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Article

Enhancing Thailand's Drought Management: Strategies and Policy Implications

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Abstract

This study aims to analyze Thailand's drought management system and policies, identifying the challenges and solutions in managing drought in the country. As the most drought-prone nation in Southeast Asia and the world's second-largest rice exporter, Thailand faces significant economic risks from drought, which can contribute to global inflation. Therefore, it is crucial to examine Thailand's drought management system and its shortcomings. The analysis reveals that the Thai government's drought response policies are predominantly reactive, focusing on drought-affected areas and agriculture, and lacking a systematic approach to managing drought-related information. This reactive stance contributes to declining economic growth and deteriorating living standards in Thailand. This study recommends that the Thai government recognize the importance of proactive drought response and enhance its management measures to increase drought resilience.

Keywords

Thailand, Drought Management Policy and Strategy, Drought Impacts

Introduction

Drought has undeniably significant impacts on human societies and the environment (Babel et al., 2024; Wang et al., 2020; Zargar et al., 2011; Zhang et al., 2019). In Southeast Asia, drought

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ranks as the third most impactful natural hazard, following storms and floods. Over the past 30 years, droughts have affected more than 66 million people in the region. Among these, over 40 million people have been impacted by drought in Thailand alone. While Thailand experiences the second-highest frequency of droughts after Indonesia, it suffers the most extensive damage from them (see Figure 1).

In Southeast Asia, Thailand is among the countries most at risk from, vulnerable to, and affected by drought (Babel et al., 2024). According to the Global Food Security Index 2022, Thailand's estimated vulnerability to drought is 25, which is below the global average of 42.7. Drought is the fourth most common natural hazard in Thailand, accounting for 78 events (48.45%), following floods (39 events, 24.22%), storms (16 events, 9.94%), and other hazards (12 events, 7.45%). However, drought ranks the highest in terms of exposure (see Figure 2) (Economist Impact, 2022b; WB, 2023a).

Thailand has seen an increase in both the frequency and severity of droughts in recent years (WB & ADB, 2021). For instance, from 2006 to 2010, the middle of the rainy season experienced leaner rainfall, with more precipitation occurring in the later years. Between 2015 and 2016, recurrent and prolonged droughts caused water levels in reservoirs across the country to drop to dangerous levels (CFE-DM, 2022; UNDRR, 2020; Yi, 2020). Notably, the Ubolrat Dam in northeastern Thailand had to utilize its dead storage capacity, the last 1% of the reservoir's bottom (Fox, 2016). In 2020, Thailand experienced its worst drought in 40 years (VOA News, 2020), and the government predicts that the country will face widespread drought conditions starting in early 2024.The Thai government considers drought to be a major national issue. In 2020, Prime Minister Prayut Chan-o-cha established the National Water Resources Committee (NWRC) to address the water crisis and severe drought, primarily focusing on budgeting and managing efforts to mitigate drought impacts (Bernama, 2020). Additionally, Thailand developed the Thirteenth National Economic and Social Development Plan (2023-2027), which includes 13 development

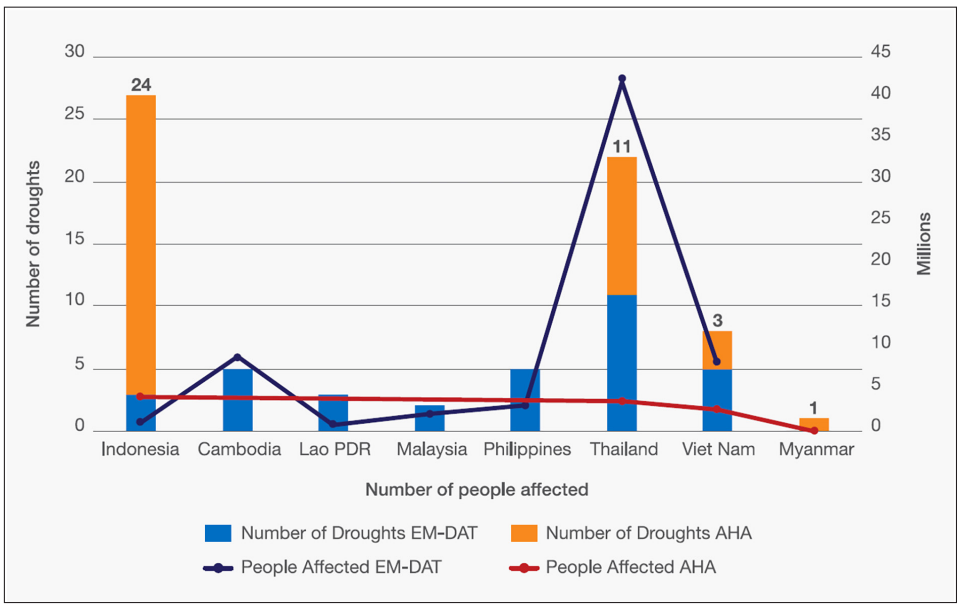

Figure 1. Number of droughts and people affected by country, 1988-2017
Source: UNESCAP (2020)

