

# Science and Technology Adaptation for Community Water Resource Management

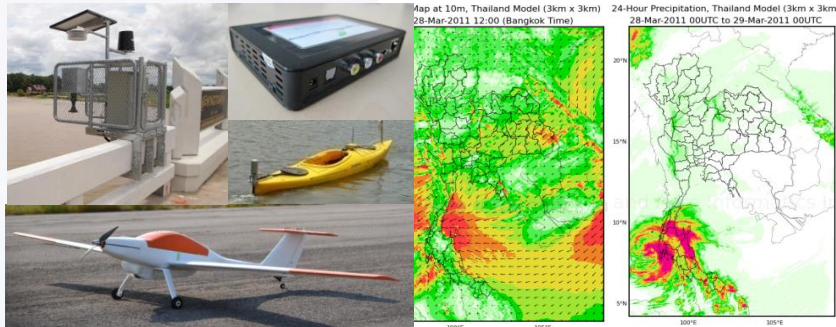
**Dr.Royboon Rassameethes**

*Hydro and Agro Informatics Institute (HAI),  
Ministry of Science and Technology, Thailand*

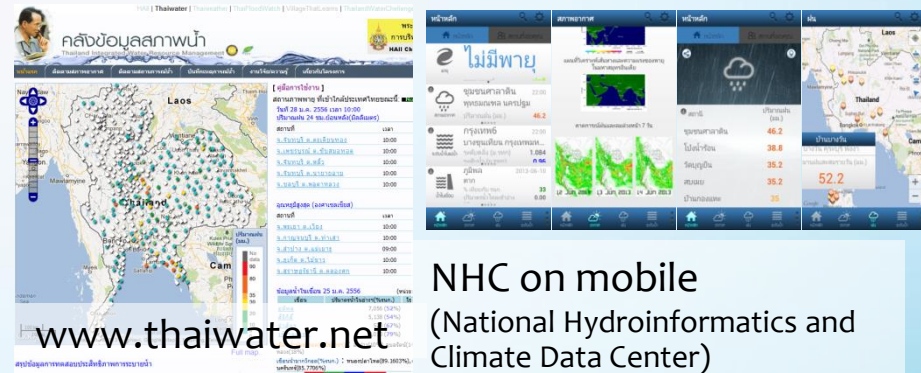


# HAI's Mission

## 1. R&D in agricultural and water resource management



## 2. Disseminating the R&D outcomes



NHC on mobile  
(National Hydroinformatics and Climate Data Center)

## 3. Promoting S&T research and development collaboration

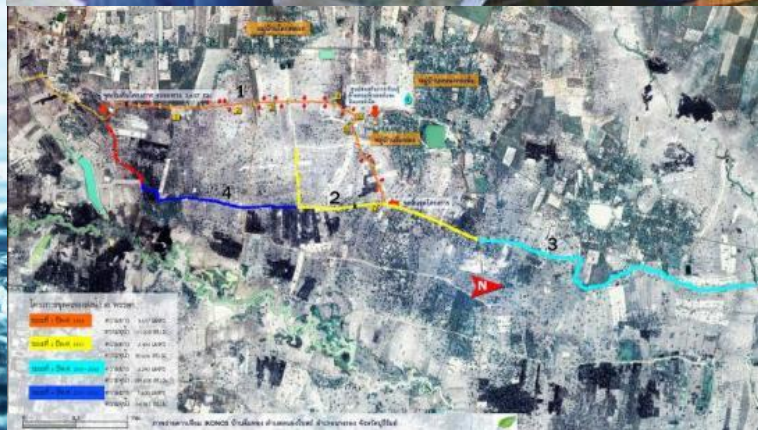


## 4. Expanding services and disseminating outcomes



# S&T adaptation for CWRM

Apply science and informatics technology for CWRM efficiency, e.g., GPS survey for making waterway map, crop and water usage planning, etc. The community could coordinate and manage their water resources with partners and to be the ownership.



## HAI

## Community

Encourage community to create thinking, analytic, and working process

Understand the context and appropriate solutions for each area

Pass on knowledge and technology for community adaptation

Survey local area, collect data of water chart, water balance, and create water resource management plan that best suits to the area.

Connect with related agencies, both public and private.

Involvement of local people to develop ownership and good management which lead to sustainable development

# S&T Adaptation for Strengthening Local Economy

To prevent economic loss from flood and drought problems, Thailand needed a good water management system in every level; nationally or locally. The CWRM Network has been expanded throughout the country, and currently covers 60 main networks with more than 421 participated communities.



