

# Application of **Science** and **Technology**

## for **Community Water-Related Disaster Risk Reduction**



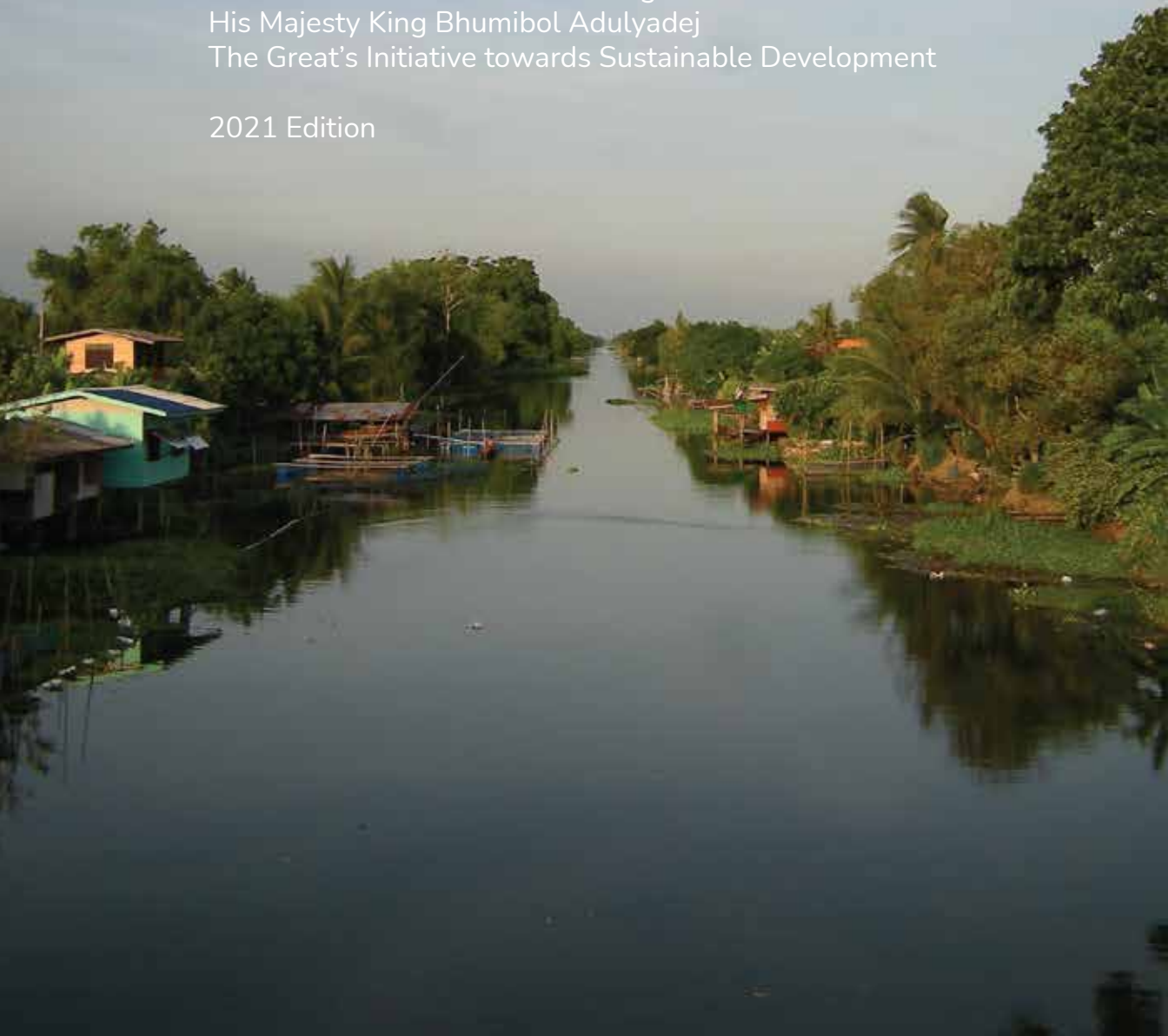
Thailand Good Practices following  
His Majesty King Bhumibol Adulyadej  
The Great's Initiative towards  
Sustainable Development



# Application of Science and Technology for Community Water-Related Disaster Risk Reduction

Thailand Good Practices following  
His Majesty King Bhumibol Adulyadej  
The Great's Initiative towards Sustainable Development

2021 Edition



Application of Science and Technology for Community Water-Related Disaster Risk Reduction  
Thailand Good Practices following His Majesty King Bhumibol Adulyadej The Great's  
Initiative towards Sustainable Development  
2021 Edition

Copyright © 2021 by **Hydro - Informatics Institute (HII)**

All rights reserved.

Printed in Thailand

First Printing, **July 2021,**

**3,000 Copies**

Published by:

**Utokapat Foundation under Royal Patronage of H.M. the King**

Hydro - Informatics Institute

901, 6<sup>th</sup> Floor, Ngam Wong Wan Road, Lat Yao, Chatuchak, Bangkok 10900, Thailand

Tel: +66 2 158 0999 / Fax: +66 2 158 0998

Web site: [www.utokapat.org](http://www.utokapat.org)

**Hydro - Informatics Institute (HII),**

**Ministry of Higher Education, Science, Research and Innovation.**

901 Ngam Wong Wan Road, Lat Yao, Chatuchak, Bangkok 10900, Thailand

Tel: +66 2 158 0901 / Fax: +66 2 158 0910

Web site: [www.hii.or.th](http://www.hii.or.th)

ISBN **978-616-584-008-8**

# Foreword

---

In a predominantly agricultural country like Thailand, “**Water is Life**”. However, water-related hazards such as flood and landslide, drought and saltwater intrusion affect people’s lives and cause economic losses. In addition, wastewater caused by unsustainable practices at household level as well as agriculture and industrial sectors is increasingly a problem.

Through more than 12,000 trips to all parts of the country since ascending the throne in 1946, His Majesty King Bhumibol Adulyadej The Great recognized the need for an integrated approach that brings together water, soil and other natural resources management to reduce flood and drought risk and improve agriculture for resilient livelihood.

Under H.M. King Bhumibol Adulyadej The Great’s Philosophy of Sufficiency Economy, he introduced the concept of “water cycle management”. Following this, important initiatives were implemented: the royal rain making to increase rainfall in drought area, preservation of upstream areas to increase moisture in the forest, construction of dams, reservoirs, water storage (known in Thailand as “**Money Cheek**” – resembling the way monkeys keep bananas in their cheeks before eating) and small water retention to cope with excessive flood and store water for consumption in the dry season. Furthermore, wastewater from households and industrial areas is treated before release to the sea.

His philosophy underscores the self-reliance of both for individuals and communities. This is built through people’s participation, their application of knowledge and creating bonds to link people of all backgrounds and boost positive and creative forces to lead to unity, balance and sustainability.



Rehabilitation and conservation of various kinds of natural resources should be at the heart of development to be sustainable. Solutions should be tailored to the topographical and sociological characteristics of each area and supported by modern but simple and appropriate technology. Research and experiment, therefore, are at the heart to identify appropriate solutions. To this end, six development study cases have been established across Thailand to serve as ‘laboratory’ to identify local solutions and for people to learn good practices.

Following H.M the late King’s approach, the Hydro- Informatics Institute (HII) of Ministry of Higher Education, Science, Research and Innovation and the Utopakat Foundation have implemented many projects in all regions of Thailand over the last 20 years. This publication shares good practices generated from 16 such projects. The good practices demonstrate successes in an integrated approach that promotes application of science and technology in community-based water resources management to reduce flood and drought risks while building sustainable agricultural production and resilient livelihoods. Public-Private-People Partnership has been the key to success.

The HII and Utopakat Foundation are pleased to share these good practices. We hope that they will contribute to more innovative solutions for the challenges of increasing flood and drought risks to achieve the world’s shared goals of ending poverty and hunger.

## **Dr. Sumet Tantivejkul**

Honorary Chairman of Hydro – Informatics Institute  
and Chairman of Utopakat Foundation under Royal  
Patronage of H.M. the King

# Acknowledgement

---

This Good Practices document are prepared with technical support from the United Nations Office for Disaster Risk Reduction (UNDRR) as part of a collaborative framework between the HII and UNDRR's Regional Office for Asia-Pacific.

Under this collaborative framework, the HII and UNDRR Asia-Pacific jointly promote the vital importance of Science and Technology in disaster risk reduction, especially in preventing creation of new risk, reducing existing risk and strengthening resilience – the goal set out by the Sendai Framework for Disaster Risk Reduction 2015-2030.

A particular focus is to promote successes of communities in applying Science and Technology to address disaster risks, natural resource management and sustainable agriculture in an integrated approach that build resilient and sustainable livelihoods. In doing so, the communities powerfully demonstrate how the Sendai Framework, the 2030 Agenda for Sustainable Development (or Sustainable Development Goals: SDGs) and Climate Change Agreement can be implemented coherently at local level.

The document is published with financial support from The Coca Cola Foundation. The Foundation is a long-term partner of HII which has provided generous financial support for many projects, some of which are presented in this document.

The selected Good Practices are the result of many years of fruitful collaboration between local authorities, research institutions, government agencies, community-based organizations as well as the private sector. Above all, villagers and communities have been the main drivers of the successes that have transformed their resilience and livelihoods.

The HII is appreciated the partnerships and thank you to all partners' collaboration and support.

# Contents

---

Foreword		3
Acknowledgement		5
Common Framework & Key Principles		8
Chapter 1	Small Reservoir and Water Distribution Management <b>Ban Muang Chum Community</b> , Krueng Sub- district, Chiang Khong District, Chiang Rai Province	16
Chapter 2	Forestry-based Disaster Risk Reduction Builds Resilient Livelihoods: <b>Conserved-Forest Lao River Basin Community Network</b> , Wiang Pa Pao District, Chiang Rai Province	28
Chapter 3	Farmers Manage Water to Increase Productivity and Reduce Drought Risk: <b>Huai Sai Reservoir Irrigated Water Management Group</b> , Prao District, Chiang Mai Province	40
Chapter 4	Strengthen Water Management Technology for Landslide and Sustain Agriculture: <b>Mae La Oup River Basin Network Community</b> , Galayani Vadhana District, Chiang Mai Province	52
Chapter 5	Effective Water Management in Small Reservoirs and Monkey Cheeks: Community Water Resource Management of <b>Ban Toon Sub-district</b> , Muang District, Phayao Province	64
Chapter 6	Suitable Crop Calendars for Natural-Rich Life: <b>Ban Huai Pla Lod</b> , Dan Mae Lamao Sub-district, Mae Sod District, Tak Province	76
Chapter 7	Tourism Blooms after Community Build-Back-Better Habitat: <b>Wiangkuk Sub-district Community</b> , Mueang District, Nong Khai Province	86
Chapter 8	Flood and Drought Management on the Rolling Plain: <b>Phu Tham Phu Kratae Forest Community</b> , Waeng Noi Sub-district, Waeng Noi District, Khon Kaen Province	96
Chapter 9	Community Based Technologies for Flood and Drought Resilience: <b>Ban Pha Chan community</b> , Samrong Sub-district, Pho Sai District, Ubon Ratchathani Province	108
Chapter 10	Hardy Community Builds ‘Canal Street’ as it Adapts to Climate Change: <b>Ban Limthong and Network Community</b> , Nang Rong District, Buriram Province	120

Chapter 11	Sustaining Community Welfare Through Good Water Resource Governance: <b>Dong Khi Lek Sub-district Community</b> , Muang District, Prachinburi Province	132
Chapter 12	4 water-related (Sea-Fresh-Brackish-Waste) management: <b>Ban Pret Nai Community</b> , Huang Nam Khao Sub-district, Meuang District, Trat Province	144
Chapter 13	Retention by Thriving Furrow and Canal System Diminish Disaster Risk and Boost Economy: <b>Rangsit Canal Community</b> , Nong Suea District, Pathum Thani Province	158
Chapter 14	Reduce 4 Water-Related Problems: Flood, Drought, Brackish, and Waste; by S&T: <b>Ban Saladin community</b> , Phutthamonthon District, Nakhon Pathom Province	170
Chapter 15	Sustainable Forest Management with the “Three Forests, Four Benefits”: <b>Ban Pak Suad Community</b> , Ban Ta Khun District, Surat Thani Province	182
Chapter 16	Holistic Management of Reservoir and Ponds to Reduce Drought Risk and Increase Productivity: <b>Thapcris Community</b> , Phanom District, Surat Thani Province	196



# Common Framework

His Majesty King Bhumibol Adulyadej The Great or King Rama IX's concept of "Understand – Access – Develop" has been introduced to Thai people as a guideline for development. It requires an understanding of the context (geography, people and society), and explanation of the process to people to establish trust as pre-conditions for any local problem solving. Water data is of particular importance. The complete water data set including water maps, water tables and water balance is required for water management analysis. This information will help technical experts determine local water quantity, water demand, and the amount of water to reserve.

With King Rama IX's vision, he has anticipated future challenges to natural resources namely soil, water and forest, driven by changes to geography, society as well as climate. Therefore, He requested related government agencies to study and systematically collect data and introduce science and technology in natural resource management which aimed for sustainable development. The approach aims at 3 dimensional results:

## 1. Water security and water resource management

- Water data, water map and water diagram: To help analyze and create water resource development plan, these three data are important to cope with flood and drought risks, improve water infrastructure and community capacity to manage local water resources
- Water security: To improve water security, it benefits to increase water capital and sufficient water reservation for consumption and agriculture throughout the year

## 2. Food security and community economy

- Food security: To support community's harvest production, food security improvement through local water usage and cropping plan and an appropriate crop planning with local weather and climate conditions enable the community to harvest all year long. These lead to increase household income and decrease production expenses
- Community economy: To strengthen community's funds, community-based sustainable water development and management, village and Sub-district levels' actions are important to improve the community's economy efficiency, society and health and environment conditions

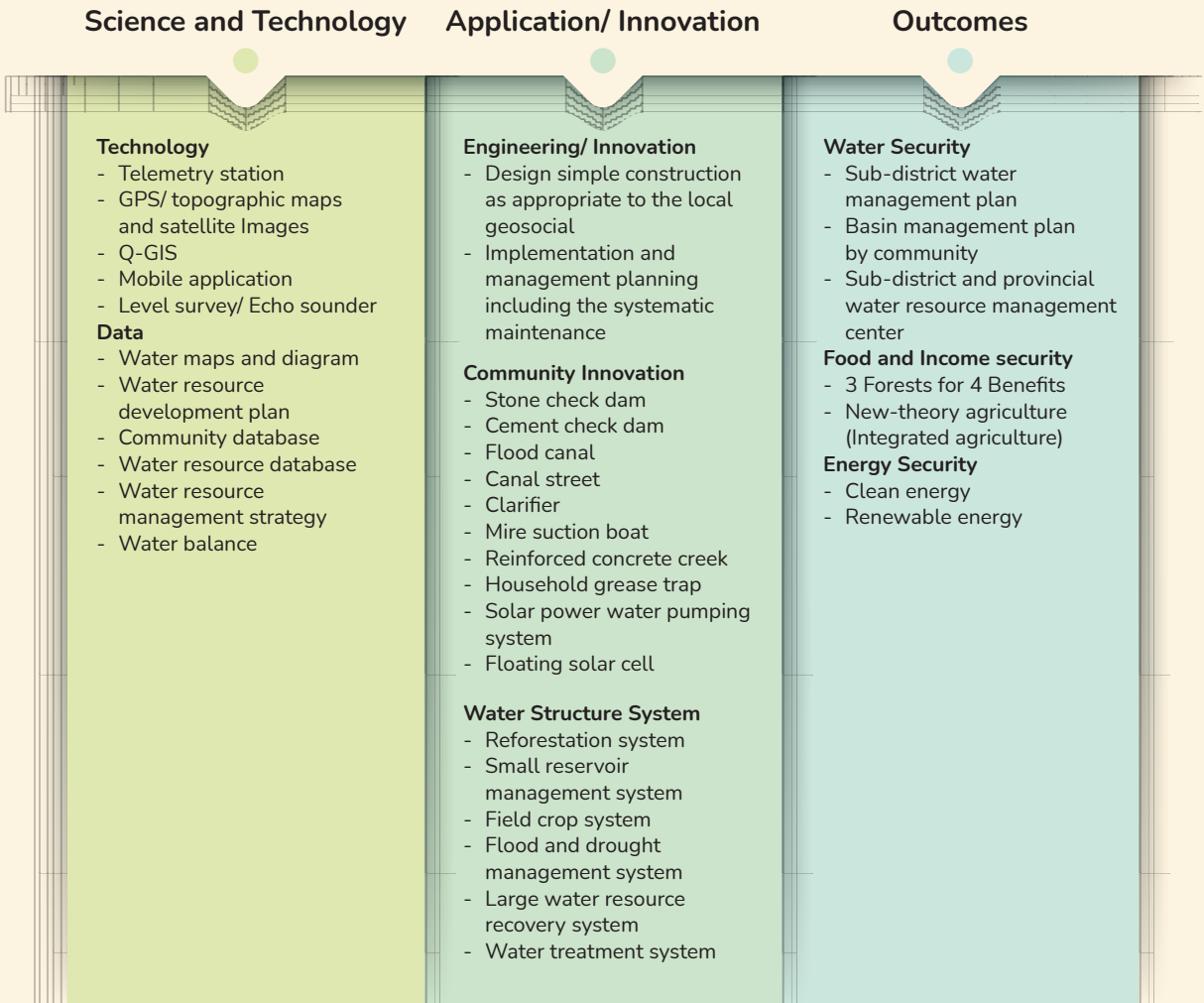
## 3. Public – Private – People Partnership (PPPP)

- Public-Private-People Partnership (PPPP): To apply King Rama IX's working principle of "Understand – Access – Develop" to integrate soil, water, forest management and agriculture development
- Expansion from people and community to the soil, water, forest management at the sub-district and river basin level
- Encourage the PPPP concept in transferring and expanding of the good practices on Community Water Resources Management following King Rama IX's initiative with the facilitation from government sector on academia and technical guidance, and financial support from the private sector for knowledge transfer and community development

Applying King Rama IX's initiatives, Hydro-Informatics Institute (HII) and Utokapat Foundation have developed a common framework that was applied by the Good Practices presented in this publication.

Under the common framework, the community is empowered and trained to apply Science and Technology (S&T) to design simple and innovative solutions for CWRM that integrate water, land, forest management and sustainable agriculture development for water, food and energy security and improved community economy.

# Apply Science and Technology to CWRM



## Application of Science, Technology, and Innovation for Community Water Resource Management

The community water resource management (CWRM) with participatory of local people will create sense of ownership and increase capability of local people to sustainably manage water in every situation: including flood and drought.

Adaptation of S&T and information systems helped communities to collect important data, identify the root causes for local problems, and develop local planning that best suited their circumstances. Examples of community application of S&T are as follows:

## Information Technology



- **Geographic Information Systems (GIS)**  
A computer-based tool designed to capture, analyze, store, manipulate and visualize geographic information on a map.
- **Global Positioning System (GPS) Receiver**  
An equipment using a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world.
- **Land and Water Survey Technologies**  
Technologies such as GPS receivers, satellite images and maps that have been used as tools for the community to understand their local context.
- **Land Use Map**  
A map that shows the types and intensities of different land uses in a particular area. The application of land use maps helps clarify local land use. By surveying their local area, villagers understand their local context and have a visual guide to comprehensive future planning.
- **Satellite Images**  
An image of the whole or part of the earth taken using artificial satellites. These images have a variety of uses, including cartography, military intelligence, and meteorology. Satellite image scan either be visible light images, water vapor images or infrared images.
- **Automated Telemetry Station**  
An equipment to measure water level, precipitation, temperature, humidity, atmospheric pressure, and solar radiation in the installed area. The collected data is automatically linked through the transmission system (3G, GPRS, or satellite) used for water modelling, weather forecast and to analyze for a disaster warning database.



## Tools and Innovation for Water Management



- **Echo Sounder**  
A device for determining the depth of the seabed or detecting objects in water by transmitting sound pulses into water and measuring the time interval between emission and return of a pulse.
- **Hydropneumatic Pumping Station (Air-ware)**  
A local wisdom innovation that developed to increase air pressure for delivery of water from lower to higher grounds over a long distance.
- **Wastewater Treatment System**  
The process of removing contaminants from wastewater, primarily from household sewage. There are some low-cost but suitable for community use examples, such as a “Household Grease Trap” (containers that filter the disposal of cooking oil before it enters into the water) or “Solar Power Aerator” (an oxygen generator equipment powered by solar panels).
- **Water Balance Analysis**  
The calculation of water demand and existing water supply enable local people to understand their current situation and the risk of potential loss from insufficient water supply for agriculture.
- **Water Reuse**  
The movement of water before it flows to another area. An increase of water circulation will add value to the water and decrease demand from outer sources. Water can be circulated from the canal to store in farm ponds for an agricultural purpose, and then non-polluted water can be used in an organic paddy field before entering the canal.
- **Water Diagram**  
A graphic chart represents the direction of water flow in one area. It shows the direction of water from upstream to downstream including their tributaries, direction, water storages, and important structures along the way.

## Innovation for Agriculture

- **Crop Planning**

The Crop Calendar is a tool that provides timely information about seeds to promote local crop production. It contains information on planting, sowing and harvesting periods of locally adapted crops in specific agro-ecological zones. This tool supports farmers in taking appropriate decisions on crops production planning to promote yearlong income to be in line with the climate change and global warming situation.

- **Pond Network**

A network of water storage and distribution system distributes water from an upstream reservoir to a small pond downstream.



Water balance analysis is crucial. Imbalance between water demand and water supply can cause an undesirable situation that might escalate to a water scarcity. In addition, seasonal variation of rainfall over time and space as well as weather extremes can cause severe floods and droughts that aggravate poverty especially in agricultural communities in Thailand.

A monthly water balance analysis is an essential tool for the community to understand and describe monthly distribution of local supplies and demands in the community. By interpreting the monthly water balance results, farmers can understand the root cause of their water stress in the area and reasonably identify appropriate solutions to collect rainwater and allocate for their cropping. In addition, surveyed results of natural streams conducted by communities provide locations and possible water resources in their own areas. All surveyed data are recorded in GIS to have the correct and common understanding of resources availability. This is essential to cope with flood and drought and strengthen adaptability and resiliency of agricultural communities against future climate change.

The innovative solutions identified by communities lead to reduced flood and drought risks, increased water security, reforestation and other natural resources. The application of theories such as “Three Forests and Four Benefits<sup>1</sup>” and the New Theory on Agriculture<sup>2</sup> helped communities improve their food security and economic self-reliance. The common framework aims at outcomes in 3 dimensions of improved water security, food and economic security as well as energy security for resilient and sustainable livelihoods of people.

The good practices have self-expanded. At the end of 2020, 60 CWRM core communities and 1,773 villages are presented in 19 river basins of Thailand.

<sup>1</sup> The theory concerns the planting of three types of forests: for timber, for fruits and for firewood, all of which would yield benefits to the people in a symbiotic manner. Besides, it also assists in the conservation of soil and water.

<sup>2</sup> A system of integrated and sustainable agriculture with the aim to optimize farmland and to build stability at the household level, dividing land into four parts with the ratio of 30:30:30:10 which can be adjusted according to the area's condition: pond 30%, rice cultivation 30%, multiple cropping 30%, and residential area 10% .



# CWRM Networks in Thailand







# Chapter

# 01



Small Reservoir and Water  
Distribution Management

**Ban Muang Chum Community,**

Krueng Sub-district, Chiang Khong District, Chiang Rai Province



# Good Practices

---

- Enhance Water Sources with Upstream Forest
- Effective Water Distribution
- Abundant Wetland Forests for Healthy Human and Natural Communities
- Well-being Community for Sufficient and Sustainable Livelihood



# The Challenge



Ban Muang Chum Community is situated at Krueng Sub-District, Chiang Khong District, Chiang Rai Province. The geography of the community is characterized by uplands alternating with lowlands. The eastern part meets with Doi Yao whereas the western part meets with Ing River. Huai Muang Chum, 3,000 meters long, is the main creek of the village whereas Huai Sang and Huai Rong Khee Ma are the tributary

flow from village into Ing River. Muang Chum Reservoir has a total capacity of 300,000 cubic meters providing water for consumption, farming and livestock benefiting to 2.72 square kilometers, including 0.94 square kilometers for habitat and public areas and 1.78 square kilometers for agriculture. Most of the total population, 518 people in 175 households, are farmers.