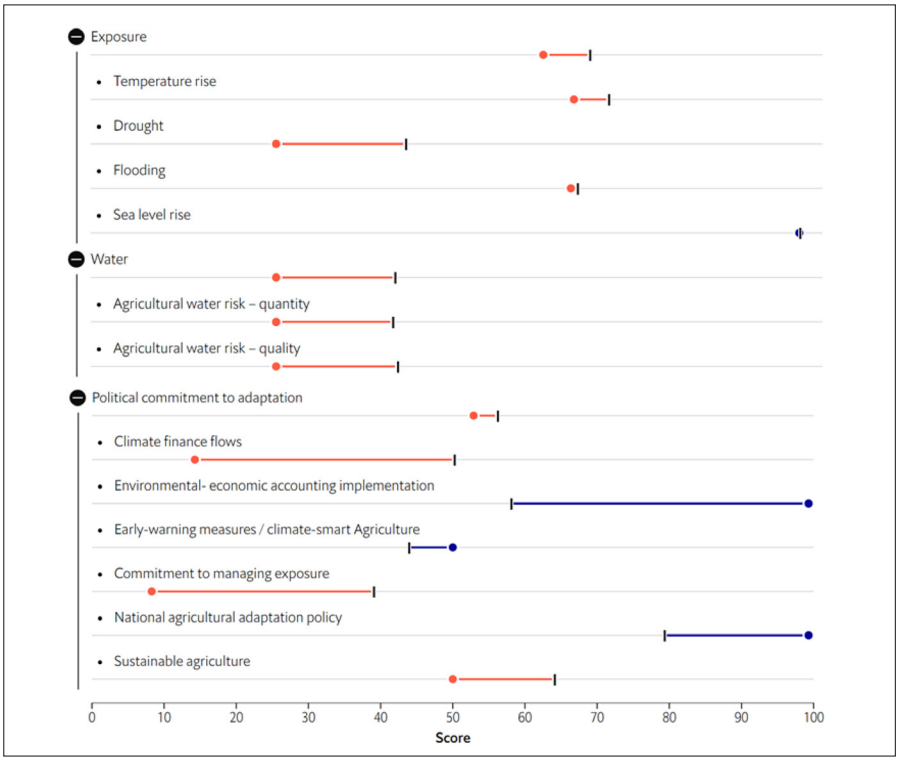

Figure 2. Sustainability and Adaptation Score of Thailand in the Global Food Security Index 2022
Source: Economist Impact (2022b)

milestones categorized into four main areas. Milestone 11 specifically aims to mitigate the risks and impacts of natural disasters and climate change by emphasizing the importance of water management and strengthening strategies in the agricultural sector to cope with climate change, droughts, and floods (Office of the National Economic and Social Development Council, Office of the Prime Minister, Bangkok, Thailand, 2023).

As the world's second-largest rice exporter, Thailand has a large population primarily engaged in agriculture. The country is also pursuing a strategic economic development policy, including the Eastern Economic Corridor (ECC), to expand manufacturing and escape the 'middle-income trap.' Additionally, while droughts and floods are highlighted as primary causes of rising poverty, frequent coups and political turmoil have hindered the consistency of drought response policies and the development of long-term plans. Conflicts between privileged vested interests and insurgent groups have further marginalized certain regions from effective disaster management, including drought response.

In this context, analyzing Thailand's drought management system and policies, given its high risk, vulnerability, and severe impacts from drought among Southeast Asian countries, is crucial. Such an analysis not only aids in addressing national issues for the Thai government but also has significant implications for the sustainable development of other Southeast Asian countries facing or likely to face similar challenges.

Sustainability is defined as the pursuit of balanced and harmonious growth of the environment, economy, and society, recognizing their interconnectedness (Qtaishat et al., 2023). According

to this definition, the drought in Thailand poses a significant threat to both the survival of Thai people and global sustainability. As the world's second-largest rice exporter, Thailand has a majority of its population engaged in agriculture. Drought negatively impacts crop production, leading to food shortages and higher international food prices, while reducing the incomes of agricultural workers. This disrupts the stability of low-income populations both domestically and internationally and undermines Thailand's environmental, economic, and social balance. Effective drought management in Thailand is crucial for enhancing sustainability, as it is closely linked to the stability of these interconnected systems.

Evidence from various studies indicates that drought policies can generate economic benefits and improve efficiency. For instance, in the Philippines, implementing a drip irrigation system during the 2015-2016 drought increased rice production by 29% and reduced water usage by 50%, while also providing environmental benefits such as reduced nutrient loss, soil erosion, and greenhouse gas emissions. This approach also improved the technical skills of agricultural workers and offered educational opportunities for women (Cuevas et al., 2024). Additionally, Kenya's drought response policies, including early warning systems and community-led measures, have effectively safeguarded food security and minimized the impacts of droughts and floods, promoting sustainable resource management and strengthening community resilience (Cabot Venton, 2018). In Australia, drought management strategies that shifted from infrastructure investment to enhancing farmers' adaptive capacities through the low-cost policies of the National Water Initiative (NWI) were found to be more effective than high-cost infrastructure projects and direct subsidies (Crase et al., 2020). These case studies highlight the economic, environmental, and social benefits of effective drought policies.

In this context, this study investigates Thailand's drought management system and policies by addressing two primary research questions: 1) What are the current drought management policies and their limitations in Thailand?; and 2) What improvements are needed in the current drought management policies in Thailand? By exploring these questions, the study aims to provide a thorough evaluation of the effectiveness of existing policies and to offer actionable recommendations for enhancing drought management practices in Thailand.

Drought Severity and Impacts in Thailand

Reduced Crop Yields and Production

According to the World Bank (WB), which has compiled data on Thailand's cereal production over the past 20 years, the cyclical droughts and floods occurring every two to three years have caused significant economic damage to rice, maize, and other cash crops. Polthanee et al. (2014) found that reduced rainfall in the northeastern provinces of Nakhon Ratchasima and Kalasin led to a decrease in agricultural yields by approximately 55-68%.

This trend has become more pronounced in recent years. In 2019 and 2020, off-season rice plantings in Thailand totaled 6.8 million rai (1.08 million hectares), 42% lower than the previous year. This decrease was primarily due to water supply restrictions in irrigated areas caused by record-low rainfall during the 2019-20 rainy seasons. Rainfall in 2019 was only 1,343 mm, about 16% below the annual average over the past 30 years (CFE-DM, 2022; Prasertsri & Nicely, 2020). Maize production in 2019-20 also dropped by about 20-25% compared to 2018-19 due to the drought (Prasertsri & Nicely, 2020).

