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Capacity building for drought adaptation

Thailand case study

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Explanatory Notes

Analyses in the Capacity building for drought adaptation, Thailand case study are based on data and information available up to 30 December 2021. The designations employed and the presentation of materials on the maps do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Mention of firm names and commercial products does not imply the endorsement of the United Nations.

Abbreviations and Acronyms

2P2R	Prevention, Preparation, Response, and Recovery
AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ACDM	ASEAN Committee on Disaster Management
ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
AHA Centre	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management
AMS	ASEAN Member States
APTERR	ASEAN Plus Three Emergency Rice Reserve
ARPA-AD	ASEAN Regional Plan of Action for Adaptation to Drought
ASEAN	Association of Southeast Asian Nations
ASMC	ASEAN Specialised Meteorological Centre
AWS	Automatic Weather System
BAAC	Bank for Agriculture and Agricultural Cooperatives
CIP	Competitive Industrial Performance
CRI	Global Climate Risk Index
CSD	National Committee for Sustainable Development
DDPM	Department of Disaster Prevention and Mitigation
DEQP	Department of Environmental Quality Promotion
DGR	Department of Groundwater Resources
DLA	Department of Local Administration
DOAA	Department of ASEAN Affairs
DOAE	Department of Agricultural Extension
DOP	Department of Older Persons
DRR	Disaster Risk Reduction
DRRAA	Department of Royal Rainmaking and Agricultural Aviation
DSDW	Department of Social Development and Welfare
DWR	Department of Water Resources
EGAT	Electricity Generation Authority of Thailand
EOC	Provincial Emergency Operation Center
ESCAP	Economic and Social Commission for Asia and the Pacific
GDP	Gross Domestic Product
GISTDA	Geo-Informatics and Space Technology Development Agency
GNI	Gross National Income
HDI	Human Development Index
HII	Hydro-Informatics Institute
IFRC	The International Federation of Red Cross and Red Crescent Societies
LDD	Land Development Department
LGUs	Local Governments Unites
MADRiD	Mainstreaming Climate Change Adaptation and Disaster Risk Reduction in Development Planning
MDES	Ministry of Digital Economy and Society
MHESI	Ministry of Higher Education, Science, Research and Innovation
MNRE	Ministry of Natural Resources and Environment
MoAC	Ministry of Agriculture and Cooperatives

MoE	Ministry of Energy
MoF	Ministry of Finance
MoI	Ministry of Interior
MSDHS	Ministry of Social Development and Human Security
MSMEs	Micro, Small and Medium Enterprises
NAP	National Adaptation Plan
NDRMP	National Disaster Risk Management Plan
NDPMC	National Disaster Prevention and Mitigation Committee
NDWC	National Disaster Warning Centre
NESDC	Office of the National Economic and Social Development Council
NSO	National Statistical Office
OIC	Office of Insurance Commission
ONEP	Office of Natural Resources and Environmental Policy and Planning
ONWR	Office of the National Water Resources
RBF	Riverbank Filtration
RID	Royal Irrigation Department
SADDD	Sex, Age and Disability Disaggregated Data
SCOSA	Sub-Committee on Space Technology and Applications
SDGs	Sustainable Development Goals
SEA RCC	Southeast Asia Regional Climate Centre Network
SFM	Sendai Framework Monitor
STI	Science, Technology and Innovations
TDRI	Thailand Development Research Institute
TGIA	Thai General Insurance Association
TICA	Thailand International Cooperation Agency
TMD	Thai Meteorological Department
TWG-PGI	Technical Working Group on Protection, Gender and Inclusion
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
VHI	Vegetation Health Index
WEF	Water-Energy-Food nexus

Summary Report

Thailand is facing a double burden of disasters namely the stress of climate change and extreme weather events, as well as the impact of successive droughts compounded by the unprecedented socio-economic impact of the COVID-19 pandemic exacerbating the vulnerabilities of specific groups in the population, such as low-income, smallholder farmers and households dependent on agriculture livelihoods, food insecurity, workers in the informal economy and micro, small and medium enterprise (MSMEs).

The impact of drought is not limited to water consumption for agricultural purposes but also affects domestic and industrial water consumption, with critical long-term implications on the people and the environment of the nation in the social, economic, and environmental aspects such as poverty, agriculture, food security, human development outcomes, and ecosystem services.

This document was developed following a concept note of Implementation of the ASEAN Declaration on the Strengthening of Adaptation to Drought project, which proposed by Economic and Social Commission for Asia and the Pacific (ESCAP) and ASEAN that was endorsed by ACDM on 3 May 2021. This project aims to contribute to the implementation of the recommendations of the ESCAP and ASEAN joint study entitled "*Ready for the Dry Years: Building Resilience to Drought in South-East Asia*". ESCAP support the development of the ARPA-AD 2021-2025 to translate the drought declaration provide to the production of training materials to building resilience to drought in Southeast Asia and Thailand as pilot national case studies was selected due to their high risks to drought.

The actions that reflect the drought management cycle are composed of (1) risk, impact and vulnerability assessment, (2) early warning system, preparedness and planning, (3) adaptation actions, and (4) response and recovery; while partnership and coordination actions are (5) strengthening coordination between ASEAN sectoral bodies, (6) partnership and collaboration with non-ASEAN partners, (7) capacity building and enhancement, (8) data sharing and dissemination, and (9) monitoring and evaluation.

The nine (9) actions are complemented by thirteen (13) sub-actions. There are twenty-three (23) national agencies involved in the implementation. One of the key recommendations is for the establishment of National Working Group on Adaptation to Drought.

Chapter 1: Introduction

1.1 Background

1.1.1 Introduction to Thailand

Thailand is located in Southeast Asia with land area about 514,000 sq.km. associated with maritime economic zones cover approximately 72,200 sq.km. (Andaman Sea) and about 140,000 sq.km. (Gulf of Thailand), totaling 212,200 sq.km. (**Figure 1-1**). The Gross Domestic Product (GDP) in Thailand was worth $501.79 billion in 2020[1], Economic growth in Thailand contracted by 6.10% in 2020[2] due to the globally impact of COVID-19 pandemic then predisposition in external demand affecting trade and tourism, supply chain disruptions, and weakening domestic consumption. The GDP value of Thailand represents 0.44% of the world economy. Industry services, ICT and agriculture being major economic sectors in Thailand.

The total population in Thailand was estimated at 66.7 million people in 2020[3], according to the latest census figures and projections from Trading Economics. Thailand's per capita Gross National Income (GNI) is $7,040 and is classified as an upper middle-income country. The Competitive Industrial Performance (CIP) index of Thailand is 0.142 placing the country 24 out of 152 countries[4].

Thailand's Human Development Index (HDI) value for 2020 is 0.777[5], which put the country in the high human development category— positioning it at 79 out of 189 countries and territories. According to the Global Climate Risk Index (CRI) 2020, Thailand is ranked 9th out of the 10 countries that have been most severely affected by extreme weather events between 2000 and 2019[6]. Especially considering the vulnerability of its geography and economy to climate change, Thailand is at risk of being severely affected by climate variability impacts such as the coastal erosion, Thailand has long coastlines of 1,875 km. and 740 km. along the Gulf of Thailand and the Andaman Sea, respectively and fragile agricultural system and susceptibility to extreme weather events.

The average rainfall is 1,420 mm. and the annual mean temperature is 28 ^{o}C, ranging from a night minimum of 20 ^{o}C in the cool season to a maximum day temperature of 38 ^{o}C in the hot season. With the high humidity the weather can be oppressive, but the widespread use of air-conditioners alleviates the heat and humidity[7]

[1] World Bank, http://data.worldbank.org/ accessed Dec, 2021

[2] World Bank, http://data.worldbank.org/ accessed Dec, 2021

[3] World Bank, http://data.worldbank.org/ accessed Dec, 2021

[4] UNIDO, 2020, Industrial Development Report 2020

[5] UNDP, http://hdr.undp.org accessed Dec, 2021

[6] Global Climate Risk Index 2021

[7] UNESCAPE, https://www.unescap.org/ accessed Dec, 2021

Figure 1-1 Map showing Thailand and neighboring countries, namely Cambodia, Lao PDR, Malaysia and Myanmar

Source: https://www.un.org/Depts/Cartographic/map/profile/thailand.pdf

1.1.2 Introduction to ASEAN Regional Plan of Action for Adaptation to Drought (ARPA-AD, 2021-2025)

Over the past two (2) decades, various impacts of drought have increased in many countries in South-East Asia including Thailand. Prolonged and severe drought adversely impact agro-food system, Water-Energy-Food nexus (WEF) and livelihood of rural households and poor communities. The impact of drought is not limited to water consumption for agricultural purposes but also affects domestic and industrial water consumption, with critical long-term implications on the people and the environment of the region in the social, economic, and environmental aspects such as poverty, agriculture, food security, human development outcomes and ecosystem services.

Association of Southeast Asian Nations (ASEAN) is facing a double burden of disasters, namely 1) the stress of climate change and extreme weather events, as well as the impact of successive droughts compounded by 2) the unprecedented socio-

economic impact of the COVID-19 pandemic exacerbating the vulnerabilities of specific groups in the population, such as low-income, smallholder farmers and households dependent on agriculture livelihoods, food insecurity, workers in the informal economy and micro, small and medium enterprises (MSMEs).

ASEAN's population is projected to increase from 660 million in 2020 to about 700 million people in 10 years' time with a corresponding increase in water consumption for agricultural, industrial and domestic purposes.

Cognisant of drought impact, the ASEAN leaders, through the ASEAN Declaration on the Strengthening of Adaptation to Drought, supported the strengthening of collaboration between the ASEAN Committee on Disaster Management (ACDM), relevant sectoral bodies and stakeholders, to:

(i) develop an ASEAN Regional Plan of Action for Adaptation to Drought;
(ii) establish networks and a community of practices for adaptive learning and continuous improvement of drought risk management in different parts of the region, building on the traditional knowledge and local solutions of communities; and
(iii) mainstream drought risks and disasters into the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) Work Programme and other relevant guidelines.

The ASEAN Regional Plan of Action for Adaptation to Drought (ARPA-AD) 2021-2025 aims to enhance coordination at the regional and national level for achieving sustainable management of drought by considering the impact of drought on the livelihood of people, natural resources and ecosystem, agriculture, energy, and sustainable socio-economic development. The ARPA-AD was developed following two (2) consultative workshops with active participation by all relevant ASEAN sectoral bodies, ASEAN Centres, and ASEAN Member States.

Noted that one of the most remarkable commitments was made at the Informal ASEAN Ministerial Meeting on Disaster Management on 22 May 2016 (**Figure 1-2**) in Istanbul, Turkey. The ASEAN Declaration on the Strengthening of Adaptation to Drought adopted on 13 November 2020 is a clear signal that South-East Asia is essentially in need and ready to move forward in developing an effective regional action plan on drought adaptation and mitigation. This action is urgent in order to cope with meteorological, hydrological, land use and water management, and agricultural and socioeconomic drought vulnerabilities.

Figure 1-2 Timeline and key milestones

Source: UNESCAP (2021).

The ARPA-AD also was developed in line with the guiding principles of AADMER Work Programme 2021-2025, which foresees the development of outputs or strategic tangible products through institutionalization; localisation and communication; finance and resource mobilisation; gender and social inclusion; multi-hazards approach; innovation; partnership; and synergy. The future success of ARPA-AD implementation will be complemented by the ongoing work of relevant ASEAN sectoral bodies that address drought adaptation and mitigation.

The ARPA-AD consists of nine (9) actions covering a full set of drought management cycle, partnership, and coordination on the regional and national levels. The drought management cycle is coherent with the three (3) parallel tracks of drought intervention (**Figure 1-3**) identified in the joint ASEAN-ESCAP study *Ready for the Dry Years*:

(i) Reduce/Prevent,
(ii) Prepare/Respond, and
(iii) Restore/recover.

Figure 1-3 Three (3) parallel tracks for drought intervention

Source: Modified from UNESCAP (2020).

There are four (4) actions that directly reflect the drought management cycle are composed of action 1) risk, impact and vulnerability assessment, action 2) early warning system, preparedness and planning, action 3) adaptation actions, and action 4) response and recovery; while partnership and coordination mission are consisted of five (5) more actions, namely action 5) strengthening coordination between ASEAN sectoral bodies, action 6) partnership and collaboration with non-ASEAN partners, action 7) capacity-building/enhancement, action 8) data sharing and dissemination, and action 9) monitoring and evaluation.

The actions of ARPA-AD are complemented by twenty-sixth (26) sub-actions and an implementation plan covering 2021-2025. Relevant regional sectoral bodies will support and contribute to the implementation and the establishment of a *Technical Working Group on Adaptation to Drought* is the key recommendation.

1.2 Rationale of the report

This report was prepared after a concept note of Implementation of the ASEAN Declaration on the Strengthening of Adaptation to Drought project, which proposed by Economic and Social Commission for Asia and the Pacific (ESCAP) and ASEAN that was endorsed by ACDM on 3 May 2021. This project aims to contribute to the implementation of the recommendations of the ESCAP and ASEAN joint study entitled "*Ready for the Dry Years: Building Resilience to Drought in South-East Asia*". ESCAP support the development of the ARPA-AD 2021-2025 to translate the drought declaration provide to the production of training materials to building resilience to drought in Southeast Asia and Thailand as pilot national case studies was selected due to their high risks to drought.