# The Approach

In 2013, Ban Muang Chum was selected to be part of the community water resource management network. Later, Hydro-Informatics Institute (HII) had transferred Science and Technology (S&T) application to carry out river schematic diagram, analyze and develop water sources. Then, Utokapat Foundation under Royal Patronage of H.M. The King got involved to teaching and implementing Community Water Resource Management (CWRM) following King Rama IX's philosophy. The villagers were participated in water use planning as well as check dam's construction to increase soil moisture and store water. Moreover, they have conducted their way of life following **"Sufficiency Economy"** principle by implementing "New Theory Agricul-

ture" by King Rama IX and expanded their network and collaboration to neighbouring villages.

***"Our community developed Community Water Resource Management (CWRM) concept obtaining from HII & Utokapat Foundation to implement with Muang Chum's villagers which showed the achievement after the implementation. It is our pride to be a part of CWRM development with HII & Utokapat Foundation for further achievement. We will expand our CWRM practice to surrounding communities for a sustainable development."*** Panya Paopromma, Sub-district Headman, Krueng Sub-district, Chiang Khong District, Chiang Rai Province.





# The Impacts

---

*Past*



*Present*



In the past, the villagers pumped water from Ing River for agriculture. However, Ing River have insufficient water during dry season, and the pumping cost became so high. Therefore, villagers systematically improve the existing

reservoirs, restore upstream forest and tributaries by constructing check dams for sediment trapping before flowing into a reservoir, and later distribute to farmland and daily consumption.



# Success Factors

---

The community has learned to manage water resources with technologies such as a map derived from a satellite imagery, GPS and water monitoring from HII. On the other hand, Utokapat Foundation helped to convey the approach of soil, water and forests conservation following King Rama IX's initiative. Those factors enhanced the villagers' capabilities to apply science and technology for data collection, water balance analysis and water management apart from water storage and distribution development plan in providing adequate water for drinking, consumption, and agriculture in a sustainable way.



# Good Practices

---

## Enhance Water Resources from Upstream Forest

### Upstream forest preservation and restoration

Community Forest Committee for Ban Muang Chum was established in 2000, after the upstream forest no entry announcement, for rehabilitation and reforestation. The check dams and firebreaks were constructed bringing back the ecosystem and its biodiversity. Native wildlife e.g. big-headed turtles or “**Puloo**” turtles and native deciduous trees returned in the rehabilitation and reforestation areas. In addition, villagers have implemented a complete reforestation project e.g. planting 1,000

trees annually to promote youth engagement parallel with the community implementation including seedling and plant nursery improvement.

Since 2014, the 5,000 meters long firebreak covering 2.4 square kilometers of upstream forest above Muang Chum Reservoir was constructed and maintained under a collaboration with Forest Protection and Fire Control Regional Office, Chiang Rai Province.

### Muang Chum Reservoir Management

The Committee of CWRM for Ban Muang Chum was collaborated in water use and management providing equitable water consumption right, agriculture and livestock for the whole village. Check dams were constructed to retain moisture, reduce sediment downstream deposit and store water supply whereas basic technologies were applied to collect data and analyze water balance for upstream forest management. As a result, 0.8 square kilometers of forests were restored, resulting in increasing water volume in Muang Chum Reservoir around 5,000 cubic meters and the sediment was reduced 1,400 cubic

meters annually.

According to a local water storage development plan, removal of all sediment was done which enlarged the water storage to its maximum capacity of 300,000 cubic meters. On the other hand, the Community Forest Committee of Muang Chum set rules and regulations to maintain the richness and biodiversity of forest resources and promote the secondary income around 80,000 – 100,000 baht per year from non-timber products collection from the forest e.g. bamboo shoot, mushroom and honey.

## Effective water distribution system

The effective water distribution systems are divided into 3 systems as follows:



**System 1)** The water pipes with manual control vault system to distribute water from Muang Chum Reservoir to 518 people in 175 households and 1.78 square kilometers of agricultural areas. Wastewater from consumption will be recycled for efficiency water management.



**System 2)** Tributaries system through Huai Muang Chum, Huai Sang and Huai Rong Khee Ma in total of 9,300 meters long can increase water storage to 8,700 cubic meters.



**System 3)** Ditches distribution system from monkey cheeks and farm ponds in total of 4,550 meters long can increase water storage to 84,725 cubic meters.



## Khon Kaen Swamp-natural monkey cheeks, Ban Muang Chum's swamp forest

Ban Muang Chum's swamp forest is surrounded with Ing River that overflows into agricultural areas during rainy season. There are 3 natural swamps namely, Khon Kaen Swamp, Ton Pueng Swamp and Gai Hai Swamp 80,000 cubic meters. The Khon Kaen Swamp performs as a monkey cheek to receive flood water before overflowing into

agricultural areas. Forest Ordainment Ceremony, an indigenous knowledge practice for forest preservation is also carry out during March-April as well as trees planting at Khon Kaen Swamp every year. The swamp is being treated as a source of foods and incomes for the community.

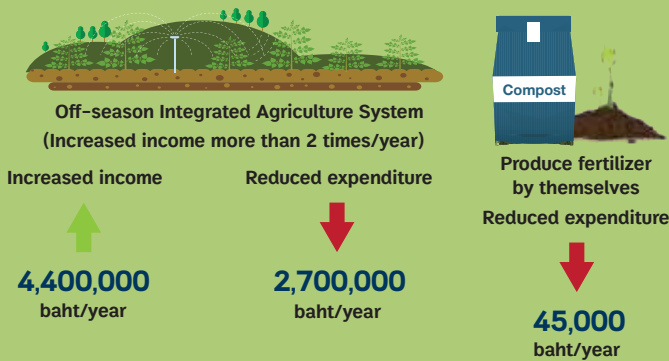




# New Theory Agriculture for community well-being and self-sufficiency life

Previously, the villagers relied on seasonal agriculture such as rice, fruit orchards and animal husbandry with fluctuating income due to unpredictable production which resulting in the insecure livelihoods and economy. Loans were made to cover their household expenses. Eventually, farmlands were sold and migrated to urban areas for jobs. In 2013, the villagers started commencing “**New Theory Agriculture**” from 10 households to 122 house-

holds in present. As a consequence, systematic land allocation facilitated the optimum land use, crop calendar, water storage and water distribution implementation, households accounting and varieties of agricultural products. According to the 'Grow what you eat and eat what you grow' concept, villagers have shared their surplus and then sell the remaining for additional income.



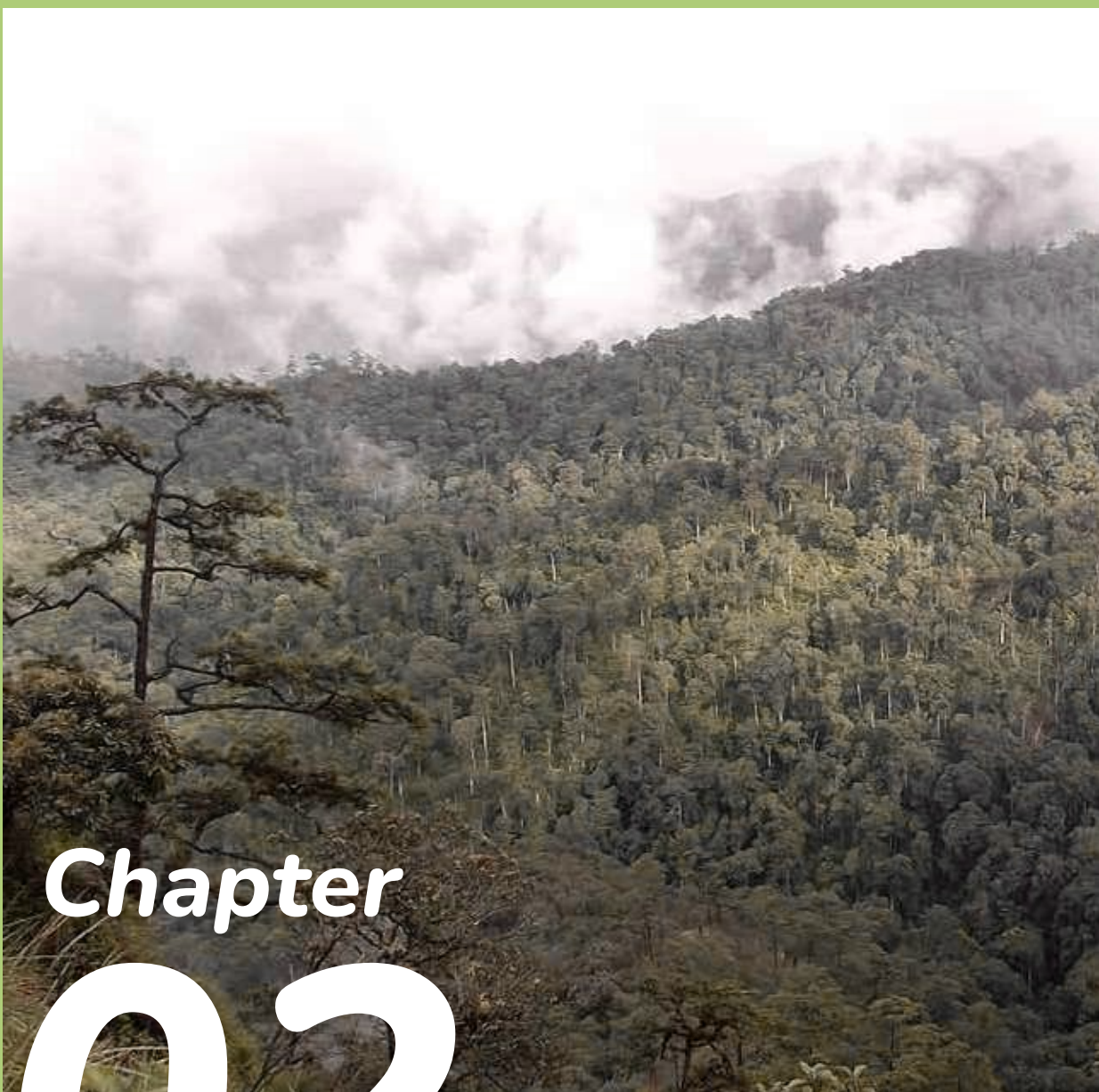
# Replication

---

At the end of 2020, Ban Muang Chum Community has successfully expanded their practices from 518 people in 1 village to cover 6,492 people in 11 villages. The agricultural area benefited from this concept has also expanded more than tenfold from 1.78 square kilometers to 18.47 square kilometers.







# *Chapter* **02**



Forestry-based Disaster Risk Reduction  
Builds Resilient Livelihoods

## **Conserved-Forest Lao River Basin Community Network,**

Wiang Pa Pao District, Chiang Rai Province



# Good Practices

- Integrate multi-hazard risk reduction and natural resource management through ecosystem-based approach
- Strengthen community collaboration to increase market value of agroforestry products





# The Challenge



Conserved-Forest Lao River Basin Community Network is located in Mae Chedi Mai Sub-district, Wiang Pa Pao district, Chiang Rai province. Covering an area of 256.03 square kilometers in the Kok river basin where land use for agricultural purpose of 51.50 square kilometers. Currently, the community network is expanded to cover 413.77 square kilometers.

In 1984, as tin mine concessions started in the area, the upstream forest



crisis took place, the Mae Tho upstream forest as a source of Lao River Basin became muddy. Whereas the villagers encroached the forest area and converted into fields for maize farming. The deforestation has impacted on flash-flood and sedimentation into water sources as well as landslides in monsoon season. Meanwhile wildfire and drought problem in dry season has affected directly for food production leading to increased insecurity of food besides income.

# The Approach

In 2005, partial communities of the Mae Lao River Basin established a **“Forest Conservation Group”**. Building on this initiative, HII and Utokapat Foundation introduced the concept of Community Water Resource Management (CWRM) to help communities address multiple challenges, including deforestation, floods, droughts and wildfires and the needs to improve the agriculture in more likely resilient livelihood manner. The Forest Conservation Group has become the **“Conserved-Forest Lao River Basin Community Network”**.

After the rules and regulations of upstream reforestation were established, the community network was educated to apply science and technology to create water map and other natural resources map including water balance analysis. Consequently, the water storage system around the upstream forest was implemented to store water for agriculture during dry season while promoting moisture retention and preventing water runoff and soil erosion. A Disaster Monitoring

Network was implemented to collect data and weekly report on water situation. The **“Three Forests, Four Benefits”** concept was replaced the monocropping with intercropping tea, coffee and herbs in the forests and promoted cash crops farming to generate regular income.



# The Impacts

---

*Past*



*Present*



With its committee and working groups comprising of individual community representatives, the Conserved-Forest Lao River Basin Community Network has promoted the community collaboration efforts to develop a water management system, restore upstream forest, and reduce disaster risks. A total of 3,332 check dams have been constructed, providing water to 3,027 households and 9,081 people in 50 villagers, 6 Sub-districts. Seedling activity was initiated comprising 70% of local trees and 30% of economic plants, to date

more than 7,000 trees have been planted. Moreover, 200-kilometers-firebreaks were implemented to prevent wildfire. A Disaster Monitoring Network has been established to engage with reporting the water situation and providing early warning.

A youth group locally named “**La-On-Hug-Nam-Lao**” or Youth Conserves Loa River Basin was established to apply S&T in collecting data as well as reporting the water situation for Disaster Monitoring Network.

# Success Factors

---

## Recognize the importance of disaster risk reduction as an integrated part of natural resource management

The Conserved-Forest Lao River Basin Community Network recognized the need to address floods, landslides, droughts and wildfires. They thus integrated the management of these disaster risks in their forest conservation and water resource management systems and activities. The water storage systems are based on natural conditions and help reduced floods and droughts risks as well as improved water supply for the communities.

## Build Capacity of Community Water Resource Management Network

The community members were facilitated to select their own committee and sub-working groups of the Conserved-Forest Lao River Basin Community Network. These bodies, consisting of community representatives, develop their own rules to work in all related areas: conservation and development of upstream forest, building the water storage systems and maintaining the Disaster Monitoring Network. Regulations set by the committee are applied by all communities bringing forwards to sustainable development.





# Good Practices

---

## 1. Integrate multi-hazard risk reduction and natural resource management through ecosystem-based approach

With the multiple challenges, the Community Network implemented CWRM based on ecosystem that provided the solution by improving water management to reduce floods, droughts, landslides and wildfire risks while supporting reforestation and improving agricultural production and agroforestry.

### Water storage systems rehabilitate upstream forest and reduce flood, drought and landslide risk

A total of 3,332 check dams in connection with upstream weirs were built to prevent flash flood during rainy season and reserve water during dry season. The check dams help slow down the water flow and allow more to infiltrate into the soil. Whereas sediment yields the nutrition in farmlands.

A reduced flow and extended flow period help reduce river bank erosion. Moreover, the check dams also act as firebreaks since they increase the moisture of atmosphere.

A better water resource management helped communities implement the 3 forests and 4 benefits for both reforestation and improved livelihood. Seventy percent (70%) of the whole Lao River upstream area of 560 square kilometers is planted with the wildwood whereas thirty percent (30%) has

been harvested with economic crops. As a result, more than 7,000 trees have been planted.

The water storage systems improved water supply from upstream weirs through the purifying systems that linked with the water storage tanks for 24 communities. Total 9,081 people in 3,027 households have adequate drinking water throughout the year.



## Disaster Monitoring Network helps monitor water situation and early warning

The Disaster Monitoring Network was incorporated from three sub-watershed members becoming youth network so called “**La-On-Hug-Nam-Lao**” or Youth Conserves Loa River Basin began with 20 teenagers of each community. These young group were educated to apply S&T to collect data for summary current report regarding natural resources every Monday.

The communities participated in 200-kilometers-long firebreaks construction and combined local wisdom to complement modern technologies such as telemetering, media box, and water level monitoring to carry out water storage systems planning and forest conservation.



## 2. Strengthen community collaboration to increase market value of agroforestry products

Water supply improvement and better forest management allowed the Conserved-Forest Lao River Basin Community Network to apply the concept of the “**Three Forests, Four Benefits**”. The communities have shifted from monocropping to integrated farming with more than 58 varieties of plants such as teas, coffee and herbs while maize farming is planted only at foothills.

However, the Community Network has learnt how to make agriculture viable in order to minimize expenditure

and maximizes income. They were trained to divide the farmland for different uses and improve production planning accordingly. Moreover, water situation reports and warning messages were engaged in crop rotation planning in addition to the practice of household accounting.

Although they confronted with over-supply production but the collaborative selling method promoted the negotiate power in dealing with traders for better prices.







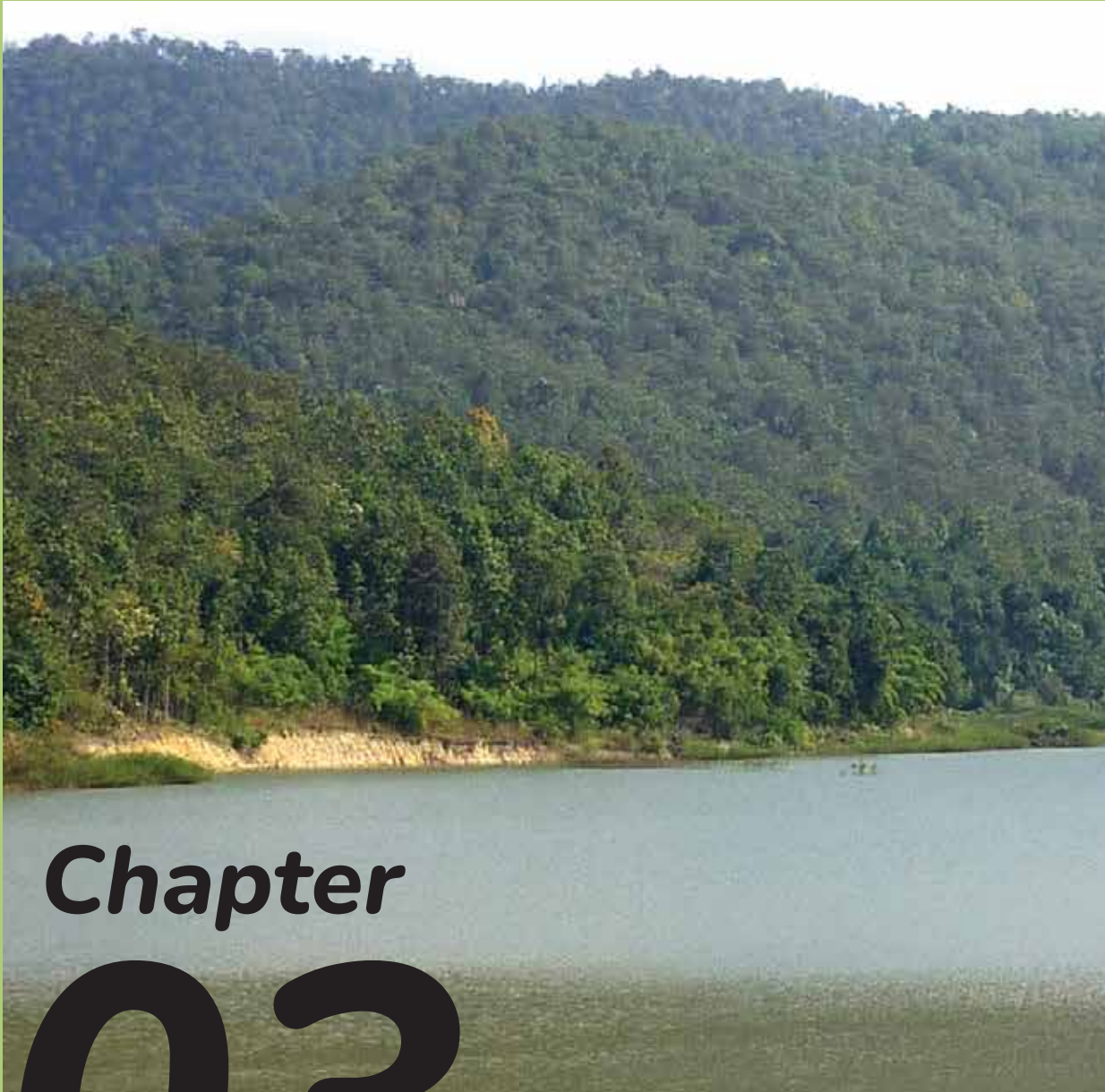


# Replication

---

Beginning with 10 villages in 2007, the Conserved-Forest Lao River Basin Community Network has been expanded to 30 communities in 5 Sub-districts namely Mae Chedi Mai, Pa Ngew, San Sali, Wiang and Ban Pong covering the upstream forest area of the Lao river of 48.47 square kilometers and 7,203 people.





## *Chapter*

# 03



Farmers Manage Water to Increase Productivity  
and Reduce Drought Risk

## **Huai Sai Reservoir Irrigated Water Management Group,**

Prao District, Chiang Mai Province



# Good Practices

- Apply science and technology to improve integrated water, forest and drought risk management
- Empower community networks to foster shared responsibilities and equity for sustained results and social cohesion





# The Challenge

Huai Sai Reservoir Irrigated Water Management Group comprising 2,104 people lives in four villages at Khuan Phak Sub-district, Prao district, Chiang Mai province, by the Ping River. Most of this area is prolonged shortages in the water supply with hilly characteristic where Huai Sai, a small brook, is the main water source providing to the villagers which inadequate for agricultural purpose. Later, conflicts over water shortages were raised.

In 1991, the villagers have filed a petition for reservoir construction, later H.R.H. Princess Maha Chakri Sirindhorn initiated Huai Sai Reservoir construction project responded by Royal Irrigation Department. In 2000, the reservoir was constructed with storage capacity of 225,000 cubic metres distributing to the agricultural area of 0.64 square kilometer. The Huai Sai Reservoir Irrigated Water Management Group was established to manage water distribution since then.

However, the water management system was inefficient and water demand



continued to rise for 12.68 square kilometers which 3.43 square kilometers of land use is for agricultural purpose. The majority of which is used for fruit crops-perennial plants 3.62 square kilometers (76.7%), 0.067 square kilometers (1.4%) for rice field and 1.03 square kilometers (21.9%) for farm crops that impact to water shortage. In addition, the forest concession caused the upstream forest as the main water source for the reservoir gradually deteriorated. This led the community suffered from severe water scarcity since then.

# The Approach

Introducing Community Water Resource Management (CWRM) to Huai Sai Reservoir Irrigated Water Management Group, HII and Utokapat Foundation aimed to help the community improve water resource management and distribution from Huai Sai Reservoir which lower water budget quantity comparing the water demand. The community members learned how to analyze water balance and use technologies to identify where to install water pipelines. Then plotted the water pipelines location on the map in order to manage and improve water distribution. The landowners were encouraged to pay the cost of water pipelines installation by themselves. They were educated how to implement this system for effective water allocation. Meanwhile, the community worked together to restore the upstream forest. The conservation map was generated to indicate the boundaries between preserved forest and arable areas. Community regulations were also developed for equitably water resources and forest management.

Agriculture has shifted from monoculture to integrated agriculture, the groups such as rice farming, mushroom cultivation and organic vegetables were established to share ideas and resources with each other to distribute more production and income. Eventually, the Huai Sai Reservoir Irrigated Water Management Group rebuilt social cohesion and unity.



# The Impacts

---

*Past*



*Present*



From one pilot water dispenser system can be carried out water to 0.64 square kilometers agricultural area in 1998. The Huai Sai Reservoir Irrigated Water Management Group installed 20 water pipelines by themselves which allocated water for 3.43 square kilometers of farmland to 224 members. The system was further extended with two more lines for consumption water supply to 336 households. The community applied technologies of GPS to identify water pipeline on the map. This method helps integrating water resource management in their area. Moreover, the rules and regulations for equitable water allocation and system maintenance were established. Finally, the villagers can cope with droughts, on the

other hands, water is sufficient in agricultural production throughout the year.

