Water and Society (211210)
How to deal with drought

สุจริต คูณธนกุลวงศ์

ภาควิชาวิศวกรรมแหล่งน้ำ คณะวิศวกรรมศาสตร์

จุฬาลงกรณ์มหาวิทยาลัย

๒๕ ตุลาคม ๒๕๖๒

เนื้อหา

- ตัวอย่างพื้นที่เขาแบบน่าน
- พื้นที่ชายฝั่งแบบระยอง
- การบริหารน้ำเขื่อน
- การตอบสนองต่อภาวะแล้ง
- คลิป น้ำชุมชน ตย
- แผนสู้ภัยแล้ง
- บทความวิชาการ robust system of drought
- เอกสารแนะนำวิศวแหล่งน้ำ

Download from watercu.eng.chula.ac.th

- 01 nan strategic
- 10 ระยอง
- 20 เชื่อน
- 30 drought response
- 40 คลิป น้ำชุมชน
- 50 drought plan
- 60 robust system
- 70 แนะนำ วิศว แหล่งน้ำ

02 nan poster

11 บทความ

21 บทความ

31 paper

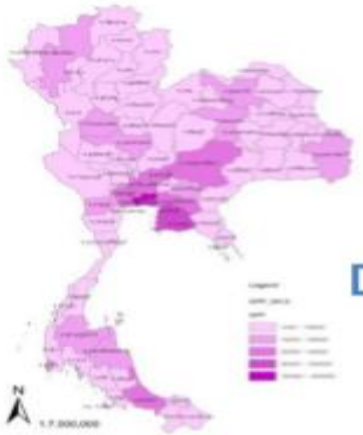
03 รายงานจัง

Demand side:

Water for Development

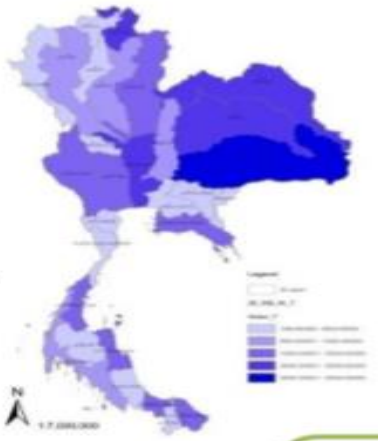
GDP

Provinces



Water use (Basin)

Provinces

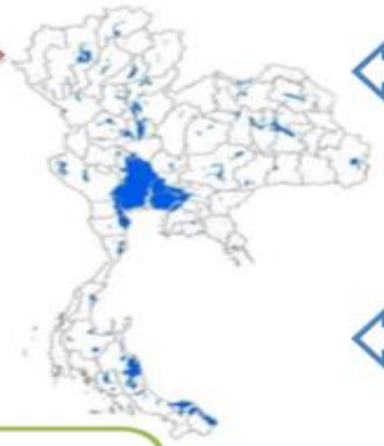


Supply side:

