

Regional Food Reserve Policy in Responding to the Climate Crisis and Food Production Uncertainty

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Abstract:

This study analyzes regional food reserve policy in Indonesia as a preparedness instrument for responding to climate crisis and food production uncertainty. The study focuses on the readiness of local governments to build and manage food reserves in the face of drought, flooding, harvest failure, and food distribution disruption. Using a descriptive qualitative approach with policy implementation analysis, this research examines regulations, official reports, climate information, food production data, and relevant academic literature on food security governance, climate adaptation, and regional preparedness. The findings show that regional food reserves have a strategic role in strengthening local food security resilience, particularly because climate-related food risks are spatially uneven and often emerge first at the local level. However, the effectiveness of regional food reserve policy depends on local implementation capacity, including reserve calculation, budget allocation, procurement, storage, stock rotation, quality control, institutional coordination, and emergency distribution mechanisms. The study also finds that regional food reserves must be integrated with climate-risk information, food vulnerability maps, disaster-risk data, and local food balance analysis. The novelty of this study lies in framing regional food reserves as an anticipatory governance instrument rather than merely a logistical stock policy. The study concludes that strengthening regional food reserves is essential for building climate-adaptive food security governance in Indonesia.

Keywords: regional food reserves; food security governance; climate crisis; production uncertainty; local preparedness; Indonesia.

1. Introduction

Food security governance increasingly requires an adaptive policy framework because food production is no longer shaped only by land availability, farmer capacity, and market access, but also by climate variability, extreme weather, harvest failure, and distribution disruption. In Indonesia, the urgency of regional food reserves has become more apparent as climate-related shocks affect production stability and food availability across provinces and districts. The 2023 El Niño event created prolonged drought conditions in several parts of Indonesia, disrupted agricultural activities, and increased the risk of crop failure, while the transition toward a weak La Niña pattern from late 2024 to early 2025 was expected to bring higher rainfall and potential flooding in several regions (BMKG, 2024; Reuters, 2024). These conditions show that food security policy cannot rely only on production expansion and market distribution, but must also include preparedness instruments that enable local governments to respond quickly when food supply is disrupted.

The vulnerability of Indonesia's food system can be seen from the decline in rice production indicators in 2024. BPS initially estimated in October 2024 that Indonesia's paddy harvested area would reach approximately 10.05 million hectares, decreasing by 167.25 thousand hectares or 1.64 percent compared with 2023, while paddy production was projected at 52.66 million tons of dry unhusked paddy, decreasing by 1.32 million tons or 2.45 percent from the previous year (BPS, 2024a). In its final release, BPS reported that paddy production in 2024 reached 53.14 million tons of dry unhusked paddy, still decreasing by 838.27 thousand tons or 1.55 percent compared with 2023 (BPS, 2025). These data indicate that food production remains exposed to seasonal shifts, rainfall anomalies, irrigation constraints, and regional differences in harvest performance. Even when national production does not collapse, a decline in harvested area and paddy output can increase pressure on food availability, especially in regions that depend heavily on interregional supply flows.

The climate crisis also creates food security risks that are uneven across regions. Some areas may experience drought and delayed planting, while others may face flooding, landslides, crop damage, or disruption of transportation routes. These risks affect not only production, but also distribution, storage, price stability, and household access to food. In archipelagic countries such as Indonesia, distribution disruption can quickly create local food scarcity even when national supply is statistically sufficient. This makes regional food reserves strategically important because local governments are closer to vulnerable communities, local producers, local markets, and emergency response systems. Regional food reserves therefore function not only as stored commodities, but also as instruments of local preparedness during climate shocks, harvest failure, and supply-chain disruption.

