

Drought conditions and management strategies in Thailand

Background :

It is considered that Thailand has sufficient water sources and high volume of water catchment. In the past, most of the water problem during the dry season is happening as a normal cycle, however, the climate change causes less precipitation. It affects to long term period of the river level volume and underground water. Therefore, the drought problem in Thailand is more frequent and severe combined with increasing of water requirement, causing the effects to normal livelihood and destroying ecology and environment system.

1. Thailand Climate and Geography :

Thailand is composed of 76 provinces and divided into 4 regions namely; north (17 provinces), central (25 provinces), north east (20 provinces), south (14 provinces) and Bangkok, 63 million population in Thailand. There are 3 seasons as the follows;

1) Summer : It starts from mid of February to mid of May which is considered as changed of north east monsoon to south east monsoon. Sometimes, warm air meets cold air from China which covered the upper part will cause thunderstorm or summer storm with hails.

2) Rainy Season : It starts from mid of May after south east monsoon covers Thailand and low pressure, causing a lot of precipitation. Normally, this low pressure covers the down south during May , It occasionally moves to the north until June which cease the rainfall around 1 - 2 weeks.

3) Winter : It begins from October to February.

2. Meteorological Condition

From the Thai Meteorological Department database for 15 years since 1998 - 2012, the amount of the precipitation rate is fine. The average annually least precipitation rate is in the north and the central is 1,295.5 millimeters and 1,204.6 millimeter respectively. Whereas the average rainfall in each part are as follow; 1,486.1 millimeter in the northeast, 2,213.7 millimeter, 2016.8 millimeters and 2,538 millimeters in the west south.

3. Water Resources and Water Requirement

Water resources are composed of natural water resources and man - made resources such large project (dam), middle project (reservoir), small project (dike), water supplies and wells.

There are 25 river basins in Thailand which is the total amount of 199,627 cubic meters; it is divided into 2 parts; 168,167 cubic meters (84.241 %) in rainy season and 31,460 cubic meters (15.167 %).

Table 1 Annually average quantity of water in basins of the river in Thailand.

: cubic - metres

Part	Rainy Season	Drought Season
North	35,791.2	7,633.5
North-East	41,432.6	7,607.5
Middle	16,139.6	5,510.6
East	14,992.2	2,008.4
South	59,811.2	8,700.7
Total	168,166.8	31,450.7

Resources : Draft of Master plan about drought in Thailand.

The priorities of water requirement are as follows;

1. Agriculture Sector : It is utilized for the significant crops and livestock such as rice, potato, rubber, palm tree, sugar cane, corn, cow, pig, chicken and fisheries
2. Water for Consumption and Utilization
3. Water for Tourism Industry
4. Water for Industrial sector such as frozen food, chemical industry, material coating industry

Due to climate change situation caused severe affected to the agricultural sector especially farmers, the shorter period of rainfall means long period of drought. The less amount of rainfall in the upper north is also has an effect on a smaller amount of water volume in the dams and reservoirs throughout the country. It is inadequate water supply for consumption and agriculture segment particularly water sources out of irrigated areas. The consequence effect is drought and lack of water in many areas. From the statistics during 2007 – 2013, in average 59 provinces, 14.9 millions of people 614,680 acres and loss value the amount of 23.20 millions affected by drought.

Table 2 Statistic of drought between 2007 to 2013

Year	Area of drought (Province)	Vulnerability		
		People	Agricultural area (acre)	Value (US.\$)
2007	66	16,754,980	540,047.2	6,109,203.1
2008	61	13,298,895	209,999.6	3,200,888.5
2009	62	17,353,358	237,773.6	3,337,853.2
2010	64	15,740,824	686,741.2	43,598,997.7
2011	55	16,560,561	324,672.0	4,062,376.2
2012	52	15,234,597	594,604.8	12,297,552.2
2013	58	9,066,185	1,708,918.8	89,802,429.3

Resources : Department of Disaster Prevention and Mitigation

Drought monitoring and early warning systems :

1. Drought problem and affected areas

Drought is normally happened because rain delay in water shed areas for long period together with the expansion of community areas, agriculture farmland inside and outside irrigated areas and economic activities. The increasing of requirement of flesh water during dry season, while the capacity of water source development projects such as large, medium and small reservoir or natural water source is not sufficient for agriculture, consumption and industry. The following examples are drought in each region;

1.1 Northeastern Region (Mekong Chi River Basin) The geography and water source in this region has large amount of water volume, however, the water source development is low level. Therefore, the region is lacking water source during rainy season and could not drain during dry season. Additionally, the decentralization authority to local administration organization of water supply management at

community, underground water and irrigation system, shortage of official in charge and budget for maintenance.

1.2 North Region (Ping, Wang, Yom, Nan River Basin) The water is insufficient and drought is directly originated from long delay of rain fall affected to outside irrigated areas. In general the farmers cultivate their farmland during rainy season except the farmland in water shed area or small scale irrigated areas. The problem of water insufficient originates from outside irrigated areas or even the irrigated areas, there are still chances of drought because of several water consumption activities and high volume of cultivation.