Economic Growth and GDP Decline

Thailand is a major food exporter in Southeast Asia, ranking second in the world for rice exports, first for cassava exports, and third for sugar exports. Agriculture contributes approximately 8.8% to Thailand's GDP. Despite accounting for less than 10% of all industries, agriculture is a significant sector of the economy, employing 11.81 million people, or about one-third of the population. Since climate is a critical factor in agricultural productivity, droughts significantly impact the livelihoods of the Thai people. According to the Asia Disaster Reduction Centre (ADRC), droughts affected 17 million households in Thailand between 2011 and 2020, resulting in an economic loss of around 500 million baht (see Figure 3).

In particular, the volatility of drought disasters significantly impacts the income security of local farmers (UNISDR, 2015). The Bank of Thailand (2018) identified drought as a major factor contributing to the increase in local farmer debt (Ikeda & Palakhamarn, 2020). Farmers' spending power is crucial for sustaining economic growth. However, as drought-induced crop failures increase farmers' debt, their spending decreases. Given that about one-third of the Thai population is employed in agriculture, drought damage quickly spreads throughout the economy, causing a recession. For instance, the severe drought of 2019-20 led to a reduction in agricultural economic growth by around 5% in the first quarter of 2020 (Prasertsri & Nicely, 2020). UNESCAP (2020) found that the probability of agricultural drought, the absolute and relative number of people affected by drought, and the frequency of drought contribute to GDP reduction in ASEAN countries. This is illustrated by Thailand's particularly low total GDP in 2015 and 2020, the two years of extreme drought in the last decade.

Threats to Food Security

Declining agricultural production and increasing water scarcity severely undermine Thailand's food security. According to the 2022 World Food Security Index, Thailand's food security environment is ranked as "Moderate" out of five levels. However, it is significantly lower than that of neighboring countries such as Malaysia, Indonesia, and Vietnam, and ranks at the

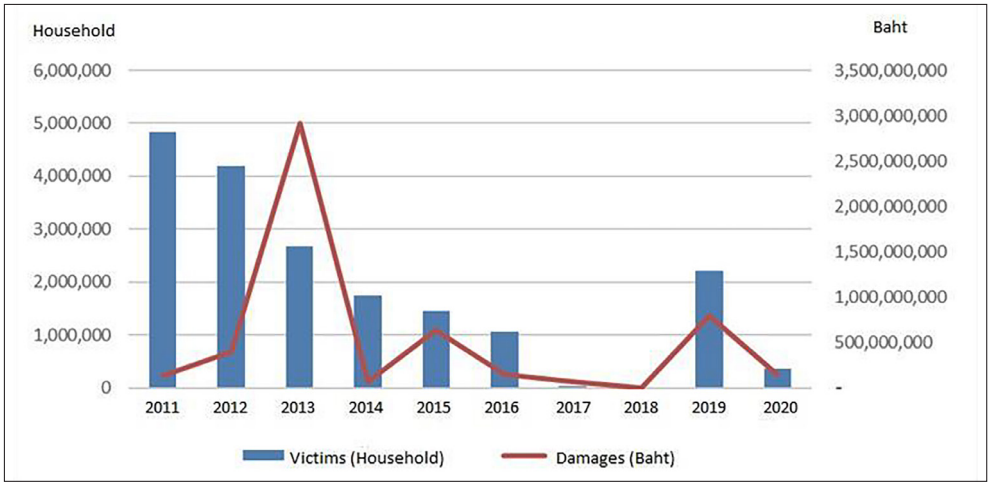

Figure 3. Number of Drought-Affected Households and Economic Impact in Thailand during 2011-2020
Source: ADRC (2022)

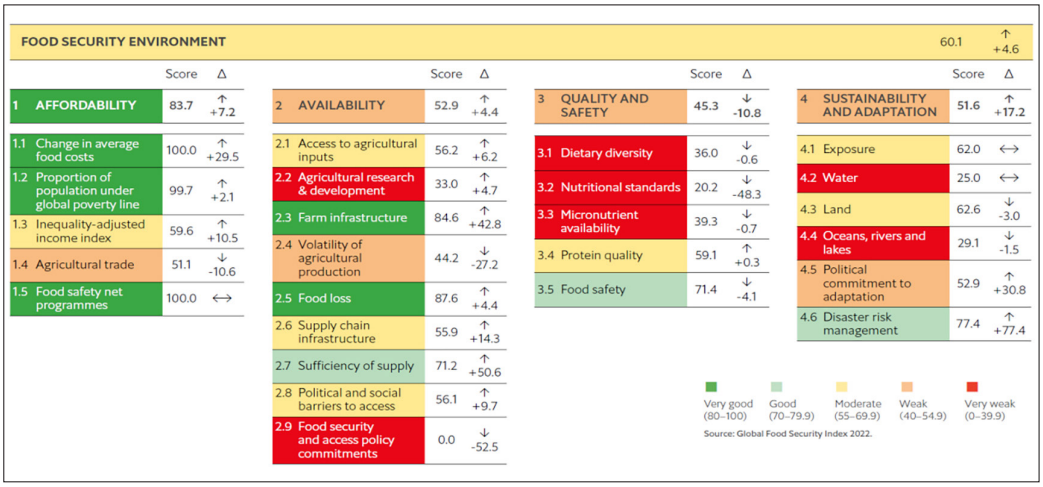

Figure 4. Thailand's Food Security Environment
Source: Economist Impact (2022b)

bottom of the Moderate group alongside the Philippines. Thailand's food security is weak in all dimensions (availability, quality and safety, sustainability and adaptability) except affordability (Economist Impact, 2022a) (see Figure 4). Given that the food security score is below the global average, maintaining stable agricultural productivity through effective drought management is a priority for the country.

Worsening Inequality and Poverty

Water scarcity due to drought exacerbates inequality and poverty among water users (Jaewisorn, 2020). Local populations, who often lack power, are usually the first to face water crises directly. These communities have the weakest voice and are unable to influence policy decisions. In northeastern Thailand, local people, farmers, and CSOs experiencing water scarcity point out that it is often a political issue used to justify inequitable water distribution and access. While local communities and farmers are at the greatest risk of water scarcity, they lack the political power to negotiate with more influential actors who share Thailand's water resources. Additionally, Thai government agencies often exhibit a paternalistic attitude towards local communities and distrust local authorities and residents (Manorom, 2020; Tanwattana & Andriesse, 2023).