## S & T Application

- Apply S&T such as GPS receivers, telemetering station, maps and satellite images for community survey
- Identify problems and solutions
- Water balance analysis
- Area-based analysis

## Engineering/Innovation

- Simple infrastructure design suitable for the socio-geographical condition
- Systematically plan the work process, management and maintenance
- Local innovation

## Sustainable Agriculture

- Agroforestry
- Integrated agriculture
- Water quality management

## Success

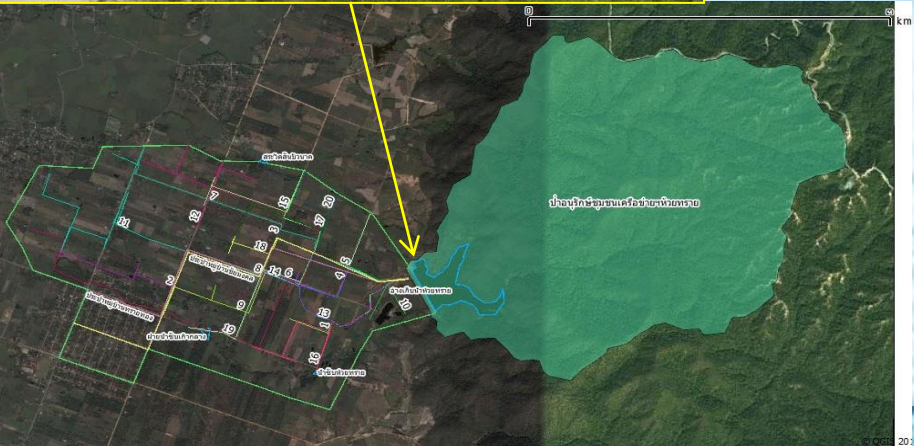
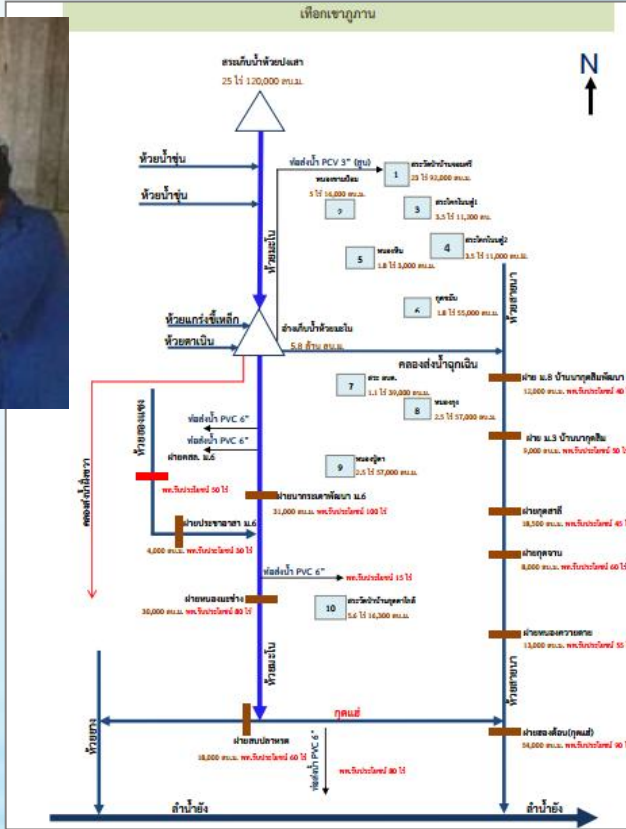
- Self-sufficiency
- Food security
- Expand the success to other communities

A background image showing a vertical line of water droplets falling from the top left, creating a splash at the bottom. The water surface is covered in ripples, and the overall color palette is light blue and white.

# Example of S&T Adaptation

# Example: Application of Science and Technology usage

- GPS receivers, Topographic Maps, and Satellite images
- Water chart
- Water Balance Analysis
- Telemetering station
- Level survey
- Echo Sounder



## Huay Sai reservoir, Chiang Mai province

With total capacity of 225,000 cubic meters, the reservoir is originally expected to supply water for **500 Rai** of agricultural area.

\*1 Rai = 1,600 sqm.

