

Stunting Distribution Mapping in Tanjung Morawa District: Geographic Information Systems Implementation

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Abstract. Indonesia, a developing nation, faces a critical issue of hindering, particularly in regions like Tanjung Morawa. Data from the World Health Organization shows Indonesia has a hindering rate of 21.6 percent among young children. Tanjung Morawa, part of Serdang, is one of the regions with high hindering prevalence. This study aims to analyze hindering distribution in Tanjung Morawa through interviews, field studies, and GIS-based data analysis. The research includes direct surveys and mapping to provide real-time spatial information on hindering. The goal is to use this information to reduce hindering rates in Tanjung Morawa and achieve Sustainable Development Goals, particularly focusing on improving child health.

Keywords: Stunting, GIS, SDGs, Tanjung Morawa District.

1 Introduction

In the framework of the Sustainable Development Goals (SDGs), especially Goal 3, which focuses on ensuring healthy lives and promoting well-being for everyone, advancements in nutrition plays a vital role in speeding up the achievement of these objectives. Achieving targets like eliminating poverty, reducing child mortality, and enhancing health and education is strongly tied to improvements in nutrition.

Recognizing the importance of nutrition in national development is crucial and requires the support of all stakeholders, not just those in the health sector. However, awareness of nutrition's pivotal role in improving community productivity and reaching national targets remains inadequate, as seen in the failure to meet nutrition-related goals. Recent data on nutritional status shows that 17.1% of toddlers are underweight, 7.7% suffer from wasting, and 21.6% are affected by stunting [1].

Stunting, a condition characterized by short stature in toddlers, represents a critical nutritional issue affecting young children globally. The term "stunting" is derived from the English word "stunted," which refers to hindered growth or dwarfism. According to [2], stunting is defined as impaired growth and development in children under the age of five, primarily resulting from chronic malnutrition, recurrent infections, and inadequate psychosocial stimulation, particularly within the first 1,000 days of life—from conception to the child's second birthday. Malnutrition frequently begins during pregnancy and continues into the early postnatal period, although stunting typically becomes evident after the child reaches two years of age. A child is classified as stunted if their height-for-age (H/A) z-score falls below -2 standard deviations (SD), in accordance with the nutritional status classification outlined in Regulation of the Minister of Health No. 02 of 2020.

Stunting remains prevalent in many low- and middle-income countries, including Indonesia. The prevalence of stunting is reported to be 18.6% in South Africa, 26.4% in Ethiopia, and 22.2% in Nigeria. In Latin America and the Caribbean, an estimated 6 million children are affected by stunting. In Asia, the prevalence is 38.4% in India (2015), 45% in Pakistan (2012), 36.1% in Bangladesh (2014), 20.7% in Malaysia (2016), 10.5% in both the Philippines and Thailand (2017), and 21.6% in Indonesia (2023) [2]. According to data from the World Health Organization (WHO), Indonesia ranks third in the Southeast Asia Region (SEAR) for the highest prevalence of stunting, with an average rate of 21.6% among toddlers in 2023. In North Sumatra Province, the prevalence of stunting in 2023 is reported to be 21.1% [3]

It is both interesting and concerning that the prevalence of stunting among toddlers in Deli Serdang Regency increased from 12.5% in 2021 to 13.9% in 2022 [1]. This trend is particularly notable given the relatively rapid economic growth experienced by the region in recent years. In 2022, Deli Serdang Regency's Gross Regional Domestic Product (GRDP) grew by 4.70%, reaching IDR 75.60 trillion [4]. Despite this economic expansion, which serves as a benchmark for community welfare, it has not necessarily translated into improvements in the nutritional status of the population.

The incidence of stunting in Deli Serdang Regency is widespread across nearly all sub-districts, with Tanjung Morawa District being among the areas with a particularly high prevalence. According to data from 2021-2022, provided by the Women's Empowerment, Child Protection, Population Control, and Family Planning Service of Deli Serdang Regency, 5.93% of children in Tanjung Morawa District were classified as stunted.

The Tanjung Morawa District Government has implemented various efforts to address stunting, yet the number of cases continues to rise. Tackling this issue requires consideration of additional risk factors, such as geographic conditions. Currently, stunting data in this area is primarily processed manually through tables and graphs, which makes regional analysis challenging. However, stunting is also influenced by spatial factors. One alternative visualization method that could be utilized is mapping.