The legal foundation for food reserves in Indonesia has been established through Law No. 18 of 2012 on Food, Government Regulation No. 17 of 2015 on Food Security and Nutrition, and Presidential Regulation No. 125 of 2022 on Government Food Reserves. Presidential Regulation No. 125 of 2022 defines Government Food Reserves as food supplies controlled and managed by the government and regulates the types, quantities, administration, assignment of state-owned enterprises, and funding of food reserves (Republik Indonesia, 2022). The regulation also identifies several strategic food commodities under government food reserves, including rice, corn, soybean, shallot, chili, poultry meat, poultry egg, ruminant meat, consumption sugar, cooking oil, and fish (Republik Indonesia, 2022). This framework shows that food reserve policy is not limited to rice-centered food security, but is directed toward broader staple-food stability. However, the effectiveness of this policy depends on how national reserve policy is translated into regional preparedness at the provincial, district, and municipal levels.

Regional governments occupy a critical position in food reserve governance because climate shocks and distribution disruptions are usually experienced locally before they become national crises. The National Food Agency has encouraged local governments to strengthen Regional Government Food Reserves as part of a layered food security system, while the calculation mechanism for regional government rice reserves has been regulated through National Food Agency Regulation No. 15 of 2023 (Badan Pangan Nasional, 2023, 2024). In February 2025, National Food Agency Regulation No. 3 of 2025 amended Regulation No. 15 of 2023 to strengthen the calculation and management of regional rice reserves and to support reserve funding through regional budgets and village funds (Badan Pangan Nasional, 2025). This regulatory development reflects a shift toward strengthening local readiness. Nevertheless, the existence of regulation does not automatically mean that all local governments have adequate stock volume, storage infrastructure, budget allocation, food-quality control, procurement capacity, and rapid distribution mechanisms.

The main challenge in regional food reserve policy lies in implementation capacity. Local governments must be able to calculate food needs accurately, procure food from reliable sources, maintain stock quality, coordinate with Bulog and local food agencies, and distribute reserves rapidly to vulnerable communities during crisis. Weak budget allocation, limited warehouse capacity, poor stock rotation, inadequate data on food vulnerability, and delayed distribution mechanisms may cause regional food reserves to become administratively available but operationally ineffective. In this sense, regional food reserves should not be treated merely as warehouse stock, but as an integrated governance mechanism connecting planning, procurement, storage, monitoring, and emergency response. A region that has reserve policy but lacks operational readiness may still fail to respond effectively when drought, flood, crop failure, or distribution disruption occurs.

Previous studies have examined food security, climate change, and food reserves from different perspectives. Rusono (2019) emphasized the importance of strengthening government rice-stock management as part of national food security policy. Jamaludin (2022) argued that food security in Indonesia requires stronger institutional roles, including state-owned food enterprises and reserve management. Several studies on climate change and agriculture have shown that rainfall variability, drought, and extreme weather increase production risks and threaten farmer livelihoods (Anjani, 2024; Suarja et al., 2024). Research on rice production forecasting also shows that production planning requires reliable data and anticipatory policy because rice output is affected by seasonal patterns and climatic uncertainty (Putri & Suryana, 2024). These studies provide an important foundation for understanding food reserves as part of a

broader food security system, but they often focus separately on production, climate risk, or national stock management.

The research gap lies in the limited analysis of regional food reserve policy as a local preparedness instrument for responding to climate crisis and food production uncertainty. Existing discussions on food reserves often emphasize central government stocks, Bulog's role, or food price stabilization, while less attention is given to the readiness of provincial, district, and municipal governments in building and managing reserves before a crisis occurs. In fact, climate shocks, harvest failure, and distribution disruptions are often experienced first at the local level, where households may face food scarcity before national intervention arrives. This article offers a novel contribution by positioning regional food reserves as a form of anticipatory governance that links climate adaptation, local food-system resilience, and emergency response. Accordingly, this study aims to analyze regional food reserve policy in responding to the climate crisis and food production uncertainty, with particular attention to local preparedness, reserve calculation, procurement, storage, distribution, and institutional coordination.