UNESCAP (2020) argues that drought has a more significant impact on the poor. Evidence shows that rural households in Thailand face increased income risks due to drought (Sricharoen, 2019). Economically vulnerable groups, especially those with less stable income, are more severely affected by drought.

Inequalities in income and wealth can lead to disparities in access to healthcare, education, technology, and protection from natural and environmental hazards. For instance, countries in Southeast Asia with high disaster risk indices tend to have high income inequality (Gini coefficient) or high opportunity inequality. Drought further exacerbates social inequality in these countries. This is supported by regression analysis showing that as the drought index in ASEAN countries increases, per capita health expenditure decreases (UNESCAP, 2020).

Intensification of Conflict

Drought significantly alters resource availability and, when combined with poverty, inequality, insecure land tenure, and power imbalances, it increases the risk of conflict (Homer-Dixon, 1994). In the ASEAN region, there is a strong correlation (88%) between conflict risk and natural disasters. Thailand exhibits the highest correlation, followed by Indonesia, the Philippines, and Myanmar. Additionally, recurrent droughts in Thailand and Vietnam have a significant negative impact on local people's migration decisions (Poontirakul et al., 2022). This reduction in labor mobility undermines economic dynamism, posing a serious problem for Thailand, which relies heavily on the constant movement of an active labor force.

Frequent coups, as seen in Thailand, further destabilize the country, and natural disasters such as drought exacerbate this instability. Effective crisis management policies for drought require a stable political environment, which is challenging to maintain amid such frequent political upheavals.

Thailand's Drought Management Framework and Policies

Developing appropriate and integrated drought management strategies is crucial for mitigating the impacts of drought (Wendt et al., 2021). Water scarcity, while often natural and absolute, is also a socially generated phenomenon (Bakker, 2000). Stakeholders can exploit the complexities of drought to pursue political goals and influence water management during such periods (Kohl & Knox, 2016). For instance, during the 2015 drought in Thailand, local governments prioritized water supply to the urban middle class over the needs of the urban and rural poor. Marks (2019), who studied the 2015-16 extreme drought in Khon Kaen, a province in northeastern Thailand, argues that Thai government policies exacerbate community vulnerability to drought. Specifically, the vulnerability of slum neighborhoods to drought disasters is heavily influenced by political and economic factors. Various political and economic variables, including government policies, diminish the urban poor's capacity to cope with drought. Therefore, effective policy governance, including political accountability in drought management, is essential for an adequate drought response (Wilhite et al., 2014). From this perspective, this study analyzes the main components of an effective disaster management system, including the primary ministries and agencies responsible for drought management, relevant laws and institutions, and comprehensive drought response plans and strategies.

1. Drought Management Ministries and Agencies

Since the 2000s, the Thai government has been earnestly working to overhaul laws and institutions and develop detailed plans and strategies to effectively respond to drought at the national level. Before the 2000s, Thailand's water management system faced numerous challenges, including the involvement of over 30 different ministries and agencies, the absence of a leading public agency, lack of policy coherence, inefficient and repetitive investments, and weak enforcement capacity.

Following the 2011 floods, the Thai government initiated reforms in the water management sector, leading to the amendment of the Water Resources Act in 2018 and the establishment of the Office of National Water Resources (ONWR). The revised law mandates the participation of water use organizations, basin committees, and the National Water Resources Council in water management policy.

The ONWR is responsible for coordinating the efforts of various ministries and organizations involved in drought and flood management. It compiles and analyzes drought and flood-related statistics, formulates short- and long-term implementation plans, and develops ecosystem-based adaptation methods and community-led responses. Additionally, the ONWR prioritizes education and training for agricultural water use during droughts and promotes benefit-sharing through drought response policies and projects (WB, 2023b).

Three ministries in Thailand collect statistics on natural disasters, including drought: the Ministry of Agriculture and Cooperatives, the Ministry of Natural Resources and Environment, and the Ministry of Interior. Since drought disaster management is directly and indirectly linked to water resources management, these ministries are also involved in drought preparedness, prevention, response, and recovery. The structure of the drought-related water management system is illustrated in <Figure 5>.

Of the three ministries, the Department of Disaster Prevention and Mitigation (DDPM) of the Ministry of Home Affairs leads disaster management. Established in 2022, the DDPM analyzes relevant information and supports key policy bodies. It oversees the Disaster Prevention and Mitigation Academy, which is responsible for disaster management training and capacity building for its officials and those from other departments.

The Department of Water Resources (DWR) under the Ministry of Natural Resources and Environment is tasked with developing the knowledge base and skills necessary for water resources management and compiling relevant data. It promotes drought-related research and conducts disaster preparedness studies in drought-prone areas to mitigate the impact of drought-related disasters. The DWR has established and operates an Early Warning System (EWS) for drought and flood preparedness (MRC, 2019).