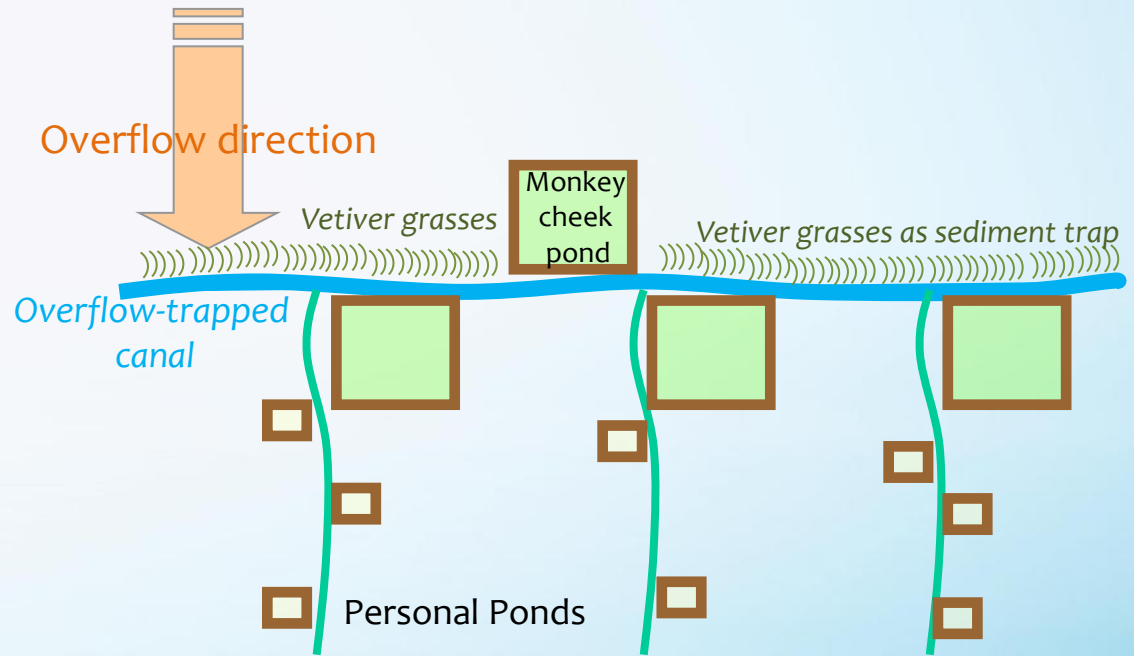
By calculating water balance and proper manage water resource, the community can expand their beneficial to

**2,145 Rai.**

**4 times increased**

# Example: Adaptation of water management techniques

- Overflow-trapped canal
- Canal street
- Sediment trap ponds
- Stone or concrete check dams
- Reinforced concrete gutter through creek



Sediment trap



Canal street

# Example: Production planning

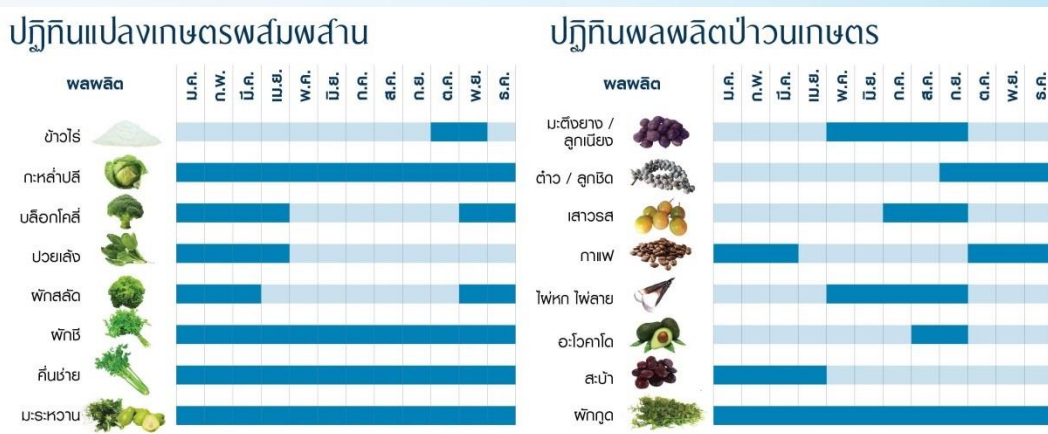
**Past:** Cultivation only in rainy season.  
**Income = 4 months/year**

**Present:** Enough water for all year cultivation.  
**Income = Yearlong**

Example: Crop calendar of Limthong community (Rainfed area)

ชนิดพืช	2557											
	ม.ค.	ก.พ.	มี.ค.	เม.ย.	พ.ค.	มิ.ย.	ก.ค.	ส.ค.	ก.ย.	ต.ค.	พ.ย.	ธ.ค.
ดาวเรือง												
กล้วย												
มะละกอ												
ข้าว												
ตะไคร้												
มะเขือพวง												
มันสำปะหลัง												
เห็ดฟาง												
มะพร้าว												
พริก												
มะเขือยาว												
ดอกแค												
มะเขือเปราะ												
ผักสวนครัว												
ข้าวโพด												
ฝรั่ง												
มะม่วง												
ส้มโอ												
น้อยหน่า												
ใผ่												
เลียงม๊อ												

Example: Crop calendar of Huay Pla Lod community (Upstream area)