2. Methodology

This study employs a **descriptive qualitative approach** with a **policy implementation analysis** design. This approach is used because the study examines regional food reserve policy not merely as a regulatory instrument, but as a preparedness mechanism for responding to climate crisis, harvest failure, and food distribution disruption. The qualitative approach enables the study to analyze how food reserve policy is translated into local governance practices, particularly in relation to reserve calculation, procurement, storage, stock rotation, distribution mechanisms, and institutional coordination. Rather than measuring the effectiveness of regional food reserves through statistical modeling, this study focuses on interpreting the readiness of local governments to manage food reserves as part of climate-adaptive food security governance.

The object of this study is the implementation of **Regional Government Food Reserve policy** in Indonesia within the framework of national food security governance. The policy is analyzed through the legal and institutional framework established by Law No. 18 of 2012 on Food, Government Regulation No. 17 of 2015 on Food Security and Nutrition, Presidential Regulation No. 125 of 2022 on Government Food Reserves, and National Food Agency Regulation No. 15 of 2023 as amended by National Food Agency Regulation No. 3 of 2025. These regulations provide the basis for examining how food reserve policy is structured across levels of government and how regional governments are expected to prepare reserves for emergency needs. The study places particular attention on the role of provincial, district, and municipal governments because climate shocks and distribution disruptions are often experienced locally before they become national-level food security problems.

Data used in this study consist of **primary and secondary data**. Primary data may be obtained through semi-structured interviews with relevant stakeholders, including officials from regional food security agencies, agricultural agencies, regional development planning agencies, disaster management agencies, Bulog representatives, village government officials, farmer groups, local traders, and food policy experts. These interviews are directed at understanding how regional food reserves are planned, funded, procured, stored, rotated, and distributed during food supply disruption. Secondary data are collected through document studies, including laws and regulations, National Food Agency policy documents, BPS agricultural statistics, BMKG climate information, regional development planning documents, food vulnerability maps, budget documents, official reports, and academic literature on food security, climate adaptation, disaster preparedness, and food reserve governance.

Data collection is conducted through **document analysis, semi-structured interviews, and limited field observation where possible**. Document analysis is used to examine the formal policy framework, reserve calculation mechanisms, food reserve commodities, budget allocation patterns, and institutional responsibilities. Semi-structured interviews are used to obtain empirical perspectives from actors involved in regional food reserve planning and implementation. Field observation may be conducted in selected regional food warehouses, local food agencies, disaster-prone areas, or food distribution points to understand how

reserve management operates in practice. This combination of techniques allows the study to compare the normative design of food reserve policy with its operational readiness at the local level.

The data are analyzed using **interactive qualitative analysis**, which consists of data reduction, data classification, thematic interpretation, and conclusion drawing. Data reduction is carried out by selecting information relevant to regional food reserve governance, climate-related food risks, harvest failure, distribution disruption, and institutional readiness. Data classification is conducted by grouping the findings into several analytical categories, including policy design, reserve calculation, procurement mechanism, storage capacity, stock quality control, emergency distribution, institutional coordination, and climate-risk responsiveness. Thematic interpretation is then conducted by linking these categories with the concepts of food security governance, climate adaptation, and local preparedness. The final stage draws conclusions regarding whether regional food reserve policy has functioned as an effective anticipatory governance instrument or remains limited to administrative compliance.

The analytical framework of this study is built around five main dimensions. The first dimension is **policy readiness**, which refers to the existence of local regulations, planning documents, budget allocation, and institutional mandates for regional food reserves. The second dimension is **operational capacity**, which includes procurement ability, warehouse availability, stock rotation, quality control, and distribution logistics. The third dimension is **climate-risk responsiveness**, which assesses whether regional reserves are linked to drought, flood, harvest failure, and food vulnerability data. The fourth dimension is **institutional coordination**, which examines cooperation among regional food agencies, agricultural agencies, disaster management agencies, Bulog, village governments, and local producers. The fifth dimension is **community protection**, which evaluates whether regional food reserves can reach vulnerable households, disaster-affected communities, and areas experiencing temporary food supply disruption.