The community's land use map covers a total area of 3.84 square kilometers. The villagers were engaged in the protection and restoration of the upstream forest covering 7.2 square kilometers in 5 villages. Shifting from monoculture to integrated agriculture has helped the communities increased their income for example, farmers earn an average annual income of 40,000-50,000 baht per household which increasing household income to 20,000 baht per year while reducing household expenditure by 9,600 baht per year.



# Success Factors

---

## Empowered community for self-management

The villagers were facilitated to identify and implement their own solutions such as sharing cost and responsibilities to expand the water dispenser system that improve distribution. They were empowered to set their own governance structure such as through the Committee of Community Water Resource Management, the Forest Conservation Council and the agricultural groups. Based on the principles of shared responsibilities, fairness and collaboration, the Huai Sai Reservoir Irrigated Water Management Group has learned together through trial and error. They became confident in managing the system and embarked on new initiatives such as diversified agriculture and marketing their products.

## Promote continuous learning and innovation

The potential youth group has joined the capacity building of Science and Technologies application for data collection and design water resource management system with the villagers. They also were guided to initiate crop planning as well as household accounting. The Huai Sai Reservoir Irrigated Water Management Group was motivated to learn new approach especially organic products and marketing channel.



# Good Practices

---

## 1. Apply science and technology to improve integrated water, forest and drought risk management

The application of science and technology was instrumental for the Huai Sai Reservoir Irrigated Water Management Group to identify their own solutions.

### Water outlet pipelines to improve allocation

The villagers were trained to conduct the survey, collect data using advanced technologies such as satellite maps, Quantum Geographic Information System (QGIS), and Global Positioning System (GPS) for mapping. The GPS has been used to indicate the pipelines location from the top to the farmlands. Water balance analysis helped in calculating the relationship among rain

water, water in reservoir and crops water requirements.

The villagers have learned how to survey the ground and install the water pipelines appropriately. Twenty water outlet pipelines were installed by landowners to convey water throughout the communities of 3.43 square kilometers agricultural area.



## Forest restoration

The villagers applied technologies to conduct the survey and develop forest map with clear boundaries between protected forests and agricultural farmlands. They worked together to restore the upstream forests above



the reservoir while a “**Forest Conservation Council of Huai Sai Network**” from the representatives of 7 villages was established to develop rules and regulations of forest protection.



## Integrated agriculture for resilient livelihood

The HII and Utokapat Foundation introduced the Huai Sai Reservoir Irrigated Water Management Group to integrated agriculture following the New Theory and Self Sufficiency Philosophy of H.M. the late King. The villagers learned to transition from monocrop rice farming to diversified crops in different seasons. They established the agricultural groups for sharing information and knowledge and learning new technologies such as mushroom growing or organic products.

Moreover, the villagers were engaged in the crop calendar development techniques as well as tracking their financial transactions. The agricultural groups developed accounting system

to monitor their income. Crop calendar, household expenditure and income accounts helped to analyze the suitable agricultural products to secure their income.





## 2. Empower community networks to foster shared responsibilities and equity for sustained results and social cohesion

Based on H.M. the King's philosophy of self-management and self-reliance, the HII and Utokapat Foundation facilitated the communities to collaborate and strengthen their sense of ownership. The principle of shared cost and responsibilities has been well applied. Villagers who want the water pipeline dispenser in their land had to pay for the cost and install the water pipelines by themselves. The committee for Huai Sai Reservoir Irrigated Water Management Group and waterlines headmen were selected among the members to ensure water allocation was made equally upon the demand and availability. Job allocation and collaboration were counted as key success factors of the Group. Moreover, the young people were participated during the implementation process to ensure the working direction was conveyed appropriately.



The representative from individual village was selected to participate the Working Group for Upstream Forest Conservation Council of Huai Sai Network in developing rules and regulations to protect the upstream forest.

The agricultural group was engaged and involved in providing advice and guidance to the farmers in terms of method and investment of varieties crops to increase their income and strengthen the social bonds.









# Replication

---

The Huai Sai Reservoir Irrigated Water Management Group model was replicated at Huai Luek reservoir where a new cooperation was created to allocate water for 220 households and 2.08 square kilometers of agricultural area covering two villages. A youth group comprised of 25 members (called Yaowa Chon Rak Dee) conducts the survey to collect data, prepare maps and develop water resource management system within their community. At the end of 2020, Huai Sai network has successfully expanded their practices to cover 1,536 people in 5 villages. The agricultural area benefited from this concept has also expanded from 0.36 square kilometers to 3.97 square kilometers.







*Chapter*

**04**



Strengthen Water Management Technology  
for Landslide and Sustain Agriculture

## **Mae La Oup River Basin Network Community,**

Galayani Vadhana District, Chiang Mai Province

# Good Practices

- Empower people to combine indigenous knowledge with modern technologies for locally appropriate solutions
- Strengthen land ownership for sustainable management of natural resources
- Integrate water, forest and agriculture to achieve balanced conservation and development





# The Challenge



Mae La Oup River Basin Network Community is situated at Moo 3, Jam Luang Sub-district, Galayani Vadhana District, Chiang Mai province covering area of 78.35 square kilometers (48,974 rai) which accounts for forest 79.05%, agricultural land for 20.40% and only 0.05% is for habitat. The member of the network comprised of 221 households, 810 people where ethnic group (called Paka-Kyaw) have lived for centuries.

Since Paka-Kyaw had no title deed, the boundary between their arable areas and conserved forest was unclear.

Population growth and migration increased the natural resources consumption and caused of forest encroachment. Moreover, capitalists entered the area and hired local people to clear forests. Forest deterioration worsens the water shortages faced by the community. Long term conflict over water existed in the community as people seized water for consumption, especially for agricultural production. In 2009, the implication of soil erosion and landslides by heavy rainfall had become natural disasters concerns that impact the community.

# The Approach

In 2009, Community Water Resource Management (CWRM) was introduced to Mae La Oup River Basin Network Community. The community then were trained to apply Science and Technology to prepare water maps, undertake water balance analysis to design and develop check dams and water distribution systems. Land use plans were created by the community and land use titles were provided, enabling collaborative upstream reforestation. The canal street was introduced to solve landslide problem by constructing street along the ridge area. In normal situation, the street will be function normally. While, during rainy season, the street will function as a canal to control flash flood and transport water to reserve at the retention pond (monkey cheek). Indigenous knowledge was applied to design the water storage dams and local irrigation system. In addition, local traditions such as the River Goddess Worship Ceremony or 'Natee Khunnam' and traditional rhymes were revived to teach people to preserve the nature.

***“We learned how to conduct the survey and develop our own Land Use Map. We are the first district in Thailand to do that”,*** said Decha Nateethai, villager of Mae La Oup River Basin Network Community.

With improved water resource management, people shifted from monocrop and nomadism to integrated agriculture. Household incomes has been boosted by developing organic farming and agroforestry.



# The Impacts

---

*Past*



*Present*



Land use maps were implemented to 35 communities in 4 Sub-districts and 4 river basins for a total of 644 square kilometers (402,290 rai). Land use titles were issued for 9,501 plots, giving local people opportunities to earn their living in own land and switching from encroachment to the preserved forest. The community developed their own regulations and plans to jointly manage the forest. The canal street 920 metres long was constructed to drain flash flood water along the street. The landslide problem in this area was completely solved. In addition, the amount of reserve water in retention area were increased. Also, the water crisis has been resolved through the

network of check dams. The good practice of canal street was expanded to their network communities at the higher mountain area.

After the reforestation, the ecosystem was restored, wild animals such as gibbons, barking deer, jungle fowls and dwarf snakehead were returned. The integrated agriculture, agroforestry and organic farms have been established.

Annual household expenses decreased approximately 93% (53,900 baht per year) while the household income increased by 64% (191,600 baht per year).



# Success Factors

---

## Respect of indigenous knowledge and culture

The HII and Utokapat Foundation's technical experts and local coordinators spent great efforts to understand the Paka-Kyaw's traditional beliefs, indigenous knowledge and water resource management practices, which are important for community solidarity. This included significant time for local coordinators to master Paka-Kyaw language for successful transfer of modern technologies and skills to them. Villagers were facilitated to apply local knowledge and wisdom with their natural resource base and design appropriate water resource management system.

## Empowering community-based networks

Committees and networks established by the communities have been critical for success. The Committee for Mae La Oup River Basin Network Community Water Resource Management and sub-working group structure in the community have led the design and implementation of water resource management system and water distribution. The Ae-Pa-Wa-Dou Upstream Forest Conservation Youth Group led on the learning and application of science and technology for natural resource conservation.



# Good Practices

---

## 1. Empower people to combine indigenous knowledge with modern technologies for locally appropriate solutions

Recognizing the importance of indigenous knowledge for Paka-Kyaw, the HII and Utokapat Foundation paid special attention in facilitating the community's sharing of this knowledge and these traditions and promoting their application while transferring modern technologies.

### Land Use Maps by Community

Training was provided to Paka-Kyaw community to develop their own land use maps in local language, using their knowledge of the area. They were introduced to new technologies such as satellite map, Geographic Information System (GIS), and Global Positioning System (GPS) to map and create vivid boundaries of community, preserved

forest, usable forest, rehabilitating forest, crop rotation area and arable land. They conducted the survey in the area to collect data and create their land use maps. The maps were endorsed by the community as the basis for providing land use titles to people.



## Three-level filter check dams

The Mae La Oup River Basin Network Community participated to construct check dams with three levels of filter system i.e. primary, secondary and tertiary, based on their topography and geography. The primary and secondary levels help to slow down

water and trap sediment as well as promote upstream reforestation whereas the tertiary level helps increase water storage for using during dry season. To date, 394 check dams were built to provide water for 20 brooks to flow throughout the year.



## Local irrigation system

Household water supplies in high land areas and rice terraces were a great challenge. A local irrigation system, using indigenous knowledge was the solution. Communities dredged ditches and built dams for impounding water which was then distributed to the rice terrace areas as a monkey cheek before further distributing water for reuse 4-5 times. The water from

upstream to downstream areas is managed more effectively.

In addition, Paka-Kyaw's traditions for water resource management such as Natee Khunnam (River Goddess Worship Ceremony) and traditional rhymes were revitalized to preserve the nature.





## 2. Strengthen land ownership for sustainable management of natural resources

Engaging Paka-Kyaw in developing land use maps helped them realize the importance of protecting upstream forest and better management of other natural resources. With land use maps, endorsed by the community, land use titles of 9,501 plots were given to the communities. This was instrumental

for Paka-Kyaw to set clear boundaries of conservation forest. They reached agreements on required actions, adopted regulations and implemented collaborative plans to restore the upstream forest and manage water resources.



### 3. Integrate water and forest management and agriculture improvement to achieve balanced conservation and development

Conflict over water, deteriorating forest and other natural resources, coupled with insufficient income for a growing population had led to a severe strain on social relationships among local people in Mae La Oup River Basin Network Community.

There was the need to demonstrate how better management of forest and water would help the community food security, agricultural production and livelihoods.

The process to bring community members together to learn about their land and natural resources base was extremely useful. Paka-Kyaw under-

stood the root causes of their problems and worked together to identify what they believe as fair solutions for managing land, forest and water.

With enhanced land use ownership, people learned how to use their land effectively, for afforestation, agriculture and household use.

Supported by improved water management, Paka-Kyaw increased agricultural production, shifting from monoculture to organic farming for better cash crops. This brings food security, agricultural employment and a better life for people. Paka-Kyaw no longer eager to migrate for livelihood opportunities.



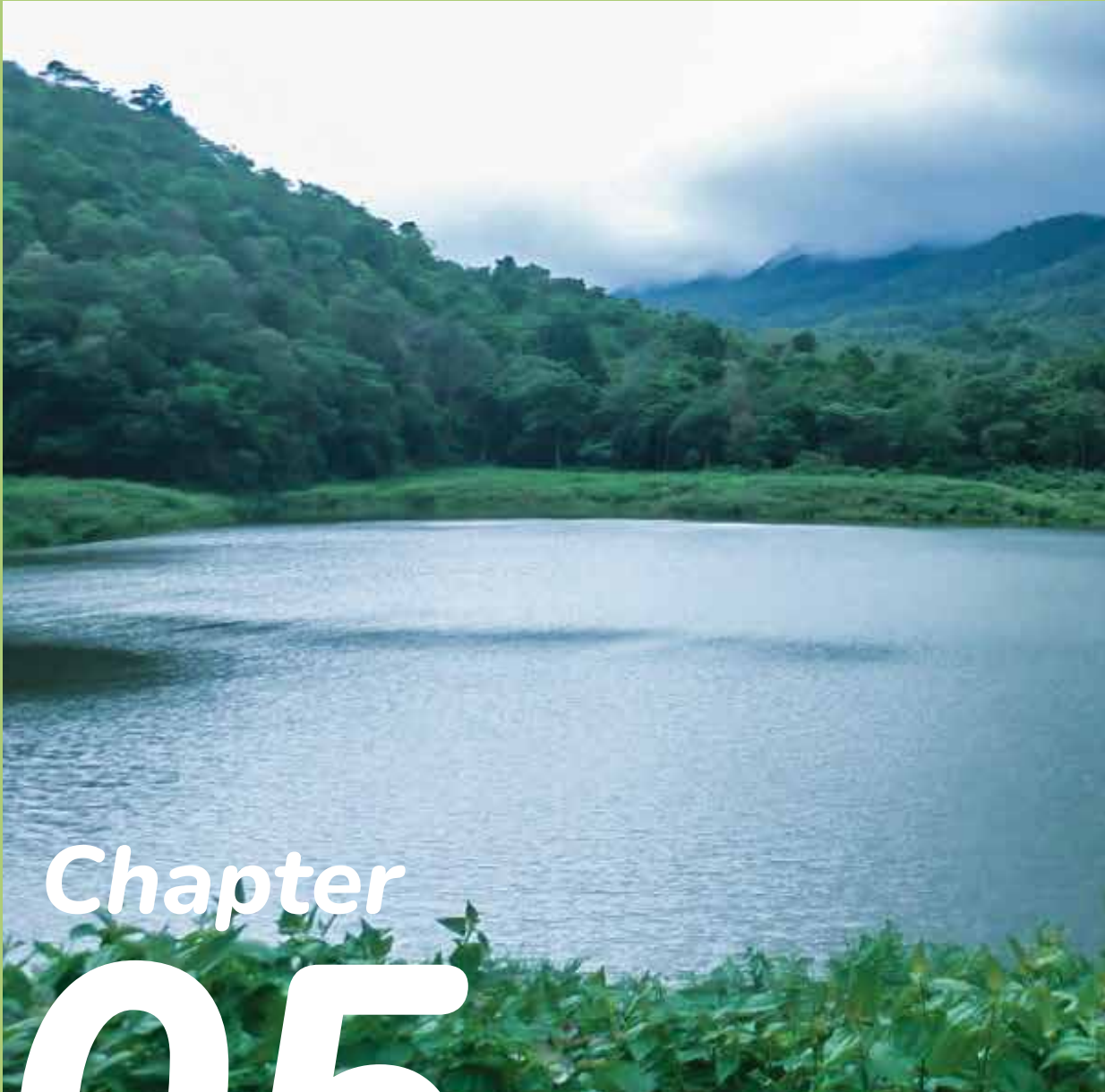
# Replication

---

At the end of 2020, the Mae La Oup River Basin Network Community has successfully expanded their practices to cover 8,648 people and 465.05 square kilometers. The network has been expanded to 7 Sub-districts, namely, Jam Luang, Mae Daet, Wat Jan, Mae Najorn, Mae Suek, Ban Tab, and Tha Pha. The Working Groups on Land Management and Regulation have also been established. The “**Ae-Pa-Wa-Dou**” a Youth Network of CWRM has been established in 8 communities consisting of 105 members. In addition, the success of Mae La Oup model has expanded to Mae Jam River Basin. All good practices has transferred to 3 sub-district in 9 villages.







*Chapter*

# 05



Effective Water Management in  
Small Reservoirs and Monkey Cheeks

**Community Water Resource Management  
of Ban Toon Sub-district,**

Muang District, Phayao Province

# Good Practices

---

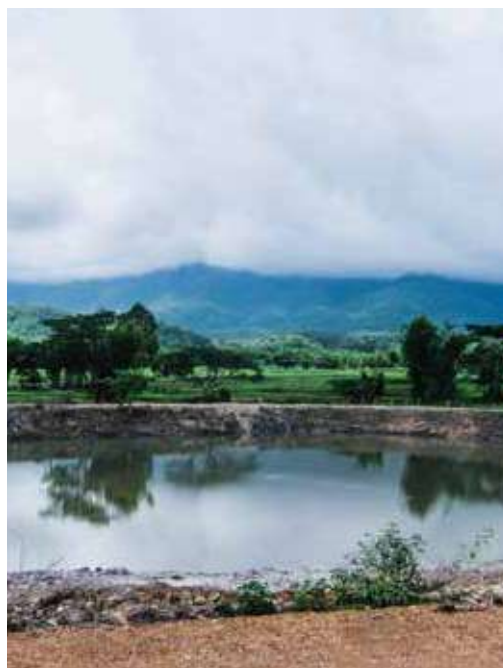
- Synergy people to conserve, preserve and restore upstream forests
- Sustainable water management to tackle floods and droughts
- “New Theory” by King Rama IX for sustainable development





# The Challenge

Ban Toon Community, Muang District, Phayao Province is located in the east slope side of Doi Luang National Park toward a famous freshwater lake namely Kwan Phayao (Phayao Lake). Mae Toon Creek flows through Ban Toon Sub-district which comprises of 11 villages with 5,462 people in 1,683 households in 2019. During 1972 – 1977, villagers encroached into upstream forested areas of more than 2.4 square kilometers for slash and burn or shifting cultivation practice, such activity later caused water scarcity in the area. Natural water resources got shallower from the sediment resulting in less ability and capacity to store enough water supply during summer and speed up water flow during rainy season which create annual drought and flood in the area. On 27th February 1982, His Majesty King Bhumibol Adulyadej The Great (King Rama IX) visited an irrigation dike project at Ban Tam Phra Lae, Ban Tam Sub-district, Muang District, Phayao Province, a village headman at that time, Fong Chaisarn, had a chance



to respectfully provided information to H.M. King Rama IX regarding both problems. H.M. King Rama IX bestowed a reservoir and Huai Toon Reservoir was finished in 1984 by the Royal Irrigation Department.

# The Approach

In 2011, Ban Toon Sub-district participated in the National Community Water Resource Management Competition and won. Then, the Committee for Community Water Resource Management (CWRM) of Ban Toon Sub-district was established to officially receive full supports from Hydro-Informatics Institute (HII) and Utokapat Foundation under Royal Patronage of H.M. the King. Later in 2012, the technology and knowledge transfer process began by conducting field survey to fully understand the total picture of their lands through full local participatory following a holistic problem solving approach, then learning CWRM approach following King Rama IX's initiative. The villagers have been encouraged to adapt the Philosophy of Sufficiency Economy following self-reliance and self-improvement including the pursuit of knowledge and happiness in a sustainable way. As a consequence, the upstream holistic forest management system has been implemented i.e. building check dams to reduce water velocity and to trap sediments, storing and supplying water to farmlands in

dry season, or reporting water situation every week. Once the self-reliant mindset has been grounded, the villagers began disseminating the success to nearby villages in term of knowledge sharing in water, forest and natural resources survey and map production, rules and regulations for upstream forest preservation, and water balance analysis. In 2016, Ban Toon CWRM had been selected as the number 11th of National CWRM Good Practices.

***"I'm very grateful and impressed for what HII and Utokapat Foundation supported and worked with us. We are clearly understanding soil, water and forest problems by using tools and scientific information in implementing for successful and sustainable outcomes. We have sufficient water and can pass on forest preservation mindset to our descendants through a public learning center on sustainable soil, water and forest management. Thanks to HII and Utokapat Foundation", said Som Luangmanochai, Chairman of the Committee for CWRM of Ban Toon Sub-district.***



# The Impacts

---

*After*



*Present*



The CWRM Committee of Ban Toon Sub-district in co-operation with villagers have been associated in meeting, planning and surveying water resources in order to understand the real status of situation to tackle all problems holistically and correctly. The creeks, canals and existing water resources have been restored to maintain their functions. The local farmers shifted their cultivation from monoculture to alternative crops that consume less water in the mean time be able to generate better income. The youth have been engaged in the capacity building process to carry out the community natural resources preservation and administration.





# Success Factors

---

## Restore upstream forests from the top of mountains to the reservoir

The villagers and youth were co-operated in a pilot project of 36 check dams construction at Tongsard Creek and Jampasard Creek. After one-year of the implementation, the community discovered the 10-20 centimeters height of trapped sediment within each check dam that would flow into a reservoir. Moreover, those check dams would help to increase moisture to the surrounding forested area as well. They were continuing to construct more check dams in appropriate locations since then.

## Planting Forests in the heart of people

The community and youth were associated to conduct a native plant species survey on a 4.5-kilometer walking trail at Doi Nork, a natural attraction located in Doi Luang National Park by putting name tags for those native plant identification. The implementation was under supervised and educated by local wisdom elites.



# Good Practices

---

## 1. Synergy people to conserve and restore upstream forests

### Check dam construction

The community, youth and Ban Toon Sub-district Administrative Organization were participated in check dams construction since 2015. To date, 54 check dams were built to reduce sediment settlement in Huai Toon Reservoir as well as increase moisture in the forested areas.



### Synergy in Huai Toon's upstream forest conservation

The Huai Toon's Upstream Forest Conservation Youth Group carried out conserving and restoring upstream forests with the CWRM Committee of Ban Toon Sub-district by conducting survey and planting native plants where appropriated which brings about the synergy working for the community.



## 2. Sustainable water management to tackle floods and droughts

### Huai Toon Reservoir water management

Huai Toon Reservoir has a capacity of 580,000 cubic meters, managing water inflow and outflow between rice paddy by local wisdom distribution water system. The amount of 14 kilograms of rice per one rai (1,600 square meters, 0.16 hectare or 0.395 acre) will be paid after harvesting as an administration fee of ditches, weirs, Huai Toon Reservoir and Mae Toon Creek, which totally cover 5.92 square kilometers of beneficial areas.



### Tackle floods and droughts with weir management

28 semi-permanent weirs were built across 9 kilometers length of Mae Toon Creek to slow down water flow and trap sediments. This also reduces bank erosion in flood season meanwhile

retaining water reserve in dry season and diverting water from a creek to the agricultural area. The additional water storage has increased up to 20,000 cubic meters.





## “Kaem Ling” or Monkey Cheeks system for agriculture

To improve and restore Phak-la Creek, the culvert was installed to divert flood water and store it in Prong Aor Pond. As a result, the farmers around Phak-la Creek, around 0.096 square kilometers, are able to plant rice one to two months earlier than the normal period. In addition, the pond will prevent flooding in paddy field covered 0.032



square kilometers.

Moreover, rising the edge of Prong Aor Pond has enhanced its efficiency as a monkey cheek to store water from Huai Toon Reservoir. The additional water storage has increased to 38,000 cubic meters, benefited over 0.312 square kilometers of areas.



## Water reservoir system linkage and Kwan Phayao restoration

Huai Toon canal were excavated for water resources linkage purpose. The sediment was trapped before flowing to Kwan Phayao. Water inlet and outlet were adjusted to improve water flow which helped recover ecosystem and increased water reserve in Kwan Phayao.

Moreover, it mitigates flood and creates a fruitful collaboration among Royal Thai Army, Regional Royal Irrigation Office 2 (Phayao Province), Phayao Municipality, Kwan Phayao Water Development and Management Center and Ban Toon Sub-district Administrative Organization.



### 3. New Theory Agriculture for Sustainable Development

The farmers transformed their rice monoculture into New Theory Agriculture with multiple crops. Water distribution system was implemented to more efficient water usage and, at the same time, retain water within the farmlands. Self-reliance or sustainable farming is promoted to cut down the household expenses. In the meantime, farmers gained more incomes average

20,000 – 50,000 baht per household per year.

Since 2013, the New Theory Agriculture has been expanding, there are total 17 members up to date. Besides, Ban Dok Bau School, the local school, has also applied the approach for educational purpose in parallel with the compulsory curriculum.