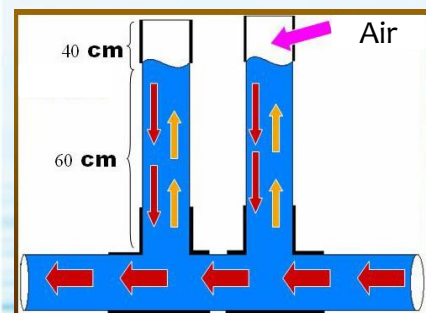


# Example: Community innovation

- Mire suction boat
- “Air-ware”: energy saving water pumping method by using air pressure
- Solar cell water pumping



Mire suction boat



Air-ware



Solar cell water pump



## 60 Main Communities in 19 River Basins

### Expected Outcome

1. Decrease problem of flood and drought in agricultural area
2. Rehabilitated abandoned water structure and self-reliance management
3. Secure local economic security with agroforestry and integrated agriculture

# Success

	Past	Present
Information	<ul style="list-style-type: none"> <li>• Enormous but non-organized data</li> </ul>	<ul style="list-style-type: none"> <li>• Apply S&amp;T for data manage</li> </ul>
Social	<ul style="list-style-type: none"> <li>• Rely on government</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reliant and Self-sufficiency</li> <li>• Concrete community plan</li> <li>• Create Community Water Resource Management committee</li> </ul>
Water Management	<ul style="list-style-type: none"> <li>• Not maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Expand Community Water Resource Management network to solve the drought and flood problem to 341 network communities (2014)</li> </ul>
Production/ agriculture	<ul style="list-style-type: none"> <li>• Monocrop</li> <li>• Cultivation only in rainy season</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated agriculture</li> <li>• In drought situation 2015, <b>89%</b> of main communities involved in Community Water Resource Management Network can still have income during dry season.</li> </ul>
Network	<ul style="list-style-type: none"> <li>• Not collaborate</li> <li>• No involvement</li> </ul>	<ul style="list-style-type: none"> <li>• Expend working network</li> <li>• One target</li> <li>• Exchange knowledge and experience</li> </ul>

# Example of CWRM in Thailand

- Upstream area – Huay Pla Lod community, Tak Province
- Rainfed area – Limthong community, Buri Ram Province
- Downstream area – Pred Nai community, Trat province
- Irrigated area – Rangist canal, Pathum Thani Province
- Ecological restoration – Wiang Kook community, Nong Khai province

The background of the slide features a light blue gradient with a vertical line of water droplets falling from the top left. The bottom portion of the slide is dominated by a close-up, high-speed photograph of water splashing, showing numerous bubbles and ripples in shades of blue and white.

Upstream area

# CWRM in Huay Pla Lod Community

Dan Mae La-mao sub-district, Maesod district, Tak province, *Salawin River Basin*

# Problems

Deforestation problem from shifting cultivation and mono-crop, such as corn and opium for over 40 years



# Solutions

- Reforestation by planting trees, and building check dams
- Agroforestry and plant industrial crop such as coffee, bamboo shoot, and chayote



# Achievements

- **Increase biological integrity of 14,500 Rai** of upstream forest by planting trees and constructing over 400 check dams
- Income from agricultural products **increased 4 times**. At present, Muser hill tribe have their own local market to sell agricultural products.
- Huay Pla Lod community act as mentor for Karen hill tribe, Pa Ka community, to survey and analyze data to develop local water infrastructure, and preserve water for consumption purposes.

## Multiple crop calendar



## Agroforestry calendar



The background of the slide features a vertical line of water droplets falling from the top left, creating a series of ripples and splashes on a light blue surface. The overall aesthetic is clean and aquatic.