To ensure analytical validity, this study applies source triangulation by comparing data from regulations, official reports, statistical data, climate information, academic literature, and stakeholder perspectives. Triangulation is important because food reserve policy involves several institutions and may produce different interpretations between national policy design and local implementation practice. The study also applies conceptual consistency by interpreting findings through the same analytical categories across all sources. Through this methodological framework, the research seeks to provide a comprehensive understanding of regional food reserve policy as a climate-adaptive food security instrument in Indonesia.

3. Results and Discussions

1) Regional Food Reserves as Climate-Adaptive Food Security Governance

The findings show that regional food reserves occupy a strategic position in Indonesia's food security governance because climate-related disruption increasingly affects both production and distribution. Food reserve policy is no longer sufficient if understood only as a conventional stockpiling mechanism. In the context of climate crisis, regional food reserves should be interpreted as an anticipatory governance instrument that enables local governments to respond to drought, flood, crop failure, delayed planting, and temporary supply disruption. This is particularly important because climate impacts are spatially uneven and often emerge first at the local level before they are visible in national food statistics.

The decline in rice production indicators in 2024 strengthens the argument that regional food reserves are needed as a preparedness mechanism. BPS reported that Indonesia's paddy harvested area in 2024 reached approximately 10.05 million hectares, while paddy production reached around 53.14 million tons of dry unhusked paddy, decreasing compared with the previous year (BPS, 2025). This decline was associated with seasonal shifts and delayed planting patterns following climate variability, especially after the 2023 El Niño event that caused prolonged drought in several regions. BMKG also projected that a weak La Niña condition from late 2024 to early 2025 could increase rainfall, which may support planting in several food-producing areas but also create flood and landslide risks in vulnerable regions (BMKG, 2024). These conditions show that food security policy must be prepared for both drought-related production decline and rainfall-related distribution disruption.

Regional food reserves are therefore important because they provide a localized response capacity when food supply is disrupted. In an archipelagic country such as Indonesia, food scarcity may occur locally

even when national supply is considered sufficient. A district may face temporary shortage when transportation routes are damaged, when market supply is delayed, or when disaster-affected communities lose immediate access to staple food. In such circumstances, regional food reserves can function as a first-response instrument before national stock intervention is mobilized. This makes regional food reserves part of climate-adaptive food security governance, particularly in disaster-prone and food-vulnerable regions.

The regulatory framework already recognizes the importance of food reserves through Law No. 18 of 2012 on Food, Government Regulation No. 17 of 2015 on Food Security and Nutrition, and Presidential Regulation No. 125 of 2022 on Government Food Reserves. Presidential Regulation No. 125 of 2022 expands food reserve policy beyond rice by including several strategic commodities such as corn, soybean, shallot, chili, poultry meat, egg, ruminant meat, sugar, cooking oil, and fish (Republik Indonesia, 2022). This broader commodity framework is important because climate crisis affects not only rice production, but also horticulture, livestock, fisheries, and food distribution systems. Nevertheless, the implementation of regional food reserves remains strongly rice-centered because rice continues to be the dominant staple food and the most politically sensitive food commodity in Indonesia.

The shift toward regional preparedness is also reflected in the regulation of Regional Government Rice Reserves through National Food Agency Regulation No. 15 of 2023 and its amendment under National Food Agency Regulation No. 3 of 2025. The amendment strengthens the calculation and funding basis for regional rice reserves, including support through regional budgets and village funds (Badan Pangan Nasional, 2025). This indicates that the central government recognizes the need to strengthen food reserve capacity below the national level. However, the existence of regulatory instruments does not automatically guarantee operational readiness. The effectiveness of regional reserves depends on whether local governments have the fiscal capacity, storage infrastructure, procurement mechanisms, stock management systems, and rapid distribution procedures required during crisis.

2) Implementation Gaps in Regional Food Reserve Readiness

The second finding indicates that the main challenge of regional food reserve policy lies in the gap between regulatory obligation and implementation capacity. Regional governments are legally expected to maintain food reserves, but their ability to do so varies depending on budget allocation, administrative capacity, local production availability, warehouse infrastructure, and institutional coordination. This creates uneven preparedness among provinces, districts, and municipalities. Some regions may have stronger food agencies and better access to local production, while others may depend heavily on interregional supply and lack sufficient storage facilities.

