



# Thailand Drought 2014-2016 Counter Measures Assessment

By

Assoc. Prof. Dr. Sucharit Koontanakulvong Department of Water Resources Engineering Chulalongkorn University

Presented at SSMS2019 Tokyo September 10, 2019

(NRCT-TSRI Program Chair on Spearhead Research Program on Water Management)





# Outlines

- 1. Introduction
- 2. Objectives and scope of study
- 3. Approach and methods used
- 4. Results
- 5. Conclusions
- 6. Acknowledgement
- 7. References





# I. INTRODUCITON





# **Pumping during Crisis**



Pongsaka@EngCU





### **Disaster Prevention Master Plan**



#### **Disaster Risk Management Cycle**







# WB Integrated Drought Management approach

#### Three Pillars of Drought Preparedness

#### 1. Monitoring and forecasting/early warning

Foundation of a drought plan

Indices/ indicators linked to impacts and action triggers

Feeds into the development/ delivery of information and decision-support tools

2. Vulnerability/ resilience and impact assessment

Identifies who and what is at risk and why

Involves monitoring/ archiving of impacts to improve drought characterization

#### 3. Mitigation and response planning and measures

Pre-drought programs and actions to reduce risks (short and long-term)

Well-defined and negotiated operational response plan for when a drought hits

Safety net and social programs, research and extension





# **World Bank Additional Guides**

- Need of a Systematic Proactive Approach in addition to Reactive Approach
- Socio-economic losses must be considered, but also global water security and ecological resilience, not only economic analysis
- Drought monitoring activities need improvement and coordination
- Need for more capacity building, knowledge transfer, data sharing and more access to information → community involvement





# 2. Objectives and scope of the study





# **Objectives**

- To review the disaster response process on drought management,
- To assess the measures compared drought 2014 and 2015 based on WB guidance,
- Recommendation for further actions

#### Scope of the study

- Study area (central plain)
- Time periods: dry seasons in 2014/15, 2015/16











#### 

#### Survey for agricultural sector

#### GPP at market price: agriculture, M.THB.







# 5. Approach and Methods





# **Approach and methods**

- Under Concept Integrated Drought management "active response way" of WB (Nicolas G., 2017)
- Drought analysis (hydrological, salt intrusion)
- Measures review (drought and salt intrusion, damage) and field surveys ((40 samples, Sucharit K., Thongplew, 2016; 407 samples, Makasiri C., 2018)
- Assessments on measures taken (mitigation, proactive response via interview & review)
- Recommendations (for future actions)





#### **Integrated Drought Management Approach**

1. Monitoring and forecasting/ early warning	1.1 Foundation of drought plans				
	1.2 Indices/indicators linked to impacts and action triggers				
	1.3 Feeds into the development/delivery of information and decision support tools				
2. Vulnerability/ resilience and impact assessment	2.1 Identifies who and what is the risk and why				
	2.2 Involves monitoring/achieving of impacts to improve drought characterization				
3. Mitigation and response planning and measures	3.1 Pre-drought programs and actions to reduce risks (short and long terms)				
	3.2 Well defined and negotiated operational response plan for when a drought hits				
	3.3 Safety net and social programs, research and extension				
4. Proactive	4.1 Needs of systematic proactive approach				
response way	4.2 Socio-economic losses must be considered, but also global water security and ecological resilience, not only economic analysis				
	4.3 Drought monitoring activities need improvement and coordination				
	4.4 Need for more capacity building, knowledge transfer, data sharing and more access to information for community involvement				





# 6. RESULTS





### Results

- Hydrological analysis and salt intrusion
- Summarized implemented measures (before/after 2016)
- Field survey results
- Compared assessment via Interviews before and after proactive responds (2015 and 2016)
- Case study (Bang Rakam model)

	Rainf	all (mm)	Rainy	จุฬาลงกรณ์มหาวิทยาลัย		
Year	Central plain	National average	Central plain	National average	Chulalongkorn University Pillar of the Kingdom	
2000	1616	1787	131	140		
2001	1497	1682	129	139	Rainfall data	
2002	1442	1586	122	132	and raining	
2003	1252	1335	153	173	deve during	
2004	1037	1258	136	165	days during	
2005	1172	1298	149	166	2000-2016	
2006	1348	1610	164	186		
2007	1246	1379	150	166		
2008	1388	1525	160	179		
2009	1635	1608	126	130		
2010	1644	1677	126	133		
2011	1499	1736	163	185		
2012	1649	1730	148	148		
2013	1638	1763	126	131		
2014	1354	1570	113	122	Source: Agricultural Economic	
2015	1429	1430	109	117	Office (2016), Agricultural Statistics 2016, Ministry of	
2016	1338	1355	144	160	Agriculture and Cooperatives.	
Average	1423	1549	138	151	18	



#### Precipitation anomalies of Thailand

#### during 1981-2015

(from HAI, 2018)

