

***EVALUATION OF TEMPORARY EVACUATION SHELTER (TES) FOR TSUNAMI IN
BANGGAE TIMUR, MAJENE BASED ON LOCATION-ALOCATION ANALYST***

**EVALUASI TEMPAT PENAMPUNGAN SEMENTARA (TEMPAT PENAMPUNGAN
SEMENTARA) UNTUK TSUNAMI DI BANGGAE TIMUR, MAJENE BERDASARKAN
ANALISIS LOKASI-ALOKASI”**

Skripsi



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EVALUATION OF TEMPORARY EVACUATION SHELTER (TES) FOR TSUNAMI IN BANGGAE TIMUR, MAJENE BASED ON LOCATION-ALLOCATION ANALYSIS

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ABSTRACT

Majene Regency, specifically the Banggae Timur District, is at considerable risk of tsunamis due to its coastal location and increasing urban density. This research evaluates the effectiveness of current Temporary Evacuation Shelters (TES) using a spatial analysis methodology combined with location-allocation modeling. The methodology included tsunami inundation mapping utilizing historical data, identification of building points, analysis of TES capacity, and modeling of service areas within a maximum evacuation radius of 935 meters. The study concentrated on two specific TES: Prasamya Stadium and the Majene Regency Police Station. Although both locations possess adequate capacity for hosting evacuees, they are situated within high-risk tsunami inundation zones (5–6 meters), making them inappropriate for safe evacuation. Spatial allocation modeling indicates that these TES predominantly serve the western section of Banggae Timur District, resulting in considerable underservicing of eastern coastal areas and increased risk. Of the 2,774 houses located within the tsunami inundation zone, 1,506 are currently unserved by the existing TES. The findings highlight the necessity of identifying and establishing new TES in safer, elevated areas with enhanced accessibility to improve evacuation coverage and safety. This study emphasizes the importance of spatial modeling in enhancing evidence-based disaster mitigation planning. It offers precise, data-driven insights for optimizing emergency infrastructure and minimizing population risk exposure in urban areas susceptible to tsunamis.

Keyword: Disaster Mitigation, Location-allocation, Spatial Analysis, Temporary Shelters, Tsunami Evacuation.

1. INTRODUCTION

Sulawesi Barat Province has the highest disaster risk index, with a score of 160.08 [1]. Of the five regencies in Sulawesi Barat Province, Majene Regency has the highest disaster risk index, with a score of 186.83. This score decreased from 2019 to 2023 (fig. 1) but remains in the high-risk category.

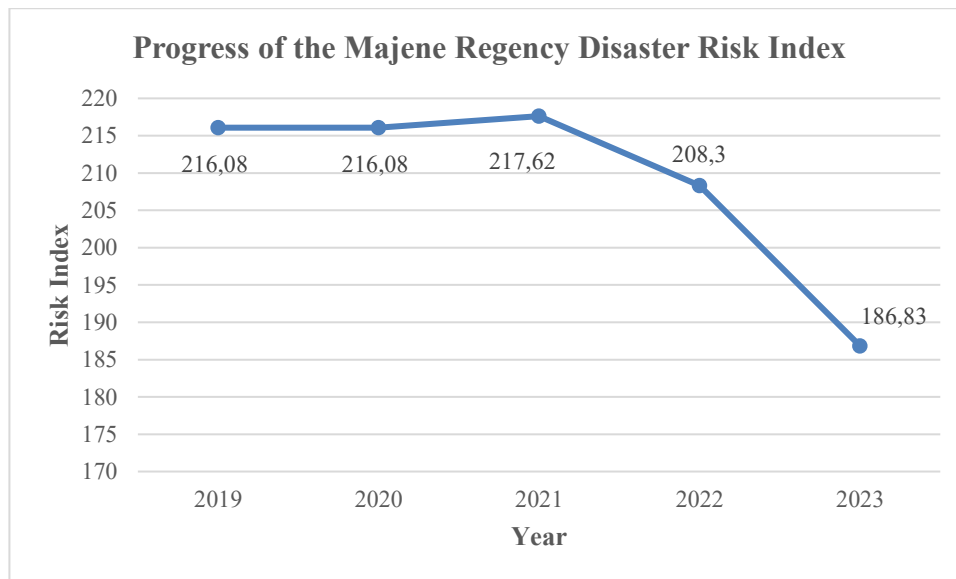


Figure 1. Progress of the Majene Regency Disaster Risk Index

The high disaster risk in Majene Regency is attributed to its elongated shape, its direct border with the Makassar Strait, and its geological location, which is influenced by the Makassar Fault, a tectonic feature exhibiting reverse movement with an average annual displacement of 1-5 mm [2]. These conditions make the Majene Regency highly vulnerable to tsunamis. Based on historical data, Majene Regency experienced earthquakes followed by tsunamis in 1967 and 1969 [3], with the 1969 event causing quite severe impacts due to tsunami heights reaching 2-6 meters in several areas [3] [4] [5]. Furthermore, based on studies conducted, Majene Regency and its urban areas are the areas in Sulawesi Barat Province with the most excellent chance of being impacted by a major tsunami disaster (with a height of more than 3 meters) in any given year [6].