1.3 Central Region (Chao Phraya River Basin) This river basin has many paddy fields and cultivation areas more than the capacity of water sources together with the utilization as industrial estate or residential areas. Some irrigated areas are utilized for paddy fields at least twice a year, so the agencies concerned have tried to utilize and develop underground water which is still not sufficient.

1.4 Western Region (Bang Pa kong River and Prachin Buri River Basin) There are two causes of insufficient water ; 1. consumption and 2. plant cultivation. In the branch of Bang Pa Kong River Basin and branch of Klong Ta Lad River Basin are the prone areas of risk for insufficient water for consumption whereas the branch of Klong Ta Lad river basin is prone area of risk of lack of water for plant cultivation.

Besides of natural phenomena is the main cause of drought, the environmental changes and imbalance of ecology system such as deforest is also the significant factor for drought. There are a lot of water in the water source during rainy season and drought in the dry season. The accumulated sediments caused ineffective water catchment system.

1.5 South Due to this region does not develop large scale water source project which are not enough for water catchment system during dry season. Normally there are only small and medium water source development project. Most of the water for consumption problems occurs during March - April.

2. Definition of Drought

It is defines as the lacking of drinking water, water for consumption, water for plantation in some areas for long period causing losses and large affects to communities. The causes may be derived from natural phenomenal or man- made disaster.

3. Affected Factors to drought severity

The drought severity factors depend on humidity, soil moisture, length of drought and drought expanded areas. (Pranee and Smith 2009 and Thirawong 2010) The additional explanation regarding the average annual precipitation rate and humidity are significant factors for drought. The more precipitation and humidity, the less drought. Types of soil are also reduce drought such as loose soil and marl. Besides, the irrigated areas are less affected by drought. The GIS is also design by using overlay and spatial analysis. Drought risk prone areas divided into 4 levels; most high risk, moderate, risky and least risk. The related factors of drought are as follows;

- 1) Average annual precipitation rate
- 2) Irrigated areas and water sources
- 3) Cover cropping
- 4) Drainage Soil
- 5) Land Using
- 6) Density of river basin and branches
- 7) Drought Statistics

4. Criteria and Analysis System

From the 7 above mentioned factors are analyzed for drought hazard mapping under the GIS system and weighting under the following rating;

Most High Risk : more than 80

Moderate : 56-80

Risky : 30-55

Least risk : less than 30

5. Drought affected areas

On October 2012 - May 20 2013, there were 56 provinces, 588 districts, 3,958 sub-districts, 37,820 villages affected by drought ; 20 provinces in the northeast, 18 provinces in the north, 7 provinces in the south and east and 4 provinces in the central.

Source : Department of Disaster Prevention and Mitigation, Ministry of Interior

6. Drought Mitigation and Preparedness

6.1 Conduct Drought Risk Assessment : The main agencies concerned such as Thai Meteorological Department, Department of Royal Irrigation, Department of Land Development and Department of Agricultural Extension, Department of Water Resources, Department of Groundwater Resources, Department of Disaster prevention and Mitigation, Provincial Office, District Office, Local Administration Authority and Bangkok Metropolitan Authority have assessed and analyzed risk factors and possibilities of drought that will affect to the public properties and environment in order to resolve and acquire proper measures regarding drought.

6.2 Update Drought Database and Hazard Mapping : Department of Water Resource, Department of Underground Water Resource, Department of Forest, Department of Natural Parks, Wildlife and Plant Conservation, Department of Disaster Prevention and Mitigation, Department of Royal Irrigation, Department of Land Development, Department of Agricultural Extension, Department of Groundwater Resource, Thai Meteorological Department, Provincial Office, District Office, Local Administration Authority and Bangkok Metropolitan Authority have verified, updated, prepared drought hazard mapping of drought and prepared water sources map.

6.3 Mobilize human Resource and equipment for drought : All main relevant agencies such Department of Disaster Prevention and Mitigation, Thai Meteorological Department, GISTDA, Department of Royal Irrigation, Department of Land Development, Department of Agricultural Extension, Department of Groundwater Resource, Thai Meteorological Department, Provincial Office, District Office, Local Administration Authority and Bangkok Metropolitan Authority will mobilize human resources and equipment during drought.

6.4 Develop Drought Database and GIS System : All main relevant agencies such Department of Disaster Prevention and Mitigation, Thai Meteorological Department, GISTDA, Department of Royal Irrigation, Department of Land Development, Department of Agricultural Extension, Department of Groundwater Resource, Thai Meteorological Department, Provincial Office, District Office, Local Administration Authority and Bangkok Metropolitan Authority will develop drought database system and link it to each other.

6.5 Develop Drought Monitoring and forecasting System : The main relevant agencies such the Permanent Secretary Office of ICT, Department of Disaster Prevention and Mitigation, Department of Royal Irrigation, Department of Agricultural Extension, Department of Land Development, Department of Public Relations,

Provincial Office, District Office, Local Administration Authority and Bangkok Metropolitan Authority will develop drought monitoring and forecasting system.

6.6 Promote and Raise Public Awareness : The Permanent Secretary Office of Ministry of Education, and other relevant agencies concerned will promote, release, create public awareness regarding the drought situation to the students, youth and people.