เปอร์เซ็นต์ปริมาณฝนที่ต่างไปจากค่าเฉลี่ยบริเวณประเทศไทย







### **Fluctuations of dam storage**







### Salt Intrusion in Chao Phraya River







#### **Drought Counter measures in 2014/15 and 2015/16**

Year 2014/15	Year 2015/16
Preparation works	M1 Promotion of knowledge, cost down and change to other crops
Inform water situation	M2 Extension of rental fee and/or debt payment
Repair water gates	M3 Job creation or training
maintenance canals	M4 Skill development based on community request
review water allocations	M5 Water saving and improve water efficiency
Measures for farmers	M6 Increase water sources
find local water sources (ponds/wells)	M7 Secure health and security
recommend suitable crops	M8 Promotion of Community enterprise and inform weather information















Drought counter measures from Ministry of Agriculture and Cooperatives, 2016





### Field survey results (2014/2015)

	Central (Plaichumpol Project)		Northeast (Lam Pao Project)			
irr	igation area	rainfed area	irrigation officers	irrigation area	rainfed area	irrigation engineers
			most drought year			most drought year
ses)			preparation works :			preparation works :
age	68.2	75	a) inform situations to farmers	54.5	66.7	a) warning for appropriate
	20.5	13.6	b) repair gates	4.5	16.7	cultivation area
nages	68.2	36.6	c) canal maintenance	18.2	11.1	b) gate repair
raded	54.5	22.7	d) prepare water allocations	29.5	22.2	c) canal maintenance
	25	4.5		25	44.4	
ures			measures recommended :			measures recommended:
a	54.5	34.1	a) farmers use gw 88.9 %.	34.1	33.7	a) farmers used pond water 62.5%
crop	38.6	40.9	c) farmers used pond water 55.6%.	29.5	44.4	b) farmers used shallow gw 25 %
	27.3	6.8	c) find other water sources	34.1	11.1	c) recommended suitable crops
	36.4	15.9	d) recommended suitable crops	6.8	11.1	d) reduce cultivation area
	27.3	6.8		4.5	0	
	ses) age nages raded cures a crop	irrigation area         irrigation area         ses)         ses)         age         68.2         age         68.2         raded         54.5         age         54.5         age         54.5         age         38.6         27.3         36.4         27.3	Image         Central (P           irrigation area         rainfed area           ses)         -           ses)         -           sage         68.2           75         13.6           mages         68.2           saded         54.5           area         -           a         54.5           a         -           a         54.5           a         54.5           a         -           a         54.5           a         -           a         -           a         -           a         -           a         -           a         -           a         -           b         -           a         -           b         -           a         -           a         -           b         -           a         -           b         -           a         -           b         -           a         -           b         -           a<	Central (Plaichumpol Project)irrigation arearainfed areairrigation officersirrigation arearainfed areairrigation officersses)IMost drought year preparation works : a) inform situations to farmersage68.275a) inform situations to farmersmages68.236.6 22.7c) canal maintenance d) prepare water allocationsmages68.234.6c) canal maintenanceaded54.522.7a) farmers use gw 88.9%.a54.534.1a) farmers used pond water 55.6%.crop38.640.9c) farmers used pond water 55.6%.a36.415.9d) recommended suitable crops27.36.8c) find other water sources27.36.8c) precommended suitable crops	Central (Plaichumpol Project)irrigation arearainfed areairrigation officersirrigation areaareamost drought year—ses)1most drought year—ses)68.275a) inform situations to farmers54.5age68.275b) repair gates4.5mages68.236.6c) canal maintenance18.2raded54.522.7d) prepare water allocations29.5ures254.52525a54.534.1a) farmers use gw 88.9 %.34.1a27.36.8c) find other water sources34.1a36.415.9d) recommended suitable crops6.84.5	Central (Plaichumpol Project)Northeasirrigation arearainfed areairrigation officersirrigation arearainfed areairrigation areaareamost drought year preparation works :ImageImageImageirrigation ses)68.275a) inform situations to farmers54.566.7irrigation sege68.275b) repair gates4.516.7mages68.236.6 c) canal maintenance18.211.1raded54.522.70) prepare water allocations29.522.2irrigationmeasures recommended : s5.6%.34.133.7irrigation6.840.9c) farmers used pond water s5.6%.29.544.4irrigation36.415.9d) recommended suitable crops34.111.1irrigation36.415.9irrigation officersirrigation officersirrigation officersirrigation36.415.9irrigation works : airrigation works : airrigation works : airrigation officersirrigation36.415.9irrigation works : airrigation works : airrigation officersirrigation officersirrigation36.415.9irrigation works : airrigation officersirrigation officersirrigation officersirrigationirrigation works : airrigation officersirrigation officersirrigation officersirrigation officersirrigationir