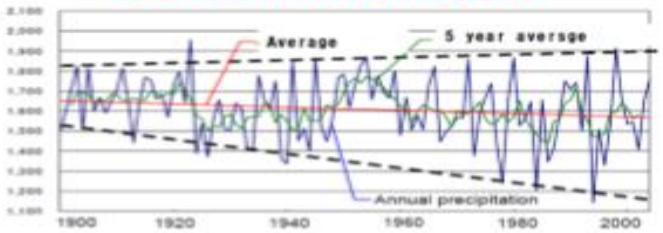
Water, disaster management

Water Stock

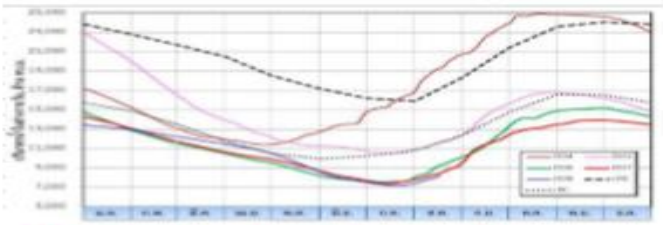
อ่างเก็บน้ำ พื้นที่ชลประทาน



Nature : Fluctuations



Human : water management



Water account

Floods

Drought

Loss and Damange

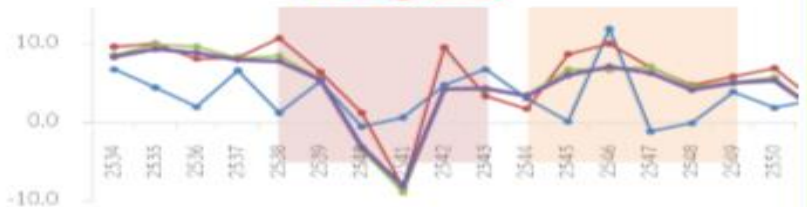
Impact to GDP

Future drivers

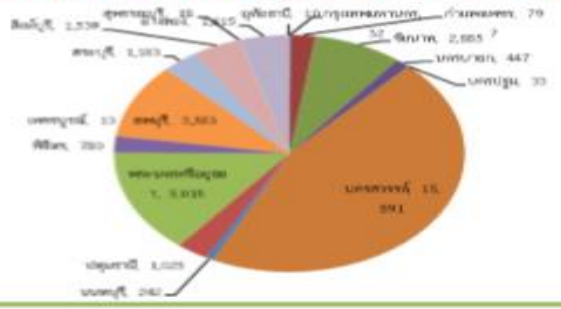
Super cluster

Petro, digital, elect, auto

GDP gr, %



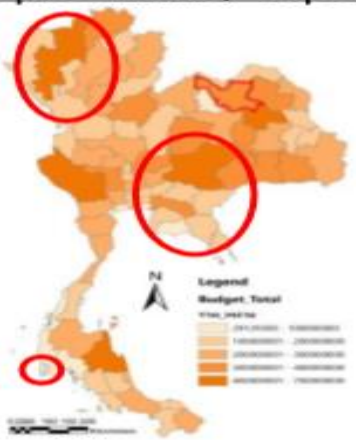
Damage in each province (M baht)



Future budget planning

Demand & supply side

Priority: provincial / super cluster



Water Resources Study for Strategic Water Management in Nan River Basin

1. Introduction

- The upper of SIRIKIT dam is the critical area to study land use change and deforestation affect to runoff.
- Land use in the upper watershed of Nan Basin had changed dramatically due to the increasing population and agricultural growth in the past decade.
- Forest area changed to agriculture and after that the agricultural area was transformed residential areas.

2. Study area

The upper part of Nan river basin is located in the northern region of Thailand with the total catchment area of 13,000 sq.km The basin originated from Bor Klua District, Nan Province.

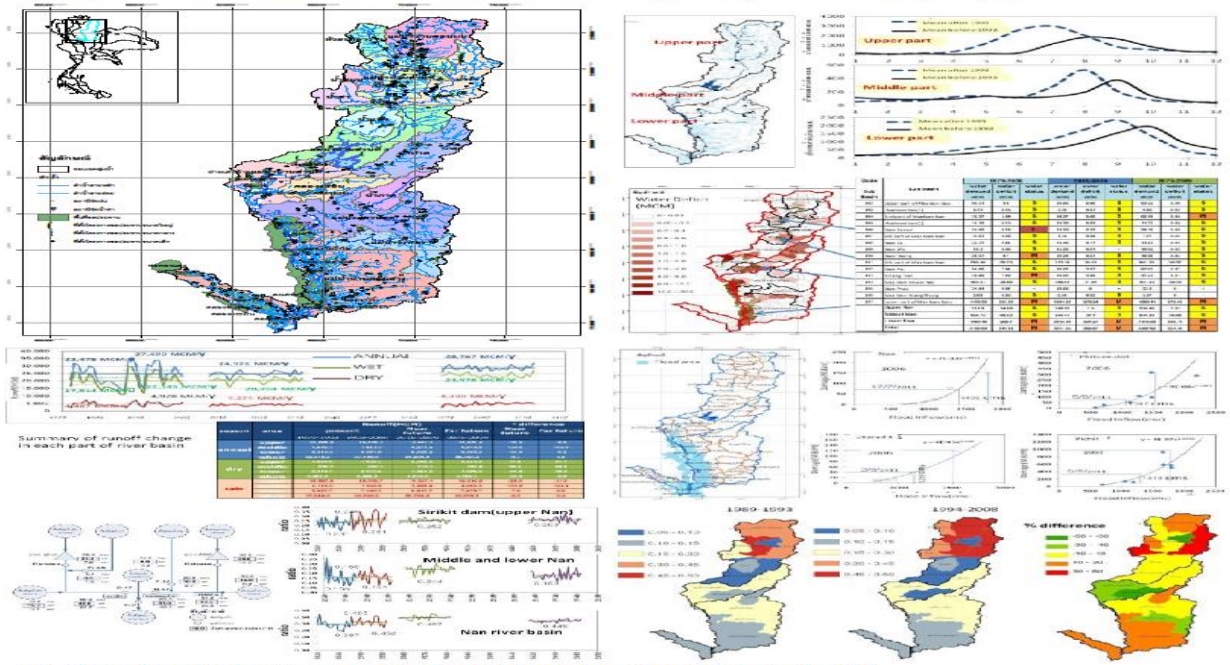
Four sub-basin with different percentage of forest area are selected to investigate the runoff difference via field measurements.