The requirement from a concept note that aforementioned above indicated in activity 2 was to develop a national case study and organize national workshop for capacity building in order to exchange knowledge and expertise from national decision makers, experts, officer in charge and researchers on drought adaptation. Thus, national case studies report in context of Thailand was developed to response activity 2 of project concept note. National report was prepared follows the reviewed template from ESCAPE and ASEAN secretariat and at the last portion of this chapter, briefly outline of each chapters in the report was explained. After the report was finalized, then one (1) day national workshop (virtual meeting) was conducted on February 10, 2022 to build capacity for drought adaptation at national level. Workshop was organized in close collaboration with ACDM, focal –point (DDPM), Thailand. Representatives from departments, ESCAP and ASEAN secretariat were participated (**Annex 1**).

1.2.1 Objectives of the country case study

Country case study aims to provide knowledge on drought adaptation at national level associated with details of actions, sub-actions, challenges, opportunities, policy actions and related topics corresponding with ARPA-AD and useful information from national workshop.

1.2.2 Overview of report chapters

National case study was developed in line with the guiding principles of the ASEAN Regional Plan of Action for Adaptation to Drought (ARPA-AD) 2021-2025, the second (2nd) edition of *the Ready for the Dry Years* and Concept note on Implementation of the ASEAN Declaration on the Strengthening of Adaptation to Drought project.

There are five (5) chapters in this national case study report. CHAPTER 1 explained about background of the country case study (Thailand) in terms of geographic locality, socioeconomic information, drought risk and its impact in year of 2015 and 2020 were introduced. Map of Thailand is presented. Moreover, the ARPA-AD was presented with their timeline. Objectives of the country case study also briefly explained. CHAPTER 2 provides information on Thailand drought situation, drought in related to climate risk. Past and current drought hazard assessment at country level was reviewed. Impacts caused by drought on the economy and society was arranged with water national laws, related acts, regulations, programmes and disaster risk governance. Institutional issues, drought risk management, policy and practices gaps was explained. CHAPTER 3 describes how to implement the nine (9) actions of ARPA 2021-2025 at national level. Selected major challenges that have hampered progress in the development and implementation of adaptive measures to drought were listed. Appraise future climate risks and potential impacts to guide future policies on adaptation to drought was described. CHAPTER 4 purpose a tentative yearly timeline to implement ARPA-AD at national level in table form. Provide recommendation on action plan (What, When, Who) for implementation of the ARPA-AD at the national level, identify national priorities in line with each action/sub-action defined in the ARPA-AD, aim to enhance national capacity and strengthen regional cooperation and collaboration among ASEAN Member States (AMS) on drought risk management and adaptation. Recommend a national network in drought risk management, building on existing networks and working groups, in line with and linking it with the regional network in drought risk management developed as part of ARPA-AD while country case study report conclusion was recapitulated in CHAPTER 5.

Chapter 2: Drought Situation and Drought Risk Management in Thailand

2.1 Drought situation

Three (3) types of drought may affect Thailand, namely 1) meteorological drought usually associated with a precipitation deficit, 2) Agricultural drought normally refers to conditions that result in adverse plant responses, which can range from reduced crop and forage yields to total crop or forage failure and 3) hydrological drought which basically considered as shortage in surface and subsurface water flow, potentially originating in the region's wider river basins. Local soil and land management practices can also interact with the hydrological conditions to result in agricultural drought.

All droughts originate from a deficiency of precipitation or meteorological drought but other types of drought and impacts cascade from this deficiency such as agricultural drought occur majoring from soil water deficiency, while hydrological drought discover during the reduction of stream flow, inflow to reservoirs, lake, and ponds, which impacts to socioeconomic and environment such reduced wetlands and aquatic habitat (**Figure 2-1**).

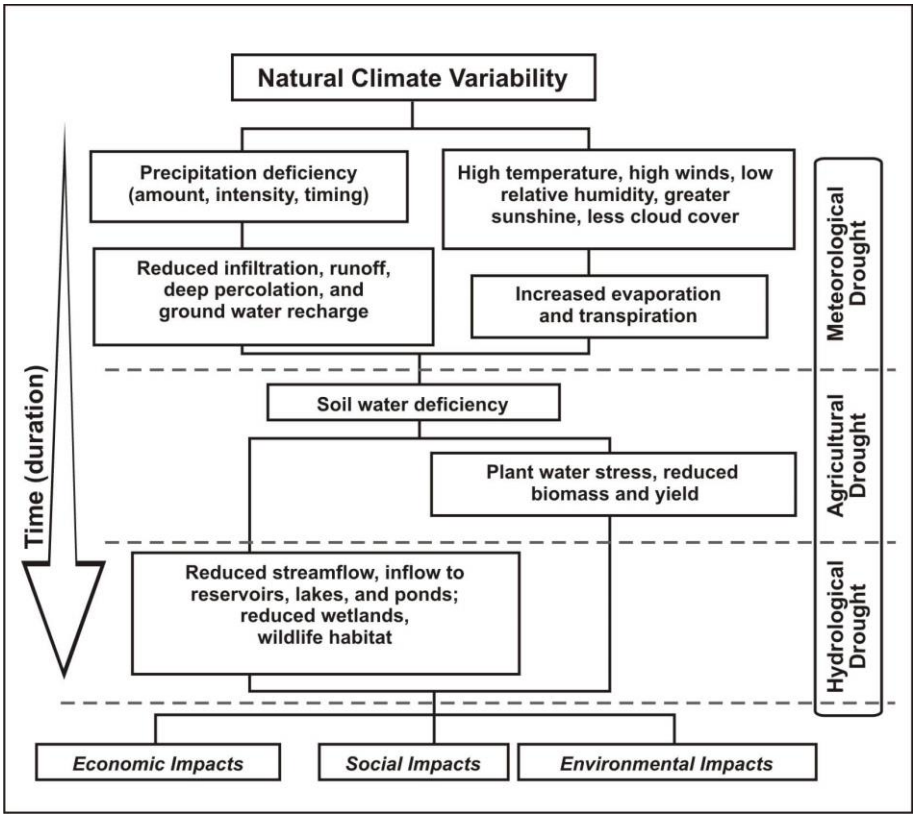

Figure 2-1 Complexity of drought situation with starting point from global climate change and variability. All droughts originate from a precipitation deficiency. Other drought types and impacts cascade from this deficiency

Source: National Drought Mitigation Center, University of Nebraska-Lincoln, U.S.A. (2021).

Drought is a perturbation, not a stress (Conway, 1986). This phenomena is an irregular, infrequent, relatively large and unpredictable disaster, thus, people adaptation to drought better than reaction to drought or response. Drought found many places even in the forest, however, drought at upland area sometime coexist with soil erosion problem and crops that be able to grow are cassava, sugarcane and water melon while rainfed lowland rice is the most common crop ecosystem in Northeast Thailand (Monkham, et.al. 2018). Drought is a state of such consistent decrease of the water quantity, water-flow quantity or water level as to be likely to cause effects on the living of human-beings, animals and plants in any particular area (Water resources act, 2018). But, we can improve the better situation of drought by working together, following the actions guideline of ARPA-AD 2021-2025.

Droughts risk also increase impact of pollution, pests and diseases, heat waves, water contamination, loss and damage of ecosystem services and lately lower quality of life. UNESCAP (2021) reported that droughts force people to migrate, there is often an increase in child malnutrition, stunting, and even adult malnutrition. For example drought result to heat waves increasing in Thailand excess death by 1.90%. Thailand, will remain at risk with almost 14.00% of the population being exposed to drought under the worst-case climate change scenario. UNISDR (2014) suggested that vulnerability assessment is a process which monitors and assesses an area to prepare mitigations and prevent future drought problems caused by land degradation and desertification.

Drought hazard causing significant disruptions to the economy in the Thailand. Extremely low precipitation and sharp drops in water levels in groundwater aquifers of water catchment areas have caused severe shortages affecting agro-food system, consumption and ecosystem services. However, the Department of Groundwater Resources (DGR) has implemented the large-scale groundwater development project by using Riverbank Filtration (RBF) technique to supply water in drought prone areas nationwide. The pilot areas include Chainat province, Ratchaburi province, and Suphanburi province. The project aims to develop a large groundwater supply system and promote conjunctive use of surface water and groundwater[8].

Thailand is one of the most drought affected countries in the Asia Pacific region (Pandey et al, 2007). Thailand drought of 2004-2005 resulted in a damage of about $220 million (Wichitarapongsakun et al., 2016) while drought of 2015-2017 caused an estimated damage of $3.30 billion (EM-DAT, 2019), which was recorded as drought years in Thailand (Khadka, et al, 2021). For example in Thailand, the evidence of persistent drought event during 2015-2016, which accounted to be the worst drought in 20 years in Thailand resulted in considerable losses exceeding $2.50 million (**Table 2-1**), affecting severely on the rice production (UNDRR, 2020). Similar to a study of Pak-Uthai and Faysse (2018) described that in 2015, a major drought hit many regions of Thailand particularly at the Chao Phraya River basin, the largest river basin in Thailand. In 2015 more areas in Thailand experienced severe drought, notably the northern parts of the country (UNDRR, 2020; UNESCAP and ASEAN, 2021).

Drought of 2019 was estimated to cause losses of $312,000 (**Table 2-1**) due to lost crops from rice, maize, sugar cane and cassava. The drought is also expected to affect

[8] DGR, http://www.dgr.go.th/en/newsAll/302/4285 accessed Dec, 2021

off-season field crops, fruit trees, and freshwater fish farming production but to a much lesser degree than for rice. At the macro-levels, the implications of such events yet again instigate the decline of purchasing power among farmer households and cause an increase in debt burdens as well as contribute to challenges experienced at macro-scales (UNDRR, 2020).

Table 2-1 Drought events and selected impacts, 2015-2016, and 2019-2020 in Thailand

2015-2016	2019-2020
14 provinces, 55 districts, 290 sub-districts, 2,666 villages were affected from drought risk. Over 50% of Mekong watershed area in north-eastern of Thailand at critical drought status. Economy: Losses of $1.70 billion across 14 provinces with insufficient water for agriculture and exceeding up to $2.50 million, on the rice production. Drought during 2015-2016 was considered as worst drought case in 20 years in Thailand.	By April 2020, 25 provinces declared drought disaster areas, covering 146 districts, 6,846 villages. Thai Meteorological Department (TMD) declared the worst drought in 40 years. Thai government declared a drought emergency. Economy: Losses of $312,000 due to lost crops from rice, corn, sugar cane and cassava. Seawater intrusion reported, water shortages and disruption to agriculture and industry. Secondary hazards: exacerbated forest fires in Chiang Mai during March-April 2020 associated with 5,810 hotspots were recorded across the country, 6 people have been killed whilst fighting the fires. Air pollution: fires increased level of PM2.5 particulates, which reached 1,000 mg/m3 (WHO threshold is 25 mg/m3), and the air quality index reached 296, which was the highest recording globally.

Source: Modified after UNESCAP and ASEAN (2021).

Thailand in March 2020, the Vegetation Health Index (VHI) is a measure of the severity of drought (UNESCAP and ASEAN, 2021) based on the vegetative health as estimated by satellite images. The VHI combines a vegetative condition index and a temperature condition index. Poor vegetation condition and high temperatures are associated with more severe drought, which shows in **Figure 2-2** as indicated by lower values of the VHI.

In addition, HII (2021) reported that in January 2021, almost 50 % of entire Thailand facing with drought risk especially in the North, North-Eastern and Sothern regions

while in February 2021, it is necessary to monitor salinity intrusion. Salinity intrusion occurred in the estuary and river because of low level of freshwater caused from drought situation and cascading with sea level rise particularly found at beginning in March and likely decrease until the end of the month. Thus, it is necessary to monitor the salinity intrusion together with drought condition in the Northern and Central part of Thailand due to low precipitation.

