups are in Sedayu, Pajangan, Pleret, Dlingo, Pandak, Bambanglipuro, Srandakan, Pundong, and Sanden Districts.

Bantul Regency has 16 sub-districts; out of 16 sub-districts, two are classified as high density of vulnerable groups. Five sub-districts are classified as moderate-density vulnerable groups. Nine sub-districts are classified as low-density vulnerable groups. All regions are prioritized in reducing earthquake risk to vulnerable groups (Ekmekcioğlu et al., 2021; Rabby et al., 2019). However, it is necessary to determine priorities that need to be prioritized in reducing earthquake disaster risk for vulnerable groups.

Prioritization needs to be prioritized in reducing earthquake risk for vulnerable groups in the Bantul Regency, considering that the number of vulnerable groups in the Bantul Regency is 42% of the total population of the Bantul Regency. This percentage is relatively high, so it is necessary to prioritize implementing earthquake risk reduction programs for vulnerable groups.

The priority that needs to be

prioritized in reducing earthquake disaster risk for vulnerable groups in Bantul Regency is areas classified as high density of vulnerable groups, namely Kasihan District and Piyungan District. Then, after the earthquake, a disaster risk reduction program for vulnerable groups runs in sub-districts with highly vulnerable group density, followed by sub-districts classified as moderate to low vulnerable group density.

The existence of spatial distribution mapping is helpful to find out the distribution of areas easily (Liu et al., 2023; Gebregziabher et al., 2022; Lasaiba and Arfa, 2022). Mapping the spatial distribution of vulnerable group density can determine areas in Bantul Regency that are classified as highly vulnerable group density to be prioritized first, then moderate to low vulnerable group density. Thus, this research can be helpful for Bantul Regency policymakers to carry out earthquake disaster risk reduction programs for vulnerable groups to see the results of spatial distribution maps. Hopefully, this research can be implemented in other regions in Indonesia.

CONCLUSION

Kasihan and Piyungan sub-districts are areas with a high density of vulnerable groups. Banguntapan, Sewon, Bantul, Jetis, and Imogiri sub-districts are areas with a moderate population density of vulnerable groups. Meanwhile, areas with a low density of vulnerable groups are in Sedayu, Pajangan, Pleret, Dlingo, Pandak, Bambanglipuro, Srandakan, Pundong, and Sanden Districts. Kasihan sub-district and Piyungan sub-district, included in the overcrowding vulnerable group, must be a top priority in reducing earthquake risk in Bantul Regency. The earthquake disaster risk reduction program for vulnerable groups starts with high-density sub-districts, followed by moderate to low-density vulnerable groups.

Mapping the spatial distribution of vulnerable group density can determine areas in Bantul Regency classified as high, moderate, and low vulnerable group density. This research can be helpful for Bantul Regency policymakers to carry out earthquake disaster risk reduction programs for vulnerable groups to see the results of spatial distribution maps. Hopefully, this research can be implemented in other regions in Indonesia.

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