Rainfall

Rainfall data from 76 rainfall gagging stations were used to analyze the average annual rainfall in Nan river basin and its vicinity area varies between 759.6 — 2,200.6 mm/year, the maximum average annual rainfall depth is 2,2006 mm/year at the station code 28164 (Doi Phuka station, Amphoe Pua) and minimum average annual depth is 759.6 mm/year at the station code 090901(Ban Chai Daen Station). Overall average annual rainfall for the project and vicinity areas is 1,260.0 mm/year.

Streamflow

The mean annual streamflow in Nan river basin is 12,199.60 MCM/year with average annual specific yield is 11.33 lps/sq.km. The Nam Pad sub-river basin has a low figure of 5.08 lps/sq.km, and the Nam Wa sub-river basin has a highest figure of 27.68 lps/sq.km.



3. Strategic issues in Nan Rived basin (Overview)

The upper part of the basin:

- Decrease in runoff cause by decreasing forest area in upper section of upper Nan river basin, War sub river basin, Yao 2nd sub river basin and 3rd section of Nan sub basin
- Flash flood
- The water deficit for agricultural use especially in Nam Samun and Nam Haeng sub river basin

Middle part of Nan river basin:

- Flash flood in Pad and 4th section of Nan sub basin
- Water deficit in dry season in Khlong Tron and Nam Pad sub river basin.

Lower part of Nan river basin:

- The appropriated releasing rule of Sirikit Dam for irrigation water demand
- Model for water management in the rainy season
- Warning system, retention area

4. Objective

The purposes of this project are to build adaptation capacity and risk management corresponding to the future change and to provide solutions for the key strategic issues of the Nan River basin. According to Strategic issues , the solutions for the following issues: flash flood, a decrease in runoff, water deficit, and water security analysis, are needed for the Nan River basin.

5. Methods& Tools

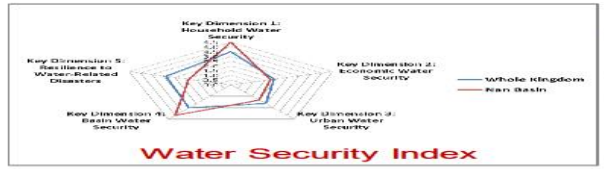
The analysis was performed by simulating options of water management using the following data:

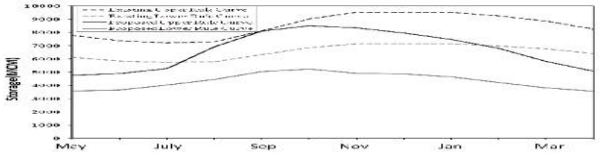
1) short and seasonal rainfall forecast,
2) the relationship between an increase in forested area and runoff in the sub-basin,
3) rainfall-runoff model,
4) flood model,
5) water balance model,
6) reservoir water balance model,
7) the simulation and analysis of water management for water situation under existing condition and climate change condition,
8) options for water management strategies in the basin such as water development project plans of the government agencies (e.g. RID, DWR) that have not been implemented and new options in middle and long period plans such as adjusting release rules from Sirikit Dam using multiple conditions, proposing new flood retention area and other additional options.