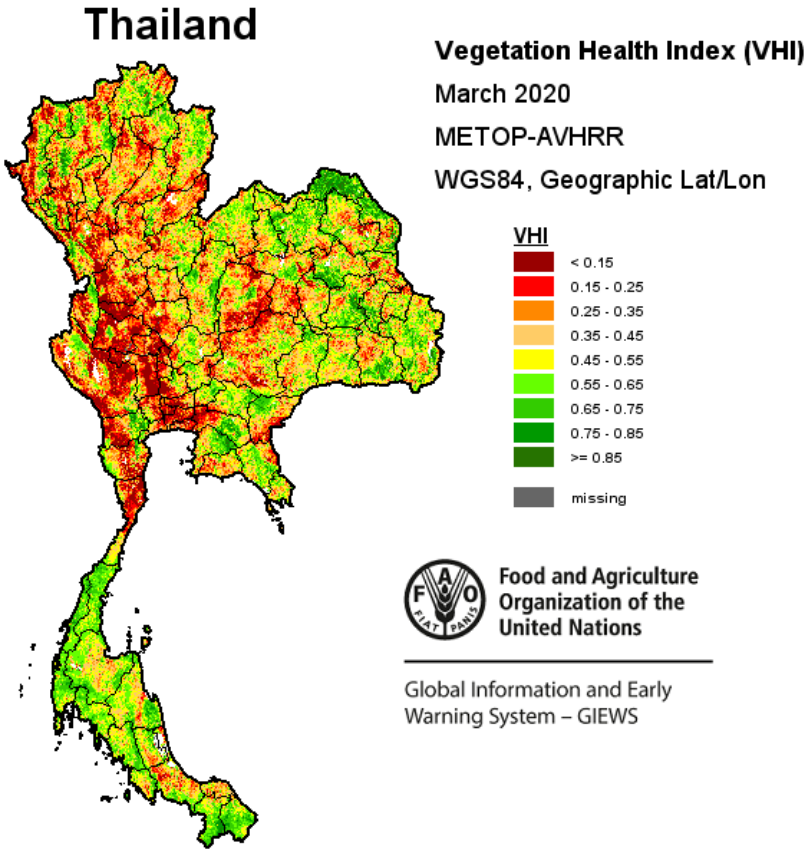

Figure 2-2 Map showing VHI spatial distribution drought pattern in Thailand, March 2020

Source: Maps were generated by the UN FAO online analysis tool, available at http://www.fao.org/giews/earthobservation/country

2.2 National laws, regulations and programmes

In Thailand, a number of national laws and regulations, programmes and disaster risk governance have been carried out to improve the understanding of drought disaster and climate risks in the country, led by various government agencies, technical institutions and academia. For example, the Department of Disaster Prevention and Mitigation (DDPM), in collaboration with government and technical agencies, has developed risk information databases programmes for drought hazards at all levels--from provinces down to villages (DDPM, 2014). Some national laws and regulations,

programmes and disaster risk governance of Thailand in various sectors and relatinship to international agreements such as Sendai Framework for Disaster Risk Reduction (DRR), Sustainable Development Goals (SDGs) and the Paris Climate Agreement or Environment shows in **Annex 2**.

The Disaster Prevention and Mitigation Act 2007 (DPM Act) served as the principal legal mechanism for disaster risk management practices in Thailand, coupled with an application of other disaster risk management related laws regulations notifica- tions directives. It stipulates the DDPM as the core government department in handling national disaster management work. Also it authorizes local governments to take responsibility of disaster management in their respective areas, in line with the Provincial Plan (Thanyalakmetha, 2020).

Drought risk maps was developed by DDPM with technical support by the Geo-Informatics and Space Technology Development Agency (GISTDA) using GIS and remote sensing technique. Drought maps which cover sub-district levels was developed in 2017 by Land Development Department (LDD), recurrent drought maps for the entire country (2017) and drought maps by region, developed by LDD, under Ministry of Agriculture and Cooperatives (LDD, 2017). Drought risk assessments are conducted by different levels of administration under the lead of the DDPM which provides guidelines for provincial and local authorities for developing drought risk profiles to national strategies and plans.

Measures to control drought including public awareness campaigns to encourage people employ wise use of water and participate in implementation of a national drought management/adaptation plan as a comprehensive measure with support from related national institutes. Again as drought risk generate cascade effect to human lives, properties and livelihoods in various forms, such as rising temperatures, seawater intrusion, hungers and malnutrition increasing rate etc. Society and communities need to adapt to reflect current and future drought risk in order to reduce and response their impacts. **Figure 2-3** illustrates the process of adaptation to drought with important components.

The analysis of drought risk and vulnerability is to identify the target groups, risk areas and impacts to various sectors, including exposure, sensitivity and adaptive capacity to present the level or order of vulnerability of target groups, areas, and sectors. Identification of adaptation options is an analysis of the current adaptation, evaluates adaptation options, planning, implementation, monitoring and evaluation (M&E) through economic cost breakdown analysis to determine the appropriate adaptation options; local wisdom, research finding, science, technology and innovations (STI) that is suitable for the context of society and community. The process of drought adaptation must take into account the integration of information, knowledge in science and social sciences, combined with the participation of all stakeholder.

German Cooperation (2019) described that Thailand has begun establishing a national M&E system for the water and agriculture sectors. These sectors are planning to integrate the M&E of adaptation measures in line with the country's National Adaptation Plan (NAP) and coherent with the overall information governance framework. The requirement of M&E has been highlighted in the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement, the

Sustainable Development Goals (SDGs), and the Sendai Framework for Disaster Risk Reduction 2015-2030.

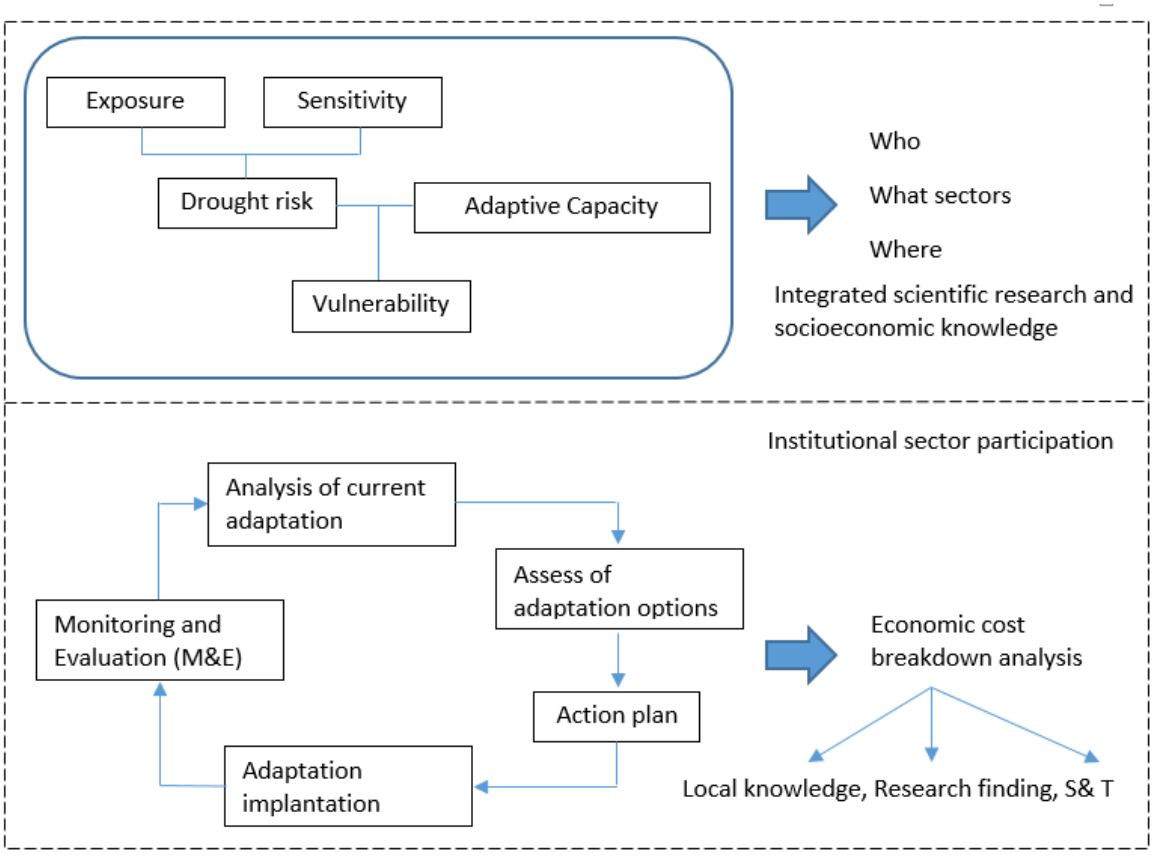

Figure 2-3 Element of adaptation and management to drought risk
Sources: modified from T-PLAT (2022).

The establishment of a national level M&E system will facilitate the reporting of Thailand's achievements towards the goals set out in these agreements. For example, in agriculture and water sectors, adaptation interventions, such as organic agriculture, piloting drought-resistant crop varieties and soil and water conservation, are already functioning to achieve resilience to drought. In both sectors, adaptation interventions often have their own M&E system or framework at the project level.

Local level drought planning has also been supported by partnerships including United Nations Development Program (UNDP) and the Asian Disaster Preparedness Center (ADPC) which have been involved in project-based risk assessments under the Mainstreaming Climate Change Adaptation and Disaster Risk Reduction in Development Planning (MADRiD) have been useful in identifying contextual hazards, exposure and vulnerability aspects, compiled into handbook for relevant government authorities and other stakeholders.

Thailand has also maintained systematic collection of data assessing drought hazards, which is utilized in drought risk monitoring, climate trend projections, seasonal forecasts and the annual forecasting of drought risks across the country. Such programmes serve as tools for sectoral planning, especially in the drought prone

provinces in Thailand. Systems used in collecting data include weather observation networks comprising automatic rain gauges, weather radars and remotely sensed data, automatic weather system (AWS) of TMD, Thailand as well as real-time monitoring of water volumes in reservoirs.

Again, the country has fully implemented its National Disaster Risk Management Plan, 2015, together with implementing the Agriculture Strategic Plan on Climate Change, 2017-2021, Climate Change Master Plan, National Adaptation Plan, and 20-Year Water Management Master Plan.

However, to meet drought information requirements, countries need an inter-agency operational plan. This could be drawn up from a *working group* which can consider how all government agencies might gather the required information on a sustainable basis, how this might be delivered, and the mechanisms for receiving user feedback and evaluation. The working group should be inter-sectoral, with the relevant technical lead. Solutions need to be scalable and updated and adapted as new technologies emerge such as geospatial technology, satellite earth observation and AI.

To implement multi-sectoral strategic actions on drought adaptation, mitigation, and emergency response at both national and subnational levels, approaches such drought risk and adaptation communication exchange among all stakeholders in Thailand, institutionalization, localisation and impact communication/drought research translation are needed. **ANNEX 3** shows ministry, department and their responsibility in water resources and drought disaster management in Thailand

Thailand also should continue promote the institutionalisation of Sex, Age and Disability Disaggregated Data (SADDD) which corresponded and explained in ARPA-AD, 2021-2025. The disaggregation data in the Sendai Framework Monitor (SFM) specifically composed of Sex indicated as male and female, Age ranged as children (0 – 14 years), adults (15 – 64 years), and seniors (65 years and older) while Disability focused on people with an existing “pre-event” disability that are effected by a disaster, and not people who develop a disability from a hazardous event including drought event (UNDRR, 2021). SADDD can inform priorities and practice to shape a rights-based and evidence-based approach for drought risk adaption all sectors. Combined with other data, such as exposure or socio-economic vulnerability and intersectional data, critical questions can be answered, like: Who is most at risk? Which rights are at stake? How can drought risks be reduced for vulnerability groups.

The collection for risk, vulnerability and impact assessments, and incorporation into drought preparedness and planning, prevention, and response and recovery policies are key elements that relevance to drought risk management in Thailand.

Each of Ministries along with several departments (**ANNEX 3**), bureaus, offices and centers are reflected into lower administrative levels, for instance, the Department of Water Resources (DWR) has a branch at the provincial level, at district and sub-district level and the DDMP has the same manners. Thus, it is necessary to understand the complexity of institutional arrangements as well as the number of government officials involved in the hierarchical Thai bureaucracy in charge with drought adaptation.

At national level, the National Disaster Prevention and Mitigation Committee (NDPMC) chaired by the Prime Minister or designated Deputy Prime Minister has prominent

tasks and responsibilities for policy-making on disaster risk management. At local level, the Provincial Disaster Prevention and Mitigation Committee and Bangkok Metropolitan Committee are formed (Thanyalakmetha, 2020). The provincial Disaster Relief Committee is responsible for organizing efforts among sectorial agencies (e.g. RID, DWR, LDD, DOAE etc.) coordinates lower levels (districts and sub-districts). The Provincial Emergency Operation Center (EOC) are in charge of command, control, support and coordination of drought response and disaster relief measures (NDPMC, 2009).

2.3 Example Practices to alleviate drought impacts

The water management system for drought of Thai Government lunched in 2013 associated with the cabinet resolution dated 12 February 2013 has designated Ministry of Interior by Department of Disaster Prevention and Mitigation (DDPM), Ministry of Agriculture and Cooperatives and relevant agencies to operate under single command system by 2P and 2 R measures. (Prevention, Preparation, Response, and Recovery) There are totaled 14 Ministers are in charge for drought management in 29 provinces such monitor, follow up and implement and collaborate with Ministry of Agriculture and Cooperatives for artificial rain together with short term & long term measures such as water distribution, well digging, canal drainage.

There are 4 measures for drought response of all relevant agencies as the follows;

1. Maximum water utilization especially for consumption
2. Water accessibility such as groundwater and water distribution
3. Operation system under the 2P2R measures
4. The Provincial Governor is in charge as the commander under single command system

In the short term activity/plan (90 days) the cabinet resolution approved $21 million to solve drought disaster and designated related agencies concerned such as National Water Management Committee, Ministry of Interior and etc. to prioritize and accelerate victim assistance. In addition, the data warehouse of water management is established by the academic and private sector for decision makers for drought solving and collaborated with private sector for water distribution in remote areas.