# Replication

---

At the end of 2020, Ban Toon Ban Toon Sub-district has successfully expanded their practices from 1,494 people in 3 villages to cover 3,920 people in 12 villages. In addition, the Ban Toon success is the CWRM prototype for 19 Sub-districts surrounding Kwan Phayao. The agricultural area benefited from this concept has also expanded from 1.77 square kilometers to 7.46 square kilometers.







# Chapter 06

Please Scan  
for VDO





Suitable Crop Calendars for Natural-Rich Life

# **Ban Huai Pla Lod,**

Dan Mae Lamao Sub-district, Mae Sod District, Tak Province



# Good Practices

- Build local capacity to apply science and technology for integrated water resource and forest management
- Strengthen Public-Private and Community Partnership





# The Challenge

Ban Huai Pla Lod of 912 people is located in Dan Mae Lamao Sub-district, Mae Sod District, Tak Province in the Salawin River Basin. Covering an area of 37.06 square kilometers (223,162 rai) divided to conserved land 81.83%, rice farming 11.88%, vegetable farming 2.73%, public use 1.60%, living area 1.50% and community market 0.46%.

In the past, Black Muser, the ethnic group of Ban Huai Pla Lod, undervalued the forest where they lived. The forests were cleared to cultivate opium, monocrops and shifting cultivation. As a consequent, the conflict over water for consumption and agricultural production due to deforestation, barren land and drought was addressed.

In 1981, King Taksin National Park reclaimed the community forests from Ban Huai Pla Lod as forest reserves from villagers in particular of promoting reforestation that was fully supported by the villagers. However, despite the afforestation efforts, the villagers still suffered from water shortage, soil degradation and insufficient income.



# The Approach

In 2008, HII and Utokapat Foundation introduced H.M. the King's initiative in upstream forest rehabilitation and Community Water Resource Management (CWRM) to Ban Huai Pla Lod. The villagers were trained to apply Science and Technology (S&T) to seek their water resources as well as carried out water balance analysis. In addition, they were able to design and improve check dam and weirs system to increase the capacity of water storage.

Ban Huai Pla Lod's villagers were assisted to create maps that divide boundaries between community forest and conservation forest. The maps were



used to develop an upstream forest conservation framework and regulations to improve water resource management. Moreover, the implementation of **“Three Forests, Four Benefits”** approach was also enhanced their living in harmony with the forest afterwards. Subsequently, their household income began rising as they earn a living from reforestation while planting vegetables and winter fruits at the foothill areas.



# The Impacts

---

*Past*



*Present*



An upstream forest area of more than 27.76 square kilometers in King Taksin National Park has been restored, beneficiaries 213 households and 912 people. Ban Huai Pla Lod community forest is the most productive ecosystem forest in Tak Province. Water storage at the upstream forest from check dams and weirs supply to agricultural area of 1 square kilometer.

To date, the community agricultural products market (Muser market) is established as a center to promote non-timber products such as coffee, bamboo shoot, Archidendrom Jiringa, Indian gooseberry and chayote. At least

14.4 million baht cash flow per year generated to Ban Huai Pla Lod with average monthly income of 20,000-35,000 baht per household.

Forest and water resource management became the way of living for Ban Huai Pla Lod's villagers. They have gradually shifted to organic farming with regards to head of watershed protection.



# Success Factors

---

## Create a sense of ownership

Public consultation is an approach to make Ban Huai Pla Lod villagers understood the root causes of problems and shared the ideas to manage the natural resources. Villagers are voluntarily participated in conduct survey to create natural resources map besides set up rules and regulations for water and forest management. In the meantime, the community capacity building was promoted in terms of new technologies application with the combination of the local wisdoms.

## Stronger collaboration

Great efforts have been made to enhance the collaboration among the community, Sub-district government the King Taksin National Park office, and the private sector in addition to promote the awareness of reforestation with seedlings for afforestation activities.



# Good Practices

---

## 1. Build local capacity with Science and Technology (S&T) application

Ban Huai Pla Lod Community was trained to apply S&T such as Global Positioning System (GPS) to designate water resources and water infrastructures to outline water resource management system from upstream to downstream.

Over 400 check dams were built in the upstream areas to slow down the water flow helped increase water absorption. While local regulations were developed to set clear boundaries between community and conservation forest. The moisture brought by the check dams to the upstream forest helped to revitalize the ecosystem and habitat of rare wildlife such as : wild birds, barking deer, monkeys, and rare frogs. The community forest of 27.76 square kilometers was rehabilitated.

In the midstream, impounding weirs increased water supply for agriculture and consumption to 912 people in 213 households.

At downstream, water was supplied to 1 square kilometer of agricultural areas all year round. Furthermore, the community diverted water to produce 3-kilowatt hydroelectric power providing at community public areas in the night.

In addition, the villagers were adopted the “**Three Forests, Four Benefits**” approach engaging with reforestation to maintain a natural balance besides planting industrial trees for use and cultivating agricultural products to secure food and income. Eventually, Ban Huai Pla Lod’s community forest became a food bank as the natural balance brought a better quality of life.



## 2. Strengthen Public-Private and Community Partnership

The villagers initiated the collaborative mechanisms for water resources and forest management. Roles and responsibilities of the members were clearly defined in response to rehabilitate and conserve upstream forest. Regulations were issued in fair and equitable use of timber products. Agreement was reached on the period of harvesting forest to allow reforestation without planting in such period as well as conducting seasonal crop rotation to replace their past monoculture. With community members joining together as groups, they can reduce their dependency on external parties, while increasing their bargaining power in the acquisition of production factors and the sale of their produce. Costs can also

be reduced in transportation and marketing through economies of scale. Production planning can also be done for the community for common benefits.

The community enterprises were established that helped villagers generate more income from agricultural products and strengthened community networks.

On the other hand, the community collaborated with King Taksin National Park in reforestation with seedlings activity as well as applied local wisdom in natural resources conservation. Moreover, Muser organic coffee was selected as a premium product by Air Asia Airways for selling on boards.





# Replication

---

At the end of 2020, Ban Huai Pla Lod community has successfully expanded their practices from 280 people in 1 village to cover 1,957 people in 7 villages and benefited 35.2 square kilometers in the forest area.

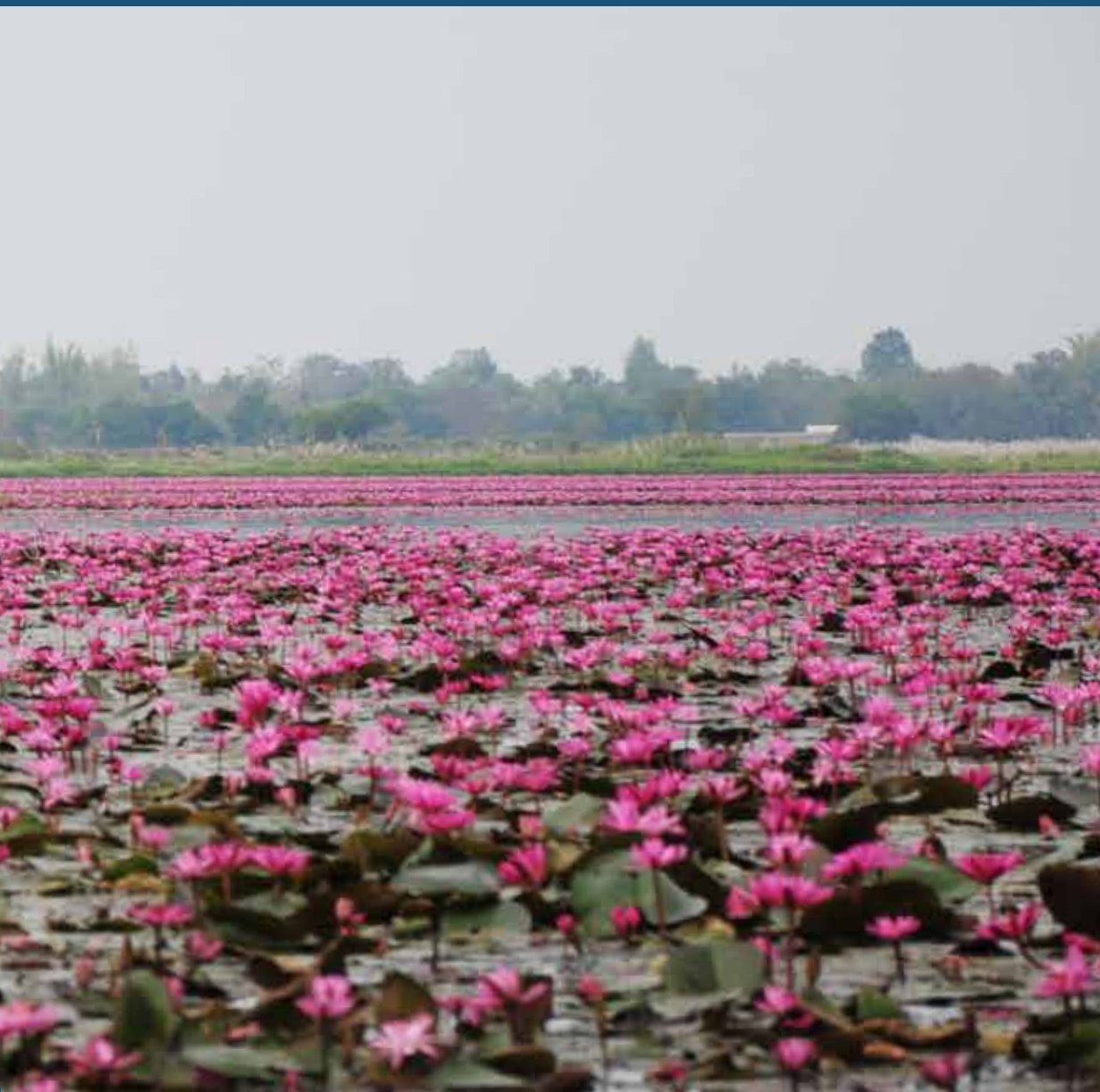




## Chapter

# 07





Tourism Blooms after Community  
Build-Back-Better Habitat

## **Wiangkuk Sub-district Community**

Mueang District, Nong Khai Province



# Good Practices

---

- Reduce disaster risk through ecosystem restoration
- Build community ownership for expansion and sustainable results



# The Challenge

The Wiangkuk Sub-district Community is located in Wiangkuk Sub-district, Mueang district, Nong Khai province by the Kong river basin. Here 6,112 people live in an area of 15.44 square kilometers, while the area of 5.65 square kilometers is utilized for agriculture activities.

Wang Bua Daeng (a red lotus pond), locates in Wiangkuk and Pa Ko Sub-districts, previously was a wetland ecosystem (or Pa Boong-Pa Tham as called by local people) originating water flows from Phu Kao-Phu Phan Kham Mountains through small and large swamps before flowing to the Mekong River. The ecosystem was rich with many species of fishes, birds and aqua plants.

Later on, the abundant ecosystem of Pa Boong-Pa Tham forest was destroyed. The upstream areas were cleared for rice cultivation. In 1958, the construction of Nongkhai-Tha Bo road invaded the water flow. Subsequently in 1966, red lotus in Wang Bua Daeng pond was took place by excessive water hyacinth population, water channels were lack



of maintenance as well as drainage system caused more than 30 days flooding. At the same time, shallow water from sediment and aquatic weeds reduced the efficiency of water storage and dried out quickly in dry season. Local fish such as the giant snakehead, clown knifefish, and featherback fish went extinct and replaced by alien species such as the mango fish and seven-striped barb. For more than 40 years, recurrent floods and droughts had challenged Wiangkuk Sub-district villagers, who had to rely on government aid, to restore Wang Bua-Daeng.

# The Approach

---



In 2011, with the HII and Utokapat Foundation's support, Wiangkuk Sub-district villagers adopted Community Water Resource Management (CWRM) to restore the ecosystem. More than 5 kilometers of canal around Wang Bua Daeng, brooks and levee were dredged to increase water storage capacity and to link with local water sources. Water inflow and outflow network system helped draining floodwater to the Mekong River and retaining

water for agriculture in dry season. Flood impacts were reduced while there was sufficient water supply throughout the year. Local dredging methods were applied to maintain water level while protecting the ecosystem. Swamp boundaries were clearly defined to prevent invasion and build-back-better habitat. The community also established Mekong river fish spawning and restored local fish such as the giant snakehead and feather-back fish.



# The Impacts

*Past*



*Present*



With drainage system improvement, Wiangkuk Sub-district Community reduced the period of inundation during flood season from 30 to 15 days impacted to only 2,000 households and 4.8 square kilometers agricultural fields in 4 Sub-districts of Phra That Bang-Phuan, Ban Thon, Pa Ko and Wiengkuk. Water supply was improved providing more agricultural products over 19.91 square kilometers of agricultural areas.

The Wang Bua Daeng ecosystem has been restored while massive of red lotuses have been reoccurred. Local birds and waterfowl such as the water goose, open-billed stork gradually return to the area. This includes Mekong river indigenous species such as the clown featherback fish which is listed in the IUCN Red List of Threatened Species . During November to February, millions

of lotus flowers stretch above the water reflecting the incomparable picturesque scenery and the rich history of Wang Bua Daeng. Lotus blossoms attraction increase tourism, bring a new source of income for local communities. The local fishery are in place for additional income. Consequently, average household expenditures were decreased by approximately 6,000 bath per year whereas annual income was increased about 118,000 baht.

Wiangkuk Sub-district community have solved their 40 years challenge of recurrent floods and droughts. They have also restored the valuable ecosystem of Wang Bua Daeng, which is significant for the whole ecosystem of the Lower Mekong River Basin including more than 60 million people from Lao PDR, Thailand, Cambodia and Vietnam.

---

IUCN Red List of Threatened Species, Guiding Conservation for 50 years, 2012. Source: <http://www.iucnredlist.org/details/181056/0>

# Success Factors

---

## **Awareness of ecosystem-based disaster risk reduction**

In the past, Wiangkuk Sub-district Community suffered from floods and droughts every year for over 40 years. Now the villagers understand the linkage of water structure, upstream forests and natural swamps besides the impacts from disaster towards their life and livelihood.

This awareness has changed their mindset and collaborated in working together to restore the ecosystem as the proven approach to reduce disaster risks successfully.

## **Cooperation between community network, local government and the private sector**

Local community took a leading role in the implementation process as well as collaboration among local government and public organizations especially the Royal Thai Army as an important association in labour force and machinery for dredging the canals.



# Good Practices

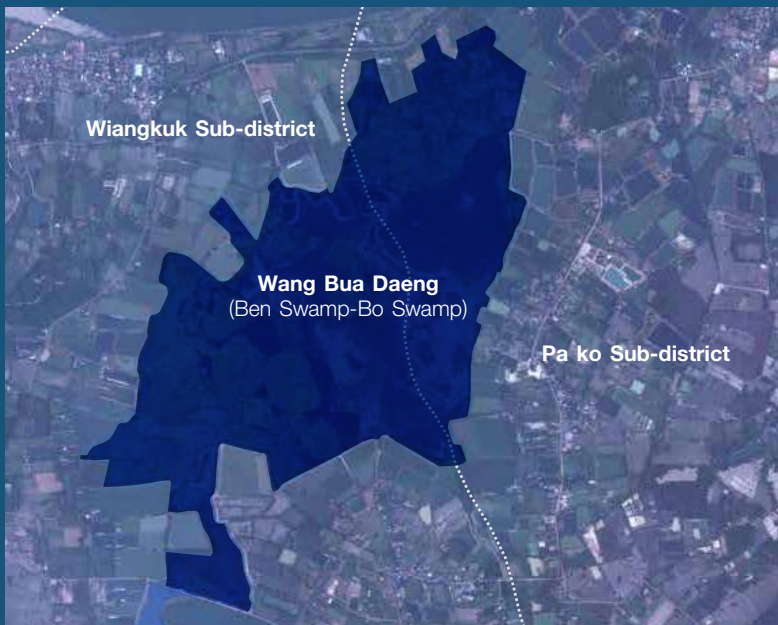
---

## Reduce disaster risk through restoring the ecosystem

Recognizing the link between poor water resource management, ecosystem degradation of Wang Bua-Daeng and flood and drought problems, community worked to identify the solutions to restore the Wang Bua-Daeng habitat. They learned to map their water resources and water structures, using decision-making support equipment such as telemetering and echo sounder for water level monitoring. Water balance analysis showed insufficient water for 4 consecutive months from January to April with a total water shortage of 100,000 cubic metres despite the

fact that the average annual water supply is greater than demand by 2.8 million cubic metres implying the need to increase potential water storages within the area.

Hence, CWRM plan has been implemented i.e. developing inflow and outflow network system, reinforcing levee in brooks and canals and connecting water sources in order to improve the inflow and outflow.



Map of channels, inflow and outflow of network system and levee



The villagers have been conducted in collaboration with defining clear swamps boundaries to prevent lawsuits. Moreover, dredging of canals around the swamps can help increase water storage as well as connecting with ponds and local water sources. These dredged soils were used as levee to prevent overflow and to define the public swamp borderline. As a result, the ecosystem was restored and returned natural resources back to its conditions.



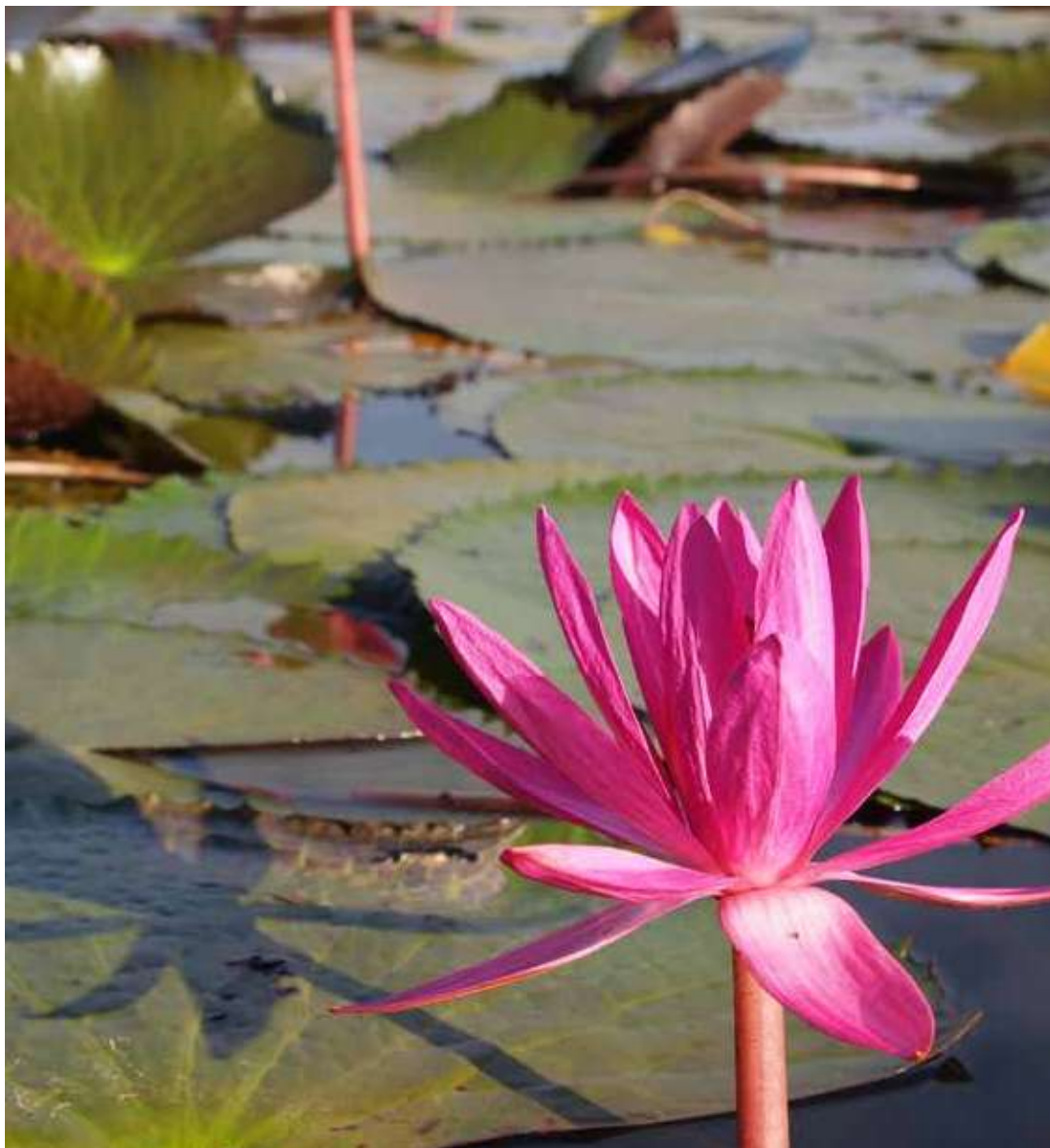
## Build community ownership for expansion and sustainable results

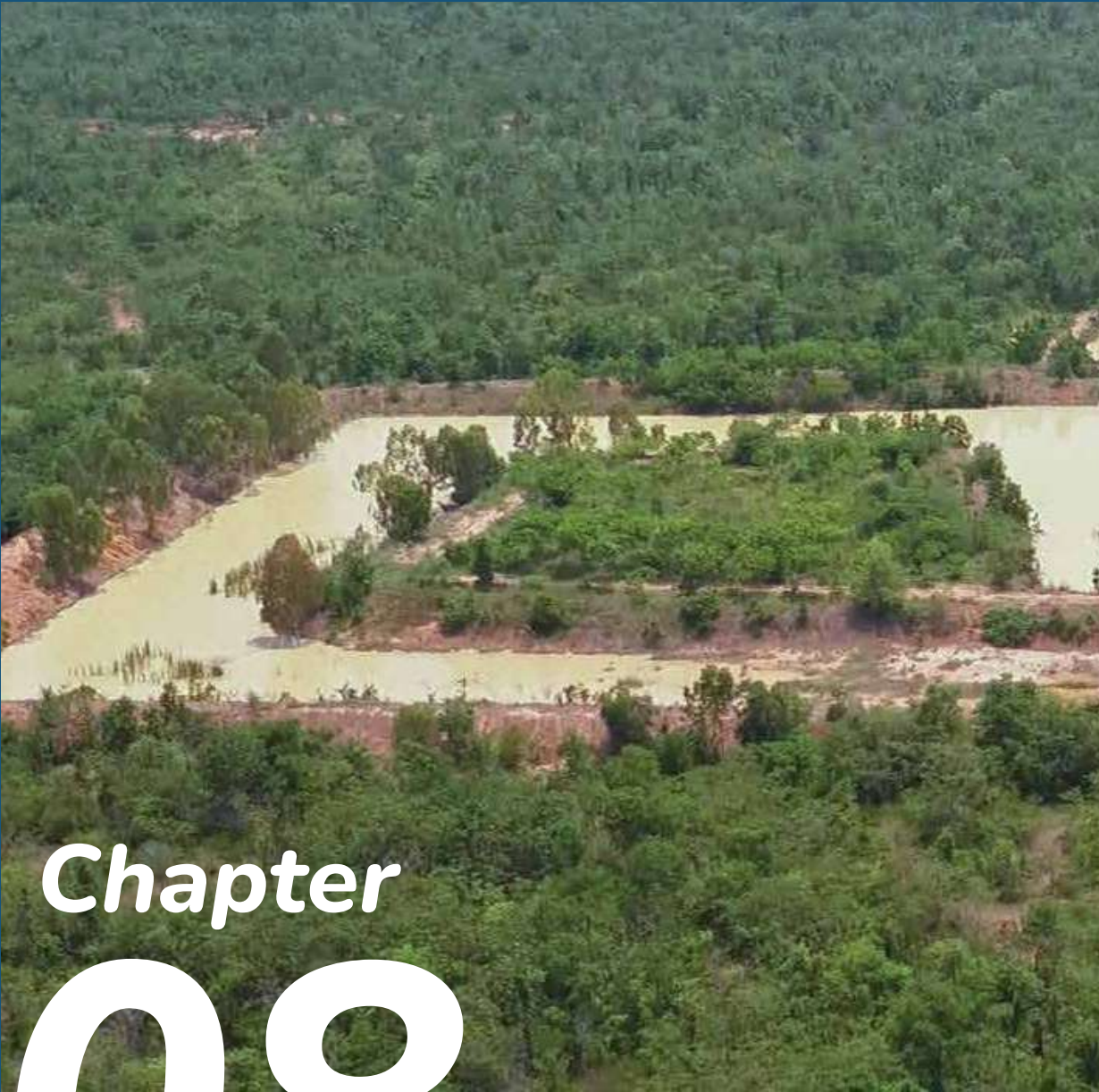
Since 2011, the villagers have been conducted dredging canal in the Ben Swamp to open waterways that help providing more water retention and distributing to the agricultural areas. With the network development, the Committee for CWRM of Wiangkuk Sub-district engaged in disseminating information and good practices to other communities for expansion and sustainable results.