A map is a representation or depiction of abstract elements or features selected from the Earth's surface, or those related to the Earth's surface, typically presented on a flat, scaled-down surface [5]. A map illustrating the epidemiological conditions of an event can be created using a distribution map displayed in a WebGIS format. WebGIS serves as an epidemiological Stunting, a condition marked by short stature in young children, is a significant global nutritional concern. The term "stunting" comes from the English word "stunted," meaning hindered growth or

dwarfism. According to [2], stunting is defined as impaired growth and development in children under five, primarily due to chronic malnutrition, frequent infections, and insufficient psychosocial stimulation, especially during the first 1,000 days of life—spanning from conception to the child's second birthday. Malnutrition often begins in pregnancy and continues into early infancy, with stunting typically becoming noticeable after the age of two. A child is classified as stunted if their height-for-age (H/A) z-score is below -2 standard deviations (SD), as specified in the nutritional status classification by Regulation of the Minister of Health No. 02 of 2020.

Stunting remains a widespread issue in many low- and middle-income countries, including Indonesia. The prevalence of stunting is reported at 18.6% in South Africa, 26.4% in Ethiopia, and 22.2% in Nigeria. In Latin America and the Caribbean, approximately 6 million children are affected by stunting. In Asia, stunting rates are 38.4% in India (2015), 45% in Pakistan (2012), 36.1% in Bangladesh (2014), 20.7% in Malaysia (2016), 10.5% in both the Philippines and Thailand (2017), and 21.6% in Indonesia (2023) [2]. According to the World Health Organization (WHO), Indonesia ranks third in the Southeast Asia Region (SEAR) for the highest prevalence of stunting, with an average of 21.6% among toddlers in 2023. In North Sumatra Province, the stunting rate in 2023 stands at 21.1% [3].

Of particular concern is the rising prevalence of stunting in Deli Serdang Regency, where the rate increased from 12.5% in 2021 to 13.9% in 2022 [1]. This is striking given the region's relatively rapid economic growth. In 2022, Deli Serdang Regency's Gross Regional Domestic Product (GRDP) grew by 4.70%, reaching IDR 75.60 trillion [4]. Despite this economic growth, which is typically seen as a measure of community welfare, it has not resulted in significant improvements in the population's nutritional status.

Stunting is widespread across nearly all sub-districts in Deli Serdang, with Tanjung Morawa District showing particularly high rates. Data from 2021-2022 from the Women's Empowerment, Child Protection, Population Control, and Family Planning Service of Deli Serdang Regency reveal that 5.93% of children in Tanjung Morawa District were stunted. Despite the efforts made by the Tanjung Morawa District Government to address stunting, the number of cases continues to rise, pointing to the need to consider additional risk factors, such as geographic conditions.

Currently, stunting data in the region is mainly processed manually using tables and graphs, complicating regional analysis. However, spatial factors also influence stunting. One alternative is mapping, which provides a visual representation of abstract features from the Earth's surface on a scaled, flat surface [5]. A map displaying the epidemiological distribution of an event can be developed through a WebGIS format. WebGIS serves as an epidemiological tool to visualize the spatial distribution of conditions, allowing policymakers to perform regional analyses and create informed policies.

"The incidence of stunting and its related risk factors in Tanjung Morawa District should be examined from a regional perspective. WebGIS can help identify patterns in stunting distribution, analyze its relationship with risk factors, pinpoint areas for intervention, and determine strategic locations for health facilities accessible to the community for both treatment and prevention of stunting" [6].

Developing and managing WebGIS requires a Geographic Information System (GIS), a computer-based system that enables users to collect, manage, analyze, and access spatially referenced data and related attributes from various sources [7]. GIS facilitates simultaneous user access and efficient data processing, making it a valuable tool for managing resources due to its versatile applications [8].

GIS addresses complex problems in geography, hydrology, and urban planning by integrating data from multiple sources. The digital database created at each stage of GIS can be utilized in the future for easy and efficient information extraction, as GIS functions as an information system [9]. Accurately measuring spatial locations is essential for understanding spatial effects [10].