A central implementation issue is the calculation of reserve needs. Regional food reserves should be based on accurate assessment of population needs, disaster risk, poverty levels, food vulnerability, consumption patterns, and potential disruption scenarios. If reserve calculation is based only on administrative formulas without considering local climate risk and distribution vulnerability, the amount of stock may be insufficient during emergency. Conversely, excessive stock without proper rotation may create quality decline, storage losses, and budget inefficiency. Therefore, regional reserve calculation must be linked with climate data, food vulnerability maps, disaster-prone area data, and local food balance analysis.

Procurement also becomes a critical issue in regional food reserve implementation. Ideally, regional food reserves should be procured from local farmers or local food producers where possible, so that reserve policy also supports local food systems and farmer income. However, this requires reliable local production, quality standards, procurement timing, and budget flexibility. Regions that procure reserves too late may face higher prices or limited supply, especially during climate disruption or market instability. Regions that procure without quality control may experience stock deterioration before the reserve is distributed. This indicates that procurement governance is not merely a purchasing activity, but a strategic process that connects local production, price stability, farmer protection, and crisis preparedness.

Storage and stock rotation also determine whether regional food reserves are operationally useful. Food reserves that are stored without proper warehouse standards, pest control, humidity control, inventory monitoring, and stock rotation may lose quality before they are needed. Rice reserves, for instance, require careful management to prevent damage, weight loss, or declining consumption quality. Other commodities

such as eggs, poultry meat, fish, chili, and shallots require more complex storage systems because they are more perishable. Although Presidential Regulation No. 125 of 2022 recognizes multiple strategic food commodities, many regional governments may not yet have the cold-chain infrastructure and logistics capacity needed to manage non-rice reserves effectively (Republik Indonesia, 2022). This shows that broadening reserve commodities must be accompanied by infrastructure readiness.

Another implementation gap concerns the relationship between food reserves and disaster response. In many regions, food reserve policy is managed by food agencies, while emergency response is handled by disaster management agencies. If coordination is weak, reserve release may be delayed by administrative procedures even when communities need immediate assistance. During climate-related emergencies, speed is crucial because vulnerable households may face food access problems within days. A well-functioning regional food reserve system must therefore establish clear triggers for stock release, beneficiary identification, distribution channels, and coordination between food agencies, disaster management agencies, social affairs offices, village governments, and Bulog.

3) Institutional Coordination and Multi-Level Food Reserve Governance

The third finding shows that regional food reserve policy requires multi-level governance because food security risks cannot be handled by one institution alone. At the national level, the National Food Agency provides policy direction, calculation mechanisms, and reserve governance standards. Bulog plays an important role in public food stock management, especially for rice. At the regional level, provincial and district governments are responsible for planning, budgeting, procurement, storage, and distribution of Regional Government Food Reserves. At the village level, local governments and community institutions may become important actors in identifying vulnerable households and supporting distribution during emergency. Without coordination across these levels, food reserves may exist formally but fail to function as a rapid-response instrument.

The institutional challenge is particularly visible in the relationship between regional reserves and national reserves. Regional food reserves should complement national reserves, not duplicate or depend entirely on them. If regional governments rely too heavily on national stocks, local response may be delayed because distribution must wait for central intervention. If regional governments build reserves without coordination with national stock systems, there may be inefficiency, overlapping procurement, or unequal distribution among regions. The most effective model is a layered reserve system in which village, district, provincial, and national reserves operate through clear roles and escalation mechanisms.

Climate-risk responsiveness should also become a core principle in food reserve governance. Regional food reserves should not be managed only based on annual administrative planning, but should be updated according to climate forecasts, production estimates, disaster-risk information, and market conditions. BMKG's climate outlook for 2025, which projected generally normal to above-normal rainfall with weak La Niña influence in early 2025, illustrates the need for local governments to link food reserve planning with climate information (BMKG, 2024). This does not mean that higher rainfall always creates food security risk, because it may support crop growth in food-producing areas. However, it also means that flood-prone regions must prepare for distribution disruption, crop damage, and temporary access problems. Food reserves should therefore be integrated into local climate adaptation planning.