6. The main results

6.1The study of the water security index in the Nan basin

Data were collected from the Nan basin for the calculation of water security indices. The indices of the Nan basin were compared with those of Thailand (including world data and Asian data). Then calculate the index in province level and prepared in the scoring criteria for each side of water security based on the distribution of the index calculation. In the final section calculates the index in the district and issuing questionnaires to survey the general pool, water use in agriculture and adaptation. The selected sample areas were Muang, Tha Wang Pha and Chieng Klang districts in Nan province, and developed the water security index, define the definition, principle and scoring method for water security index co-operated with Department of water resources in order to construct the method for water security evaluation.





Operational Rule Curve

6.2 The development of release rules from Sirikit Dam using multiple conditions

For the analysis of water release rules from Sirikit Dam, it can be considered from the patterns of reservoir release. The release rules can be determined from the proportion between the monthly release and effective storage corresponding to water year. The release ratio can be classified based on the effective storage of the water year and probability which is classified into five levels i.e. higher (Probability >= 0.9) high (0.9 > Probability >= 0.7) medium (0.7 > Probability > 0.3) low (0.3 >= Probability > 0.1) and lower (Probability <= 0.1), respectively. However, the improvement of release ratio cannot reduce water deficit. The reduction of water deficit should be considered with water allocation rules. Water management will be more effective and sufficient to the water demand.

The simulated storage obtained from the reservoir water balance model can be used to formulate new reservoir operation by setting the lower rule curve at the probability of 0.2 and upper rule curve at the probability of 0.8 in each month.

6.3The proposals for strategic water resources management in the Nan basin

The key strategic proposals are increasing forested area in the upper Nan basin and adjusting the release rules from Sirikit Dam. These two proposals were found to help alleviate the problem of water deficit for the entire Nan basin in both near and far futures. When forested area was increased, the water deficit decreased 27%. When the release rules from Sirikit Dam was adjusted , the water deficit decreased 44%. When combining both cases, the water deficit decreased 54%. . Providing potable water supply (tap water) to reach all villages must be done urgently.

The results of strategic water resources management

Rule Curve		Existing			Purpose		
	Climate	Present (MCM)	Near future (%)	Far future (%)	Present (MCM)	Near future (%)	Far future (%)
Land use Forest area	existing	-102.9	-65.01	-65.40	0.87	6.90	8.65
	decrease	-	-152.09	-139.07	-	-21.38	-21.57
	increase	-	-20.99	-24.76	-	22.45	24.98