Rainfed area

# CWRM in Limthong Community

*Nangrong district, Buri Ram province, Mun River Basin*

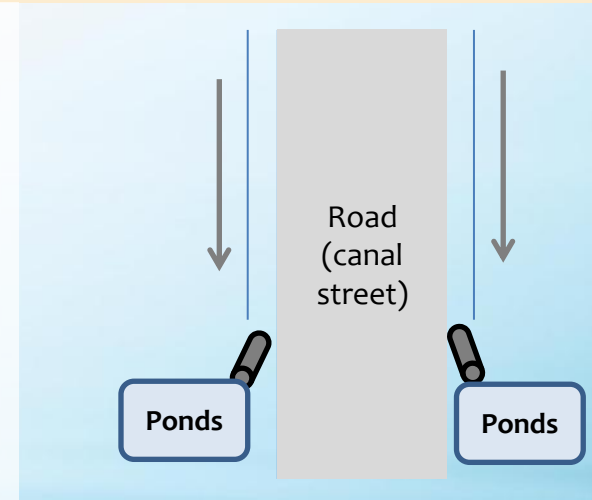
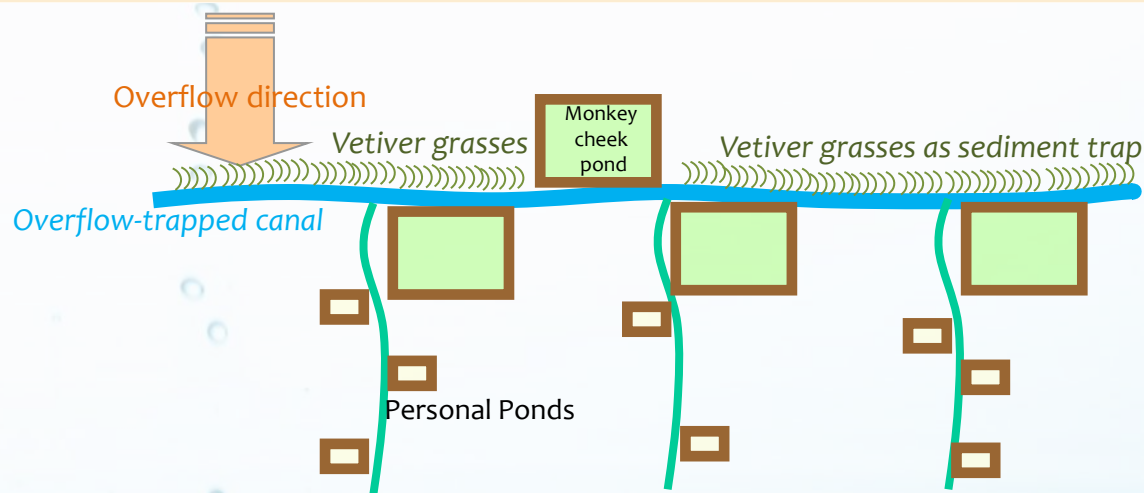
# Problems

- Flood and drought for over 40 years
- Shortage of water for consumption and agriculture
- High cumulative debt
- Villagers left town



# Solutions

- Create pond networks with total canal distance of 42.2 kms.
  - Canals to trapped overflow and connect water to ponds.
  - Increase water storage by building 100 ponds, 1,167,000 m<sup>3</sup>
  - Canal street: use street as a canal to deliver overflow through ponds or catchment areas
- Change cultivation pattern to follow integrated agriculture concept.
- Set up group of planning, production, and selling for price negotiation.



**Past:** flood in communities caused damages to roads, products, residences.

**Present:** "Canal Street" no damage to roads, products, and residences.



# Network expansion: from 1 community to 3 sub-district

Expand working network from Ban Limthong to 3 sub-districts, and start the 4<sup>th</sup> and 5<sup>th</sup> sub-district in 2015.



# Achievements

- With water management, water balance, analysis, and crop planning, Ban Limthong network can increase agriculture value during dry season 2015 around 9,720,000 Baht
- Create pond network: link water storages by canals (42.2 kms) and increase total volume of 1,167,000 cubic meters.
- Expand working network from one community (3,700 Rai) to three sub-districts (71,566 Rai) and start the expansion to the 4<sup>th</sup> and 5<sup>th</sup> sub-district in 2015.
- With enough water, villagers can receive all year income, have enough productivity, and food security. Income increased approximately 2.5 times, and 15 times for properties (comparison between 2550 & 2556)
- People return home. 😊



A background image showing a vertical line of water droplets falling into a pool of water, creating ripples and bubbles. The scene is captured in a high-speed, close-up shot, emphasizing the clarity and movement of the water. The color palette is a range of blues, from light sky blue to deep, dark blue.