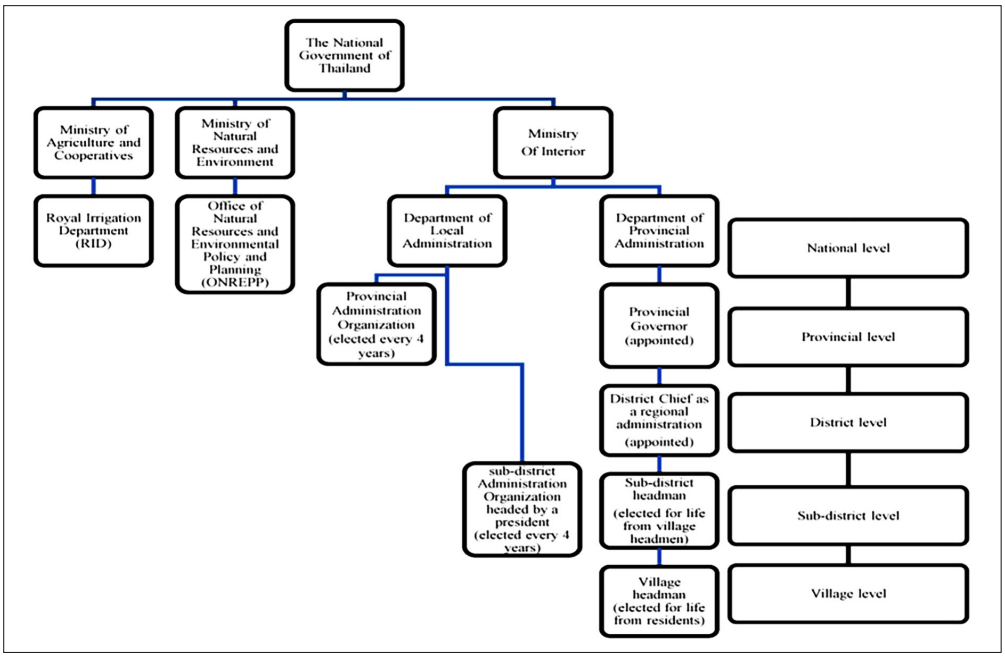

Figure 5. Multi-Level Governance Structure of Central Ministries Involved in Water Management
Source: Singto et al. (2018)

Additionally, the Thai Meteorological Department and the National Statistics Office under the Ministry of Digital Economy and Society contribute to building disaster statistics. Local governments compile basic data, including socio-ecological information, local disaster information, and population information.

2. Drought Legislation, Planning and Strategy

Drought-Related Legislation

Thailand's disaster management system is anchored in the Disaster Prevention and Mitigation Act of 2007. According to this Act, drought is classified as a natural disaster, making the state responsible for its management. The National Disaster Management Plan is also based on this legislation.

All disaster management activities in Thailand fall under the jurisdiction of the commanders and/or directors at the three administrative levels: national, provincial, and local. The Disaster Prevention and Mitigation Act designates the National Disaster Prevention and Mitigation Committee (NDPMC) as the primary policymaking body for disaster management, chaired by the Prime Minister or Deputy Prime Minister, with the Director General of the DDPM acting as the Secretary. The NDPMC comprises 34 members and several sub-committees. In the event of a major disaster (Level 3), the Minister of Interior acts as the National Incident Commander. For an extreme disaster (Level 4), the Prime Minister or Deputy Prime Minister assumes command. <Table 1> outlines the stages of disaster management in Thailand and the responsible commanding authorities.

The Water Resources Act, as amended in 2018, specifically addresses drought and flooding in Chapter 5. According to this law, the Prime Minister may implement measures to alleviate drought conditions, such as restricting water use or enforcing water-sharing methods, by declaring an area to be in severe drought if it significantly affects economic conditions or the livelihoods of citizens. Additionally, each district's Drainage Basin Committee is required to develop a plan for drought prevention and resolution in advance. This includes establishing budgets with key organizations, preparing information on drought prevention and resolution, creating publicity materials for the public, outlining water use restrictions in the district, preparing additional water supplies for drought-affected areas, and coordinating with organizations to assist drought-affected residents (OCS of Thailand, 2018).

An important legal instrument to review alongside Thailand's national legislation is the Bangkok Declaration on Disaster Risk Reduction in Asia and the Pacific 2014. The Bangkok Declaration calls for improving resilience at the local level, increasing public investment in disaster and climate risk management to protect development efforts, and promoting public-private partnerships for disaster risk reduction. It also emphasizes the need for improved

Table 1. Disaster Management Levels in Thailand

Level	Disaster Scale	Key Incident Commander
1	Small	Local administration or district chief officers
2	Medium	Provincial Governor or Governor of Bangkok
3	Large	Minister of Interior
4	Catastrophic	Prime Minister/Deputy Prime Minister

Source: Ikeda & Palakhamarn (2020)

governance, transparency, and accountability among all stakeholders in disaster risk management, and the inclusion of disaster risk reduction as part of sustainable development. Thailand has incorporated the principles and content of the Declaration into its domestic policies. This alignment reflects the value placed on human life and the philosophy of His Majesty the King to minimize the impact of disasters on communities (NDPMC, 2015).

Drought Response Plans and Strategies

Thailand's primary disaster plans include the National Disaster Prevention and Mitigation Plan 2010-2014 (NDPMP) and the National Disaster Risk Management Plan 2015 (NDRMP). Along with the Disaster Prevention and Reduction Act, these plans form the foundation of disaster management in Thailand, including drought response. All relevant ministries and public agencies in Thailand are required to develop disaster risk management plans aligned with the NDRMP. For instance, the Department of Disaster Prevention and Mitigation, the National Safety Council, and the National Disaster Warning Centre have their own disaster and emergency management plans, which are integrated into the national plan.

The NDPMP, as amended in 2015, mandates that all relevant ministries and public agencies use the plan as an operational guide for jointly implementing disaster risk management activities. The plan provides guidelines for pre-disaster, during-disaster, and post-disaster management activities for both the Thai government and non-governmental organizations. It outlines four main strategies for disaster risk management: a) focusing on disaster risk reduction; b) applying an integrated emergency management system; c) improving and strengthening sustainable disaster recovery and efficiency; d) promoting international cooperation in disaster risk management. To implement these objectives and strategies, the Government of Thailand allocates and disburses budget according to the type, scale, and local circumstances of disasters, including drought.

Seven years after its development, the Government of Thailand is in the process of revising the plan in 2023. The revision includes three new strategies for disaster risk reduction: a) improving disaster risk knowledge at all administrative levels, including central and local levels; b) establishing standards for disaster risk reduction measures; c) building cooperation and partnerships in the field of disaster risk reduction.

In response to the country's worst drought in 2015, the Thai government developed two drought management plans. One of these is the Integrated Plan for Drought Management for 2015. In February 2015, the National Council for Peace and Order held a joint meeting with several ministries to approve the plan, and the Ministry of Interior obtained cabinet approval. Ministries and public institutions conducted surveys to assess the extent of drought damage and developed action plans to minimize impacts. These plans included the use of irrigated agricultural systems, artificial rainfall, water pumping operations, water supply vehicles, pipes, and water allocation. The main strategies of the plan are detailed in <Table 2>.