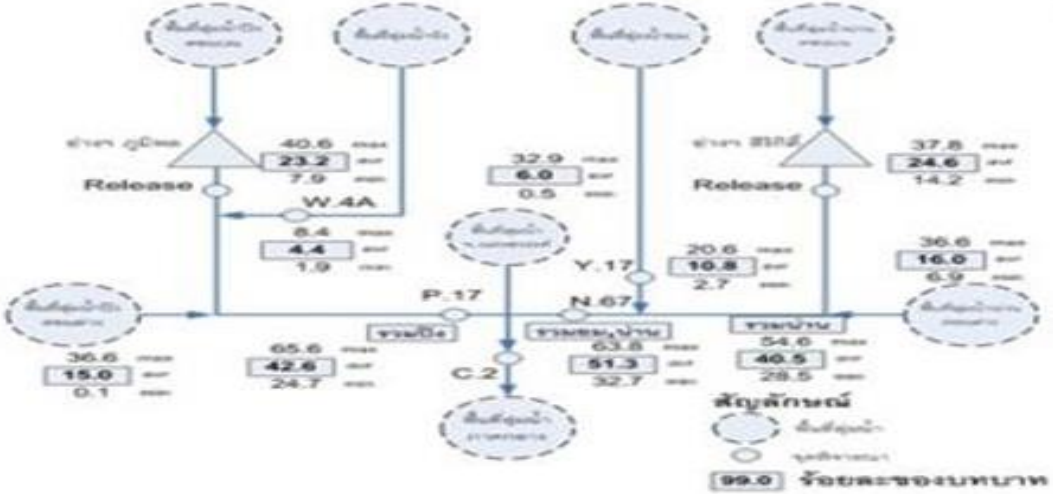
Released Pattern of Rule Curve

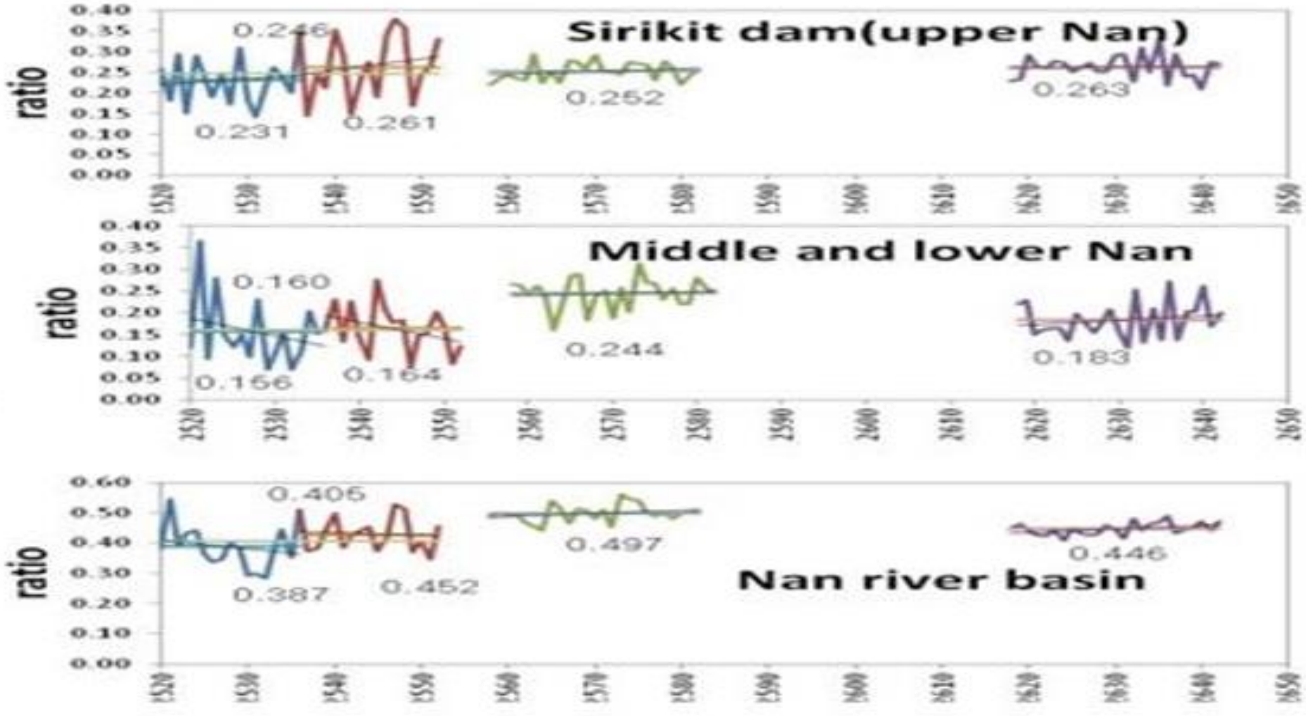
Dry Season	Probability	Effective Storage (MCM)
High	[illegible]	x > 3767
Normal	[illegible]	3826 > x >= 3767
Less	[illegible]	2033 > x >= 3826
Verylless	[illegible]	x < 2033

Wet Season	Probability	Effective Storage (MCM)
High	[illegible]	x > 2901
Normal	[illegible]	1381 > x >= 2901
Less	[illegible]	648 > x > 1381
Verylless	[illegible]	x < 648