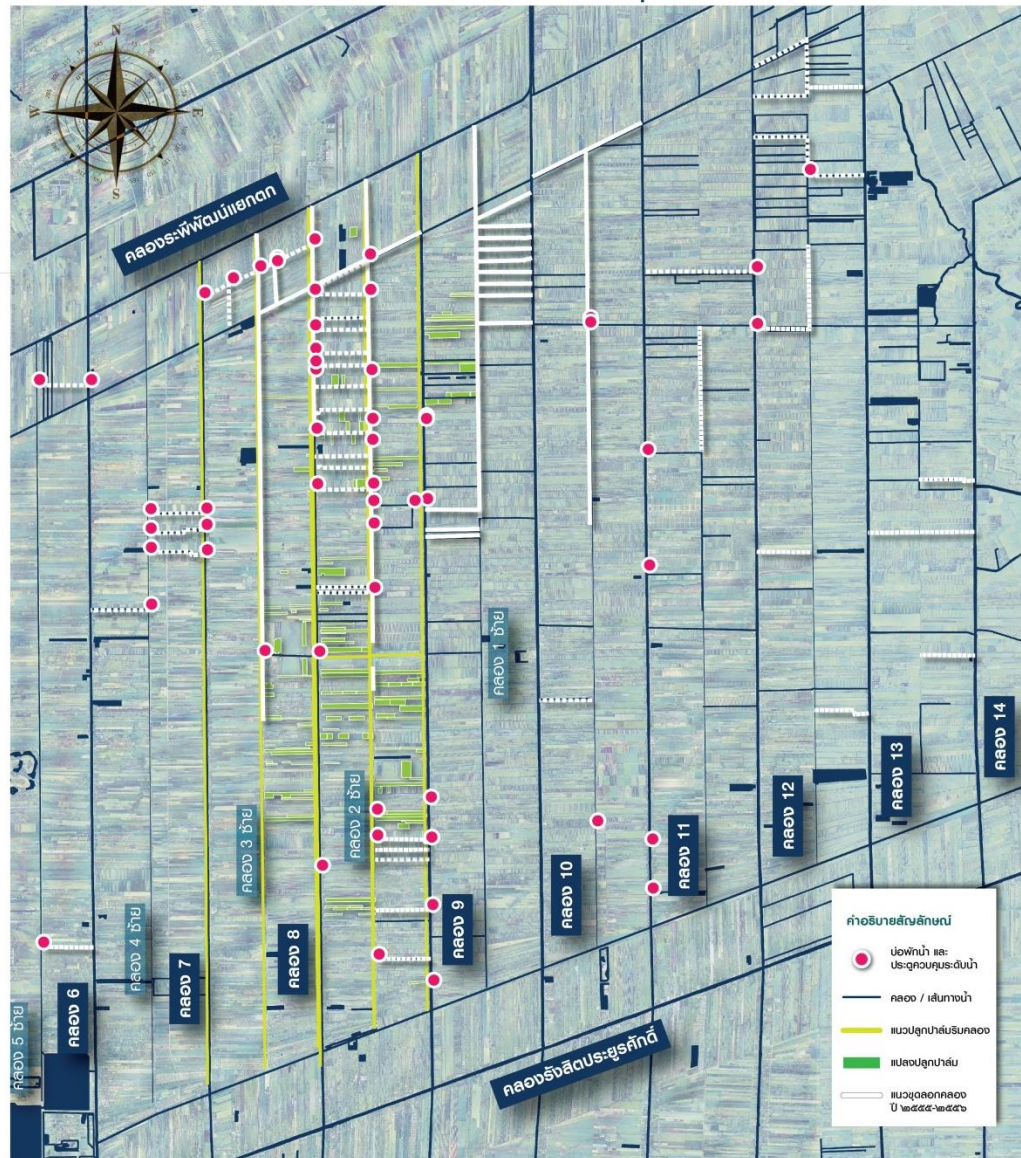
Irrigated area

## The Development of Catchment Area in Rangsit Agricultural Area

*Khlong Rangsit, Nongsue district, Pathum Thani Province, Chao Phraya River Basin*

# The Development of Catchment Area in Rangsit Agricultural Area

## Map of Community Water Resource Management following HM. the King's initiative: Rangsit Agricultural Area, Pathum Thani



### Problems:

- The existing water structure is shallowed; sub-canals could not link to the main irrigation system and furrows.
- Over 400 water gates are damaged.
- Water infrastructure ineffectively stored and managed water.
- Long term problem of flooding and drought management

### Solutions:

1. **Increase capacity of water storage and drainage** by dredging drainage canals and water-distribution canals; dredging sub-canals to link with the main irrigation system; and improving furrows by mire suction boats
2. **Increase capacity of water resource management** by building clarifiers and installing water gates to control water level
3. **Renovate waterside area** by planting palm trees beside the canals

# Water Resource Management

**Conserve the waterside area** prevent canal collapse and constructions along the canal; establish Palm fund in the village.



**Optimize water storage, drainage, and reservation** renovate the furrow areas and local canals to store water.



**Optimize water resource management** control inflow and outflow level; and link water system between irrigated canals and sub-canals.



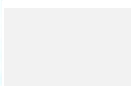
# Cultivation Adjustment

The communities adjust their cultivation with the quantity of local rainfall; cultivate mixed plants; expand the area for small integrated agriculture around public canals; decrease cultivated area in dry season; plant less consume water trees; and earn the additional incomes all year.


Area of 40 x 3 meters

Able to increase income for 12,000 baht/year and reduce expenses in consumption by 6,000 baht/year


month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
season	Dry					Raining					Dry	
lettuce												
Sweet ivy gourd												
kale												
parsley												
Morning glory												