# Replication

---

At the end of 2020, Wiangkuk Sub-district has successfully expanded their practices from 658 people in 1 village to cover 15,000 people in 13 villages. The agricultural area benefited from this concept has also expanded from 2.08 square kilometers to 13.68 square kilometers.





## *Chapter*

# 08





Flood and Drought Management on the Rolling Plain

# Phu Tham Phu Kratae Forest Community

Waeng Noi Sub-district, Waeng Noi District, Khon Kaen Province

# Good Practices

---

- Organizing the Traditional Festival for Rehabilitation of the Watershed Area
- Integrate Flood and Drought Management on the Rolling Plain
- Enhance Land-use Management for Sustainable Happiness
- Build Strong Network of Chi River Basin





# The Challenge

---

Phu Tham Phu Kratae Forest Community is located on a rolling plain of the northeastern Thailand. The main issue of this area is a long period of low precipitation. Phu Tam Phu Kratae usually has regular rainfalls for two years, then following with drought for four years and this pattern keeps alternated as has been recorded for more than 40 years whereas pumping water from the low to high land is at high cost. The past initial problem solving started from dredging ditches on low land or any existing streams and creeks to expand water storage capacity.





# The Approach

---



After learning how to use science and technology to manage water with Hydro-Informatics Institute (HII) in 2009, the community had a more efficient water management. They started by surveying water resources and their conditions, natural waterways, topography and summarizing the demand of water consumption in order to design an appropriate water scheme. For

instance, they designed the water system using different elevations to divert water from high land to low land in steps and reuse water multiple times without any additional cost. Afterwards, Utokapat Foundation Under Royal Patronage of H.M. the King introduced a water resource management following His Majesty King Rama IX's initiative to analyze, plan and adopt a suitable and efficient way of living.

# The Impacts

---

*Past*



*Present*



The community uses the gravity-driven water management system that traps, catches and diverts water from high to low land in the designated direction, terrace reservoirs or a reservoir network. The water in the system could be used repeatedly over five times which has low cost or no cost of water usage. After that, farmers have shifted an agricultural

practice from monoculture to integrated agriculture and have organized a plot-level water management. The land pattern has been transformed to support the recycling water system in the field. This strategy saves water and cost of production while increasing cost-effectiveness and sustainability of the practice.

# Success Factors

---

Searching for community's problems and opening up for new information to seek solutions for the community is the key success. In addition, there are mentor agencies that fills the gap of knowledge and support equipment to quickly and effectively seek and recheck solutions. The tools answer the problems and find the deficient part of the system. Hll and Utokapat Foundation are important mentors who transfer knowledge of science and technology such as maps of satellite imagery for surveying the area, designing the management plan and managing water resource data, GPS devices for identifying position, waterway and beneficiary area, Microsoft Office Suite for collecting data, Quantum GIS for demonstrating the results obtained from field surveys on satellite imageries or topographic maps, and planning for project operation based on the found evidences.





# Good Practices

---

## Organizing the Traditional Festival for Rehabilitation of the Watershed Area

Phu Ra-Ngam National Forest is a sparse dry dipterocarp forest. During the dry season every year, forest fires regularly occur. The area has low hills with a mix of large, medium and small trees. Plant species commonly found in this area include Teng, Rang, Hiang, Pluang, Pradu as well as a variety of herbs.

Phu Tham Forest is a part of the lower Phu Ra-Ngam National Forest in Khon Kaen Province. It was declared as national forest in 1969, with the total area of 252.88 square kilometers, covering four districts, namely Mancha Kiri District, Chonnabot District, Waeng Yai District and Waeng Noi District. In 1987, Phu Kra Tae Rancher Society has rehabilitated forests for food and for use on the degraded forest area. Various plants, e.g. mangoes, cotton, Pradu, Tiew, were grown in empty spaces between trees while not destroying the original forests.

In 1998, Phu Tham Phu Kratae Forest Conservation and Rehabilitation Group was established to protect the remaining

forests from encroachment by farmers and stop Agricultural Land Reform Office to segregate lands for farmers. The members comprised of eleven major villages around the forests and sixteen outer villages from five sub-districts in two districts who took advantages from the forest.

During 2007-2013, fifteen villages around the forests gathered and formed the committee to develop Forest Protection Voluntary Group. The volunteers looked after the forests, constructed firebreak, created buffer-zone forests, built check dams and rehabilitated degraded forests.

Farmers usually organize a forest ordination ceremony during the sixth month merit ritual. The ceremony consists of organizing savory and dessert to worship and forecast before farming including fortunetelling fireballs. The community also coordinates with local networks, from public and private sectors, including transferring their determination from generation to generation to protect and maintain Phu Tham Cultural Forest.

## Integrate Flood and Drought Management on the Rolling Plain

In the past, the development concept in this was dredging canals or brooks in the low plain, and when needed, the villagers would have to pump water up to the high plain for agriculture and consumption at high cost

After the community learned water resource management knowledge from HII and Utokapat Foundation Under Royal Patronage of H.M. the King in 2010, they applied science, technology, and information to understand local geographical condition, water resources, natural waterways, and water consumption. The application of technology helps the community understand the area and develop a suitable water storage and distribution system. They can manage water from high plain to low plain and reuse water without having any additional cost. This strategy is a remarkably effective water management on a rolling plain.





## Fah Pratan Chon Canal—A Pond Network System and Overflow-trapped Canal

is designed canals which dredged to trap water from the high elevation, similar to setting rainspout under the roof to collect rainwater, and transport water through terrace ponds system. The system allows diverting water from high elevation to the lower areas. The reserved water would be used in the dry season or irregular rainfall period.

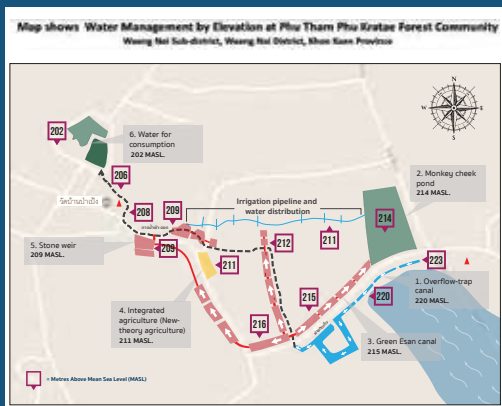
**Kha Kae Local Wisdom** is a method linking excess water from a high-level water storage area to lower level without drainage pipes. It mainly uses the lifting earth soil to prevent water from overflowing and force the excess water to flow out to the side (Kha Kae), leaving the desired storage level.



**Gravity force dissipating water in 3 directions** is the water distribution point on the high elevation that transports water to lower elevation in three directions with the use of gravity to discharge water to a lower level. Excess water will flow down to a lower level step by step. The system reuses water several times and does not require a pumping system.

## Direct Flood Water – Gather Excess Water – Store Consumptive Water

is the strategy that direct water from high plain to low-level storage areas or farm ponds. When water overflows, it will be trapped in the water channel and small canals. Additional catchment area is located at the lower plain to gather, direct and store water in the community's reservoirs for household consumption.





## Enhance Land-use Management for Sustainable Happiness

The arable land in Phu Tham Forest Community is on rolling plains and its size is relatively small. The monoculture of large-scale farming is therefore not cost-effective and difficult to manage. The water resource is also not sufficient because farmers do not want to dig a pond from their unwilling to lose the paddy cultivating area.

After learning H.M. King Bhumibol Adulyadej The Great's New Theory approach, farmers applied and developed a better land-use management. For instance, they survey the area to plot growing fields, dig a pond to collect water that is sufficient for production. The demand for production should meet amount of water that can be reserved in each season. Farmers also reduce the area of rice plantation to the amount that meets their household's need. This strategy maximizes the usage of limited land and water resources while being

able to sufficiently feed the whole family. Previously, in monoculture, farmers would earn 1,500 baht from planting 0.0016 square kilometer (0.16 hectare or 1 rai) of potatoes (excluding cost of production). After adopting new land-use management and production planning, the equal period and land size generated 200,000 baht per household. Today, 68 farmers have changed their way of farming and earn approximately 12 million baht each year.



## Build Strong Network of the Chi River Basin

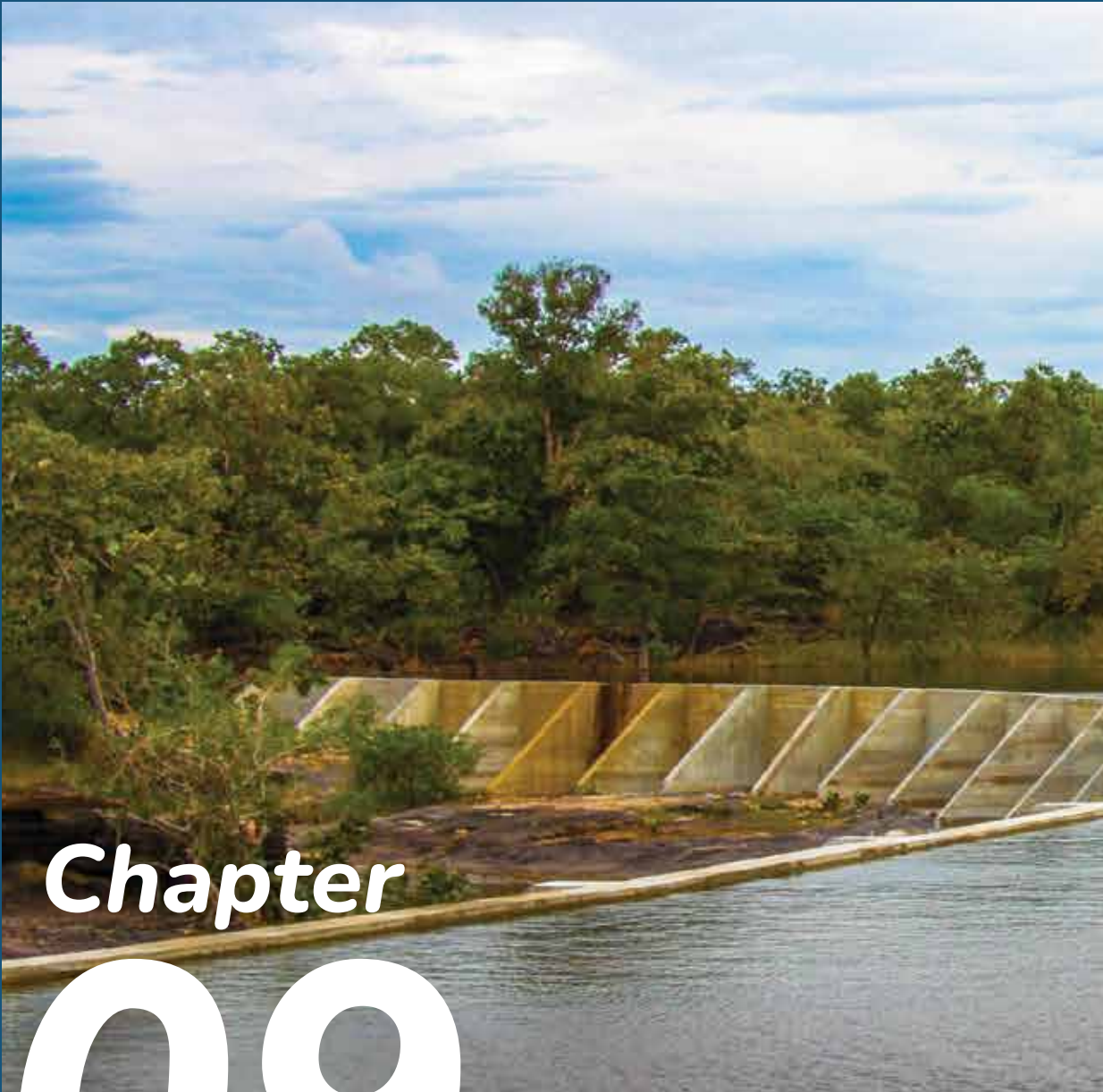
The Chi River Basin Network is a network of victims suffering from the 10-year continuous floods and droughts uncertainty and had begged for government support. Currently, they learned and adopted King Rama IX's approach from CWRM network. The community start field surveying to understand local area, explore water resources data to understand geographical condition, and water diagrams. Maps are used to analyze and review water for consumption and agriculture to understand the community's water balance. The community can develop their water system and expand water management idea as follows:

- Water resource management on rolling plains
- Monkey cheeks (retention ponds) restoration and development
- Retention canals management
- The New Theory Agriculture
- Map and water diagram of the Chi River Basin

# Replication

---

In less than 10 years, the CWRM Network of the Chi River Basin has expanded to 60 communities in 37 sub-districts, 12 districts, 9 provinces which covers 320 square kilometers and relieve yearly flood and drought issues in the area of Chi River Basin.



*Chapter*

**09**





Community Based Technologies for  
Flood and Drought Resilience

## **Ban Pha Chan Community**

Samrong Sub-district, Pho Sai District, Ubon Ratchathani Province

# Good Practices

---

- Promote community water resource management innovations
- Apply integrated agricultural production to utilize water supply



# The Challenge

---

Ban Pha Chan Community is located in Samrong Sub-district, Pho Sai district, Ubon Ratchathani province, by the Khong river basin which covers 32.06 square kilometers. The total population is over 600 people. The community is located between the Pha Taem National Park and Mekong River bank. With a geology of alternating stone and shale mountain, retaining water before draining to the Mekong river was a great challenge. Monoculture of rice cultivation and fishery were the main source of living for Ban Pha Chan community. Over twenty years, villagers suffered from water shortages during dry season (November-May). Poor villagers had to either pump groundwater or buy drinking water. While rainy season, the overflowing Mekong River sent floodwaters to many parts of the villages, damaging farmland.





# The Approach

---



In 2009, the Hydro-Informatics Institute (HII) promoted Community Water Resource Management (CWRM) in combining local wisdom and modern technologies to identify their own solutions for their multiple water challenges: how to reserve and equitably distribute water for

household consumption and increase water availability for agriculture, especially in upland areas. Later, Utokapat Foundation conveyed the CWRM following the initiative of His Majesty King Bhumibol Adulyadej The Great in analyzing and implementing CWRM on area-based.

# The Impacts

---

*Past*



*Present*



Indigenous knowledge was applied to construct reservoirs system. Two dams were connected with seven weirs located in 5 brooks to store floodwater use during dry season. Local wisdom of an “Air-ware” system was invented to increase air pressure for a long-distance delivering water from lower to higher ground. After the Committee for CWRM of Ban Pha Chan Community was established, water use zones, rules and regulations in maintenance were clearly defined. The villagers also invented household water use and conservation models for example reusing water from bathing and laundry reducing 50% of normal water consumption. They also shifted from monoculture to integrated agriculture,

maximizing land surround their houses with variety of crops. Secondary vegetable crops along the Mekong river bank during dry season also generate higher income with less water demand. The two main dams, Wang E-Rang 1 and Wang E-Rang 2, have a storage capacity of 68,000 cubic metres providing consumption water to 151 households throughout the year. Water supply to 0.92 square kilometers of agricultural land benefiting 55 households. The community dams in 5 brooks have a storage capacity of 6,502 cubic metres help alleviating 44 households and 0.65 square kilometers of agricultural area from floodwater and preventing floods and droughts for 76 households in an area of 1.25 square kilometers.

# Success Factors

---

## Combining local wisdom with innovation

The Ban Pha Chan Community used modern technologies and their indigenous knowledge to devise innovative ways to improve water resource management and reduce flood and drought risk. This ranged from design and implement of a reservoir system, to use of air pressure to push water from lower to higher ground, to models for residential water use and conservation. This is the result of the due respect to and encouragement of community people to use their indigenous knowledge of their natural resources base and local practices.

## Empower community for self-management

Active participation of communities and leadership of the CWRM Committee were instrumental for the success in Ban Pha Chan Community. With trust and respect of the community, the CWRM Committee managed to reinforce community regulations and rules for water use and management. Responsibilities were defined for community members engaging with the maintenance of water storage and distribution system to ensure its effective operation and fair utilization. The committee also effectively promoted community collaboration for more productive agriculture.





# Good Practices

---

## 1. Promote Community Water Resource Management Innovations

Ban Pha Chan Community's specific geological condition of mixed stone and shale mountain required locally suitable approaches to water resource management. More importantly, the community was lacking of water management and water reservation system despite the water balance analysis showing that the quantity of water budget is sufficient to water demand for all year.

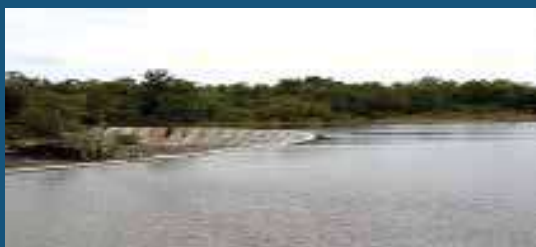
Recognizing this crucial need, the HII has put a special focus on maximizing local knowledge and wisdom while introducing science and technologies to help the communities identify their own solutions.

### Community reservoir system

Villagers learned how to use GIS maps, GPS and other tools to undertake survey and estimate water balance. They were also facilitated to share their own knowledge of the natural water flows, weather patterns as well as types of soil in different zones of the village. While contributing to construct the two big dams, the communities identified locations and built the seven dams on the five brooks, using their local knowledge.



Wang E-Rang No.1 Dam



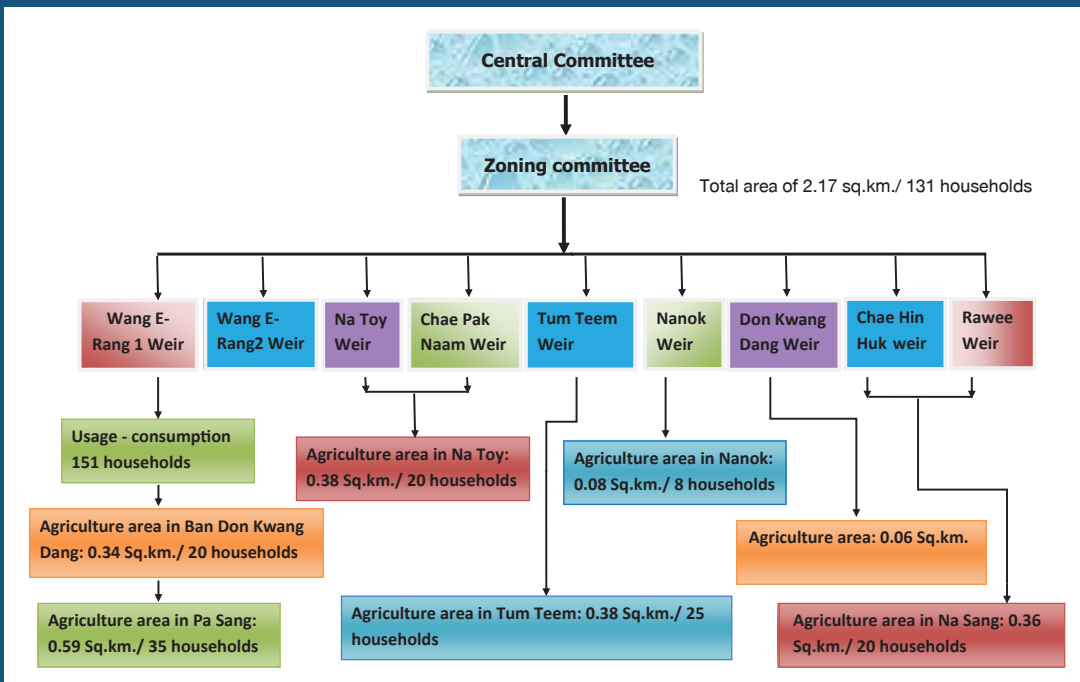
Wang E-Rang No.2 Dam

## Air-Ware system

Local communities invented the “Air-Ware” system that uses air pressure to push water from lower to higher ground, saving energy for water pumping.



The CWRM Committee of Ban Pha Chan Community, selected among villagers, worked together to define water use zones, drawing on their knowledge of the population, agriculture activities and water demands



## Water Distribution Plan

## Household Water Use and Conservation Models

Understanding Ban Pha Chan community's culture and water consumption habits, the CWRM Committee promoted household water use and conservation models. This encouraged family's member to come up with innovative ways of saving water in household uses. The models helped the community save the water consumption over 50%.



## 2. Apply integrated agricultural production to utilize water supply

With improved water supply and household water saving models, additional crops during the dry season became possible for Ban Pha Chan's villagers. Learning the New Theory, the villagers divided their farmland and utilized land surrounding their houses for different crops. They shifted to vegetable and other cash crops that demand less water but provide better income. They prepared a crop planning and managed household accounting to monitor investment and income.

The Mekong river bank was also utilized for cultivation. Vegetable farming in the Mekong river bank provides a significant income for the community.



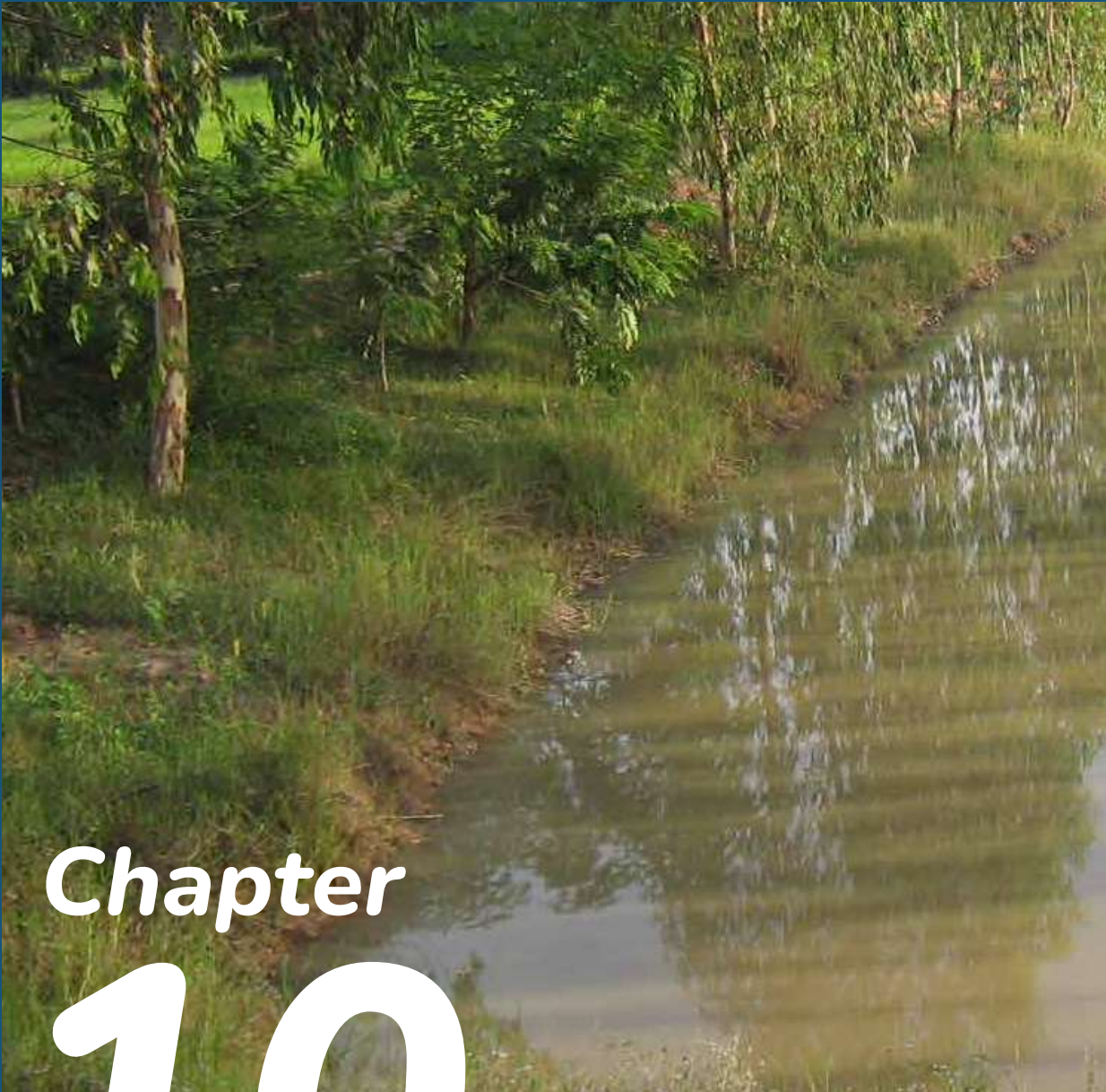


# Replication

---

At the end of 2020, Ban Pha Chan network has successfully expanded their practices to 3 villages. The agricultural area benefited from this concept has also expanded from 2.17 square kilometers to 11.04 square kilometers.