Summary of runoff change in each part of river basin

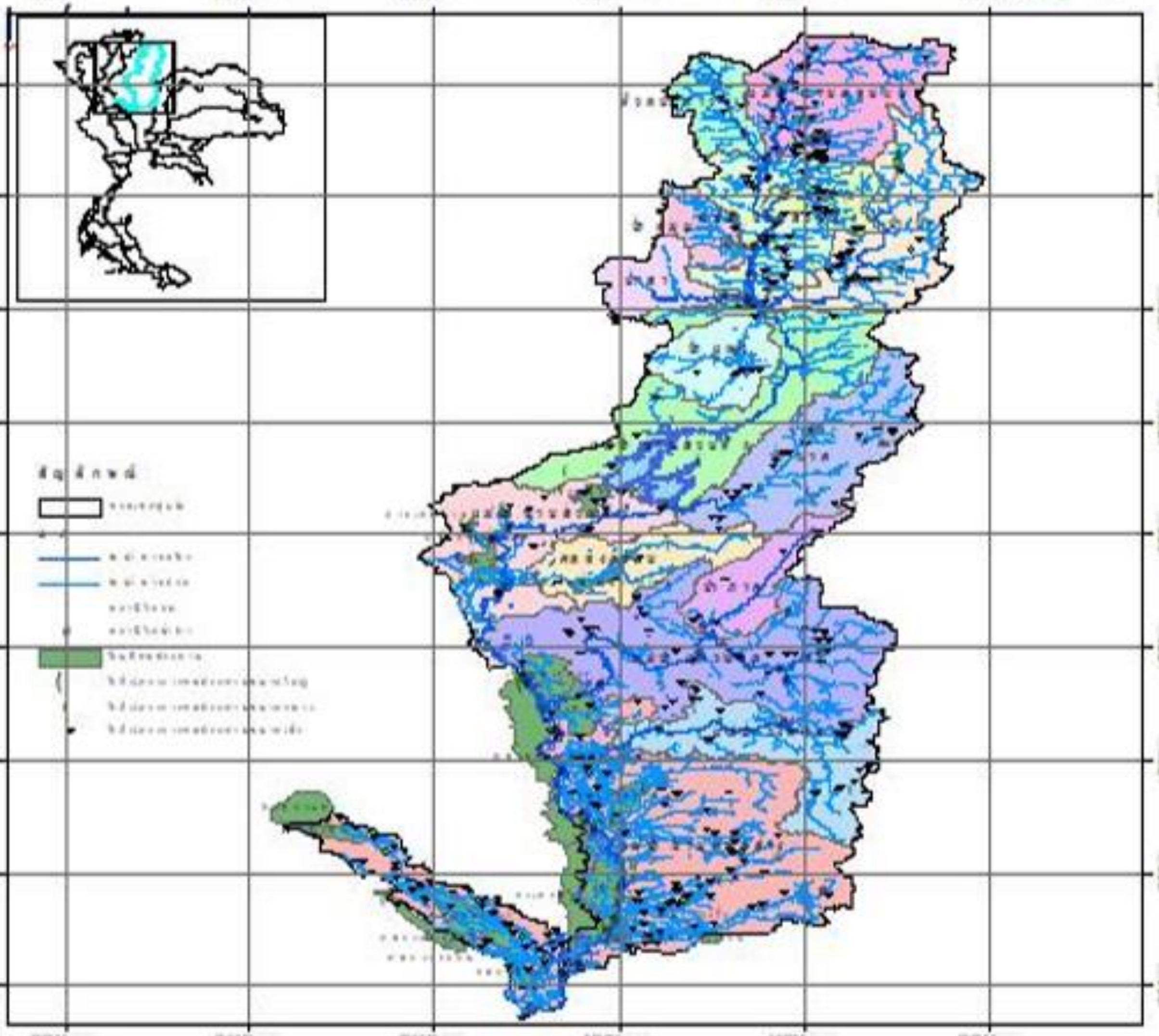
season	area	Runoff(MCM)				% difference	
		present		Near future	Far future	Near future	Far future
		1979-1993	1993-2008	2015-2039	2075-2099		
annual	upper	[illegible]	15,438.1	12,487.7	14,430.8	[illegible]	[illegible]
	middle	1,636.1	1,863.3	4,271.6	4,873.9	[illegible]	[illegible]
	lower	8,343.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	whole	22,478.2	27,495.4	[illegible]	[illegible]	[illegible]	[illegible]
dry	upper	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	middle	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	lower	2,316.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	whole	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
rain	upper	[illegible]	13,599.7	10,327.1	[illegible]	[illegible]	[illegible]
	middle	1,119.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	lower	[illegible]	7,396.7	[illegible]	[illegible]	[illegible]	[illegible]
	whole	17,314.6	22,545.2	20,784.2	23,878.1	[illegible]	[illegible]