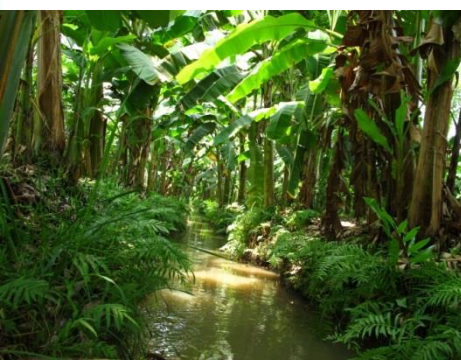
Trees: cannot cultivated in dry season



Trees: appropriate with dry season



Fruitful trees



# Achievements



- Started working under the authority of the CWRM Network Committee of 4 sub-districts; expanded the success of water resource management to nearby networks of 4 sub-districts; now benefit to 226,997 rai
- Renovated Palm oil trees furrows to be water storage area; total area 1,382 rai; catchment capacity 967,400 m<sup>3</sup>
- Increase water storages for agriculture in canals and furrows for 2,598,696 m<sup>3</sup>
- Palm trees along the canals can increase incomes for Palm fund 656,000 baht/village/year
- Prevent encroaching on waterside areas; have additional incomes from waterside agriculture



A background image featuring a vertical column of water droplets falling from the top left, creating a series of ripples and splashes on a blue surface. The overall color palette is light blue and white.

Downstream area

# **CWRM in Pred Nai Community**

*Huang Nam Khao sub-district, Mueang District, Trat Province, East Coast Basin*



# Solutions

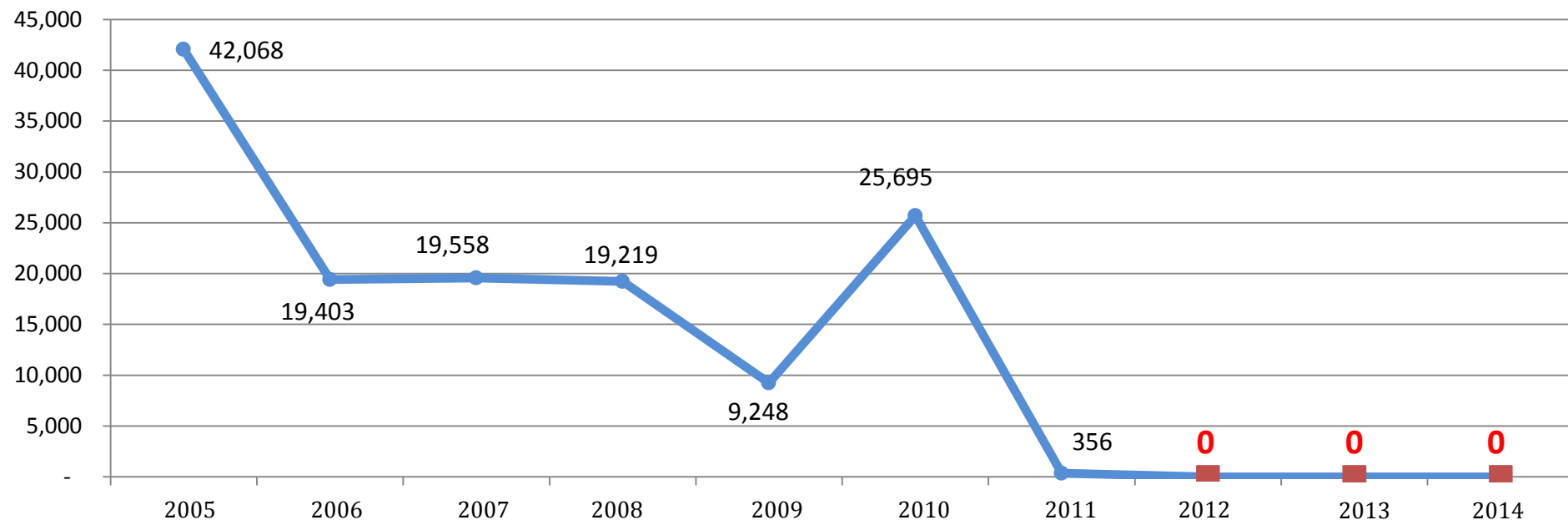
- Take care of ecosystem by using tires as artificial reef
- Prevent saltwater intrusion by retaining freshwater in the community area by creating check-dams with bags or reinforced concrete
- Use the desolated shrimp ponds into water storage ponds to increase local freshwater area.



# Achievements

- In dry season, the community can extend freshwater in the area for 30 -35 days longer.
- Total freshwater storage about 117,100 cubic meters.
- Decrease problems of saltwater intrusion into agricultural areas and ponds
- 100% decrease problems of water scarcity. Since 2011, Huang Nam Khao sub-district no longer requested extra freshwater from Nong Kan Song sub-district in dry season.

Graph shown the amount of freshwater(cubic meter) bought from Nong Kan Song sub-district for Agricultural purpose during dry season by Huang Nam Khao sub-district



The background of the slide features a light blue gradient with a vertical line of water droplets falling from the top left. The bottom half of the slide is dominated by a close-up, high-speed photograph of water splashing, showing numerous bubbles and ripples in shades of blue and white.