The ongoing water crisis in Thailand could potentially act as a trigger to take proactive actions against drought, provide a window of opportunity for the country for capacity building for drought adaptation. A policy statement recognizing that drought is not to be considered only a disaster but needs to be addressed under the ordinary water resources management would reflect an increased awareness among high-level government officials. Moreover, in order to effectively perform a drought preparedness and mitigation process, political stability is important. **Table 2-2** shows example of institutional strengths and weaknesses in addressing drought-related climate hazards and risks which derived from literature reviewed

Table 2-2 List of strengths and weaknesses of each section in addressing drought risk in Thailand

Section	Strengths	Weaknesses
Institutional	• Role and responsibility of ACDM, DDMP, NDPMC • Impacts communication among agencies • Adaptation on paradigm shift on drought • Stakeholder involvement	• Highly fragmented institutional and legal framework
Technical	• Available of drought and climate database • Clear drought definition and classification • Drought assessment capacity	• Lack of qualified personnel
Political	• Policy and awareness on drought risk	• Unstable political context • Water as object of bargaining
Economic/Financial	• Shift towards pro-active drought risk management is more cost-effective than the costs of inaction	• Lack of water markets and water-saving incentives
Socio-cultural	• Drought awareness and better preparedness at all levels • Self-reliance concept	• Water as a common properties • Very hard to change farmers' behavior

Source: Modified after Franzetti (2016).

Chapter 3: Implementing ARPA-AD 2021-2025 at National Level

3.1 Implementing ARPA-AD 2021-2025 at national level

The ASEAN Regional Plan of Action for Adaptation to Drought (ARPA-AD) 2021-2025 is formulated to outline a clear regional plan of action based on the three (3) tracks transformation for drought adaptation recommended by UNESCAP (2021)-*Ready for the Dry Years* (**Figure 3-1**). This is correspond with the three (3) pillars of effective drought management highlighted in the Integrated Drought Management Programme 2019 covering (a) monitoring and early warning; (b) vulnerability and impact assessment; and (c) mitigation, preparedness and response; to address the current drought risk and the future climate-induced drought severity occurrence comprehensively.

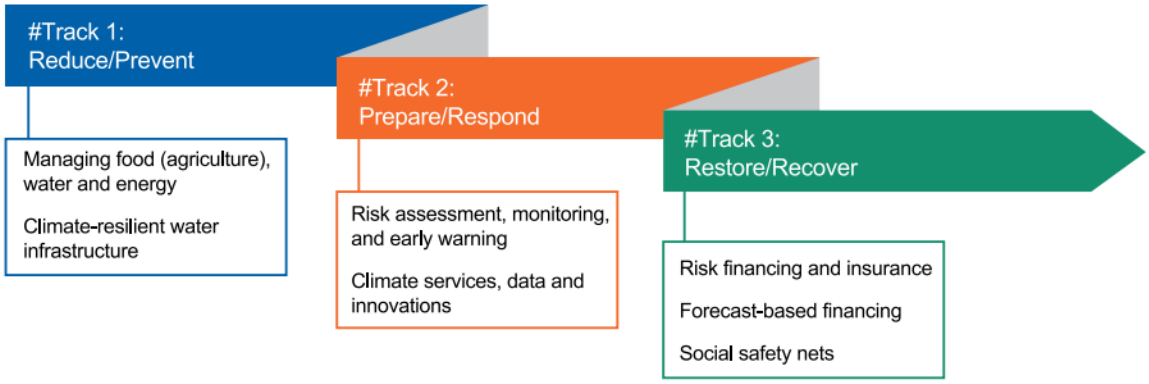

Figure 3-1 Three (3) parallel tracks for drought adaptation

Source: UNESCAP (2021).

The ARPA-AD consists of nine (9) actions covering a full set of drought management cycle, partnership, and coordination on the regional and national levels. The drought management cycle subjected in line with the three (3) parallel tracks of drought intervention identified in the joint ASEAN-ESCAP study *Ready for the Dry Years*: (i) reduce and prevent, (ii) prepare and respond, and (iii) restore and recover (**Figure 3-1**). The actions that reflect the drought management cycle are composed of Action 1: Risk, impact and vulnerability assessment, Action 2: Early warning system, preparedness and planning, Action 3: Adaptation actions, and Action 4: Response and recovery; while partnership and coordination implementation focus on Action 5: Strengthening coordination between ASEAN sectoral bodies, Action 6: Partnership and collaboration with non-ASEAN partners, Action 7: Capacity-building and enhancement, Activity 8: Data sharing and dissemination, and Action 9: Monitoring and evaluation.

Action 1: Risk, impact and vulnerability assessment

The objective of Action 1 is to assess at the regional and national levels (a) the past, present and potential drought impacts on economic sector, environment, and society; (b) basal or underlying causes of the impacts; and (c) drought vulnerability of the vulnerable groups driven by the underlying causes. The action focuses on assessment framework as well as the underlying causes of the impacts and the potential economic losses.

There are three (3) sub-actions in Action 1 and all of them covers national action plan. The sub-actions include: (1.1) Develop regional and national drought risk, impact and vulnerability assessment framework and develop detailed national integrated drought management programme by involving all relevant agencies, (1.2) Conduct a national drought risk, impact and vulnerability assessment every decade (10 years) with experts from relevant agencies or partners, and (1.3) Promote the institutionalisation of sex, age and disability disaggregated data (SADDD) collection for risk, vulnerability and impact assessments, and incorporation into drought preparedness and planning, prevention, and response and recovery policies.

<u>Implementation of Action 1 in Thailand:</u>

(1.1) Develop national drought risk, impact and vulnerability assessment framework and develop detailed national integrated drought management programme by involving all relevant agencies

DDPM has reviewed and updated as of 2020--National Disaster Risk Management Plan to assess risk, impact and vulnerability including drought risk management, Thailand. The potential for life exposure, economic losses, and environmental damage as a result of the drought in 2015 and 2020 as described in Chapter 2. Thai Government, leaded by NESDC has conducted 20-year National Strategy (2018-2037) which links to SDGs (Goals 13: Climate Action) and various department are employed and adopted this national law. Furthermore, the ONEP has issued Climate Change Master Plan (2015-2050) to investigate impacts of climate change include rising temperatures, longer summers, shorter winters, and more severe droughts during the dry season. However, detailed national integrated drought management programme by involving all relevant agencies has not been developed. Thus, Thailand needs to establish National Working Group on Adaptation to Drought consisting of all relevant agencies to develop detailed national integrated drought management programme.

(1.2) Conduct a national drought risk, impact and vulnerability assessment every decade (10 years) with experts from relevant agencies or partners. Thailand has not conduct a national drought risk, impact and vulnerability assessment every decade (10 years) with experts from relevant agencies or partners. National Working Group on Adaptation to Drought mentioned in sub-action (1.1) is assigned to conduct an assessment of drought risk, impact and vulnerability every 10 years. In conducting the assessment, the national team needs to communicate and work together with relevant experts and partners.

(1.3) Promote the institutionalisation of sex, age and disability disaggregated data (SADDD) and impact assessments, and collection for risk, vulnerability incorporation into drought preparedness and planning, response and recovery policies.

Thailand already has a National Plan for Older Persons (2002-2021) which carried out by DOP associated with The Women Development Strategy (2017-2021) developed by MSDHS. However, sex, age and disability disaggregated data in drought disaster management has not consolidated, gender and age mainstreaming in disaster management, guidelines for the handling, protection, and participation of people with disabilities in disaster management and relevant issues need to be considered by DDPM and DSDW.

Action 2: Early warning system, preparedness and planning

The objective of Action 2 is to enhance and develop: (a) regional and national drought conditions monitoring, forecasting, and early warning system; and (b) risk reduction and intervention planning prior to drought events. The action focuses on drought forecasting and early warning tools, communication framework for drought information sharing within the ASEAN sectoral bodies and AMS to share and disseminate drought conditions and data across the region, and the mitigation plans. Action 2 has four (4) sub-actions. Two (2) of them are implemented at national level, namely, (2.2) Enhance national drought early warning system based on the national best practices through the national assessment study and build ground monitoring stations considering hydro-meteorological and agricultural parameters, and (2.3) Develop and operate a regional drought early warning system – officer in charge to be identified - with data sharing from and exchanging with the national forecasting systems, in coordination with the AHA Centre, SEA RCC, and ASMC.

The other two (2) sub-actions are implemented at the regional/ASEAN level: (2.1) Conduct a regional study on ASEAN and AMS existing drought monitoring, forecasting and early warning systems to collate best practices and lessons learnt to serve as reference for the future development/enhancement of such systems at regional level, and (2.4) Develop regional guidelines on drought risk reduction and suggested interventions that could be implemented by AMS to mitigate the impact of drought, with the needs of vulnerable people taken into consideration.

Implementation of Action 2 in Thailand:

(2.2) Enhance national drought early warning system based on the national best practices through the national assessment study and build ground monitoring stations considering hydro-meteorological and agricultural parameters. The TMD is an essential institution in providing an early warning system for drought. The TMD will produce a map of rainfall forecasts for Thailand every 7 days. TMD will also give drought status and early warning in each province and district/city, particularly during the dry season. The HII is developed Drought monitoring system which available at https://www.hii.or.th/en/research-development-en/research-development/2020/04/16/drought-monitoring-system/.

Following that, the DDPM will distribute circulars to regions that are at risk of drought, as well as instructions on how to take readiness actions based on drought status. One of the DDPM's readiness procedures is to anticipate the possibility of forest and land fires. The public can get information on hotspots with the potential for forest/land fires generated from remote sensing satellite data developed by GISTDA at https://fire.gistda.or.th/.

DWR provides water crisis prevention center platform including drought risk data, which available at http://mekhala.dwr.go.th/en/download-cate.php?txtdoccate=28. Other monitoring based on hydrological parameters is performed separately by reservoir's operator by EGAT and RID in collaboration ONWR. Agricultural parameters, however, have not been monitored and considered in the early warning system.

(2.3) Develop and operate a national drought early warning system - custodian to be identified - with data sharing from and exchanging with the national forecasting systems, in coordination with the AHA Centre, SEA RCC Network and ASMC).
Thailand has developed and implemented a national early warning system. Best practices and lessons learnt from Thailand may serve as references for the future development/enhancement of such systems at the regional level. Thailand will contribute to regional (ASEAN) sub-actions such as developing and operating a regional drought early warning system, conducting a regional study on ASEAN and AMS existing drought monitoring, forecasting, and early warning systems, and developing regional guidelines on drought risk reduction.

Action 3: Adaptation actions

The objective of Action 3 is to reduce drought risk, mitigate impacts, and strengthen resilience to raise adaptive capacity for vulnerable groups and stakeholders. The action focuses on long-term drought adaptation strategies for social, economic and environmental aspects. Action 3 consists of two (2) sub-actions that should be implemented at the national level: (3.1) Develop recommended regional drought adaptation policies and mitigation strategies for identified drought risks and vulnerabilities as a guide for AMS's consideration. (3.2) Conduct national study to assess the adaptive capacity and recovery ability of the vulnerable groups.

Implementation of Action 3 in Thailand:

(3.1) Develop recommended regional drought adaptation policies and mitigation strategies for identified drought risks and vulnerabilities as a guide for consideration of AMS. The national drought management team as aforementioned in sub-action 1.1 can be assigned to develop recommendations for regional drought adaptation policies and mitigation strategies based on experience and practical in Thailand.

Thailand already has a National Disaster Risk Management Plan which was compiled in 2013 being reviewed and updated in 2020. NDRMP has consolidated disaster risk management – related new thinking and concepts, including the development of disaster prevention and preparedness system and the creation of disaster immunity through developing knowledge and wisdom as well as strengthening disaster

surveillance system and coping capacity, living in harmony with nature and creating the self – immunity into the communities in line with an approach entitled “sufficiency economy philosophy”.

The strategies for an implementation of NDRMP focus on disaster risk reduction, an application of integrated emergency management system, strengthening and enhancing efficiency of sustainable disaster recovery or building back better and safer, and promoting international cooperation on disaster risk reduction. These focused strategies will serve as guidelines to achieving objectives set forth in this National Plan and contributing to successful disaster risk reduction which is a foundation for sustainable development.

In relation to drought adaptation, the strategies developed in NDRMP to conduct artificial rainmaking operations and water management activities with an intention of preventing and addressing the challenges of water scarcity and droughts by DRRAA and RID respectively, while introduced of disease resistant and drought – tolerant plants, as well as encouraging the cultivation of crops suited to local climate and soil conditions.

Community capacity building to deal with disasters is carried out through educational programs by DDPM in collaboration with other government agencies, universities and communities.

Climate Change Master Plan (2015-2050) is corresponded with 20-year National Strategy (2018-2037). Several national programs that support efforts to adapt to drought are the construction of house small-scale reservoirs, modernization of irrigation, construction of raw water and groundwater supply systems, especially in water-critical areas, protection of food security from climate change, as well as conservation and rehabilitation of forests, water sources, and watersheds. These programs are elaborated in more detail in Annex 3: Ministry, department and their responsibilities involved in water resources and drought risk management in Thailand.

(3.2) Conduct national study to assess the adaptive capacity and recovery ability of the vulnerable groups.

There has never been a national study assessing the capacity of vulnerable groups to adapt and recover from drought in Thailand. The national drought management team needs to compile this study in collaboration with relevant experts and partners. Several national laws, regulation, programmes that can strengthen the basis of this study are NDRMP-2015 (updated 2020), National Plan for Older Persons (2002-2021) and the Women Development Strategy (2017-2021) on age issue and gender in disaster management.

Action 4: Response and recovery

The objective of Action 4 is to develop post-drought financial relief/assistance, social welfare, and technical support to facilitate recovery of the impacted agricultural and industrial sectors, and the affected communities. The action focuses on regional,

national and subnational initiatives to provide financial and technical support to recover from a drought occurrence.