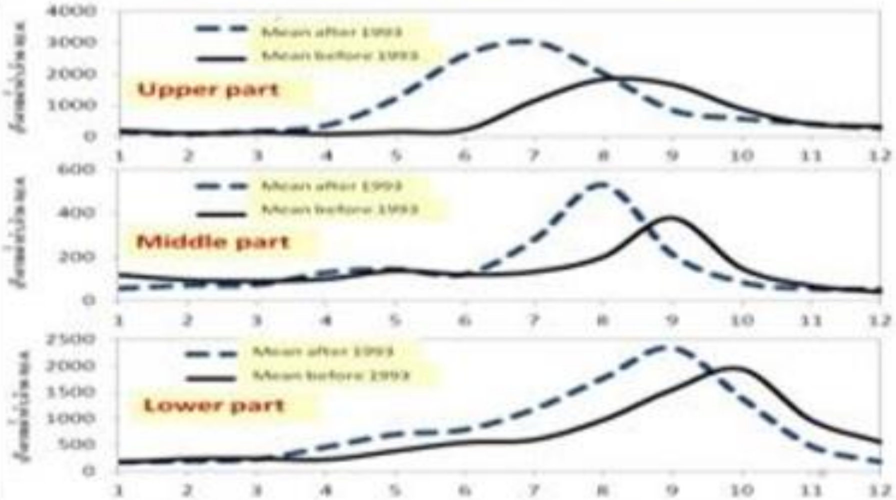


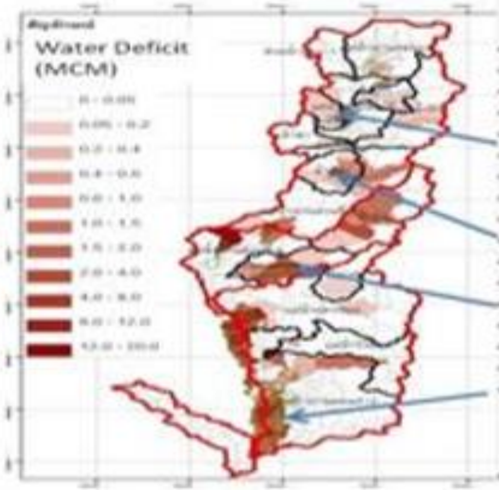


Streamflow

The mean annual streamflow in Nan river basin is 12,199.60 MCM/year with average annual specific yield is 11.33 lps/sq.km. The Nam Pad sub-river basin has a low figure of 5.08 lps/sq.km, and the Nam Wa sub-river basin has a highest figure of 27.68







Code Sub Basin	Sub basin	1979-2008 water demand	1979-2008 water deficit	1979-2008 water status	[illegible] water demand	[illegible] water deficit	[illegible] water status	[illegible] water demand	[illegible] water deficit	[illegible] water status
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	M
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	L	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	-	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	M	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	M	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	-	[illegible]	[illegible]	-
[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	-
[illegible]	[illegible]	[illegible]	[illegible]	M	[illegible]	[illegible]	M	[illegible]	[illegible]	M
	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	S	[illegible]	[illegible]	S
	[illegible]	[illegible]	[illegible]	M	[illegible]	[illegible]	M	[illegible]	[illegible]	M
	Total	[illegible]	[illegible]	M	[illegible]	[illegible]	M	[illegible]	[illegible]	M