# Chapter 10

Please Scan  
for VDO







Hardy Community Builds 'Canal Street' as it  
Adapts to Climate Change

## **Ban Limthong and Network Community**

Nang Rong District, Buriram Province

# Good Practices

---

- Empower community to apply science and technology in water resource management
- Integrate water resource management, disaster risk reduction and sustainable agriculture for resilient livelihoods
- Promote community leadership and innovations to expand the CWRM network and enhance cooperation for natural resource management



# The Challenge

---

Ban Limthong and Network Community is situated in 9 Sub-districts, namely Nongbode, Thung Saeng Thong, Chumsaeng, Nang Rong, Lumsaiyong, Ban Sigh, Nong Kong, Nong Sano and Sup Praya, Nang Rong district, Buriram province, by the Mun river basin. Covering an area of 475.56 square kilometers (297,229 rai) where 24,696 people lived here and allocated 93.22 square kilometers (58,267 rai) for agricultural production.

Over 40 years until 2007, villagers in Ban Limthong and Network Community have frequently suffered from flooding during the monsoon season, droughts in summer. Severe damage has also been inflicted on the infrastructure and agricultural production. A rain-fed agricultural area of 5.92 square kilometers (3,700 rai) as the main source of food production and income have been damaged or destroyed with the serious implications of lower productivity result in rising household debts and labor migration for better life as mentioned in Thai idiom “Pounding water to survive in Buriram” (Buriram villagers have to gather dirt mud and pound it to extract water for consumption).





# The Approach

---

In 2006, Hydro-Informatics Institute (HII) and Utokapat Foundation transferred the concept of Community Water Resource Management (CWRM) in Ban Limthong and Network Community, self-reliance mindset was promoted in facilitating with problem solving and decision making as well as collaborative learning. Knowledge of science and technology have been transferred to analysis for understanding and solving problems related with CWRM in a more resilient agricultural system. The villagers were encouraged to apply technologies (i.e. satellite image, GPS etc.) in exploring for water flow and water balance providing water resources development plan and in finding solutions to water-related problems. A pond network system and overflow-trapped canal were showcases for

innovative water solutions to reduce flood in rainy season and increase water storage in dry season. Whereas “Canal street” can be utilized in transporting floodwater into Monkey Cheek ponds. Moreover, New Theory Farming is applied for better use farmland, strengthen crop planning and set up cooperatives for mutual support of farmers in planting, distribution and selling. Meanwhile water storage expansion is promoted crop production in the dry season, allowing multiple crops and a 3-fold increase of household income.



**“Since we work with HII and Utokapat Foundation, we have learned ourselves what were water problems and how to find solutions. When everyone cooperated with each other, we succeeded in solving the problem and have better living”. Sanit Tipnangrong, villager of Limthong community.**

# The Impacts

---

Overflow-trapped canal and sub canals of 56.4 kilometers has been connected with a network of more than 100 water retention ponds and farmers' ponds increasing water storage by 1.7 million cubic metres supply to agricultural area of 93.22 square kilometers (58,267 rai)

(or 68% of the total 475.56 square kilometers (297,229 rai)). An area of 11.76 square kilometers (7,351 rai) is now fully protected from floods and droughts while the risk of these disasters is reduced covering 21.34 square kilometers (13,337 rai).

*Past*



*Present*



**This is significant as a climate change projection shows that the Mun River Basin – the main source of water resources for districts in Buriram province will generally experience a shorter rainy season and longer dry season by about 2 months.**

Since runoff management has been developed, local floods and droughts have not occurred. Ban Limthong and network community farmers have been able to shift from monoculture to integrated agriculture and increase the added-value of their agriculture to 9.2 million baht per year. Household income has increased by 3 times and the value of assets 1.5 times. Seeing these changes, people who had migrated have returned for a better life in their own land.

# Success Factors

---

## Understanding the local context and availability of information

The topography studies collected by HII show the runoff direction from high area to Ban Limthong and network community which is proofed by actual flood in the area. More detail sources have been conducted by villagers using trained technologies from HII and stored results in GIS. Validated through community surveys and analyses, the studies also guided the technical design of the most appropriate Pond Network System, Canal Street structure and sustainable agricultural practices.

---

## Building trust

Trust was built among community, experts, local government and other stakeholders through open discussions, developing a shared understanding and transparent decision-making mechanisms. Building communication, facilitation and problem-solving skills of project coordinators who were selected from the community was important to ensure effective communication and information sharing between community, local government and other stakeholders. Through the process, local government better considered the community's views and partnerships with NGOs and the private sector in its decision making.



# Good Practices

---

## 1. Empower community to apply science and technology in water resource management

In the initial stage, it was difficult for some group of villagers to learn and understand the new technology. The HII then focused on basic training with observations of how different groups of people learned and how they could help each other.

The HII encouraged villagers to discuss their problems to identify root causes and solutions. Local wisdom was promoted. For example, elderly people were facilitated to provide information on past rainfall and water use to help the community understand the water shortage problem they faced. At the same time, this helped the HII expert team validate the scientific analyses undertaken as preparation for the project.



For the first time, the villagers were trained to apply technology such as Global Positioning System (GPS) receivers, a telemetering station, satellite images and maps to conduct the survey, collect data and undertake important analyses such as water balance, area-based analyses and water resources mapping themselves.



The building of water retention ponds for storage and the linking of water sources will be needed to reduce flood and increase supplies and storage for dry season.

### Pond Network System

A network of ponds was designed and developed to connect flood channels with Lum-mard (the major waterway in the region, located in lower Mun River Basin connected to Mekong River). It consisted of 70 water retention ponds (known in local term as “monkey cheeks”) that serve as water retention before it runs through to agricultural area, sub-canals and finally to more than 50 farmer’s ponds. The network expansion has been promoted by villagers themselves.

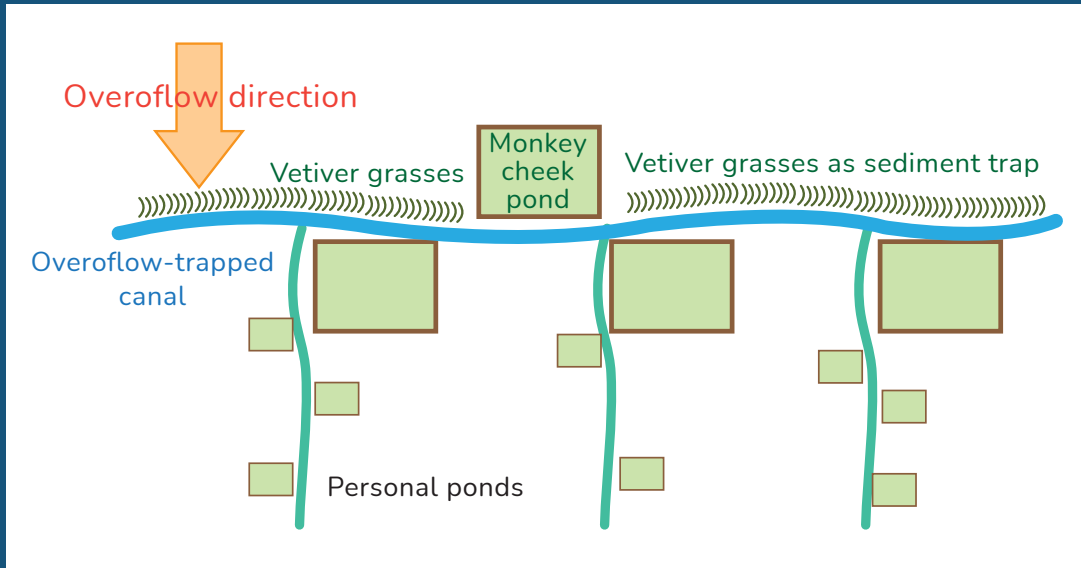


Figure 11: Overflow-trapped canal and pond network

### Canal Street

The Canal street structure was introduced to the villagers as waterways to divert floodwater to the retention ponds. This helped reduce flooding both in household and agricultural areas.

## 2. Integrate water resource management, disaster risk reduction and sustainable agriculture for resilient livelihoods

H.M. the King's New Theory under the Sufficient Economy Philosophy (SEP) encourages self-reliance of farmers through integrated practices and farmers' cooperation. This approach encourages division of farmland for different purposes (to store rainwater, for agriculture, etc), management of water and other natural resources and sustainable agriculture.

Ban Limthong and network community's villagers were facilitated to improve crop planning such as rice plantation in rainy season and production of fewer water crops during dry season, taking into account available water and flood and drought risks.

### Example : Crop Calendar of Limthong Community (Rainfed area)

Plant	2014											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mexican Marigold												
Bamans												
Papaya												
Galangal												
Lemon grass												
Turkey berry												
Cassava												
Mushroom												
Coconut												
Chili												
Eggplant												
Setbania Grandiflora												
Thai Eggplant												
Household vegetable												
Corn												
Guava												
Mango												
Pomelo												
sugar apple												
bamboo												
Fishery												

As a result, household expenditures are decreased while rising incomes. Water is available throughout the year. Cooperation among farmers was promoted by setting up groups with common interests or a cooperative to facilitate collaboration in planting, distributing and selling the products. Knowledge is shared and best practices are promoted for replication.



### 3. Promote community leadership and innovations to expand the CWRM network and enhance cooperation for natural resource management

Community ownership and leadership, supported by local governments and other stakeholders, was the key. Villagers were willing to contribute their own land for the pond network. Other villagers compensated the formers with the same size of agricultural land to help them maintain production and income.

A CWRM Committee comprising local members has been set up under local government body to implement and maintain the network in Ban Limthong.

The project coordinator was trained in project management and voluntarily took on responsibility for coordinating with HII, the community, and related public and private sectors, monitoring the water level situation and reporting the progress.

The involvement consisted of youth networks such as “Look-Ling” (baby monkey) and “Thin Thong” (golden land), local governments and other stakeholders. In addition, the HII connected the community with the private sector such as the ‘The Coca Cola Foundation’ that continues to provide financial supports to the community.

Seeing the benefits, other communities expanded the network significantly. Starting with an area of 5.9 square kilometers in Ban Limthong community, involving only 15 households, it has become an integrated network at community, Sub-district and district level with nearly 446.77 square kilometers (297,229 rai) and benefiting more than 6,664 households over several years.

In six years, the CWRM network has protected more than 15 square kilometers (9,375 rai) from flood and drought saving a total 63 million baht as well as reducing disaster risk of 20 square kilometers (12,500 rai).

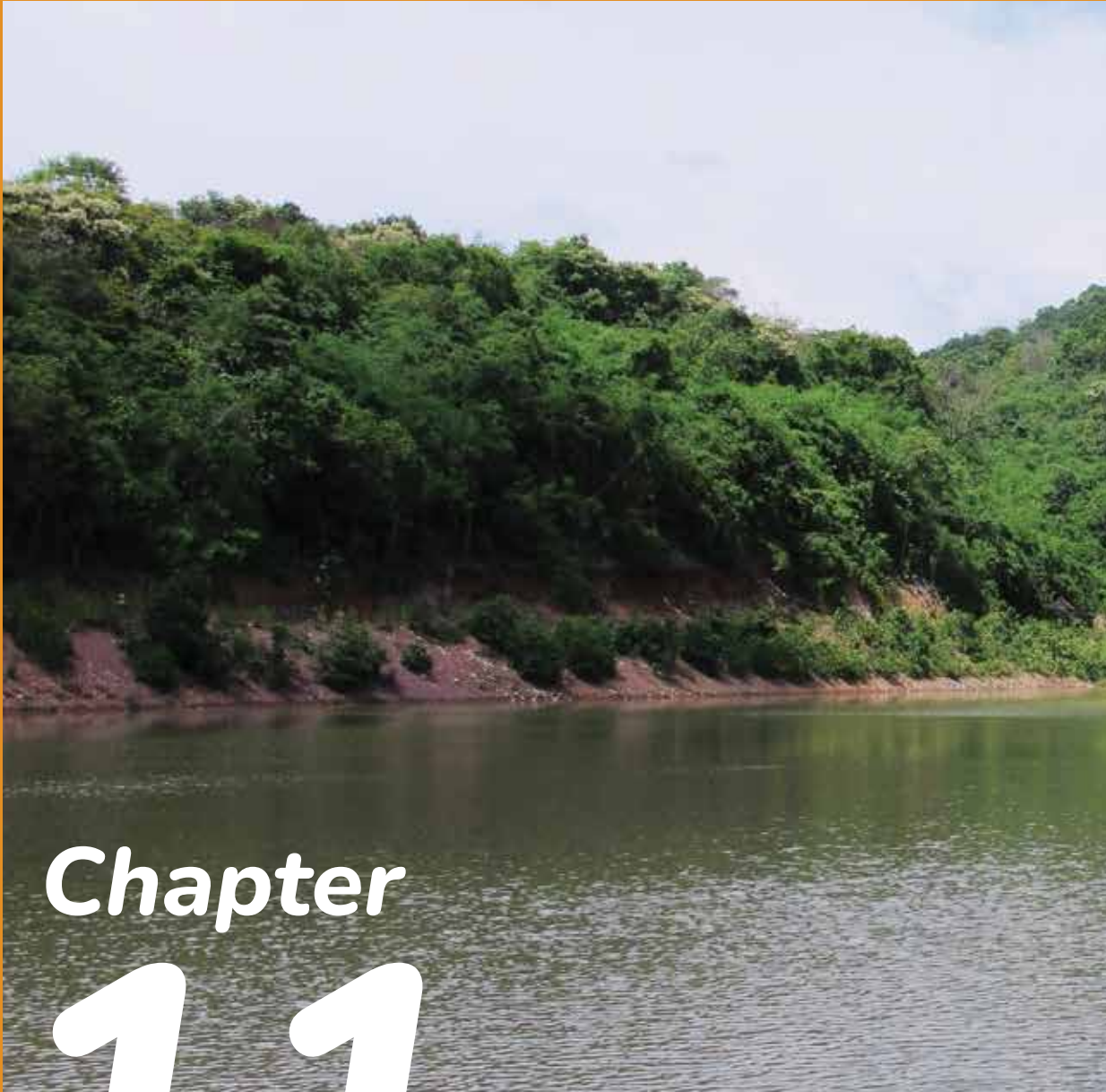
The sharing of farmers’ own experience, networks (such as youth), local champions as well as NGOs have played a critical role in this self-expansion of the CWRM network. The network has also strengthened cooperation between community members and improved water resource management.

# Replication

---

At the end of 2020, the network has expanded significantly from one community with an area of 5.92 square kilometers and 15 participating households to 65 villages in 9 Sub-districts of Buriram province, benefitting 26,452 people, 6,990 households in the area of 97.07 square kilometers.

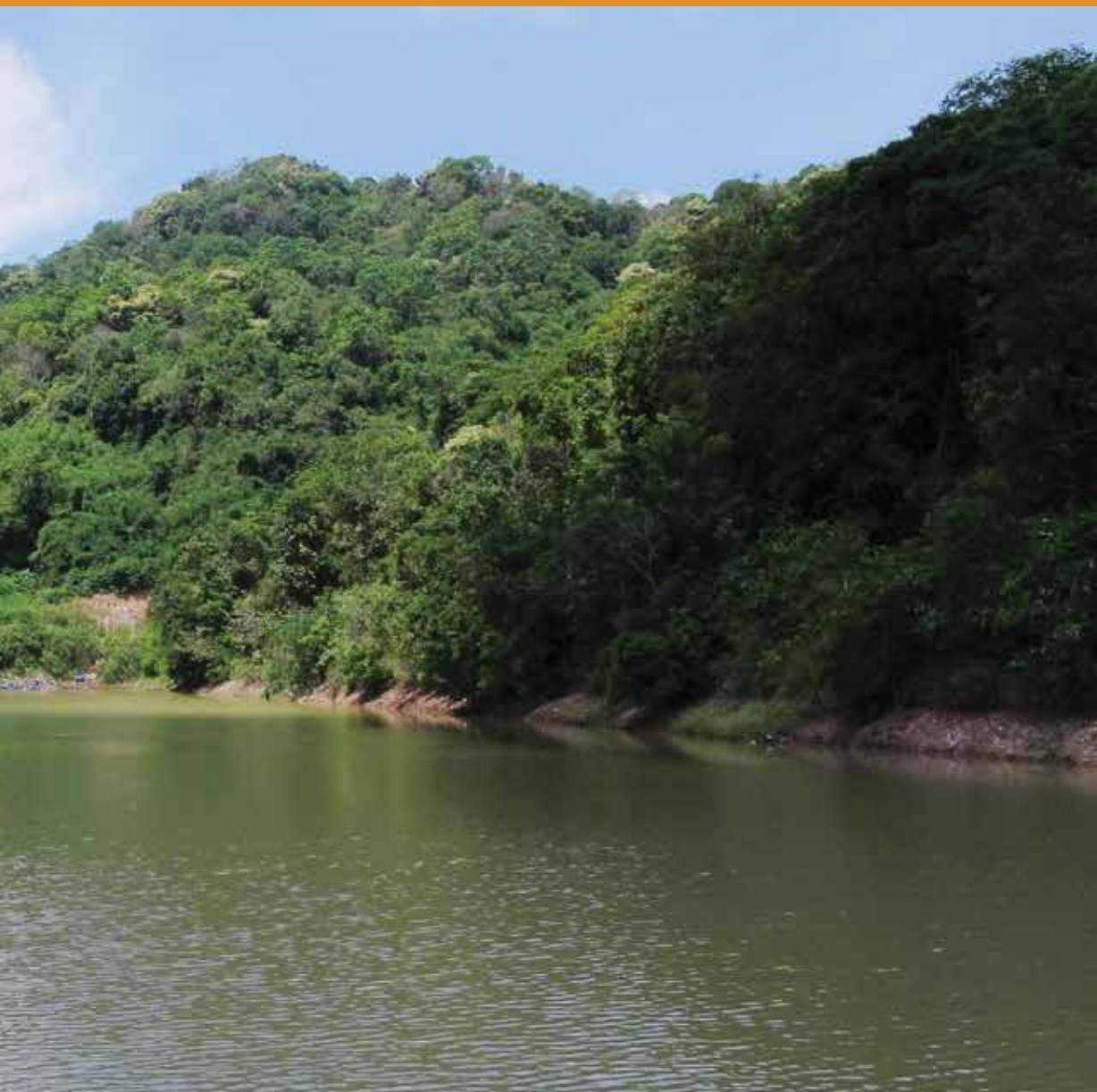




# Chapter

# 11





Sustaining Community Welfare Through  
Good Water Resource Governance

# **Dong Khi Lek Sub-district Community,**

Muang District, Prachinburi Province

# Good Practices

---

- Effort to achieve water security for sustainable management
- Integrated farming enhancing self-reliance in food security
- Local water management at Sub-district level efforts to promote water resource management at river basin level
- Sustainable community welfare saving cooperative



# The Challenge

---

Dong Khi Lek Sub-district Community, Muang District, Prachinburi Province, is situated adjacent to the southern part of Khao Yai National Park, has 56.30 square kilometers, 14 villages, and 10,230 people in 2,224 households. In the past, most of villagers were rice farmers and struggle with debts incurred from water usage expenses e.g. earthen dike and water diversion cost to the paddy fields.

Later, the villagers began to propagating native tree species and switching from rice to sweet bamboo farms, but its water consumption was still high, so they were continue to suffer from water shortage and kept losses. In 2002, the community has confronted with the serious water scarcity during dry season (February – April) due to shallow water course and excessive aquatic weed problem.





# The Approach

---

In 2014, Dong Khi Lek Sub-district Community was selected as a network community of Community Water Resource Management (CWRM) by Science and Technology (S&T) from Hydro - Informatics Institute (HII). The villagers have been trained how to apply S&T, to analyze water balance and conduct field survey, as well as increasing “**Monkey Cheek Ponds (Kaem Ling)**” within their farmlands. Later, in 2016, Utopakat Foundation under Royal Patronage of H.M. The King has participated in guidance of the CWRM approach following King Rama IX’s philosophy, as well as promoting self-analysis for problems solving started with only 3 villagers and extended to Sub-district level. Weirs were constructed to detain flood for agriculture during dry season by cultivating a mixture of products such as vegetables, fruits and fishes for household consumption and selling the surplus products which is the practice within “Sufficiency Economy” philosophy, a path towards the sustainable development.

“Thanks to Hydro-Informatics Institute (HII) and Utopakat Foundation for giving an opportunity to our community in collaborative learning, providing CWRM approach for maximum benefit and sustainability in holistic view. The community developed self-autonomy and became stronger. It is our pride and proud of following King Rama IX’s footsteps” said Banjong Promviset, Vice President for CWRM of Dong Khi Lek Sub-district.



# The Impacts

---

*Past*



*Present*



In 2014, Dong Khi Lek Sub-district community was associated in the CWRM network community with S&T to analyze the information, map and river schematic diagram that outline the individual water resources to determine where to restore and improve water structure in order to increase the efficiency of water management. The villagers have been trained to analyze and explore potential water resources within their area and excavate additional storage as “**Monkey Cheek Ponds**” within their farmlands. The concept started with three household-members and gradually extended to cover the whole sub-district. Moreover,

farmers adopted an integrated agriculture concept which replaced the standard monoculture to promote water and food security.



# Success Factors

---

## Collaborative community in systematic water management

Dong Khi Lek Sub-district Community has developed water storage ponds, or locally known as interesting name “**Khuean Tai Din,**” an underground dam, but it is not really underground instead each pond has narrow surface, so it reduces evaporation for water supply during rain recession (or dry spell) period as well as implementing water gates management to connect with sub-canals for better agricultural water distribution system.

## Community capacity building to provide greater food security

The community cultivates a mixture of products, such as vegetables, fruits, and fishes for household consumption and, then, selling the surplus products. This practice reduced the household expenditures, and on the other hand, increased their income. Community’s self-reliance is introduced to strengthen the pathway to sustainable development.





# Good Practices

---

## 1. Effort to achieve water security for sustainable management

### Water catchment area expansion to reserve water for agriculture

The villagers built their own water resources to increase community water retention e.g. small reservoirs and farm ponds. They collaboratively restore Khao Chee-Pid Reservoir and 3 Monkey Cheek Ponds to reserve water for consumption and agriculture during rain recession. As a result, their water

storage capacity reached 337,410 cubic meters, ensuring water security in their own farmlands by building 25 weirs, 15 Monkey Cheek Ponds, and 3 reservoirs, incurred 1,200 household-members of **“Ponds Fund”** that promotes water, food and incomes security.



## Floating Solar Cell installation for household's water consumption

Floating solar cells for water pumping system have been installed in the reservoir. They could also reduce losses of water through evaporation. Moreover, floating solar cells not only increase water flow from water's temperature difference to adding oxygen, but also

improving water quality for the habitat of aquatic lives. Energy management in parallel with an effective water management promote energy security and eventually introduce alternative renewable, clean and eco-friendly energy to the community.



## Water resources network connection and watergates management

The waterway connection in Dong Khi Lek Sub-district include 5 sub-canal restoration which are Saikai canal, Yang canal, Kraton canal, Rue canal and Sai canal which are linked to the main canal, Kasian. The canal restoration increased the efficiency of water resources by canals excavation covering

14 villages, 56.16 square kilometers, and increase water storage up to 1.02 million cubic meters. Weirs and spillways retain water while watergates management enhance water draining system in dry season to 19.84 square kilometers of farmlands.