There are three (3) sub-actions in Action 4, only one (1) of them is implemented at the national level: (4.2) Develop a national technical team comprising national focal points from relevant agencies to evaluate post-drought economic, social and technical damage by the severe drought hazards at the national and subnational levels with comprehensive reports.

Implementation of Action 4 in Thailand:

(4.2) Develop a national technical team comprising national focal points from relevant agencies to evaluate post-drought economic, social and technical damage by the severe drought hazards at the national and subnational levels with comprehensive reports.

In the event of a disaster, DDPM is an institution that acts as a coordinator at the national level, as well as in times of drought. However, there will actually be many government agencies that have drought response and recovery programs. Coordination between agencies for drought disaster management is usually only carried out in the event of droughts. Therefore, to ensure the integration and sustainability of drought disaster management programs, it is necessary to create a national team consisting of all institutions that work not only in the drought event. One of the tasks of this team is to compile a comprehensive report to evaluate post-drought economic, social and technical damage by the severe drought disasters at the national and sub-national levels. The following describes the drought response and recovery programmes implemented in Thailand.

DLA by municipal disaster recovery assistance unit will distribute clean water assistance to the poor in collaboration with local government institutions, NGOs, social institutions, communities, or with the private sector. In response to the prolonged drought in 2015 and 2020, DDPM in collaboration with the DRRAA implemented rainmaking with weather modification technology is used to increase precipitation.
Drought causes agricultural production to decrease and food prices to increase. DGWR is responded for drought disaster rescue by preparing 86 groundwater drill equipment, 17 mobile water service units, with 86 water trucks, 35 sets of fast-moving air conditioning repair kits, and 246 schools network that are ready to be appointed for severing a clean water to villagers during drought disaster. There are 196 water distribution volunteers' sites joining the ready for the dry year project of government agencies like Thai Army to prepare and respond to drought phenomena in 2022. RID also provides water stock and supply to national reservoirs, monkey-cheek lentic system associated with various main canals to store water for utilization as much as possible.

MoF and DOAE, MoAC has a program called Thai Rice Insurance Top Up Scheme since 2011 to help rice farmers managed their various risk exposure including drought risk in rice cultivation by using insurance tools in recovering their cost of production. The initiative of this insurance scheme was a collaboration and co-operation with

related government agencies and private sectors such as OIC, BAAC and TGIA for more details please visit https://www.tgia.org/upload/file_group/30/download_951.pdf.

Action 5: Strengthening coordination between ASEAN sectoral bodies

The objective of Action 5 is to establish coordination and communication networks among ASEAN sectoral bodies for close cooperation in the implementation of the ARPA-AD. The action focuses on coordination and communication mechanisms within the ASEAN sectoral bodies on the implementation of ARPA-AD.

Action 5 includes three (3) sub-actions that will be implemented at regional (ASEAN) level: (5.1) Establish a regional platform (e.g., Technical Working Group) for the relevant ASEAN sectoral bodies to collaborate on regional initiatives to support the implementation of the ARPA-AD, (5.2) Initiate a regional activity on communication and coordination network to strengthen the coordination among the ASEAN sectoral bodies to effectively address slow onset and accumulative impact of drought on, inter alia, the environment, agriculture, energy, and water under consideration of gender balance, and (5.3) Strengthen the cooperation and utilization of the existing emergency food reserve mechanisms, such as the ASEAN Plus Three Emergency Rice Reserve (APTERR), in order to mitigate the impact of drought on food security in the region.

Implementation of Action 5 in Thailand:

Action 5 will be implemented at regional level. Thailand representatives that are members of ASEAN sectoral organisations will participate and contribute to the ARPA-AD implementa-tion through their respective sectoral bodies. For example, DDPM as the member of ACDM, and GISTDA as Thailand representatives in ASEAN Sub-Committee on Space Technology and Applications (SCOSA).

Action 6: Partnership and collaboration with non-ASEAN partners

The objective of Action 6 is to build partnerships and collaborate with non-ASEAN regional and international institutes, organisations, and research centres to exchange knowledge, expertise and experiences in drought management. The action focuses on enhancement of drought adaptation, early warning, preparedness and planning, and response and recovery.

This action comprises two (2) sub-actions to be implemented at regional level: (6.1) Establish networks and develop collaborative initiatives with dialogue partners, and other regional and international partner organisations for technical and financial support, and sharing of expertise on drought management, and (6.2) Further strengthen regional (and international) cooperation and collaboration in research and innovation development (R&D) and technology transfer associated with drought such as climate change adaptation, water resources management, drought risks, preservation, conservation, and the restoration of natural (including water) resources and management alternatives.

Implementation of Action 6 in Thailand:

Action 6 is also implemented at the regional (ASEAN) level. As a network member, Thailand will participate and support this effort by sharing research findings and practices in drought risk reduction. Numerous international organizations have made significant contributions to Thailand's resilient development and disaster response. They include the ADB, which provides monetary assistance to rapidly growing middle-income countries, as well as the World Bank, which has also supported significant risk mapping and early warning system-related programs.

UNDP for Climate Change Adaptation, while UN Women focus on Gender Equality in Disaster Management and Response. Along with the many other organizations, the IFRC, Save the Children, CARE, and World Vision have all contributed to disaster response in Thailand.UNDP has been working closely with the Thai Government on climate change preparedness for a number of years, including building capacity to secure global finance for climate action, and efforts to integrate agriculture into national adaptation planning. Ahead of the international climate conference COP26, the global Green Climate Fund has approved a new US$17.5 million grant towards building the climate change resilience of farmers in Thailand.

UN Women provides support to the Technical Working Group on Protection, Gender and Inclusion (TWG-PGI), convened by the Association of Southeast Asian Nations (ASEAN) Committee on Disaster Management, to achieve gender equality and end gender-based violence across ASEAN's disaster management efforts.

Action 7: Capacity-building/enhancement

The objective of Action 7 is to build and enhance drought management and adaptation capacity and institutional capability on drought management. The action focuses on human resources and institutional capacity development on drought management and mitigation.

Action 7 is derived into three (3) sub-actions. The first sub-action is implemented at regional level: (7.1) Coordinate and implement regional capacity building programmes with technical support from relevant ASEAN Centres on drought impact and vulnerability assessment and drought early warning system to support drought preparedness and drought management. The other two (2) sub-actions are implemented at national level: (7.2) Initiate six (6)-month on-the-job training programmes to enable young professionals from AMS to learn and exchange their knowledge and experiences on drought management, and (7.3) Develop a national capacity-building programme on data collection (including disaggregated data) and analysis, quality assurance/quality control (QA/QC) and data dissemination to ensure high-quality and reliable data collection in a timely manner on socio-economic indicators of drought, its impacts and mitigation measures.

Implementation of Action 7 in Thailand:

(7.2) Initiate six (6)-month on-the-job training programmes to enable young

professionals from AMS to learn and exchange their knowledge and experiences on drought management. Representatives from Thailand will participate in regional capacity building programmes on drought impact and vulnerability assessment and drought early warning system to support drought preparedness and drought management. Furthermore, six (6)-moth on the job training will be initiated in Thailand to increase the capacity of young professionals in drought management. Capacity building programmes in Thailand may be lead and organized by DDPM in partnership with universities, ADPC and other institutions.

(7.3) Develop a national capacity-building programme on data collection (including disaggregated data) and analysis, quality assurance/quality control (QA/QC) and data dissemination to ensure high-quality and reliable data collection in a timely manner on socio-economic indicators of drought, its impacts and mitigation measures.

Analyzing, collecting, and managing drought and climate risk-related data (post disaster and projected losses and probabilities) is critical for gaining a deep understanding. This would be the first step in facilitating the reformative transition from reactive drought management to a resilient, whole-of-society strategy. DEQP provide data platform called Thailand Adaption Information Platform (T-PLAT) http://t-plat.degp.go.th/en/home-page/ with knowledge on climate change, Impact of climate change in Thailand by sector, local wisdom in drought adaptation and management.

Action 8: Data sharing and dissemination

The objective of Action 8 is to establish standardised indicators for regional drought monitoring and analysis, and develop drought information and data sharing, and disseminating mechanism within ASEAN sectoral bodies and the AMS. The action focuses on data sharing and dissemi-nation within ASEAN sectoral bodies Member States and AMS during the process of implementing the ARPA-AD.

This action consists of four (4) sub-actions. Two (2) sub-actions are implemented at the regional level: (8.1) Develop a regional platform for data and information technologies, best practices, and lessons learned concerning droughts of different scales, locations, and sectors in the region, and in particular, the documentation of local practices of drought risk management and their resilience capacities, subject to the respective AMS' national laws and regulations and (8.2) Develop weekly and monthly drought bulletins to disseminate current drought conditions and forecasts in the South-East Asia region to AMS. Other two (2) sub-actions implementations are at national level: (8.3) Develop national bottom-up data collection and reporting system with regular sharing of national reports with the regional level on drought risks and the water scarcity situation from different scales and sectors through mobile phones and (8.4) Establish a robust system and communication network at national and subnational levels to transfer and disseminate information on drought forecasting and early warning – including drought emergency situations and trends of water shortages – to local and vulnerable communities and are accessible for local governments.

Implementation of Action 8 in Thailand:

(8.3) Develop national bottom-up data collection and reporting system with regular sharing of national reports with the regional level on drought risks and the water scarcity situation from different scales and sectors through mobile phones.

DDPM and NSO supported by GISTDA, HII and other ministries/departments are investigating disaster data in Thailand such as spatial & non-spatial data in terms of GIS database, In situ data (e.g., land use, population exposure, and disaster areas) for improving resilience of vulnerability groups simultaneously support decision making at sub-national level.

Disaster data requires development of standardized system, easy to manage & verify the data obtained by each ministry and agency, so that it is more accurate, up to date, integrated, accountable, accessible, and shareable. It would help avoid unnecessary overlapping claims, reducing conflicts and inconsistencies. Disaster data in Thailand is expected to be detailed for drought disasters and linked to the national water information system that inform water scarcity situation. Thailand disaster data can also be developed in the form of a mobile app to facilitate data collection and reporting system.

(8.4) Establish a robust system and communication network at national and subnational levels to transfer and disseminate information on drought forecasting and early warning – including drought emergency situations and trends of water shortages – to local and vulnerable communities and are accessible for local governments.

The current practice in Thailand is that HII is implemented Drought Monitoring System to monitor meteorological drought situation by overlapping various data and factors to analyze the drought risk. Drought index is calculated by scoring various factors (e.g., irrigation area from RID, average rainfall 30 years from TMD, repetitious drought area from LDD and accumulative rainfall 15 days from remotely sensed data was used to specify drought area from rain-shortage or rain recession. HII shares drought forecasting information to DDPM. GISTDA also developed agricultural drought and water resource monitoring system in Thailand to inform situation and trends of water shortages. Moreover, DDPM issues and distributes drought early warnings to provincial sectoral. DDPM also disseminates early warnings and drought information through mass media such as social network, internet websites, newspapers, radio and television.

Action 9: Monitoring and evaluation

The objective of Action 9 is to monitor and evaluate the implementation progress of the ARPA-AD to review the effectiveness and impact of the actions 1-8. The action focuses on the progress of actions 1-8 and constraints faced during the implementation process.

Action 9 is broken down into two (2) sub-actions, one (1) sub-action is implemented at the national level: (9.1) Review and amend all existing drought management strategies and mitigation policies from different agencies to ensure a consistent and coherent

implementation of national action plans on drought adaptation, whereas the other sub-action is implemented at the regional level: (9.2) Develop clear indicators and monitoring system for the regional and national action plans on drought adaptation and perform periodic monitoring and evaluation of the implementation progress of the regional and national action plans on drought adaptation and mitigation.

Implementation of Action 9 in Thailand:

(9.1) Review and amend all existing drought management strategies and mitigation policies from different agencies to ensure a consistent and coherent implementation of national action plans on drought adaptation.

The existing drought management strategies and mitigation policies from different agencies are somehow still carried out in a scattered manner. Therefore, the formation of a national drought management team is important to review and amend existing policies and strategies to ensure a consistent and coherent implementation of national action plans on drought adaptation. The national monitoring and evaluation of drought management should be developed in cooperation with all levels in twenty-two (22) government—both central and local associate with academia as well as community sectoral to enhance its robustness and credibility. Major institute such as DDPM should take on the role of creating an overarching blueprint while the ministries and departments act as implementors of this blueprint based on their responsibilities as indicated in **Annex 3**.

At national level, there are nine (9) actions associated with thirteen (13) sub-actions will be implemented by twenty-three (23) organizations with institutional arrangement, national diplomacy and communication as described in Chapter 2. Proposed organizations are subjected to be rearranged for more affective and impact implementation based-on bureaucracy.

3.2 Challenges situation

National development and implementation of drought adaptation face different challenges when planning or implementing adaptation policies and measures and this can be hampered progress in the development and implementation of adaptive measures to drought. Some key challenges related to implement drought adaptation and management was described as below;

3.2.1 Political leadership and commitment issue

Lack of political commitment at different levels is a barrier in the development and implementation of adaptive measures to drought and hindering adaptation efforts at all levels. For instance, the absence of a strong national political leadership will result in less ambitious National plan of action for adaptation to drought or other drought regulation, programmes, which will in turn limit the action at sub-national and local level.