The same logic applies to production uncertainty. BPS data on declining paddy production in 2024 show that food availability is sensitive to changes in harvested area and seasonal planting patterns (BPS, 2025). Regional governments should use such data not only to describe production performance, but also to determine reserve adequacy and distribution priorities. Regions with declining production, high poverty levels, disaster exposure, and dependence on external supply should have stronger reserve preparedness. This requires local food agencies to move beyond administrative compliance and develop risk-based reserve planning.

Community protection is the final test of regional food reserve effectiveness. The purpose of food reserves is not only to maintain stock at the government level, but to ensure that vulnerable communities can access food during crisis. Regional food reserves should be directed to groups most affected by climate shocks and distribution disruption, including poor households, disaster-affected communities, small farmers

experiencing crop failure, remote communities, and areas facing temporary supply isolation. If reserve distribution is not targeted, delayed, or administratively complicated, the policy may fail to protect the population most in need. This means that food reserve governance must include clear beneficiary criteria, transparent distribution procedures, and accountability mechanisms.

Overall, the results indicate that regional food reserve policy has strong potential to strengthen Indonesia's food security governance in the face of climate crisis and production uncertainty. However, its effectiveness depends on the ability of local governments to transform regulation into operational preparedness. The policy will remain weak if it is limited to formal stock obligations without adequate budget, procurement planning, storage infrastructure, stock rotation, climate-risk integration, and emergency distribution mechanisms. The novelty of this analysis lies in positioning regional food reserves as an anticipatory governance instrument, not merely as a logistical stock policy. In the context of climate crisis, the strength of food security is determined not only by how much food is produced nationally, but also by how ready local governments are to protect communities when production, distribution, and access are disrupted.

4. Conclusion

This study concludes that regional food reserve policy plays a strategic role in strengthening Indonesia's food security governance in the face of climate crisis and food production uncertainty. Regional food reserves should not be understood merely as stored commodities or administrative stock obligations, but as an anticipatory governance instrument that enables local governments to respond to drought, flooding, harvest failure, temporary food scarcity, and distribution disruption. In the context of climate variability and uneven regional food risks, local preparedness becomes essential because food insecurity often appears first at the regional or community level before national intervention is mobilized.

The findings show that Indonesia already has a regulatory foundation for food reserve governance through national food laws, government regulations, presidential regulation, and technical regulations issued by the National Food Agency. However, the effectiveness of regional food reserves is not determined solely by the existence of regulation. It depends on the operational capacity of local governments to calculate reserve needs, allocate budgets, procure food, maintain storage quality, rotate stocks, coordinate institutions, and distribute reserves rapidly to vulnerable communities. This indicates that the main challenge of regional food reserve policy lies in the gap between formal policy design and local implementation readiness.

This study also finds that regional food reserve policy must be integrated with climate-risk information, food vulnerability data, disaster-risk mapping, and local food balance analysis. Regions facing drought, flooding, crop failure, poverty, remote access, or dependence on interregional supply require stronger preparedness mechanisms. Without risk-based planning, regional food reserves may become insufficient during crisis or inefficient during normal periods. Therefore, regional food reserve governance should be developed as part of climate adaptation and disaster preparedness, not merely as a routine food administration program.

The novelty of this study lies in positioning regional food reserves as a form of anticipatory and climate-adaptive food security governance. Previous studies have generally emphasized food production, national stock management, Bulog's role, or food price stabilization. This study contributes by highlighting the importance of regional government readiness in managing reserves before crisis occurs. The implication is that future food security policy should strengthen local reserve systems through adequate budgeting, warehouse infrastructure, stock rotation, local procurement, data integration, inter-agency coordination, and transparent emergency distribution mechanisms. Further research is recommended to examine regional case studies to assess the actual capacity of provincial, district, and municipal governments in managing food reserves during climate-related emergencies.

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