Another crucial plan in Thailand's drought management policy and planning is the Climate Change Master Plan 2015-2050, established in 2015. The Thai government developed this plan in recognition of the increasing frequency of extreme hydrological and meteorological events (such as droughts and floods) due to recent climate change, compounded by anthropogenic factors like socio-economic development, urbanization, and population growth. These factors pose significant threats and tensions to Thai society, necessitating a comprehensive response. According to the plan, the Government of Thailand aims to establish and implement a national action plan for climate change adaptation and resilience, prioritizing areas such as drought management, water resources and flood management, agriculture, tourism, and public health. The plan recommends designating several ministries—including the Ministry of Agriculture and Cooperatives, the

Table 2. Key Strategies in the Integrated Plan for Drought Management for 2015

No.	Strategies	Details
1	Preventing and Mitigating Drought Impacts	‣ Development of a Drought-Related Information System: Predict and prepare for drought-vulnerable areas and develop a rapid warning system. ‣ Implementing Organizations: Thai Meteorological Department, Geo-Informatics and Space Technology Development Agency (GISTDA), Hydro and Agro Informatics Institute. ‣ Selection of Implementing Agencies for Warning Systems and Communication: Public Relations Department, DDPM, National Disaster Warning Centre, Relevant local government agencies.
2	Drought Response	‣ Prioritize providing basic water supplies to drought-affected areas. ‣ Clearly define the duties of the Royal Thai Police (RTP) and the Ministry of Public Health (MOPH): RTP will oversee security in drought-affected areas, while MOPH will monitor the public health status of the affected populations.
3	Emergency Management	‣ Establish local and central operations centers and conduct emergency management campaigns.
4	Post-Drought Management	‣ Provide financial support, job placement, and livelihood assistance for people in drought-affected areas.

Source: Royal Thai Government (2015)

Ministry of Natural Resources and Environment, the Ministry of the Interior, the Ministry of Science and Technology, the Ministry of Digital Economy and Society, the Ministry of Industry, the Ministry of Energy, the Ministry of Foreign Affairs, and the Ministry of National Defence—as the executing bodies to formulate and implement relevant plans.

The plan also calls for the enhancement of accurate and reliable weather forecasting technology, climate modeling, prediction of extreme weather events (e.g., extreme droughts, floods, typhoons), and early warning systems to improve drought management. It emphasizes the importance of recognizing and incorporating climate change factors in all aspects of water management, including water quantity, water quality, ecosystem protection, and water-related disasters (droughts and floods). This includes the development of drought risk maps at the national, regional, basin, provincial, and community levels, as well as agricultural risk mapping to promote preparedness for crop and animal diseases, floods, droughts, landslides, saltwater intrusion, or other extreme weather events (MONRE, 2015).

Additionally, the Drought Management Strategy for the Lower Mekong River Basin 2020-2025, published by the Mekong River Commission (MRC), is an essential reference for Thailand's drought management policy. This strategy outlines drought response strategies and plans for the lower Mekong countries of Thailand, Vietnam, Lao PDR, and Cambodia. Its purpose is to address the interests and needs of these countries in managing and mitigating drought. The strategy is organized into five sectors: indicator monitoring, drought forecasting and early warning, capacity building for drought assessment and planning, drought mitigation measures, and drought information sharing and dissemination (MRC, 2019).

Challenges and Solutions in Thailand's Drought Management Policy

Based on an analysis of Thailand's drought management system and policies, several issues have been identified in the formulation and implementation of natural disaster management policies, including those for drought.

First, there is administrative fragmentation. Information and data related to natural disasters, including drought, are collected and managed independently by various ministries and agencies. This results in a lack of standardization and an inability to systematically collect and analyze risk information.

Second, drought and other natural disasters are often undervalued. The government's assessment of damages caused by drought and other natural disasters shows a significant disparity compared to the results from domestic research institutes and financial institutions. Government assessments frequently underestimate damages compared to private sector assessments, raising questions about their reliability. For example, according to Chinvanno et al. (2019), most assessments conducted in Thailand prioritize evaluating damage and needs to manage the allocation of financial aid from various sources. In contrast, assessments focused on actual damage and loss are typically performed by international organizations, including the World Bank, during major disaster events.

Third, there is a lack of comprehensive information on the economic damage related to multiple hazards. Assessments of the economic impact of disasters such as drought are often limited to the specific disaster in question. Consequently, these assessments do not link the various types of disasters that occur in Thailand. This limitation hinders a comprehensive assessment and analysis of disaster consequences and does not effectively support efforts to reduce the damage of related disasters in the future (Ikeda & Palakhamarn, 2020).

Improving Thailand's Drought Management Policies: A Multi-Perspective Approach

This study aims to suggest improvements to Thailand's drought management policies from four perspectives. First, policy improvement at the national level is necessary. The Thai government should recognize that drought is a critical issue encompassing many fields, including climate change, water management, and agricultural policy. National policies should be formulated and implemented to prepare for and prevent drought in the short, medium, and long term. Despite the increasing frequency and severity of droughts in Thailand, they receive less attention from politicians, the administration, and the media after they occur, making them less of a policy priority. In the context of increasing droughts due to climate change, the Thai government should recognize drought as a persistent issue, like water scarcity, and continue to pursue relevant policies, plans, strategies, and projects (Franzetti et al., 2017). Given the frequency of droughts and their high human and economic costs, a more robust framework is needed that prioritizes risk mitigation planning, water infrastructure investment, and land and water use management (Kongsawad, 2023).