Another factor is related to institutional arrangement and legislation, sometimes the responsibilities of different government levels are not clearly defined. Communication between them is not in action, which may create a conflicts between institutions that obstruct in national drought management.

Lack of certainty research finding is factor that contribute to the lack of political commitment on adaptation. This is related to lack of knowledge and awareness by administrations as well as gaps in practical and policy. Different department levels might fear on task duplication for example, doing the work that somebody has already done or will do.

In adaptation to such challenges posed by droughts in the nation, the high-level nation leaders has opportunity to develop an effective national action plan on drought adaptation and mitigation. This action is urgent in order to cope with meteorological, hydrological, land use and water management, and agricultural and socioeconomic drought vulnerabilities.

Opportunities on institutionalization, localisation and communication sector to implement multi-sectoral strategic actions on drought adaptation, mitigation, and emergency response at both national and subnational levels of Thailand and encourage communication exchange among all stakeholders.

Coordination among multi-sectoral bodies of AMS and ASEAN implementing agencies as well as ASEAN partner organizations provide window of opportunities for effectively implement ARPA-AD and to ensure that the implementation of strategic actions is well-aligned with the global frameworks on disaster management.

3.2.2 Insufficient administrative capacity

Human resources are most important components in the development and implementation of adaptive measures to drought. If we lack of officers with necessary skills and expertise on climate change and drought adaptation issues, then national development and implementation of drought adaptation may not practical. There is a need for national drought adaptation coordination team--officer in change (OIC)/volunteers to provide liaison between different regions and across departments so that efforts can be mainstreamed associated with drought knowledge shared.

Drought and climate adaptation is a new field of expertise and it can be difficult for the public actors at different levels of government to find relevant professionals to carry out. In the same vein, it can be hard to cultivate relevant expertise among existing stuff due to lack of drought risk reduction training, workshop and capacity building.

Another barrier is the difficulty in building expertise in professional structures with high staff turnover left the drought program with too many young officer. However, this may create an opportunity for the non-expert administrators to improve their knowledge, necessary re-skill, up-skill on drought prevention and mitigation in the future.

Local authorities might experience difficulties in fully exploiting the experience gained through drought adaptation projects they carried out or might not be fully able to use

the knowledge created by others to implement projects themselves. This points out to an issue of research translation both within and across different agencies which is essential to accumulate know-how and expertise.

Thus, to cope with this challenges, the same expertise--guideline/drought adaptation country reports will be provided opportunity to participants from the national and sub-national level to work together ahead of the workshop, creating a network among different ministries and departments.

To better manage drought risks from climate change and variability, particularly for those who are most vulnerable to drought risks and this will be done through the development and incorporation of science-based drought and climate information and prediction into national plan of action for adaptation to drought.

3.2.3 Insufficient financial resources

Limitation of financial support to fund drought adaptation measures remains a challenge and is often cited as a barrier to implementing drought adaptation policies and measures at the national and subnational level.

The underlying reasons for this lack of resources include limited public funding, conflicting objectives for funding, and lack of awareness about available funding, unsuccessful funding applications, and the cost of the adaptation measures.

Interventions to manage food (agriculture), water and energy together with water infrastructure are important to #Track 1: Produce/Prevent for drought adaption. In similar manners to establish drought early warning, climate services, data and innovations, which subjected to #Track 2: Prepare/Respond, necessitate considerable investment. Nevertheless, there are adaptation measures that can be linked to investments in other sectors while improving the resilience of water infrastructure and agro-food system can provide savings in future costs.

Therefore, a better understanding of climate-related drought risks and adaption plan including risk financing and insurance, forecast-based financing, social safety nets are required to elevate public budgets more resilient.

Obviously, after the drought occurring #Track 3: Restore/Recover, national and subnational initiatives to provide financial and technical support to recover from a drought occurrence. A better understanding of the full range of drought adaptation measures available mitigate over-reliance on grey adaptation measures, such as engineering responses, which are often more costly.

Finance and resource mobilization is opportunity for instance exploit all available resources, both in-house and external ones, in a complementary fashion that supports the full implementation of ARPA-AD 2021-2025 and its components.

3.2.4 Knowledge gaps about climate change and drought adaptation

Apart from above challenges, the political, human and financial resources constraints, ACDM, DDPM are also faced with more general knowledge gaps surrounding both drought research finding and drought adaptation policy.

Lack of information and knowledge on future climate trends and extreme weather events. The implementation of effective adaptation to drought measures mainly depends on the ability to forecast, detect and understand long term local meteorological and hydro-climate behaviours, which in turn enables the identification of specific local vulnerabilities and adaptation needs. However, even when data and research are available, they are generally not easily accessible or freely shared with public authorities.

Challenges are particularly disruptive for small-scale farmers, who have less capacity to cope with even small economic crisis, compared to large-scale commercial farming. Furthermore, for these small-scale farmers, reduced water availability due to drought will increase the time burden on farmers for collecting water, thus reducing time available for productive activities.

Another issue is on lack of the socio-economic impacts information of drought risk related to climate change — particularly at local level. There is still insufficient understanding of the impacts of drought and climate change in specific sectors (especially in food (agriculture), water, energy, land and natural environment). A key challenge in this regard is the limited information available concerning the impacts of past climate-related drought events, which can support better assess future impacts to support decision-making.

Question for opportunities on how to enhance the efficiency and effectiveness of ASEAN's drought adaptation? This can be achieve through science, technological and innovation which employ in each actions and sub-actions for better drought mitigation and adaptation together with strengthen and develop stronger multi-stakeholder partnerships among AMS with regional and international institutes and organizations for exchanging technical experience, including drought mitigation planning, adaptation, response, and drought monitoring and early warning systems, to support the implementation of ARPA-AD, 2021-2025.

3.2.5 Future climate risks and potential impacts on adaptation to drought

Climate change and drought risk has potential impacts on ***Food*** – Countries need to plan for future agro-food system. This will mean scaling up climate-resilient production for a large number of vulnerable small-scale farming households. This should include crop diversification, using rice intensification techniques, integrated agriculture, stress tolerant varieties, integrated pest management and rural aquaculture and conservation agriculture (RACA) approach (Doydee, 2017). The benefits of RACA in rural development are 1) improve food security, health and nutrition, 2) generate

employment and income, 3) reduce vulnerability and 4) increase efficiency small-scale farming system[9]

Extreme weathers such as drought increase ***Water*** scarcity and low water level– Successful adaptation will require scaled up investments in healthy watersheds and water infrastructure, dramatic improvements in efficiency of water use, and the integration of new climate risks. Countries in South-East Asia including Thailand need to make water management a top national priority, backed up by major governance changes and investments. In the future water component related drought should include integrated water resources management, water accounting, managed aquifer recharge, alternative wet and dry technologies, direct dry seeding rice, afforestation, reuse of wastewater, rainwater harvesting (Pal and Ghosh, 2018) traditional water management practice.

Energy is key transformation in the future for adaption to drought– Owners need to climate-proof existing hydroelectric and renewable infrastructure, and investors should plan new energy infrastructures, including the use of wind and solar energy, that are more drought resilient. This will provide opportunity to many economic sector, as on average, the benefits outweigh the costs by 4:1(UNESCAP and ASEAN, 2021). Building resilience to drought will require blended public-private approaches that share the costs and benefits.

Land cover and land use change monitoring and mapping provide the trend of landscape development pattern (Doydee, 2020), for example area convert wetland and forest area into urban and tourism site, this zone will increase poputions and consume more water. However, in the future we have to develop our land with environmental friendly approach, to safeguard nature while better support communities. Many of these solutions are also beneficial for drought mitigation and can also help achieve the objective of the United Nations 2030 climate change Agenda for SDGs to keep global warming below 2°C and help the world hit net zero by 2050. This should include integrated approaches for spatial land-use planning, and drought-smart land management and clean energy research.

Natural environment – Nature-based solutions regulate water flows, protect shorelines, cool cities, and complement built infrastructure. Meeting existing political commitments will mean large-scale protection and restoration of nature, and community-driven drought adaptation approaches.

Climate change and climate variability induced drought in the South-East Asian region including Thailand with natural phenomena like El Niño and anthropogenic-disturbance will be the driving force of future droughts, dry conditions. The poor communities with low adaptive capacity and weak recovery tend to experience the severe impacts on livelihoods and daily income. The areas with such conditions are labelled as drought hotspots. Extreme poverty and malnutrition conditions from the agriculture-based households are found in some drought hotspots. More hotspots may be emerging because of climate change, which will require proper intervention and humanitarian support planning by governments to strengthen drought resilience and

[9] https://asean.usmission.gov/innovasean_20160919/ accessed Dec, 2021

minimize drought vulnerabilities in Thailand.

Attention from the governments of the AMS as well as policymakers on drought combatting and adaptation is still very limited. Traditional methods known to be reactive against drought hazards are largely found in most AMS that lack preparedness and planning for drought disasters. In the current agenda of AADMER on disaster management and response, impact and vulnerability assessment, early warning, and preparedness and planning for drought adaptation and mitigation are still missing.

Drought early warning and preparedness as the fundamental tools for taking action on drought adaptation. Three (3) clear tracks of reduce and prevent, prepare and respond, and restore and recover are clearly introduced.

Drought effects reach far beyond water resources; they affect multiple sectors that fundamentally rely on water resources, such as agriculture, forestry, aquaculture and fisheries, river transportation, environment, socio-economics, hydropower energy, infrastructure, tourism and recreation, and human lives can all be impacted by severe or extreme drought. Cross sectoral communication and collaboration nationally and among the ASEAN Member States are necessary for implementing and achieving of ARPA-AD 2021-2025.

In addition, forecast-based financing solutions for early actions supports ex-ante drought risk management. Forecast-based financing which relies on parametric or index-based solutions, like weather or yield index, is being increasingly used to overcome these challenges. These insurance solutions use an index, such as precipitation, evapotranspiration to determine payouts which can be made faster and with less risk than products that are based on indemnity. Prompt payouts mean that farmers do not have to sell their own land and properties to survive and that the need for emergency food aid is reduced. All these advantages should make weather index-based insurance attractive to low-income farmers.

Future losses from drought could put government budgets under increasing stress. Furthermore, following the COVID-19 pandemic, social protection systems in many countries in South-East Asia, will be further strained to cover vulnerable populations. At the same time, international aid is shrinking. In Thailand, for example, the confluence of COVID-19 with droughts, forest fires, PM2.5 and salt-water intrusion, etc. (**Figure 3-2)** are creating a tsunami of challenges for the government.

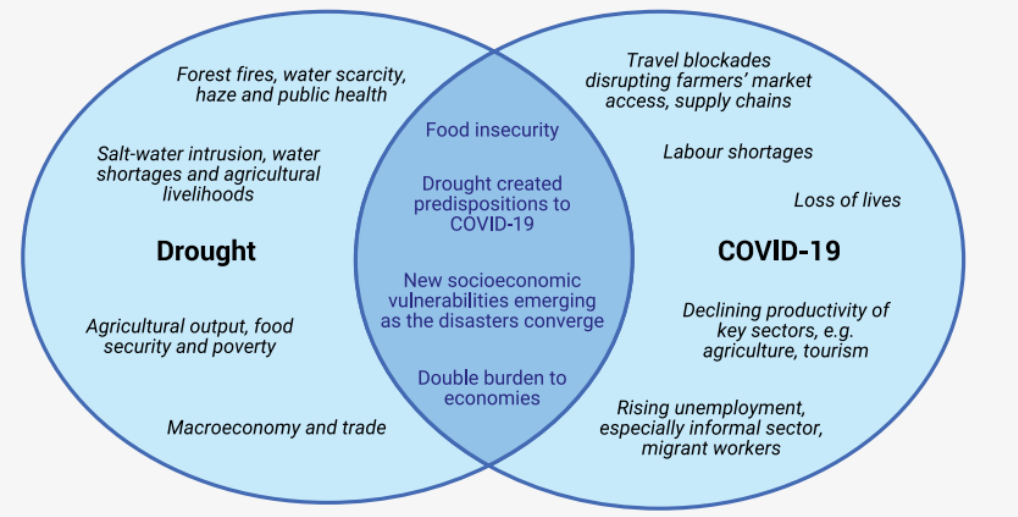

Figure 3-2 Convergence of drought and the COVID-19 pandemic

Source: UNESCAP and ASEAN (2021).

Chapter 4: Action Plan for Implementation of ARPA-AD

4.1 National action plan for implementation of drought adaptation

National plan of action was investigated for implementation of the ARPA-AD at national level which composed of action/sub-action, duration and responsibility department (**Table 4-1**), while their priorities coherent with each action/sub-action will implement along with the ARPA-AD to enhance national capacity and strengthen regional cooperation and collaboration among AMS on drought risk management and adaptation.