## 2. Integrated agriculture enhancing self-reliance in food security

The mixture of vegetables, fruits and fisheries products from the integrated agriculture are for household consumption, and the surplus will be sold to increase their income following “**Sufficiency Economy**” pathway. From 2014 to 2017, participating households were expanded from 13 households to 2,650 households for the whole Sub-district. The average income after deduction of expenses is 53,500 baht per month per household. Household expenditures reduced 5,100 baht per month. The 12 welfare funds e.g. savings fund, arable area and housing fund, community shop fund, organic farming fund, water management fund, were established to strengthen the community.





### 3. Sub-district water management to promote water management at the Basin level

The villagers have applied river schematic diagram and map to analyze water problem, solution, sub-district management plan then expanded up to Prachinburi River Basin to alleviate and mitigate damages from floods and droughts. The community network was established to strengthen communities

collaboration in Prachinburi River Basin. At present, the collaboration network has been expanded to 46 sub-districts in 2 provinces i.e. Sa Kaeo and Prachinburi Province covered 9 sub-districts in the upstream areas, 31 sub-districts in the midstream, and 6 sub-districts in the downstream areas.



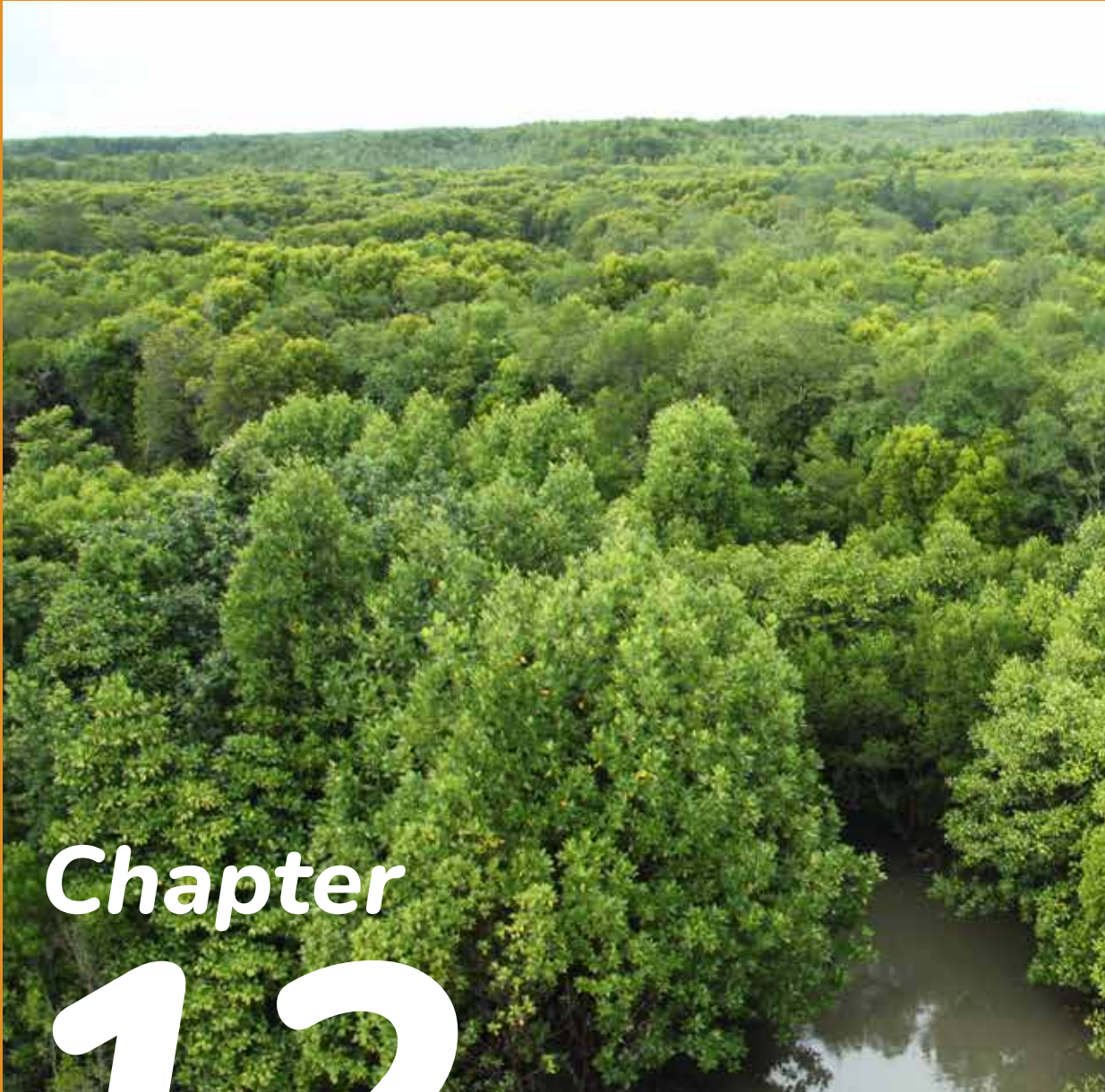
# Replication

---

At the end of 2020, Don Khi Lek Sub-district Community has successfully expanded their practices from 1,045 people in 1 village to cover 10,526 people in 14 villages. The agricultural area benefited from this concept has also expanded tenfold from 4 square kilometers to 44.21 square kilometers.







*Chapter*

# 12





4 Water-related Management  
(Sea-Fresh-Brackish-Waste)

# Ban Pret Nai Community,

Huang Nam Khao Sub-district, Meuang District, Trat Province

# Good Practices

---

- The mangrove forests of Ban Pret Nai, the Natural Heritage of Eastern Seacoast
- Community-based development to overcome 4 water-related problems, Sea-Fresh-Brackish-Waste
- Trustworthy Savings and Integrated Farming System Approach for Sustainable Expansion



# The Challenge

---

Ban Pret Nai, a medium sized community, is located at Huang Nam Khao Sub-district, Mueang District, Trat Province. It consists of five villages namely Ban Laem Po, Ban Pret Nai, Ban Klong Lord – Ao Kood, Ban Huang Nam Khao and Ban Gun Na. In 2019, there were 3,256 people in 1,160 households. Livelihoods of community members rely on rice, fruits and rubber cultivation, and are supplemented with harvests of resources such as crabs



from the mangroves. During 1980s, mangrove forest became subject to shrimp industry. More than 8 square kilometers of mangrove forest were badly degraded. It, consequently, destroyed local ecosystem causing deficient water for consumption and eventually disrupted local economy. Community's household debt was accumulated all together to a sizable amount over 30 million baht.





# The Approach

---

In 2009, Ban Pret Nai community formed Ban Pret Nai Water Resource Management Committee to solve Sea-Fresh-Brackish-Waste water problems which later Hydro-Informatics Institute (HII) has conveyed His Majesty King Bhumibol Adulyadej The Great's initiative on Community Water Resource Management (CWRM) to Ban Pret Nai community. Science and technology were applied to create water maps, analyze and come up with development plan for water reservoirs, weirs, and monkey cheek systems. The community has also been collaborated in land use planning. As a consequence of this practice, Ban Pret Nai Mangrove Conservation and Development Group was established. The abandoned shrimp farms and public areas were restored as freshwater resources for consumption and agriculture.

Moreover, the community adapted weir's concept to block and detain fresh water within the area, preventing saltwater intrusion to agricultural areas and freshwater resources. Furthermore,

the community also adopted the Sufficiency Economy Principles to improve their livelihoods by cultivating a mixture of vegetable crops for household consumption, sharing the surplus to neighborhoods and selling the remaining to generate income. This means reducing debts and household expenditures while, at the same time, increasing income. In addition, a collaborative network has also expanded to adjacent communities.



# The Impacts

---

*Past*



*Present*



As the mangrove forests had been rapidly destroyed, Ban Pret Nai Community had mutual agreement to close down the mangrove forests as well as raising the campaign to promote “The importance of Mangrove Forests” on reforestation, ecological systems restoration, and aquatic animals breeding. Moreover, the community established “**Ban Pret Nai Trustworthy Savings Group**” as funding to manage household's debts. Established to manage and solve sea water intrusion to farmlands and farm ponds, Ban Pret Nai Water Resource Management Committee secure more than 1,776,505 cubic meters of freshwater locally and

promote water security for consumption and agriculture.



# Success Factors

---

Community-empowered adaptation for self-reliance in mangrove forests conservation and restoration to bring back the abundance of mangrove ecosystem. The community mutually agreed on implementing water scarcity solution and solving sea water intrusion to farmlands and farm ponds. Consequently, the security of consumption and agricultural water supply was taking place since then. Furthermore, the adoption of Sufficiency Economy Philosophy has changed the way of living and reduced the household debt while economic stability had secured.





# Good Practices

---

## 1. The Mangrove Forest of Ban Pret Nai, the Natural Heritage of Eastern Seacoast

Since 1998, Ban Pret Nai Mangrove Conservation and Development Group took serious action to restore and conserve the mangrove forests of 19.2 square kilometers. Ban Pret Nai was recognized as the second most abundant mangrove forest of Thailand.

### Ban Pret Nai Mangrove Conservation and Development Group

The group comprised of six small groups with 20 households each. The mangrove forests patrol was divided into five zones to prevent illegal logging, charcoal production and ecosystem destruction. As a consequence, the community mangrove forests manage-

ment plan was established. The group engaged with rules and regulations on the usage of natural resources. The concept was expanded to nearby communities for sustainable mangrove forests management and reducing coastal environmental problems.



## Community Research on Mangrove Forests

A research was conducted to diminish cognitive conflict, build conscious learning process and analyze problems. The paper published as an innovative knowledge of the community such as a local wisdom on building artificial reef using old car tires to prevent shore-line and protect mangrove forest erosion.



## The Mangrove Forests Management Plan

The Mangrove Forests Management Plan is set for the brainstorming session among the villagers, stakeholders and committee's leader with the bottom up approach and full local participatory. After mangrove forests have been rehabilitated, the abundance and richness of the ecosystems and marine animals returned. Rules, regulations, and penalties for the offenders on the usage of forest and non-timber products such as timber, fuelwood, artisanal fishery and aquatic animals are set.



## Marine Animals Conservation Project

The policy of “**Stop catching a hundred, Wait for a million.**”

The community agreed on refraining from catching crabs during crab reproduction periods on the 4<sup>th</sup> – 5<sup>th</sup> – 6<sup>th</sup> day of waxing moon and 4<sup>th</sup> – 5<sup>th</sup> – 6<sup>th</sup> day of waning moon every October according to the lunar calendar.



## Coastal Erosion Protection

Pret Nai's villagers attempt to reduce the coastal degradation with blocks of used car tires, locally known as "Tao-Yang," along eight kilometers long of conservation zone to protect the coast from destructive clam dredges and coastal erosion. Moreover, Tao-Yang is also installed as artificial fish houses to increase fish population nearby shore.



## Community Coastal Resource Management Network

Ban Pret Nai Community extended the network with other local villages through exchanging knowledge and sharing experiences among parties such as community, local government agencies and public sector organizations.

Local education has also been benefited from the practice. Collaboration between schools and the village elderly was organized to transfer knowledge and local wisdom on mangrove ecology and coastal resources to youth under environmental youth camps project. The community mangrove forest has been used as a "Learning Room." This initiative has raised the awareness of traditional livelihood activities and lifestyles to a new generation. In addition, the youth group has learned to apply science and technology to collecting survey data as well as the working concept from community's leader for natural resources conservation and carried on a simple way of living.





## 2. Community-based development to overcome four water-related problems, Sea-Fresh-Brackish-Waste

Ban Pret Nai community has a longer rainy season periods of eight months each year, with an average annual rainfall accumulation of 2,882 millimeters. However, the scarcity of freshwater was a serious issue and directly impacted the agricultural sector due to lacking of systematic water resources management and freshwater storage for dry season.

The community collaborated to reserve more freshwater for a period of 30-45 days in dry season and retaining rainwater within the areas for eight months by the following four management practices:

### Freshwater Trapping

Increasing the number of monkey cheeks to collect rain and excessing flood water by transforming the abandoned shrimp ponds of 1.17 square kilometers to retain up to 1,776,505 cubic meters of freshwater in addition to converting agricultural areas of 0.019 square kilometers with 9.7 kilometers length of garden furrows to increase drainage efficiency and retain freshwater for 29,330 cubic meters.



### Brackish Water Balancing

Balancing the mangrove forest ecosystems with the buffer zone between fresh and seawater as a soft break. The convergence of fresh and seawater area was the luxurious natural resources and serving as nurseries for baby marine animals.



## Wastewater Solving

In the past, the villagers confronted with wastewater from mangrove forests encroachment and degradation by shrimp farms and seawater blockade. As a result, the natural water filtration was destroyed whereas the wastewater from shrimp farms increased rapidly. The villagers then took the action to restore mangrove forests and establish the rules and regulations of natural shrimp farming, and prohibited the polluted sludge discharges from shrimp farms.



## Seawater Pushing

The freshwater pushing seawater approach was introduced by building check dams and watergates to collect freshwater and carefully manage water level where freshwater meets seawater.

- Built 49 of sandbag check dams in the public ditches and garden furrows to impede and store freshwater, benefited 458 households, 6.47 square kilometers of agricultural areas
  - Installed 27 watergates in the public ditches to impede and store freshwater to prevent saltwater intrusion to agricultural areas, benefited 392 households, 4.87 square kilometers of agricultural areas
  - Built 24 reinforced concrete weirs to increase the efficiency of freshwater storage at the convergence of fresh and seawater, benefited 401 households, 1.48 square kilometers of agricultural areas



### 3. Trustworthy Savings and Integrated Agriculture Approach for Sustainable Expansion

#### Trustworthy Savings Group

The villagers are encouraged to initiate other livelihood activities based on mangrove forests. Trustworthy Savings Group established to manage the entire life welfare services with the help of a local Buddhist monk, Pra Ajarn Subin Panito from Pai Lom Temple. The monk supported the establishment of village saving group that provided low-interest loans to villagers for investing in education and healthcare, while keeping the earnings from the interest within the community. Through loans to commu-

nity members, this fund has allowed the development of small-scale enterprises within the village such as a marketing system for local products. Other community organizations with members from women and youth group have also been established. This system also reduced the amount of debts from 30 million baht to 10 million baht with savings of 60,000 baht per month. The savings group is currently the community-initiated model to neighboring communities.

#### Happiness Bank from Integrated Farming Approach

The villagers changed the farming method to New Theory Agriculture. Intensive land consolidation was applied to maximize the usage of agricultural area such as crop calendar, crop planning, water reserve and distribution systems. The approach promoted cultivating a mixture of vegetable crops for household consumption, sharing the surplus to neighborhoods and selling the remaining which helped to reduce annual expenditures 24,000 baht per household and increase annual income 36,000 baht per household. The good practicing currently expanded to 118 households, covering 0.25 square kilometers of agricultural areas with average water retention of 377,727 cubic meters.



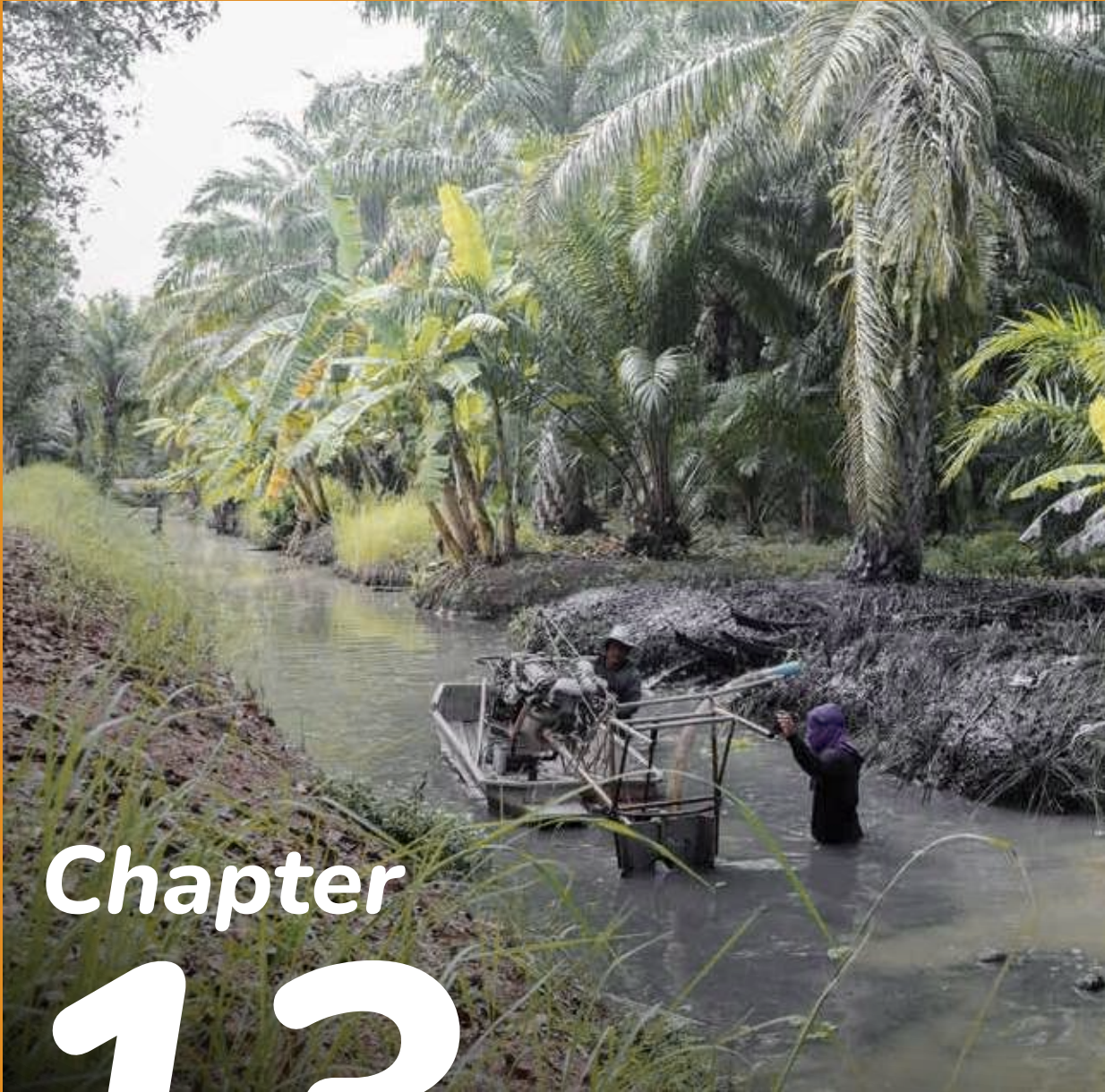


# Replication

---

At the end of 2020, Ban Pret Nai community has successfully expanded their practices from 1,047 people in 1 village to cover 3,256 people in 5 villages. The agricultural area benefited from this concept has also expanded from 28.8 square kilometers to 44.86 square kilometers.





# Chapter 13

Please Scan  
for VDO







Retention by Thriving Furrow and Canal System  
Diminish Disaster Risk and Boost Economy

# Rangsit Canal Community,

Nong Suea District, Pathum Thani Province



# Good Practices

---

- Integrated water management, drought and flood risk reduction and agriculture for resilient livelihood and environmental management
- Build partnership between community, local government and the private sector to scale up good practices



# The Challenge

Rangsit canal community is located in Bueng Cham O Sub-district, Nong Sua district, Pathum Thani province by the Chao Phraya river basin with the population of 8,926 people on total area of 54.48 square kilometers (34,048 rai) while 44.16 square kilometers (27,601 rai) have been used for agricultural productions.

For decades, community living along Rangsit canal searched for ways to improve their livelihoods. In 1984, they changed farmland back into orange

orchards. However, an outbreak of citrus diseases in 1991 put many farmers in serious debt. In 2004, the community replaced orange orchards with palm oil cultivation, they started to generate better income. Three years later, selling palm oil helped the farmers reduce their long-term debts. However, a lack of water due to the poorly maintained and shallow canal challenged palm oil cultivation. In addition, the severe flood in 2011 also revealed other challenges including canal bank erosion.



# The Approach

---

In 2011, Her Royal Highness Princess Bajrakitiyabha Narendiradebyavati graciously supported the introduction of Community Water Resources Management (CWRM) at Rangsit canal. H.R.H. Princess's donation from the College of Justice to the Hydro-Informatics Institute (HII) to solve drought problems and develop Rangsit canal to be an **“income-booster monkey cheeks area”** where the water retention in the furrow would promote palm oil and other cultivation as well as boosting the community income.

The HII encouraged Rangsit canal community to establish a CWRM Committee. This led the analysis of water balance and implementation of a new water resources management system to provide water for oil palm cultivation areas. The main canals and sub canals were dredged and linked with improved clarifiers and floodgates to maximize water reservoir and drainage system. The water reservoir area was improved by vegetable and oil palm furrows. A mire suction boat is an

important innovation for deeper dredging the canal and furrows including opens new waterways to agricultural areas in dry season. Oil palm trees were planted along the canal banks to prevent erosion and illegal construction. Increased palm oil yields together with integrated community-based agricultural production following the New Theory provide a higher and more sustainable income for the community.





# The Impacts

Past



Present



A total of 131 kilometers of the main and sub-canals have been dredged. Linked with improved clarifiers and floodgates in 94 locations, this has improved significantly water reservoir and drainage capacity. The mire suction boat dredge furrows and canals to increase water storage in oil palm groves and opens new waterways to agricultural areas in dry season. During the tropical cyclone GAEMI in 2012, Rangsit canal stored more than 17 million cubic metres which helped prevent flooding in Bangkok and central of Thailand. In the dry year of 2013, the mire suction boat helped to open new waterways for 9.6 square kilometers (6,000 rai) agricultural land.

In three years of operation (2012-2015), the irrigation system has been linked with furrows to enhance water distribution to furrows and palm trees of 36.21 square kilometers (22,632 rai) and increase water storage at the monkey cheeks to 14.82 million cubic metres providing irrigation for agricul-

tural areas to 29 million cubic metres covering 83.2 square kilometers (52,000 rai) of agriculture areas. **Number of 21,734 people from 6,473 households** are benefitted from this system.

The 72.8 kilometers of the canal bank was improved with the plantation of 13,000 oil palm trees to prevent erosion and illegal construction. Integrated agriculture along the canal banks over an area of 0.00012 square kilometers (0.075 rai) helped increasing income 12,000 baht per year while reducing household expenditures 6,000 baht per year.

The local farmers can yield oil palms 24 rounds/tree/ year with production of more than 6-8 tons per 0.0016 square kilometers (1 rai). The average income is 23,800 baht per 0.0016 square kilometers (1 rai) per year (4 baht/1 kg.).

# Success Factors

---

## Building capacity for community self-management

The villagers were guided the concept of CWRM and learnt from the success of other villages. At the start in 2011, four pilot Sub-districts were grouped to implement a water development plan, conducting survey, collecting and analyzing data, and improving water structures in the area. Later on, the concrete outcomes of CWRM were evident to people and adjacent communities. Within 5 years, the networks had expanded to 9 areas in 1 municipal district **and 8 Sub-districts** in Rangsit canal. The CWRM networks of 9 areas formed themselves to lead the process of cooperative water resource management. Moreover, the community established Community Palm Oil Funds to manage their own budget and revenue from community enterprise.

## Promoting the role of community leaders

The HII and Utokapat Foundation built the understanding in CWRM among the community leaders by showing the mutual benefits of such an approach for each area. The collaboration of community leaders from 9 areas is important for the joint working of CWRM in the Rangsit canal community.

**“Water is vital to life like a human vein, especially in agriculture which relies so heavily on it. Sooner or later, the population will increase and impact directly on water demand while the water supply remains the same. Previously, we had no water management; water weeds spread along the canals and blocked the waterways. It made a lot of trouble to the community. We can stand today with a good guidance from HII and Utokapat Foundation. They not only gave us the water management approach but also provided us with information and technology that helped us solve the problems systematically, and brought benefits to the farmers.”** said Aksorn Noisawang, Chief Executive of the Bueng Cham O Sub-district Administrative Organization and Chairman of Rangsit Canal CWRM committee

# Good Practices

## 1. Integrate water management, drought risk reduction and agriculture for resilient livelihood and environmental improvement.