6.7 Arrange Lesson Learned : All relevant agencies will gather all lesson learned in the past and the important measures for drought prevention in order to have well preparation regarding drought management in the future.

After Drought

There are 3 measures after drought occur as the follows;

1. Survey and Prepare List of Victim: After drought, the agencies will survey, prepare list of victim, collect loss damages and issue loss certificate for victim compensation.
2. Conduct Livelihood and Occupation Rehabilitation : There are several agencies concerned such as the Permanent Secretary of Ministry of Labor, the Permanent Secretary of Ministry of Public Health, the Permanent Secretary of Ministry of Agriculture and Cooperatives, the Permanent Secretary of Ministry of Human Development and Social Security, Provincial Office, District Office and BMA will conduct livelihood and occupational rehabilitation.
3. Conduct Initial Rehabilitation : After disaster the local administration authorities will provide initial assistance under their budget, in case of the large scale disaster and beyond their authorities they will request the compensation under Ministry of Finance's regulation.

Vulnerability assessment :

The main cause of drought is low level of water source in the reservoirs which will effect to agricultural sector and water for consumption such water supply in household and industry sector.

1. Agricultural Sector

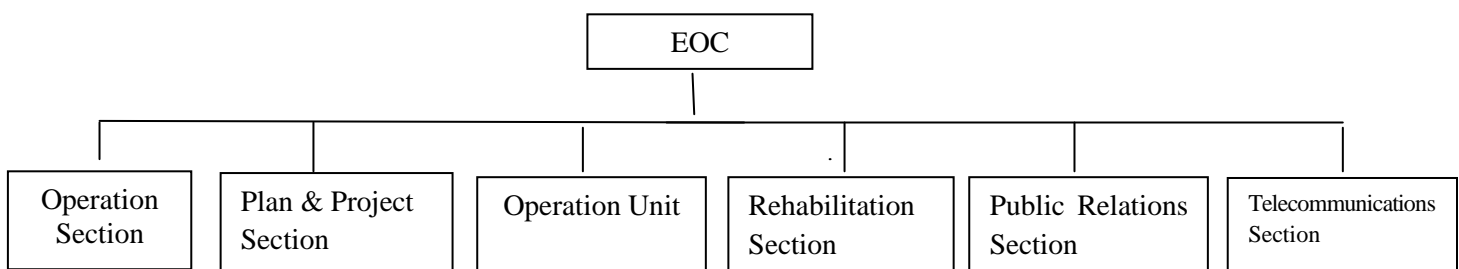
The paddy filed in Thailand is considered main land using as 70 %, farm crops 20 % and other 10 %. Most drought always happens in the northeast especially outside irrigated area around 3.28 million rai. The vulnerable people are farmers which often affect by drought.

2. Water for Consumption

Most of problem is often occur in the rural areas which could not have water supply system such as mountainous or island areas (approx 20 %) Therefore, the replacement water supply system is prepared by small water sources such as dike, dam, reservoir and underground water. The affected group is farmer family in remote areas.

Emergency relief and drought response :

Chart 1 : Structure of The Provincial Emergency Operation Center (EOC)



Resources : Department of Disaster Prevention and Mitigation

The Provincial Emergency Operation Center (EOC) which chaired by the provincial governor will command all relevant agencies at the provincial, district and local administration authority as the follows ; (Chart 1-2)

1. Provide Public Relations and update drought situation of water saving measures for agricultural sector and consumption.
2. Mobilize Emergency Response Team for providing assistance and surveying initial damage assessment
3. Support and mobilize Tools& Equipment such as water pumps, water trucks and food for cattle.
4. Request assistance from the other government sectors such as artificial rain for farmer, water container.
5. Survey initial damages and provide victim compensation budget, in case it is beyond the capacity of the provincial level it will provide support under Ministry of Finance's Regulation

Practices to alleviate drought impacts :

The Water Management System for drought of Thai Government in 2013 and the cabinet resolution dated 12 February 2013 designated Ministry of Interior by Department of Disaster Prevention and Mitigation, 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) Accordingly, the 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 flood 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 dollars to solve drought problem 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 need for knowledge and skills on drought management :

In order to solve the drought problem according to each river basin or region, it is necessary to provide appropriate knowledge dissemination in a holistic way as the follows into two level;

1. Public Sector
 - 1.1 Policy Maker Level (Central Government/ Ministry)

The Policy Makers must have the sufficient database, information and resources in order have clear command and appropriate system to minimize least effects.

1.2 Operational Level (Department/ Province/ Local Authority)

The official in charge have enough knowledge regarding standard warning system especially for drought, victim assistance procedure which will be equitable and fairness, together with provide regular exercises/drills.

1.3 Household Level

People all walk of live must well prepare for water consumption during dry season and their agriculture farmland. Besides, the forest plantation, water preservation and public awareness are important factors for drought reduction.

In the conclusion, even drought is the significant problem and affects to agriculture and economic system such as agricultural products. Additionally, the government is also providing compensation budget. Therefore, Thailand has to resolve this problem to upgrade the livelihood urgently.

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