Table 4-1 Action plan for implementation of the ARPA-AD (2021-2025) at national level

ARPA-AD Actions and Sub-Actions		Implementation at National Level (Thailand)	Year	Institutions recommended to be involved
Action 1: Risk, impact and vulnerability assessment				
1.1	Develop national drought risk, impact and vulnerability assessment framework and develop detailed national integrated drought management programme by involving all relevant agencies.	Period of drought risk, impact, and vulnerability have been assessed, Thailand still need to develop detailed national integrated drought management programme by involving all relevant agencies.	2022	▪ All relevant agencies
1.2	Conduct a national drought risk, impact and vulnerability assessment every decade (10 years) with experts from relevant agencies or partners.	National drought risk, impact and vulnerability assessment in Thailand should be conducted every ten (10) years by all relevant institutions in collaboration with experts and partners.	2022	▪ DDPM ▪ Research Institutes ▪ Universities ▪ Relevant agencies
1.3	Promote the institutionalisation of sex, age and disability disaggregated data (SADDD) collection for risk, vulnerability and	The implementation of SADDD collection and analysis in Thailand is need to be consolidated and promoted at national	2022 – 2025	▪ DDPM ▪ MSDHS ▪ DSDW

	impact assessments, and incorporation into drought preparedness and planning, prevention, and response and recovery policies.	and sub-national level.		
Action 2: Early warning system, preparedness and planning				
2.2	Enhance national drought early warning system based on the national best practices through the national assessment study and build ground monitoring stations considering hydro meteorological and agricultural parameters.	Improve and enhance current early warning system by building monitoring systems that taken hydro meteorological and agricultural parameters into account.	2022 – 2025	▪ DDPM ▪ TMD ▪ GISTDA ▪ DWR ▪ EGAT ▪ RID ▪ ONWR
2.3	Operate a national drought early warning system - custodian to be identified - with data sharing from and exchanging with the national forecasting systems, in coordination with the AHA Centre, SEA RCC-Network, and the ASMC.	Thailand has developed and operated drought early warning system. Experiences in Thailand may serve as references for the future development/ enhancement of early warning systems at the regional level.	2022 – 2025	▪ DDPM ▪ TMD ▪ HII
Action 3: Adaptation actions				
3.1	Develop recommended regional drought adaptation policies and mitigation strategies for identified drought risks and vulnerabilities as a guide for ASEAN Member States' consideration.	Thailand should develop and propose recommendations for regional drought adaptation policies and mitigation strategies based on experience and assessment result in Thailand.	2022 – 2023	▪ All relevant agencies
3.2	Conduct national study to assess the adaptive capacity and recovery ability of the vulnerable groups.	Conduct a national study assessing the adaptive capacity and recovery ability of	2023 – 2024	▪ DDPM ▪ MSDHS ▪ Experts

		the vulnerable groups in Thailand.		
Action 4: Response and recovery				
4.2	Develop a national technical team comprising national focal points from relevant agencies to evaluate post-drought economic, social and technical damage by the severe drought hazards at the national and subnational levels with comprehensive reports.	Create a national team consisting of all relevant agencies that work not only in the drought event to ensure the integration and sustainability of drought disaster management programmes. Compile a comprehensive report to evaluate post drought economic, social and technical damage by the severe drought hazards at the national and sub national levels.	2023 – 2025	▪ All relevant agencies
Action 7: Capacity-building/enhancement				
7.2	Initiate six (6)-month on the-job training programmes to enable young professionals from ASEAN Member States to learn and exchange their knowledge and experiences on drought management.	Conduct six (6)-month training programmes on drought management in Thailand to increase the capacity of young professionals.	2023 – 2025	▪ DDPM ▪ Relevant agencies ▪ Universities
7.3	Develop a national capacity-building programme on data collection (including disaggregated data) and analysis, quality assurance/quality control (QA/QC) and data dissemination to ensure high-quality and reliable data collection in a timely manner on socio	Enhance the capacity of stakeholders through education, socialization, training and establishment of forum group. Improve the existing data platform in terms of socio-economic indicators of drought, its impact	2024 – 2025	▪ DDPM ▪ DEQP ▪ Relevant agencies

	economic indicators of drought, its impacts and mitigation measures.	and mitigation measures.		
Action 8: Data sharing and dissemination				
8.3	Develop national bottom-up data collection and reporting system with regular sharing of national reports with the regional level on drought risks and the water scarcity situation from different scales and sectors through mobile phones.	Integrating data on drought disasters in the Disaster Data in Thailand which is currently being developed. Connecting disaster data with the national water information system that informs the water scarcity situation. Create a mobile application of Thailand disaster data to facilitate data collection and reporting system.	2024 – 2025	▪ DDPM ▪ NSO ▪ GISTDA ▪ HII ▪ Relevant agencies
8.4	Establish a robust system and communication network at national and subnational levels to transfer and disseminate information on drought forecasting and early warning – including drought emergency situations and trends of water shortages – to local and vulnerable communities and are accessible for local governments.	Improve the existing communication system to transfer and disseminate information on drought forecasting and early warning, especially to local and vulnerable communities. Including information on trends of water shortages, to information on drought emergency situations.	2024 – 2025	▪ DDPM ▪ HII ▪ TMD ▪ GISTDA ▪ Media
Action 9: Monitoring and evaluation				
9.1	Review and amend all existing drought management strategies and mitigation policies from	Review and amend the drought management strategies and policies from relevant	2022 – 2025	▪ All relevant agencies

	different agencies to ensure a consistent and coherent implementation of national action plans on drought adaptation.	agencies in Thailand, then, the strategies and policies are consistent and coherent with all national action plans in the ARPA-AD.		

4.2 Guideline for national development and implementation for drought adaptation

In past two (2) decades, Thailand has received less precipitation while temperature increasing, as rainfall decreases, urban expansion with higher consumption of water by the agriculture sector, industrial services, thus, increased demand of water in the country. As climate change causes less precipitation in Thailand, affects long term water levels by lowering river volume and underground water. Therefore, the drought risk in Thailand is becoming more frequent and more severe. Drought will cascade affect the various sector as mentioned in previous Chapter for example water for consumption by households and industry.

The Royal Thai Government aims to improve quality of life vulnerability groups that affected from drought disaster. This guideline reviewed from the Ministry of Interior through the Department of Disaster Prevention and Mitigation (DDPM) described guideline to cope with drought situation. In general, DDPM and its provincial offices prepared for the drought season by adopting the concept of public-private partnership in water management and an irrigation plan for the dry season. Example of drought adaptation guideline include:

4.2.1 Preparedness

- Conduct field data collection and develop a water source database: DDPM provincial offices will survey and maintain a record of existing water containment equipment in drought-risk areas. They will also update the database of high-risk areas in order to develop a plan for water irrigation at the provincial level. Moreover, there will be water distribution sites designated for household consumption throughout the province to ensure water accessibility.
- Develop a drought prevention and mitigation action plan, to systematically manage the effects of the drought with specific measure such as a water saving campaign, crime prevention, promoting good health, drought- related epidemic prevention plan, and income generation activities for affected populations.
- Preparation of resources to assist the affected population, including pre-positioning personnel, equipment, water trucks, and relief materials to alleviate the suffering of drought affected population in a timely matter.

4.2.2 Public Awareness

- Promote awareness and perform capacity building about the drought, by providing regular drought situation updates, including a drought mitigation plan, water irrigation plan, and a drought relief plan for affected population. This is to ensure that people in drought-risk communities are aware of the problems and are included in the drought prevention and mitigation mechanism.
- Engage communities in the drought relief efforts, by promoting water-saving methods, as well as encouraging households and communities to conserve water using water storage vessels. Farmers are encouraged to plant less water-intensive crops during the coming drought season.
- Supporting the community to set up their own rules and regulations for water rationing with support from the government and departments. Certain guideline are implemented in drought-risk areas such as monitoring of illegal water pumping and encouraging peaceful methods of conflict resolution (i.e. negotiation and mediation), when drought-related conflicts arise. Government and officers in charge are tasked respond to raise awareness about the drought to prevent raising tension among affected populations.

4.2.3 Relief and recovery

- The priority for water rationing is at the household level. DDPM will send water trucks to drought-affected villages. This will ensure access to water throughout the drought season.
- To ensure the effective utilization of water reserves, coordination will be strengthened between related agencies involved in producing artificial rain, when conditions allow, and those which utilize underground water sources.

These are the primary guideline to be implemented during the drought season.

In addition, DDPM plans to pump water from distant reservoirs to water purification plants in affected areas. The government will implement guideline to generate income for farmers in the drought-affected areas such as vocation training and community projects. Emergency relief funds to aids disaster victims will be activated according to the relevant laws and regulations, to aid people affected by drought.

DDPM, Thailand as ACDM chair this year, in cooperation with related agencies, will effectively implement the above guideline to prevent, mitigate, and alleviate the drought during the upcoming dry season. The focus is on effective water usage, as well as in partnering and communicating with those communities who are in the affected area. The goal is to alleviate the effects of drought and ensure sufficient water for consumption as directed by government policies.

Moreover, the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) Work Programme, 2021-2025, the implementation of ARPA-AD will be guided by the following principles, while taking into account national circumstances, and being consistent with meeting domestic laws as well as international obligations and commitments:

1. **Institutionalization, localisation and communication**. To implement multi-sectoral strategic actions on drought adaptation, mitigation, and emergency response at both national and subnational levels of AMS and encourage communication exchange among network and all stakeholders in the ASEAN Community;

2. **Finance and resource mobilization**. Exploit all available resources, both in-house and external ones, in a complementary fashion that supports the full implementation of ARPA-AD and its components;

3. **Gender and social inclusion**. Consider a whole-of-society approach in disaster management by recognizing the key roles and unique needs of those most affected during drought periods, including women, children, youths, the elderly, the poor and people with disabilities as well as other vulnerable groups;

4. **Multi-hazards approach**. Enhance regional capacities to assess, mitigate, prepare for, and respond to a wider range of national hazards and disaster risks beyond drought in the region;

5. **Innovation**. Enhance the efficiency and effectiveness of ASEAN's drought adaptation and emergency response mechanism through technological advancement and science-based approaches for better drought mitigation and adaptation;

6. **Partnership**. Strengthen and develop stronger multi-stakeholder partnerships and network among AMS and with regional and international institutes and organizations for exchanging technical experience, including drought mitigation planning, adaptation, response, and drought monitoring and early warning systems, to support the implementation of ARPA-AD, 2021-2025;

7. **Synergy**. Coordination among multi-sectoral bodies of AMS and ASEAN implementing agencies as well as ASEAN partner and network organizations, in order to effectively implement ARPA-AD and to ensure that the implementation of strategic actions is well-aligned with the global frameworks on disaster management.

Chapter 5: Conclusion

Drought risk affects to agro-food, water, energy, land and natural environment and lately destruct human life and properties. Whenever, it happened then spent money, government provide compensation payout for quick resolve livelihood for victims. Drought frequency, severity, and magnitude have increased in Thailand, particularly over the past two (2) decades. Prolonged and severe droughts adversely impact agricultural productivity, threatening food security and livelihood of rural households and poor communities.

Drought impacts occur across multiple sectors, the effectiveness and efficiency of ARPA-AD implementation will rely largely on the coordination role of the ASEAN sectoral bodies as well as the national implementing agencies, which will need to communicate and cooperate very closely with each other when implementing regional and national sub-actions on adaptation to drought.

Drought impact and vulnerability assessment will be a joint responsibility of all stakeholders from impacted sectors to determine the main impacts, the basal causes, magnitude and severity, risk and vulnerability levels as well as evaluate the economic losses of each individual sector.

A promising mechanism is building a robust and active coordination network comprising regional and national working groups on drought adaptation and mitigation to effectively implement the national action plans on drought adaptation, with participation by all involved ASEAN sectoral bodies and government agencies.

The national case study for adaptation to drought presents a set of drought management interventions for policy makers at the national level. This national plan of action identifies nine (9) actions at national levels for drought risk, impact, and vulnerability assessment; drought early warning system and preparedness and planning; adaptation actions; and response and recovery from drought disaster.

The actions are complemented by thirteen (13) sub-actions. There are twenty-three (23) institutes involved in the implementation. National policy, human resources, organizations, funding, partnership for addressing drought adaptation need to be improved for sustainable management of drought. This national implementation plan covering 2021-2025.

List of References

Conway, G.R. 1986. Agroecosystem analysis for research and development. Centre for Environmental Technology, imperial College of Science and Technology, London. United Kingdom. 112 p.

Doydee, P. 2017. Rural Aquaculture and Conservation Agriculture Practices as Sufficiency Economy Philosophy for Community Resilience in Lower Mekong Basin. Policy Brief. ASEAN-U.S. 2016/2017 Science and Technology. ASEAN secretariat, Jakarta, Indonesia. 1-5.

Doydee, P. 2020. Change Detection of Land Cover and Land Use Using Remote Sensing and GIS Techniques in Nong Han Wetland in Thailand. In: Buot, I.E. (eds) Methodologies Supportive of Sustainable Development in Agriculture and Natural Resources Management: Selected Cased in Southeast Asia. SEARCA and UPLB. 193-202.

EM-DAT, 2019. M-DAT: the OFDA/CRED international disaster database. Retrieved 2019. URL. https://www.emdat.be/emdat_db/.

Franzetti F., Pezzoli A. and Bagliani M. 2017. Rethinking Water Resources Management Under a Climate Change Perspective: From National to Local Level. The Case of Thailand. In: Tiepolo M., Pezzoli A., Tarchiani V. (eds) Renewing Local Planning to Face Climate Change in the Tropics. Green Energy and Technology. Springer, Cham. https://doi.org/10.1007/978-3-319-59096-7_

Franzetti, F. 2016. Towards the development of a drought management framework: Challenges and opportunities for Thailand. Master's thesis, University of Turin.