The GIS in this study aims to visualize stunting distribution in Tanjung Morawa District through a WebGIS-based dashboard. This tool is intended to assist policymakers in addressing stunting in the region, particularly in support of achieving the third Sustainable Development Goal (SDG).

2 Methods

This research was conducted in Tanjung Morawa District, Deli Serdang Regency, in April 2024. The research methodology involved a field survey to collect data on stunting incidents through observations, interviews, and document studies. Observations were employed to gather data on village potential, public facilities, and population density. Interviews were conducted to collect demographic information and assess socio-economic conditions, while document studies were utilized to obtain stunting data. The respondents included families identified as being affected by stunting, distributed across 22 villages in Tanjung Morawa District. The data were analyzed descriptively and qualitatively, with the results visualized using WebGIS..

3 Results and Discussion

Tanjung Morawa District, which accounts for 5.27% of the total area of Deli Serdang Regency, is home to a diverse population representing various ethnicities, cultures, and social systems. These differences contribute to varied social structures within the community, which in turn influence the economic status of individuals, largely shaped by their education and employment levels. Economic conditions have a direct impact on family well-being; when a family has a low economic status, they may struggle to meet basic nutritional needs, particularly for toddlers, increasing the risk of stunting.

According to the study's findings, 53 cases of stunting were reported in the district between 2021 and 2023, with the highest number recorded in 2022, when 34 cases were documented (Figure 1). The distribution of stunting cases over the three years was uneven: in 2021, cases were found in four villages; in 2022, in seven villages; and in 2023, in five villages. The research identified two villages where stunting cases were notably high. Tanjung Morawa A and Tanjung Morawa B villages continued to report stunting cases for three consecutive years, for an example see **Figure 1**.

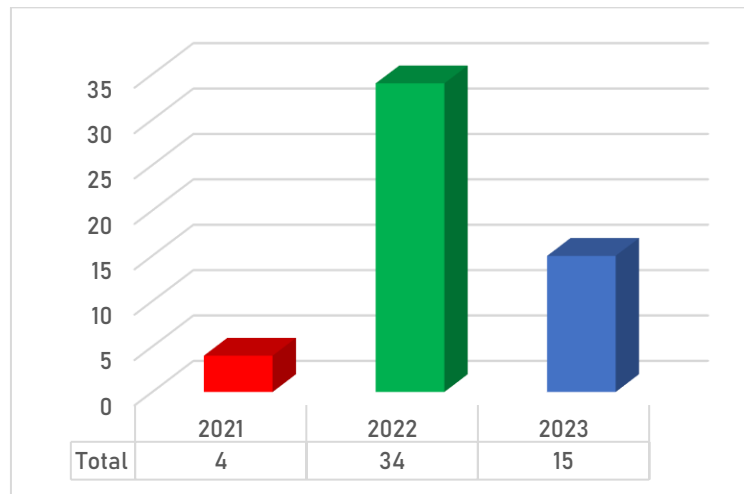


Fig. 1. Graph of the Incidence of Stunting Cases Among Children in Tanjung Morawa District, Deli Serdang Regency (2021–2023)
Source : Primary Data Analysis Results, 2024

Table 1. Distribution of Stunting Incidents in Tanjung Morawa District

No	Year		
	2021	2022	2023
1.	Bangun Sari	Bangun Sari	Bagan Sinembah
2.	Dalu Sepuluh A	Bangun Sari Baru	Tanjung Baru
3.	Tanjung Morawa A	Buntu Bedimbar	Tanjung Morawa A
4.	Tanjung Morawa B	Dalu Sepuluh A	Tanjung Morawa B
5.		Tanjung Baru	Wonosari
6.		Tanjung Morawa A	
7.		Tanjung Morawa B	

Source : Primary data Processing, 2024

Tanjung Morawa District is located near the KIM Star industrial area, which attracts many individuals of working age, particularly those seeking jobs in factories. This influx of workers has led to population growth, higher population density, and the potential development of slum areas. The living environment plays a crucial role in food security, significantly affecting the prevalence of stunting in children [11]. Residents of slum areas are often low-income, placing them at greater risk of malnutrition, a primary factor contributing to stunting. When stunting is coupled with other issues such as reduced cognitive and academic performance, lower adult wages, diminished productivity, and excessive weight gain in later childhood, it poses a serious threat of becoming a long-term problem [12].