Ecological Restoration

# CWRM in Wang Bua Daeng

*Wiang Kook sub-district, Mueang district, Nong Khai province, Mekong River Basin*

# Problems

- Redundant flood and drought in the community over 40 years



Redundant flood in the area

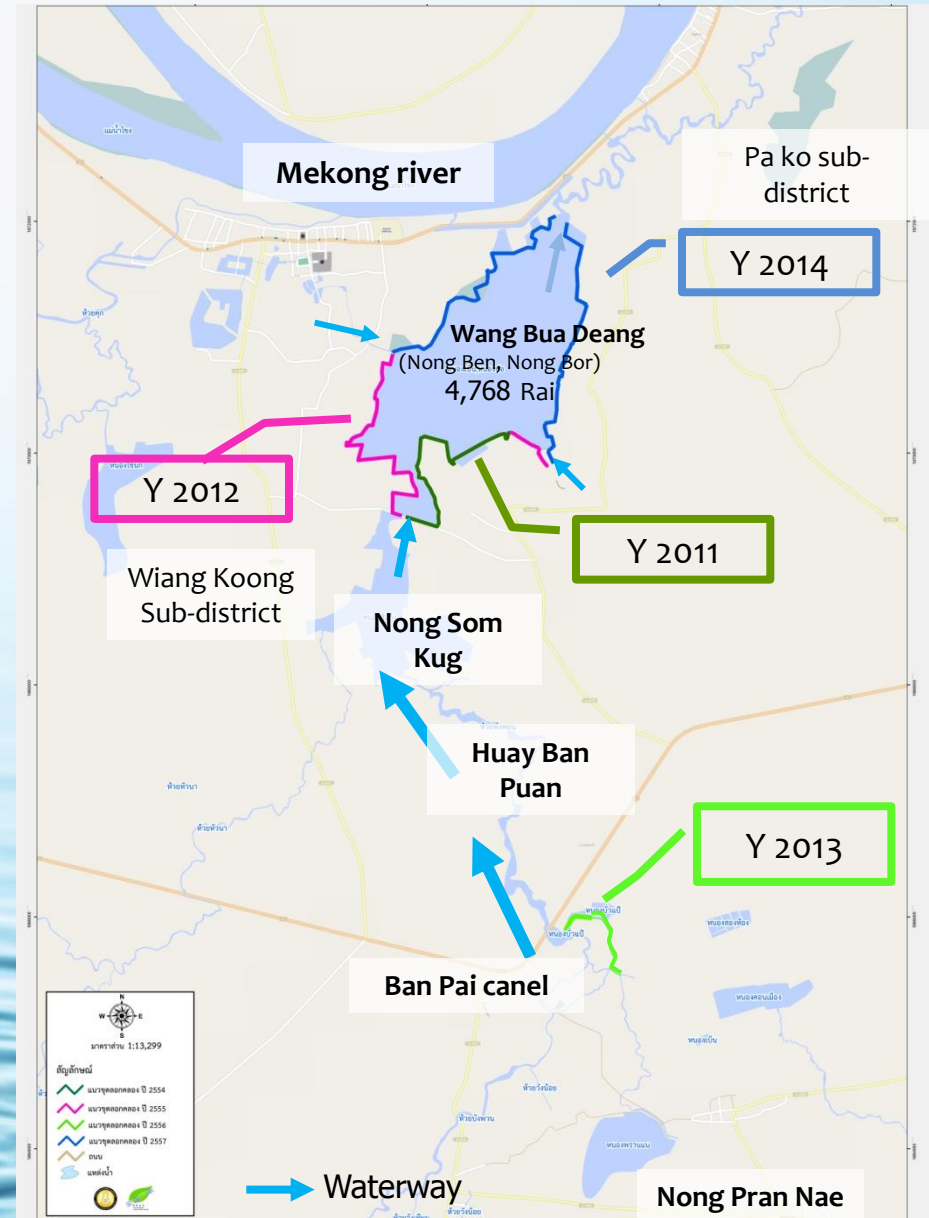


Shallow reservoirs, full of weed

# Solutions

The participation of local people in water management is the key to success for the community

Dredge up canal boundary, connect canals with ponds to increase water reservoir capacity with the collaboration of local people, local administration, public sectors and military.



# Problems & Solutions



Past  
Redundant flood in the area



Shallow reservoirs, full of weed



Y2010 - Before renovation



Y2011 - During renovation



Y2012 - After renovation



Y2013 - Present

## Achievements

- Relief flood in agricultural area over 3,000 Rai in 4 sub-districts and distribute water to 12,443 Rai of agricultural area
- Create water inflow - outflow connection to Mekong river and reserve water for agricultural purpose
- The ecological system appeared to be recover from 2012. Red lotuses bloom in the pond
- Decrease household expenses approximately 6,000 baht/year, and Increase household income approximately 118,000 baht/year