German Cooperation. 2019. Thailand, Australia and Germany pool their efforts to strengthen data management and M&E of adaptation in Thailand's water sector. Available at https://www.thaigerman-cooperation.info/en_US/fighting-against-climate-change-thailand-australia-andgermany-pool-their-efforts-to-strengthen-data-management-and-me-of-adaptation-inthailands-water-sector/

HII. 2021. Drought. Hydro Informatics Modelling System Section. Drought Bulletin, Jan 2021. Vol2. Issue 1. 2 pages.

Khadka, D., Babel, M. S., Shrestha, S., Virdis, S. G. P. and Collins, M. 2021. Multivariate and multi-temporal analysis of meteorological drought in the northeast of Thailand. Weather and Climate Extremes, 34. https://doi.org/10.1016/j.wace.2021.100399

Monkham, T., Jongdee, B., Pantuwan, G., Mitchell, J. H., Sanitchon, J. and Fukai, S. 2018. On-farm multi-location evaluation of occurrence of drought types and rice genotypes selected from controlled- water on-station experiments in Northeast Thailand. Field Crops Research, 220(June 2016), 27–36. https://doi.org/10.1016/j.fcr.2017.05.004

NDPMC-National Disaster Prevention and Mitigation Committee. 2009. National disaster prevention and mitigation plan 2010–2014.

Pak-Uthai, S. and Faysse, N. 2018. The risk of second-best adaptive measures: Farmers facing drought in Thailand. *International Journal of Disaster Risk Reduction*, *28*(August 2017), 711–719. https://doi.org/10.1016/j.ijdrr.2018.01.032

Pal, I. and T. Ghosh. 2018. Natural Hazards Management in Asia. Sage Publication. New Delhi, India. 382 p.

Pandey, S., Bhandari, H., Hardy, B. (Eds.), 2007. Economic Costs of Drought and Rice Farmers' Coping Mechanisms: a Cross-Country Comparative Analysis. Los Banos (Philippines). International Rice Research Institute. 203 p.

T-PLAT. 2022. Thailand Adaptation Information Platform. http://t-plat.deqp.go.th/en/impact_0/impact_4_en/

Thanyalakmetha, S. 2020. Thailand Country Report 2020. Visiting researcher program (FY 2020B). Asian disaster reduction center (ADRC). Department of Disaster Prevention and Mitigation (DDMP). 9 p.

UNDRR. 2020. Disaster Risk Reduction in Thailand: Status Report 2020. Bangkok, Thailand, United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific. 38 p.

UNDRR. 2020. Disaster Risk Reduction in Thailand: Status Report 2020. Bangkok, Thailand, United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific. 38 p.

UNDRR. 2021. Sendai Framework Monitor (SFM): Sex, Age and Disability Data (SADDD). UN Office for Disaster Risk Reduction. 4 pages.

UNESCAPE. 2020. Adaptation and resilience to drought: From know how to do how. A guidebook for the practitioners. [Based on the case studies from South East Asia]. 51 pages

UNESCAP and ASEAN. 2021. *Ready for the Dry Years*. Building resilience to drought in South-East Asia (2nd eds). United Nations-Economic and Social Commission for Asia and the Pacific. 126 p.

UNESCAP. 2021. ASEAN regional plan of action for adaptation to drought 2021-2025. The Economic and Social Commission for Asia and the Pacific (ESCAP). 51 p.

UNESCAP. 2021. Resilience in a Riskier World, Managing systemic risks from biological and other natural hazards. The Asia-Pacific Disaster Report 2021. The Economic and Social Commission for Asia and the Pacific (ESCAP). 95 p.

UNISDR. 2014. Progress and challenges in disaster risk reduction: A contribution towards the development of policy indicators for the post-2015 framework on disaster risk reduction. Geneva: United Nations Publication.

Venkatappa, M. and Sasaki, N. 2021. Datasets of drought and flood impact on croplands in Southeast Asia from 1980 to 2019. *Data in Brief*, *38*, 107406. https://doi.org/10.1016/j.dib.2021.107406

Wichitarapongsakun, P., Sarin, C., Klomjek, P. and Chuenchooklin, S., 2016. Rainfall prediction and meteorological drought analysis in the Sakae Krang River basin of Thailand. Agric. Nat. Resour. 50, 490–498. https://doi.org/10.1016/j.anres.2016.05.003.

Wijitkosum, S. 2021. Factor influencing land degradation sensitivity and desertification in a drought prone watershed in Thailand. *International Soil and Water Conservation Research*, *9*(2), 217–228. https://doi.org/10.1016/j.iswcr.2020.10.005

Annex 1: List of Participants

List of participants attended national workshop host by ACDM-chair, DDPM, Thailand on ***"Thailand case study in drought risk management"*** on February 10, 2022 using Virtual Microsoft Team meeting supported by UNESCAP and ASEAN Secretariat

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Annex 2: National laws and regulations, programmes and disaster risk governance of Thailand in major sectors and links to international agreements

Major sectors	**National laws, regulations and Policies/programmes with potential links to Sendai Framework for DRR**	**National laws, regulations and Policies/programmes with potential links to SDGs**	**National laws, regulations and Policies/programmes with potential links to the Paris Agreement**
National Development	National Disaster Risk Management Plan (2015) being reviewed and updated as of 2020	20-year National Strategy (2018-2037) 12th National Economic and Social Development Plan (2017– 2021)	Climate Change Master Plan (2015-2050)
Agriculture	The National Water Resources Management Strategies (2015-2026).	Agricultural Sector Development Plan (aligned with National Economic and Social Development Plan (2017– 2021)	Climate Change Strategy for Agriculture Sector (2017-2021) Integrating Agriculture in National Adaptation Plan Thailand (2016-2018)
Disaster and Climate Risk Reduction	National Disaster Risk Management Plan (2015) being reviewed and updated as of 2020	12th National Economic and Social Development Plan (2017– 2021)	The National Water Resources Management Strategies (2015-2026). Policy and Plan for Enhancement and Conservation of National Environmental Quality (2017-2036)
Vulnerability Reduction	Thailand Healthy Lifestyle Strategic Plan (2011–2020) National Adaptation Plan (2018)	Strategic Framework on Food Security (2013–2016) National Plan for Older Persons (2002-2021)	Nationally Determined Contribution Roadmap on Mitigation 2021 – 2030

		The Women Development Strategy (2017-2021)	National Adaptation Plan (2018) 20-year Energy Efficiency Development Plan (2011-2030)
Urban drought management	Bangkok resilience strategy (2017) Bangkok Comprehensive Plan (2013)	Bangkok Comprehensive Master Plan (2014-2018) Master Plan on Sewage and Wastewater Management (2017–2026)	National Environmental Health Strategic Plan (2017–2021)

Source: modified after UNDRR (2020).

Annex 3: Ministry, department and their responsibilities involved in water resources and drought risk management in Thailand

Ministry	Department	Responsibilities
Ministry of Natural Resources and Environment (MNRE)	Department of Water Resources (DWR)	Water resources policy, plans and management outside irrigated areas. Hosted the Water Crisis Prevention Centre, in charge proposing and coordinating action plans to solve water crises, drought in disaster and prone area
	Office of the National Water Resources (ONWR)	Proposing policies and formulating strategic plans, master plans and measures in national water resources management and coordinating for implementation. Mitigating the drought and improve water reservoir efficiency, and ensure the availability of clean water for all people.
	Department of Groundwater Resources (DGR)	Groundwater resources policy, plans and management. Implement large-scale groundwater to supply water in drought prone areas nationwide
	Office of Natural Resources and Environmental Policy Planning (ONEP)	Natural resources and environmental conservation policy, plans and management. National focal point for climate change and drought management
	Department of Environmental Quality Promotion (DEQP)	promote public awareness and public participation in conservation of natural resources and the environment and in formulation of environmental policy and planning
Ministry of Agriculture and Cooperatives (MoAC)	Royal Irrigation Department (RID)	Water resources management and allocation for irrigation of agricultural areas, dams and storage reservoirs under its commanded areas. Reliefs agricultural drought with irrigation water
	Department of Royal Rainmaking and Agricultural Aviation (DRRAA)	Research and development rainmaking technology to enhance efficiency on weather modification and atmospheric water management for drought disaster

		reduction as the result of global climate change
	Land Development Department (LDD)	Land use, management and research. National focal point of United Nations Convention to Combat Desertification
	Department of Agriculture (DOA)	Crop research and development, direct rice seeding, drought tolerant species
	Department of Agricultural Extension (DOAE)	Agricultural production and promotion, agricultural crop types and extension
Ministry of Interior (MoI)	Department of Disaster Prevention and Mitigation (DDPM)	Policy-making body and state agency for disaster management including drought risk reduction
	National Disaster Warning Centre (NDWC)	Monitor and control over warning towers. Disseminates warnings to line agencies
	Metropolitan / Provincial Waterworks Authorities	State-owned companies in charge of water supply provision and distribution respectively in Bangkok and at provincial level
	Department of Local Administration (DLA)	Strengthen Local Administrative Organization support community with Sufficiency Economy Philosophy for their livelihood. Involve and working with DDPM at local level
Ministry of Digital Economy and Society (MDES)	Thai Meteorological Department (TMD)	Weather and climate forecasting, drought forecasting, drought risk mapping
	National Statistical Office (NSO)	Manage statistics and information to be of integrated and standardized so as to develop and support country's competitiveness. Conduct Census or Sample Survey or facilitate in conducting census/survey so as to obtain national statistical information database on socio-economic and information including SADDD.
Ministry of Higher Education, Science, Research and Innovation (MHESI)	Geo Informatics Space and Technology Development Agency (GISTDA)	Provides satellite remote sensing and GIS data to public and private sector, Drought hazard monitoring and mapping
	Hydro and Agro Informatics Institute (HAII)	Research, develop and apply science and technologic for agricultural and water resources

		management, drought management
Ministry of Energy (MoE)	Electricity Generation Authority of Thailand (EGAT)	State-owned utility responsible electric power generation and transmission. In charge of dams/reservoirs operations and maintenance relevant to drought
Ministry of Social Development and Human Security (MSDHS)	Department of Social Development and Welfare (DSDW)	Organize and strengthened social development and social welfare which is implemented on the basis of people participation and geared towards the goal of developing a quality society, gender equitability and accelerated Rural development involving with employment and income generation
	Department of Older Persons (DOP)	Develop plans, measures and innovations including integrate tasks that promote and protect elder rights and well-being. Prepare society for well-being in old age. Protect and promote elder rights in access of social welfare system. Promote networking organizations in order to develop elder tasks

Source: modified after Franzetti et al (2017) and national workshop on Thailand case study in drought risk management on February 10, 2022

Kasetsart University

Puvadol DOYDEE <puvadol.d@ku.th>

Attention: Submission of national report on DA (THAI)

Nguyen Anh Son <nguyen.anhson@asean.org> Wed, Jun 22, 2022 at 9:31 AM
To: Puvadol DOYDEE <puvadol.d@ku.th>

Dear Dr. Puvadol,

Please be informed that we received no inputs from ACDM Thailand, so the report has been finalized as attached.

Kind regards,

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[Quoted text hidden]

Final TH Case Study_Capacity building for Drought Adaptation.pdf
1094K

FOREWORD

The Southeast Asia region remains vulnerable to intense droughts that are occurring with greater frequency than before. The slow-onset nature of drought provides a significant opportunity to prepare for and mitigate the effects of these events. The *Ready for the Dry Years* publication series, jointly produced by ASEAN and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) , builds a clear case for a paradigm shift towards more proactive drought management across Southeast Asia based on the leadership and innovation of ASEAN Member States.

Following the ASEAN Declaration on the Strengthening of Adaptation to Drought, adopted at the 37th ASEAN Summit on 13 November 2020, the ASEAN supported by ESCAP has developed the *ASEAN Regional Plan of Action for Adaptation to Drought* (ARPA-AD). The ARPA-AD advocates for policies along three tracks, namely (i) reduce and prevent; (ii) prepare and respond; and (iii) restore and recover. To this end the ARPA-AD provides 9 actions, complemented by 26 sub-actions offering clear pathways to translate strategic ambitions into solutions that can help prepare for, mitigate, and adapt to droughts.

Moving forward, the ASEAN, will work to implement the ARPA-AD as an integral part of building the capacity of ASEAN Member States for climate adaptation and disaster resilience, in collaboration with ESCAP and other potential partners.

The Case Studies on Capacity Building for Drought Adaptation undertaken in Lao PDR, Indonesia, and Thailand which aims to support governments to design national drought policies and strategies to mainstream drought risks into national development policies and strategies. The studies outline the institutional and policy landscape for implementation of ARPA-AD, which include overviews of drought risk profile along with national laws, legislations and programs pertaining to drought risk management. The studies also review major challenges and constraints in drought risk management in the countries and set out action plans for drought adaptation.

We hope this case study focusing on Thailand offers useful guidance for national actions towards achieving sustainable management of drought and the successful implementation of the *ASEAN Regional Plan of Action for Adaptation to Drought*.

KAVEH ZAHEDI

Deputy Executive Secretary
United Nations Economic and Social Commission for Asia and the Pacific

BOONTHAM LERTSUKEKASEM

Director-General,
Department of Disaster Prevention and Mitigation, Ministry of Interior of the Kingdom of Thailand