A concrete model for a drought management framework can be referenced from the World Bank (WB, 2022) report, which presents a framework for urban drought risk management, particularly for developing countries in Southern Africa facing challenges such as rapid urbanization, climate change, and inefficient water infrastructure. The key features of the World Bank's framework include: 1) an emphasis on preemptive actions before the occurrence of drought; 2) the segmentation of government roles into national, regional, city, and departmental levels with clear duties and policy directions, ensuring cohesive and integrated policy implementation; and 3) the pursuit of interdisciplinary and interagency activities. This framework consists of three main stages: 1) establishing monitoring and early warning systems; 2) assessing drought impacts and vulnerabilities; and 3) implementing preventive measures and responding to drought occurrences. This study integrates the components of the World Bank's framework with the elements proposed by Kongsawad (2023), which include drought impact mitigation, infrastructure investment, and a decision-making system for policy prioritization. The integrated

framework is applied to Thailand's drought management policies, as shown in Figure 6.

The framework prioritizes decision-making and implementation actors, including the national government, regional governments, and city municipalities, by clearly delineating their duties and scope of authority through legal and institutional means. It also categorizes considerations for effective drought response into environmental and socio-economic factors. Additionally, it divides risk mitigation activities into preventive and responsive measures, emphasizing comprehensive actions before and after drought occurrences. The framework incorporates considerations for infrastructure investments to prevent inefficient decision-making. This framework is expected to aid in addressing the fragmented and superficial perception and response system of the Thai government towards drought management.

Thailand's drought risk management policy should be formulated from both bottom-up and top-down perspectives. For example, implementing the Community-Based Water Resource and Disaster Risk Management program is useful in reducing the risk of drought and strengthening response capacity. Additionally, communities should take possible measures for drought risk management through a top-down approach, such as building drought risk maps, installing public ponds, and expanding free communal water taps (BP, 2023; Tanwattana & Andriesse, 2023; Thanapakpawin et al., 2011). Drought risk and poverty issues are interlinked, and drought response policies should be integrated with poverty alleviation policies (Poontirakul et al., 2022). Policymakers in Thailand need to consider climate justice, addressing the unequal burden of climate change, especially given the higher vulnerability of the poor to drought (Marks, 2019).

Third, Thailand and its neighboring ASEAN countries should complement their national policies with measures to strengthen drought-related resilience, minimizing drought damage and ensuring robust economic growth and sustainability. Specifically, it is necessary to establish survival measures for farmers living in vulnerable areas, develop irrigation schemes that enable

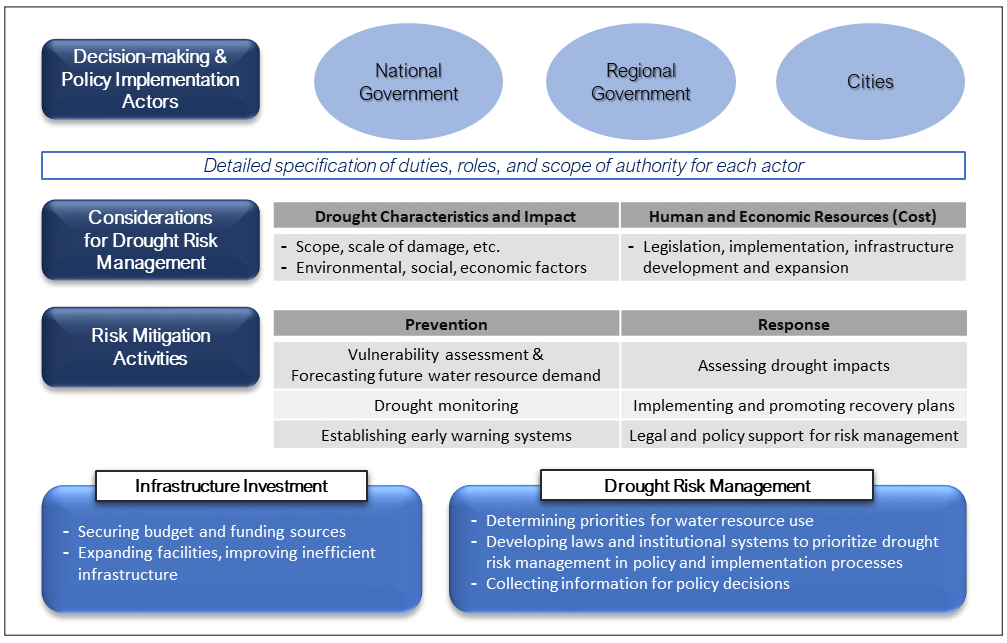

Figure 6. Framework for Improving Thailand's Drought Risk Management Policy
Source: Modified by the authors based on the World Bank (WB, 2022)

Table 3. Building resilience to drought for the SDGs

	Goal		Target
SDGs that will be achieved through, inter alia, building resilience to drought	1	1.5	- By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
	2	2.4	- By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
	8	8.2	- Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors
	10	10.1	- By 2030, progressively achieve and sustain income growth of the bottom 40% of the population at a rate higher than the national average
	11	11.5	- By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
	16	16.1	- Significantly reduce all forms of violence and related death rates everywhere
SDGs and Regional road map thematic priority areas that will contribute to building resilience to drought	6	6.5	- By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
	9	9A	- Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States
	13	13.1	- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
		13.3	- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
	15	15.3	- By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation neutral world
	17	17.6	- Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism
	Regional Road Map	a	- Management of Natural Resource
		b	- Climate Change
		c	- Disaster Risk Reduction and Resilience

Source: Modified by the authors based on UNESCAP (2020)

sustained food production during droughts, and implement policies for rapid drought recovery. Drought resilience is crucial for achieving the Sustainable Development Goals (SDGs), and related policies and projects not only address drought but also have implications for other SDGs (UNESCAP, 2020). <Table 3> shows that strengthening drought resilience positively impacts achieving other SDGs.

Second, cooperation between central and local governments, as well as public-private

partnerships for drought management, should be strengthened. Enhanced collaboration between the central government (specifically the Royal Irrigation Department of the Ministry of Agriculture and Cooperatives) and local authorities will benefit local communities and farmers. Ensuring that local voices are heard in drought response planning guarantees fair access to water and supports livelihoods during the dry season, ultimately achieving inclusive development.