In urban settings, various factors—including the timing of weaning, birth weight, the mother's age, birth location, maternal nutrition, and the father's age—are linked not only to stunting but also to low socioeconomic status and poor environmental health [13]. Poor hygiene, especially

within the home, is a significant factor in the prevalence of *Ascaris lumbricoides* infections. In areas with poor sanitation, unsafe water, and inadequate hygiene, worm eggs can contaminate water, food, soil, and hands, increasing the likelihood of infection. This study identified several risk factors for intestinal parasite transmission, such as lack of toilets, unclean water sources, insufficient drinking water, poor hygiene, improper waste disposal, low socioeconomic status, and the presence of multiple parasites in communities [14].

Social structures shape economic status, which is influenced by factors like education and employment. Economic conditions directly affect family well-being; lower economic status can lead to poor food security, negatively impacting nutrition, especially in toddlers, and increasing the risk of stunting. Raising awareness of the importance of dietary diversity and providing support to poor and marginalized households is critical, particularly in the face of climate change, which harms agricultural production and food security. The study's findings reveal alarmingly high rates of stunting, wasting, and underweight, with significant variations in these conditions [15].

Addressing the stunting issue in Tanjung Morawa District requires targeted and specific interventions to reduce stunting rates and improve community welfare. This calls for collaboration and dedication from all stakeholders involved in the stunting task force. The geographical distribution of stunting in the region is particularly concerning and needs to be closely tracked. Mapping and visualizing this data through a Dashboard-Geovisualization tool can effectively communicate the distribution of stunting cases [16].

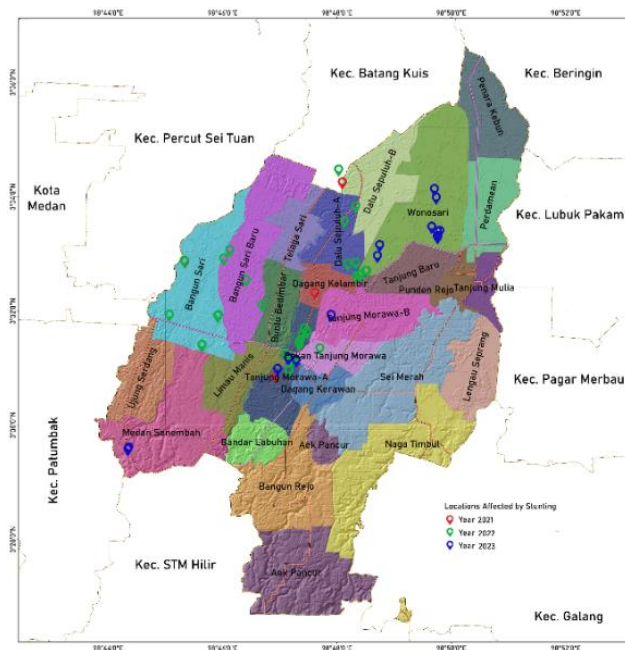


Fig. 2. Map of Stunting Distribution Incidents in Tanjung Morawa District, Deli Serdang Regency (2021 – 2023)

The spatial analysis results reveal that stunting cases in Tanjung Morawa District follow a centralized distribution pattern, with the majority of incidents concentrated in the central areas, particularly in Tanjung Morawa A and Tanjung Morawa B villages, as shown in Figure 2. This figure provides insights into the spatial distribution of stunting within the district and highlights relevant data on stunting cases. The map is expected to be a useful tool in developing strategies to lower stunting rates in Tanjung Morawa District, contributing to the achievement of the Sustainable Development Goals (SDGs), especially Goal 3. Of the 17 global SDGs to be accomplished by 2030, the second goal focuses on ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture. One of the key targets is to reduce the number of children under five affected by stunting and wasting by 40% by 2030 [12].

4 Conclusion

The distribution of stunting in Tanjung Morawa District exhibits a centralized pattern, which is visualized using a Geographic Information System (GIS). This spatial data serves as valuable information for policymakers, providing essential insights for designing effective strategies aimed at reducing the incidence of stunting in the district. Furthermore, it supports the achievement of the Sustainable Development Goals (SDGs), particularly in relation to Goal 3.

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