#### Main measures evaluation from farmers (2015/2016)

Item	Content
Input	<ul> <li>Regularly be informed about rainfall data</li> <li>Regularly be informed about irrigation water allocated</li> <li>Collaborated with RID to save water</li> </ul>
Process	<ul> <li>Participated in the counter measure program</li> <li>Regularly be informed about program activities</li> <li>Registration process is fine</li> </ul>
Output	<ul> <li>Farmers understand sufficient economy way</li> <li>Needs assistances on agricultural activities than daily life consumption</li> <li>Need to reduce agricultural production cost than reduce household cost 25</li> </ul>





#### **Assessment results of counter measures**

Items	2014/15	2015/16			
1. Monitoring					
1.1 plan	Yes (passive)	Yes (active)			
1.2 indicator	Yes (passive)	Yes (active)			
1.3decision support	Yes (passive)	Yes (active)			
2. assessment					
2.1 Identified	Yes (passive)	Yes (active)			
2.2 Improvement	No	No			
3. Mitigation M1-M8					
3.1 Pre drought	Yes (passive)	Yes (active)			
3.2 respond plan	Yes (passive)	Yes (active)			
3.3 safety net	No	Yes			
4. Proactive response M1-M8					
4.1 proactive	No	Yes			
4.2 loss analysis	No	No			
4.3 improvement	No	Partial			
4.4 capacity building	No	Partial			

Remarks: based on field survey in 2016, 2018.



### Issues left





Reasons of no adaptation to drought for farmers in irrigation area

#### Integrated plan for Bang Rakam floods (case study)



# Retention pond, cultivation

Faculty of Engineering, Chulalongkorn University www.eng.chula.ac.th

# Paddy (4) + fishing (4) + paddy(4)





# 7. Conclusions

• Counter measures improvement

(from passive to proactive)

- Assessment results (comparative better though need loss analysis/review after incedent, community capacity building)
- More integrated way of response (from sample case : cultivation shift, retention, fishing)
- Further applications to wider area (more systematic and standardized case study model)





### Recommendations

- Support hydro-meteorological networks and services improvement for early warning to community
- Promote free and open data exchange initiatives for research
- Promote indicators systems to measure drought vulnerabilities and drought impacts for decision making
- Support of user oriented drought monitoring & forecasting
   Systems that include Vulnerability and Impact Monitoring
- Promote pilot projects to put in practice these approaches
- Build internal collaboration and Communities of Practices
- Work in collaboration with other International Organizations





# 8. Acknowledgement

- 1. Thailand Research Fund/NRCT for research funding,
- **2**. Staffs for field survey works,
- 3. Colleagues in Water Resources System Research Unit, CU.





### **9. REFERENCES**





- Chulalongkorn University and RID, The Impact of Climate Change on Irrigation Systems and Adaptation Measures (Case Study: Plaichumphol Irrigation Project, Thailand), Research Report submitted to JIID, Jan 2010
- Ladawan Kampa, 20 year National Strategic Plan and SDG, Presentation materials at 7th TRF National Water Policy Forum, March 2016 (in Thai).
- Koshi Yoshida et. al., Weather-induced economic damage to upland crops and the impact on farmer household income in Northeast Thailand, Paddy and Water Environment, July 2019, Volume 17, Issue 3, pp 341–349.
- Natalia Limones, Integrated Drought Risk Management towards proactive drought management approaches, Climate Services for improved Water Resources Management in vulnerable regions to climate change in Latin America and the Caribbean, World Bank's Water Partnership Program, February 2016.
- Nicolas Gerber and Alisher Mirzabaev, Benefits of action and costs of inaction: Drought mitigation and preparedness – a literature review, Integrated Drought Management Programme Working Paper No. 1, World Meteorological Organization and Global Water Partnership, 2017.
- Makasiri Chaowagul, et. al., The Adaptation to drought of rice farmers in irrigated areas, Research Report submitted to TRF, 2018.





- Sucharit K., et.al., Water Resources Study for Strategic Water Management in the Nan Basin, Research Report submitted to Thailand Research Fund, Jan 2012 (in Thai).
- Sucharit K., GW Studies and Situations in Thailand, Technical Report, presented at 6th Asian G-WADI and 1st IDI Expert Group Meeting, Tehran, IRAN, June 2015.
- Sucharit K., et. al., Community Survey on Drought in 2016, Technical Report in the V&A assessment funded by UNDP, July 2016 (in Thai).
- Sucharit K. and Thongplew Kongjun, Impact of Climate Change towards Irrigation Operations in Central and Northeast Thailand and its adaptation towards SDG, Proc. IDDC 12, IRAN, Aug 2016.
- Sucharit K., et. al., Salt Intrusion Management in Chao Phraya River, Research Report submitted to NRCT, Oct 2017.
- Sucharit K., Water Disaster Management and Smart System Applicability, Proc. ISFT 2019, Pataya, Thailand, Aug 24, 19.