The part of the Majene Regency that requires special attention in disaster management efforts is the Majene urban area, as the center of growth in this region is located in a coastal area that is seismically active [7]. The Majene urban area, encompassing two sub-districts, Banggae, and Banggae Timur, is a tsunami-prone area, with the distribution of tsunami-affected areas in Banggae Timur District being more extensive than in Banggae District [8] [9]. The Banggae Timur District is highly vulnerable to tsunamis, primarily due to its role as the center of urban growth driven by the presence of the Sulawesi Barat University campus. This situation will lead to increased population growth and land conversion, further contributing to disaster vulnerability. Therefore, mitigation as a disaster management effort is increasingly crucial in the development of the Majene urban area, particularly the Banggae Timur District.

Mitigation efforts play a crucial role in regional planning and structuring in the Majene Regency, as disaster management practices in Majene have not been well implemented, particularly regarding emergency response [10] [11]. Disaster management must be supported by effective planning, direction, support, coordination, and implementation of various activities carried out at the stages of damage mitigation, preparedness, intervention, and recovery in order to prevent disasters and reduce the damage they cause [12]. The strategy established by the Majene Regency needs to be adapted to regional conditions by ensuring that disaster management operations are effective, efficient, and sustainable [13]. One effort that can be made to organize an effective and efficient disaster emergency response is to improve disaster mitigation, which can be done by preparing a thorough evacuation plan. In this case, mapping evacuation shelter along with their characteristics and effective evacuation routes plays a vital role [14] [15]. In 2021, the government conducted a mapping of Temporary Evacuation Shelter (TES) in the urban area of Majene, including Banggae Timur District [16]. However, no evaluation of these TES has been conducted, therefore, this research aims to evaluate each TES in Banggae Timur District, particularly by considering aspects of tsunami vulnerability parameters and TES accessibility in reaching buildings potentially affected by tsunamis.

This study's findings on the evaluation of Temporary Evacuation Shelters (TES) for tsunamis in Banggae Timur District, Majene, lead to the following policy recommendations aimed at improving disaster mitigation and preparedness:

1. The primary recommendation is to promptly identify and establish new Temporary Evacuation Shelters (TES) in areas that are clearly outside of high-risk tsunami inundation zones. The existing TES (Prasamya Stadium and Majene Regency Police Station) are located within the 5-6 meter tsunami inundation zone, making them inadequate as safe evacuation sites despite their capacity. New locations must be selected through comprehensive topographical analysis, ensuring they are situated at elevations considerably above the maximum expected tsunami height, as indicated by prior research.
2. The expansion of TES coverage to underserved areas is necessary, as the current locations primarily serve the western urban regions of Banggae Timur District, resulting in significant portions of the eastern coastal areas being underserved and vulnerable. Policy should require a thorough assessment of the spatial distribution of populations at risk from tsunamis and strategically position new tsunami evacuation shelters to enhance coverage, especially in the underserved eastern areas.
3. Investment in evacuation infrastructure and route improvement is necessary, as some routes to existing TES are accessible, yet certain sections are narrow and may hinder evacuation flows. Investment in infrastructure improvements should be prioritized in policy, focusing on widening critical evacuation routes, ensuring adequate signage, and addressing potential congestion points, particularly in densely populated areas. Evacuation planning must consider the risk associated with crossing rivers that may serve as tsunami routes.

4. CONCLUSION

Using a spatial analysis approach with location-allocation modeling, this study assessed the efficacy of This research utilized spatial analysis and location-allocation modeling to assess the effectiveness of Temporary Evacuation Shelters (TES) in the Banggae Timur District of Majene Regency. The results reveal substantial shortcomings in the existing disaster preparedness framework. Both the Prasamya Stadium and the Majene Regency Police Station are located within high tsunami inundation zones (5-6 meters), making them inadequate as safe evacuation points during a tsunami disaster, despite having sufficient capacities. This spatial vulnerability significantly undermines their reliability as safe havens.

The location-allocation analysis indicated that these two TES can serve only a limited segment of the tsunami-affected population, primarily focusing on the western urban areas of Banggae Timur District. The maximal evacuation distance constraint of 935 meters indicates that substantially high-risk areas in the eastern region are inadequately served. This highlights a significant shortcoming in the region's disaster preparedness planning, suggesting that a considerable number of households (1,506 out of 2,774) remain unserved within the tsunami inundation zone.

To enhance tsunami disaster mitigation in Banggae Timur District, it is essential to identify and establish new TES locations that are strategically located to optimize coverage of the affected population and are topographically secure, preferably at elevations well above the maximum expected tsunami height. Simultaneously, it is crucial to increase public awareness and upgrade evacuation infrastructure, which includes expanding key routes and ensuring clear signage, to enable timely and efficient evacuation processes. The incorporation of these essential efforts into holistic disaster management and urban planning frameworks will significantly improve community resilience to future tsunami occurrences in Majene Regency.

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