Disaster governance in urban areas in Thailand has been weakened by incomplete decentralization and persistent ministerial and sectoral fragmentation (Marks & Lebel, 2016). However, to advance disaster management, including drought, the central and local governments, in collaboration with the private sector, should prioritize disaster risk management partnerships as a key strategy. They should formulate and promote relevant policies and projects based on appropriate legal and institutional frameworks. Furthermore, to establish clear policies on public-private partnerships, public agencies at all administrative levels should consider assessing the demand for disaster risk management partnerships, identifying areas where the private sector can contribute, and coordinating with them.

It is also advisable to conduct comprehensive social impact assessments for the benefit of Thai society and local communities. This process should be part of a multi-year campaign and program aimed at achieving long-term sustainable development. Comprehensive social impact assessments, based on public-private partnerships, should involve communities and stakeholders affected by natural disasters in the disaster risk management process. Implementing such assessments can help reduce future negative impacts and avoid conflict by identifying effective solutions.

Third, establish effective governance among drought management institutions. This requires, first and foremost, clarifying the roles of different stakeholders within the local natural disaster management system. Thailand's local disaster management system necessitates that local governments, such as city governments, clarify the roles of the public and private sectors and collaborate effectively within the disaster management framework. Clarifying these roles enhances effective disaster management and improves coordination. For example, this involves providing accurate information to the private sector, establishing a formal basis for cooperation, and improving the legal framework to facilitate local public-private partnerships.

Next, partnerships should be built on a cooperative platform. Establishing a collaborative platform is effective when it brings together various stakeholders in the disaster management system. These platforms can take many forms depending on local culture, such as weekly meetings, social networking groups, or video conferencing. Such approaches can enhance public-private partnerships at all levels. Collaboration platforms allow different stakeholders from the public sector, private sector, and civil society to share information and create multiple opportunities for future partnerships. They also serve to improve and strengthen working relationships among stakeholders within these networks.

Finally, establish transparent and accountable communication within the local disaster management system. Engaging a large number of diverse stakeholders to discuss and reach consensus on complex local disaster issues requires a system of accurate information and communication. It is also essential that local disaster management plans are updated and revised annually. Local governments and the private sector should develop clear and efficient plans for communicating public-private partnership activities, providing communication channels for ordinary citizens to participate and contribute to their communities. Examples include local disaster evacuation drills, safety campaigns, and public workshops (Ikeda & Palakhamarn, 2020).

Fourth, promoting a Drought Risk Financing Market is crucial for strengthening drought resilience. Drought-prone developing countries often focus on post-drought compensation. Thailand, in particular, follows a policy of distributing subsidies after damage or losses have occurred. For instance, the NDRMP emphasizes establishing adequate contingency funds to

handle potential disaster situations. In 2020, the Thai government spent approximately 300 million baht to support sugarcane farmers affected by the drought. However, to minimize the impact of drought, this approach needs to shift towards providing drought risk financing and support in advance to protect lives and property, especially among the most vulnerable. This is practical in areas like Thailand, where droughts are mainly seasonal and can be predicted well in advance (Poontirakul et al., 2022; Thepgumpanat, 2020).

Disaster risk financing services register potential beneficiaries and provide cash to be used when needed, rather than offering services such as food aid. The African Risk Capacity organization has found that early warning services, combined with contingency planning and pre-risk financing, reduce drought damage by four to five times.

In Vietnam, the introduction of rural insurance to minimize drought damage and ensure efficient use of aid is a promising attempt, although it has produced mixed results. Additionally, Weather Index Insurance has been used effectively, but these programs are most productive when implemented alongside other initiatives within an integrated disaster risk framework.

Another approach is forecast-based financing, which provides a set amount of funding for preparedness and resilience-building activities based on drought forecasts. Compared to traditional index insurance, forecast-based financing can be challenging due to the complexity of pricing the underlying risk. However, even limited pre-disaster emergency finance can significantly enhance resilience. Prediction-based finance can improve accuracy through the use of space information at a regional scale based on remote sensing datasets (UNESCAP, 2020).

Conclusions

This study analyzes the drought management system and policies of Thailand to discuss the problems and solutions associated with drought management. The Thai government's policies to address the growing drought phenomenon fall into two main categories. First, the Water Resources Act, revised in 2018, aims to control water use in drought-affected areas and secure water sources in advance. Second, the Integrated Drought Management Plan, established in 2015, focuses on investing in the irrigation sector to minimize drought damage and on post-drought management to support the livelihoods of people in drought-affected areas.

However, the Thai government does not systematically manage drought information and undervalues the importance of drought damage. The government's reactive drought response policy, which focuses on drought-affected and agricultural regions, negatively impacts the survival of people and hinders Thailand's economic growth. Additionally, the amount of post-drought assistance has fallen short of the expectations of the affected population.

So far, the Thai government's drought response policies have not contributed to achieving the SDGs, such as poverty eradication, improving food security, and reducing inequality. Therefore, this study recommends that the Thai government recognize the importance of proactive drought response and enhance its management measures to increase drought resilience. Specifically, the study suggests improving policies at the national level, strengthening coordination and public-private partnerships between central and local governments, building governance among drought management agencies, and promoting disaster risk financial markets to enhance drought resilience. Given global food security concerns, strengthening Thailand's drought management system is urgent.

This study primarily utilized secondary data due to its significant benefits, such as cost-effectiveness and efficiency compared to conducting original surveys (Babbie, 2021). However, qualitative analysis methods were employed, which naturally carry limitations due to the

potential for the researcher's subjective perspective to influence the findings. To compensate for these limitations and ensure objectivity, data from multiple sources, including official documents published by the Thai government and information from international organizations such as the UN, WB, and MRC, were utilized. In future studies, it is necessary to collect primary data through interviews or surveys with local officials and stakeholders in Thailand to deepen the research.

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Conflict of Interests

The author(s) declare that there is no conflict of interest.

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