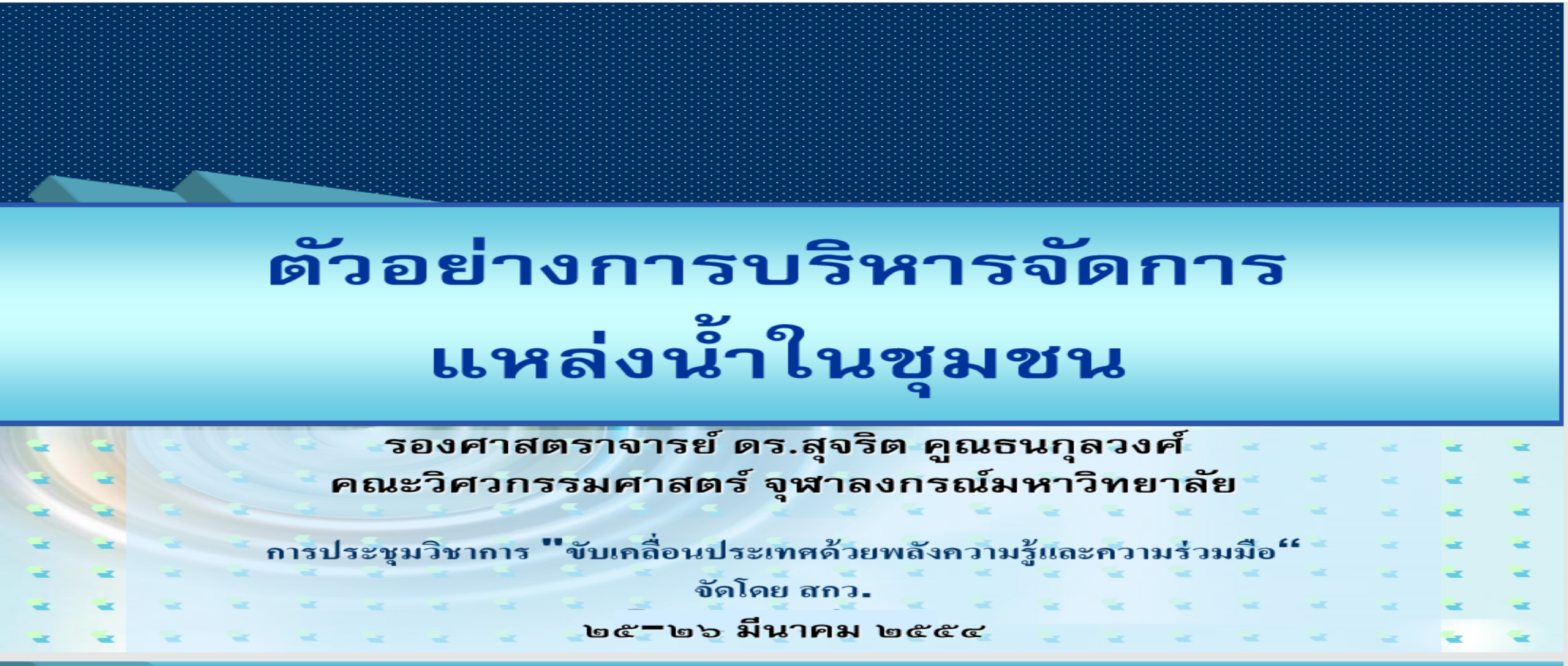
Findings

- Deforestation in Nan Basin induced less water security in both Nan Basin and Central Plain,
- The change of Sirikit Dam inflow, storage affected to water shortage, floods and groundwater use in lower area (due to CC).
- Strategic water management schemes are necessary and co-beneficial for both Nan Basin and Central Plain Development (Forest-Water-Food),
- New technology will increase water management capability.


ทฤษฎีศาสตร์ "รักษ์ป่าน่าน"
40%

03 รายงานผลการดำเนินงานตำบลเมืองจัง 60

10 ตัวอย่างการบริหารน้ำในชุมชน ระยอง



20 iddc12 drought power pt

Impact of Climate Change towards Irrigation Operations in Central and Northeast Thailand and its adaptation towards SDG

Assoc. Prof. Dr. Sucharit Koontanakulvong
Faculty of Engineering, Chulalongkorn University

Dr. Thongplew Kongjan
Royal Irrigation Department

Presented at 12th INTERNATIONAL CONFERENCE ON DEVELOPMENT OF DRYLANDS (IDDC)

21-24 August 2016, Alexandria, Egypt

30 ssms 2019 drought response

CHULA ENGINEERING
Foundation toward Innovation

จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University
Pillar of the Kingdom

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)

50 model drought plan

Guidelines and Background Documents

For Development of

National Drought Plan

United Nations
Convention to Combat
Desertification

Question and Answer

- More information
  www.watercu.eng.chula.ac.th