A new water management system based on proper analysis of water resources and technological innovations has been instrumental for Rangsit canal community to tackle drought risk and improve agricultural production.

### Water balance analysis

Using various technologies, the Rangsit canal community was trained to undertake water balance analysis as the fundamental step in designing the new water management system.

The analysis shows a serious lack of water throughout the year. Increasing water storage is the only solution for Rangsit canal community.

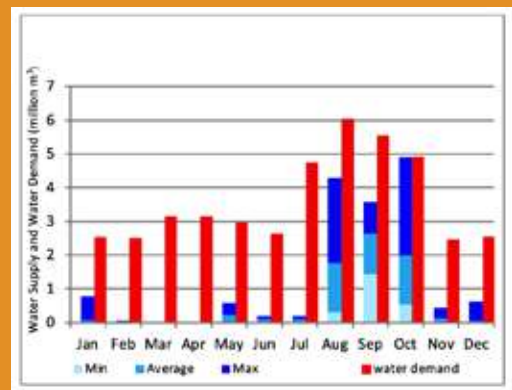


Figure shows Water Balance Analysis in Rangsit canal community area





## The Mire Suction Boat

The community dredged the canals and sub-canals, combined with improved clarifiers and floodgates, to maximize the inflow and outflow. They also dug monkey cheeks in oil palm furrows and link these with the canals and sub-canals to improve the drainage of flood water for storage in the retention ponds.

The use of a mire suction boat increased drainage capacity during flood season while opening new waterways during dry

season to provide water to remote areas. Farmers were also guided to dredge their oil palm furrows to allow better absorption of water into the soil. Sediment derived from the dredging process helped to increase soil moisture and use as fertilizer to trees.

As a result, there was a reduction in consumption of irrigation water from Pa Sak Jolasid dam.



## Strengthen canal banks

Strengthening the canal banks to prevent erosion was an important part of the system. In addition, palm tree plantation and integrated agricultural production along the 72.8 kilometers of canal banks provides significant additional income for the community. Results of the implementation.



## Water security

The linkage of water resources in furrows enhances water distribution to furrows and palm trees of 36.21 square kilometers (22,632 rai) and increase water storage at the monkey cheeks to 14.82 million cubic metres providing irrigation for agricultural areas to 29 million cubic metres covering 83.2 square kilometers (52,000 rai) of agriculture areas. Total **21,734 people from 6,473 households** are benefitted from this system.



## Disaster Prevention Stability

The monkey cheeks help increase water in ponds for use in dry season and prevent sea water intrusion as well as impede water flow more than 137 million cubic meters.



## Food Security

New Theory Farming approach help increase income to 15,000 baht/0.0016 square kilometers (1 rai) or 4.2 times income from monocropping practice.



## Community Welfare Security

The waste lands along canal banks have been developed with integrated farming help protect soil erosion and increase income from palm trees 0.66 million baht/village.

## Energy Security

Solar powered water pumping system, seafloat type, saves the electricity cost 48,000 baht/year.



## 2. Build partnership between community, local government and the private sector to scale up good practices

The great flood in 2011 was the starting point for cooperation between villagers and Sub-district administrations in water resource management to overcome the crisis. HII provided data support.

With the strong-willed of the community leaders and Sub-district administration, the villagers and related parties began water resource management, dredging the canal, reverting farmland back to oil palm furrows, and managing the whole water system. The community was open-minded to adopt and apply new science and technology, with the support of HII, to prevent disasters for better manage water resources. The collaboration among community, local authorities and Sub-district authorities was a significant reason for the success in getting over water challenges in

the area. CWRM was at the core of this and it is why CWRM networks have been expanded from 4 to 9 Sub-districts in 5 years. Recognizing the outcomes, Coca-Cola Thailand, whose factory is located nearby, has since 2013 continued to support the community under Utokapat Foundation's management.



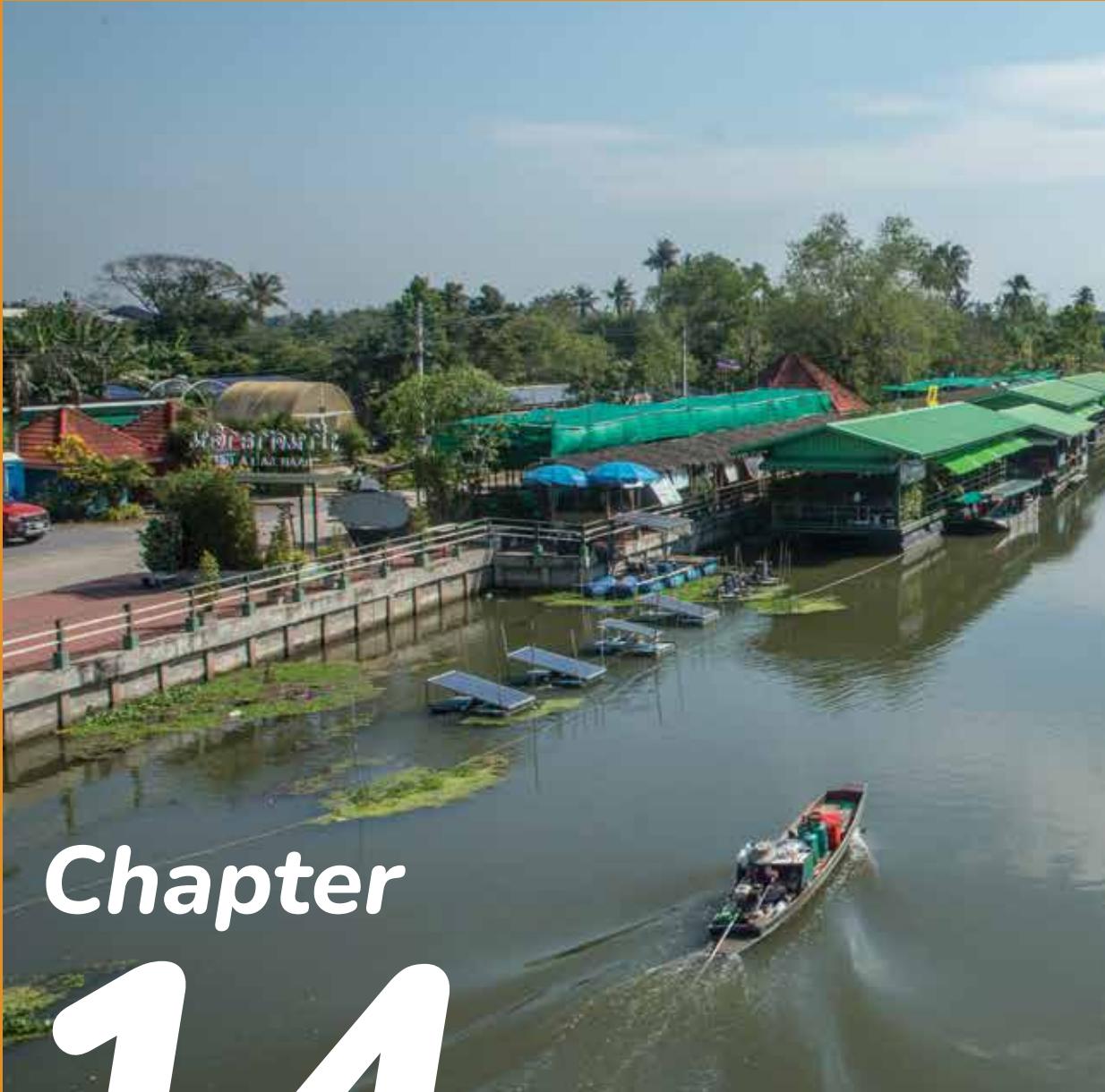


# Replication

---

At the end of 2020, Rangsit canal community has successfully expanded their practices from 18,000 people in 4 village to cover 40,026 people in 8 villages. The agricultural area benefited from this concept has also expanded from 113 square kilometers to 305 square kilometers.





# Chapter

# 14





Reduce 4 Water-Related Problems:  
Flood, Drought, Brackish, and Waste; by S&T

# Ban Saladin community,

Phutthamonthon District, Nakhon Pathom Province



# Good Practices

---

- Build capacity of community to develop appropriate technologies for water resource management
- Mobilize contributions from community to complement Government activities
- Increase value of agriculture products and diversify income



# The Challenge

Ban Saladin community is located in Mahasawat Sub-district, Phutthamonthon district, Nakhon Pathom province by the Tha Chin river. Here 8,926 people live in an area of 12.97 square kilometers (8,106 rai), total agricultural area of 9.98 square kilometers (6,239 rai).

Farmers in Ban Saladin community used to rely on monoculture of rice production. They were faced with four water related problems: flood, drought, wastewater and brackish water. Flood and drought were partly due to lacks of care and respect of the water resource. These local disasters contributed to poverty in the area. The 27 kilometers of Mahasawat Canal that goes through the community, as well as its sub-canal, were clogged with household rubbish. A layer of grease also formed on water surface as a result of the disposal of cooking waste directly into the canals. This prevented sunlight from penetrating below the surface and further affected the quality of the canal water. In addition, the canals became clogged from an inundation of water hyacinth. In 1995, local road

construction replaced the canals as a means of transportation. This resulted in a further deterioration of the maintenance of canals. In the same year, water gates were built to control the flood level, but making the water stagnant.

Several attempts by Mahasawat Sub-district Administration and villagers to collect water hyacinth and clean the canals since 1997 were not successful. The weeds kept growing fast and community leadership to sustain the efforts was lacking. The severe flood in 2011 also revealed serious water issues to the Ban Saladin community.



# The Approach

---

After the 2011 floods, HII and Utokapat Foundation worked with the villagers to build the community's ownership in managing local water resources. Local leaders were identified, appropriate technologies, combined with local wisdom, were introduced. Slowly but surely the village's relationship with the natural resource on its doorstep began to change.

The farmers applied the New Theory Agriculture to the 1.61 square kilometers (1,009 rai) land, graciously donated by H.M. King Bhumibol Adulyadej The Great in 1975 for agricultural purpose which allocated 0.032 square kilometers (20 rai) for each household. Community enterprises of water users were established for stronger collaboration among farmers for water resource management.





# The Impacts

---

*Past*



*Present*



Drainage was improved through dredging of 15 kilometers canals and pipelines. Less waste was disposed into the canals. Villagers also invented a simple and cheap technology to trap grease that reduce the impacts on the canals. They also installed solar-powered turbines to increase the oxygen in the water. The community began to view the canals as part of bigger system and understood the need to manage their water resources on a catchment area basis.

As the health of the canals improved, the area of water habitat was increased. So were the economic spin-offs. Water hyacinths were harvested and used as fertilized soil. Watercraft transportation returned. Agricultural tourism was encouraged. Lotus farming began, paying a higher return than the

previous paddy; and crops such as basil leaf, banana and fish began to provide livelihoods for local families. Villagers learnt how to dredge the sub-canals so that water storage areas could be created. While many parts of Thailand suffered from the 2015-2016 El-Nino and drought, Saladin community had sufficient water for agricultural production.

**“We were affected by the 2011 flood because of the shallow canals and the fact there was no drainage system. The Hll and Utokapat Foundation taught us how to solve problems in simple ways and to gain economic benefits from water management”,** said Wanchai Sawaddaeng, Chairman of the Community Enterprise of Water Users for Agriculture.

# Success Factors

---

## Build community ownership and leadership

A major part of the challenge faced by the Ban Saladin community was lacks of care and respect of local villagers to their water resource. Helping villagers understand their problems, identifying local leaders who facilitated the community work together to find out the prompted solutions was the key factor for success and sustaining the development.

## Promote adaptation of technologies



Because the Ban Saladin community encountered multiple water challenges, technologies had to be comprehensive to solve all the problems at a reasonable cost. The community applied new technologies such as solar energy. It has also adapted and invented low-cost technologies such as simple way to trap grease and use solar-powered turbines.

## Strengthen collaboration between community, local government and other stakeholders

The water management challenges were beyond the capacity of the local community. Technical support from academic institutions such as HII, support and cooperation from the Sub-district administration as well as financial support from the Utokapat Foundation and Royal Thai Army were crucial for achievements in Ban Saladin community.

# Good Practices

---

## 1. Build capacity of community to develop appropriate technologies for water resource management

Villagers in Ban Saladin community came together with clear determination to restore the canals within Mahasawat Sub-district. They were trained on collecting data and analyzing root causes of the problems, using technologies such as satellite image map and Global Positioning System (GPS). In promoting self-reliance of the community, attention was paid to encouraging solutions that are appropriate to the local context. As a result, simple, cheap but efficient technologies have been developed and used for:

- Checking water quality;
- Installing household grease trap containers to trap the cooking oil before release to the canal;
- Producing Micro-organism liquid and EM ball for water treatment;
- Installing a solar powered turbine in the canals to add oxygen into the water;
- Using dried water hyacinth to make ready-mixed soil



Grease trap in household



Water hyacinth as mixed soil



Solar powered water turbine

These technologies not only help improve water quality and environment but also provide income opportunities for villagers. The water hyacinth which was perceived as waste provided income for people and the community self-managed fund.



## 2. Mobilize contributions from community to complement Government activities

The Mahasawat Sub-district Administration Organization helped with dredging and removal of hyacinths for watercraft transportation in the main canal. With support from the Mahasawat Sub-district Administration Organization and HII, the community carried out a survey of sub-canals and applied water maps for analysis to increase drainage in the whole canal system. They then decided to dredge the sub-canals to improve water circulation, drainage capacity and transport capacity. In 2013,

the Railway Canal, Patiroop 1 Canal, Patiroop 2 Canal and Rong-Jay Canal were dredged by the community.

In 2014, the community dredged canals to connect with the Mom Chao Chalerm Sri canal and installed block conversion under the roads to connect them to increase the water flow. This is a natural method for water quality treatment, using clean water to push away the waste water.



Map of canal network and its improved drainage

The community also removed constructions that obstructed waterways in order to increase the efficiency of water drainage and strengthened the maintenance of the canals.

In 2015, the agreement was reached to plant local trees along the canals throughout the whole Sub-district for future agro-tourism in the community.

To cope with flood, the community and local stakeholders developed their food preparedness and response plan that identified assembly points for evacuation, established a center for providing assistance, prepared an evacuation kit and disaster relief package and equipment, as well as the donation registration system. A plan to grow floating plants which can be used for cooking during floods has also been discussed.

### 3. Increase value of agricultural products and diversify income

In 1975, together with the gracious donation of 1.61 square kilometers of land for the farmers of Ban Saladin community, H.M. King Bhumibol Adulyadej The Great also introduced the integrated agriculture approach to Ban Saladin community, and continues the practice until present day.

With improved water resource management, the community learnt how to allocate land for different agricultural production. Lotus farming and other crops such as basil leaf, banana and fish have begun in addition to rice production, providing people with more incomes and resilient livelihood.

Community enterprises of water users for agriculture have been established to help farmers collaborate on water use and agricultural production, and to expand CWRM approach.





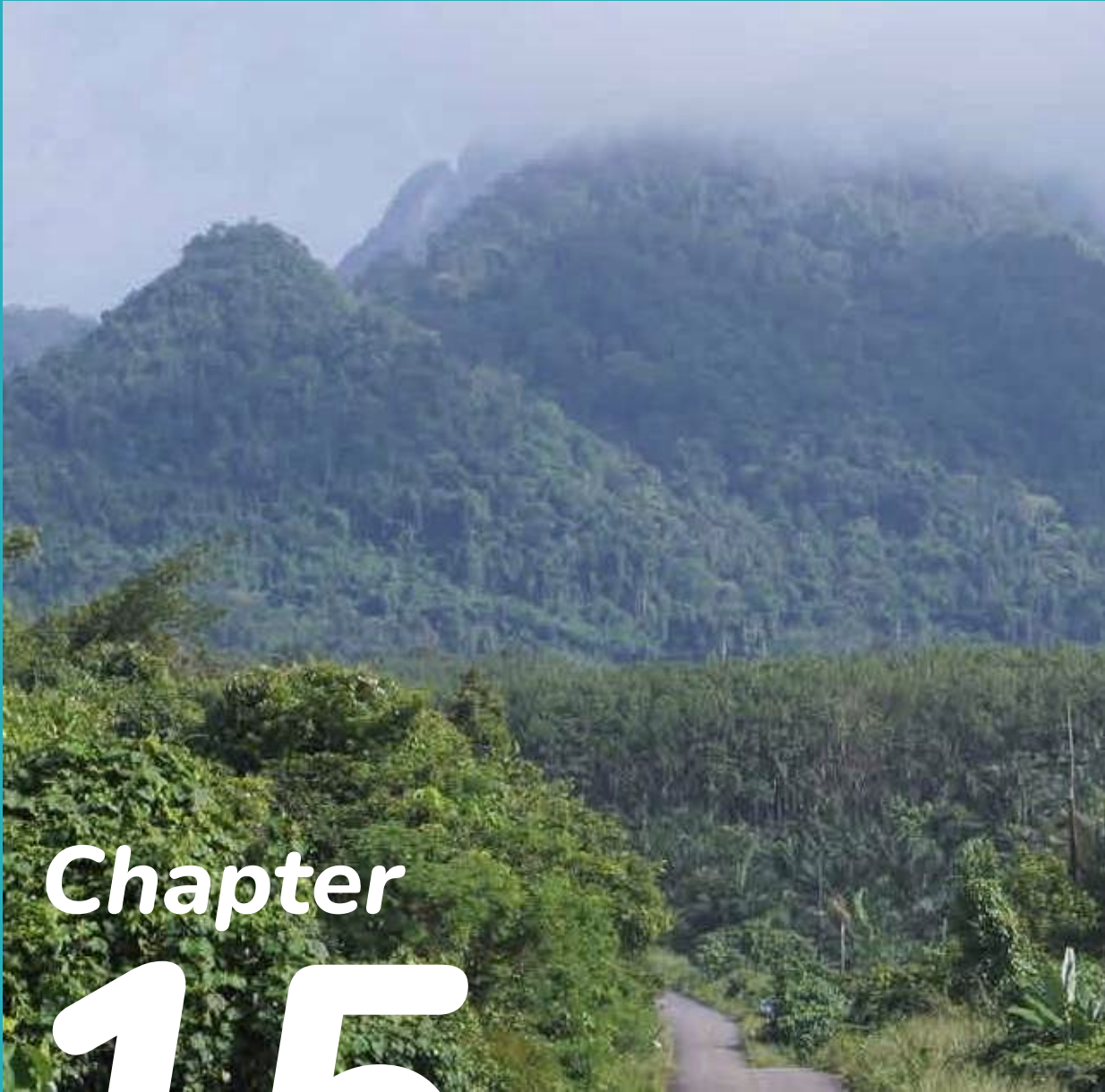


# Replication

---

At the end of 2020, Ban Saladin community has successfully expanded their good practices from 1,635 people in 1 village to cover 8,884 people in 4 villages. The agricultural area benefited from this concept has also expanded from 3.4 square kilometers to 12.97 square kilometers.





*Chapter*

# 15



Sustainable Forest Management with the  
“Three Forests, Four Benefits”

# Ban Pak Suad Community,

Ban Ta Khun District, Surat Thani Province



# Good Practices

---

- Sustainable forest and livelihood
- Water reservation system for consumption and agriculture
- Community Funds – Long lasting happiness



# The Challenge

---

Ban Pak Suad was founded 200 years ago in Tor Tao Mountains, Pa Saeng Sub-district, Ban Ta Khun District, Surat Thani Province. Nowadays, it is the upstream forest of Ratchaprabha Dam. The community members have been relying on water from Klong Bang Krok and earn their living from agriculture and non-timber products. In 1980, Khao Sok National Park was established and Ratchaprabha Dam was constructed which changed waterways and hugely affected the community.



Additionally, the community confronted with the issue of overlapping cultivated land claims in the newly announced National Park or protected areas after they had encroached on the forest for rubber and oil palm monoculture. The natural water resources were destroyed. In 1994, the problem was worsened. Most villagers were charged with forest encroachment, thus, the community could not access the watershed forest.









# The Impacts

---

*Past*



*Present*



In 2011, the community established “**Ban Pak Suad’s Water Management Network Committee**” to manage water resources and water-related issues e.g. floods, droughts, and develop water reserve system in the area. However, the dispute between the community and the National Park remained. Subsequently, Utokapat Foundation under Royal Patronage of H.M the King, together with Hydro-Informatics Institute (HII), helped bridging the understandings between the two conflict parties and encouraging them to work together to protect the watershed forest and support mutual and sustainable living between man and forest as suggested in H.M. King Bhumibol Adulyadej The Great’s approach. In 2014, the community and the National Park collaboratively defined the boundary

of protected forest in Pasang and Pang Karn Sub-districts. The National Park also granted the proof of land rights for the villagers in order to clearly separate forest and cultivated areas. As a result, the community can mutually live with the forest while assisting the National Park officers to protecting it. The community rehabilitated the structure of Bang Krok canal by dredging up sediments inside the front of the dam and building extra water storage dams. This adjustment has increased community water supply where farmers are able to grow at least 30 additional types of crops in rubber and oil palm plantations. The transformation of plantation also generates income for the community throughout the year.

# Success Factors

---

## Rehabilitation and protection of the upstream watershed forest area

People in the community define land use type into five types as protected forest, rehabilitated forest, upstream forest area, residential area, and agricultural area, in order to strengthen mutual, resilient and sustainable livelihood between man and forest by following the community's rules and regulations to protect the upstream watershed forest.

## Men live in the realm of nature

The community can continue cultivating within protected areas as usual; however, they definitely do not allow to extend their cultivated land. The new practice had been transformed to the **“Three Forests, Four Benefits”** concept to increase forest area, restore an ecological system in upstream area, and inter-crop fruits and vegetables within rubber and oil palm plantations. Following such model, they are able to obtain food from the plantations and generate income throughout the year.



# Good Practices

---

## 1. Sustainable Forest and Livelihood

### Participatory Watershed Management

Today the community obtains 0.06 square kilometers of forest land from the private sector to build a plant nursery for culturing plants that will be planted in community forests. They quit encroaching on the forest and merely

cultivate on their lands. The village collaboratively participate to restore the forest's prosperity and biodiversity richness. The concept has expanded and covered the area up to 2.56 square kilometers.

### Protected area map for sustainable and resilient livelihoods

Community Water Management Committee together with Department of National Park, Wildlife and Plants Conservation's (DNP) Survey Unit surveyed the upstream protected area in Khao Sok National Park with the Global Positioning System (GPS) and survey equipment to define land use types' boundaries e.g. protected forest, rehabilitated forest, watershed, dwelling area and cultivated area. Later, under the Cabinet of Thailand Approval on 30<sup>th</sup> June 1998, land use titles of 66 plots were given rights, but cannot sell to others, to the community by DNP in 2009. This delineation clarifies symbiotic living of man in the forest. The rules of watershed forest protection are also developed and adopted. The community can continue their farming and cultivating as usual, but

in any circumstance they are not allowed to extend their cultivated land. Moreover, the community proved their ability to restore forest's richness and biodiversity following the **“Three Forests, Four Benefits”** concept.





## The “Three Forests, Four Benefits” improves food and economy security

The use of this concept has changed the way of farming. Following “**Three Forests, Four Benefits**” concept, local people increase forest areas and improve the condition of the upstream forest. The community initially inserts fruit and vegetable crops within rubber and oil palm plantations, and turns them to rubber and oil palm forests. This strategy increases each household’s annual income by 28,500 baht and generate 18 representative households who adopt “**Three Forests, Four Benefits**” concept within 0.09 square kilometers. The representatives continue disseminating this knowledge to other 13 households which account-

ing for 0.16 square kilometers. At present, Pak Suad Community has increased their income by 30%.



## 2. Water reservation system for consumption and agriculture

### Water storage system, Bang Krok Canal

Pak Suad Community faced problems of a water-related issue as a result from forest encroachment and the changing of waterway. The problem was so severe during dry season in February until May of 1989. Consequently, the community started the plan to develop Bang Krok Canal, which is the main canal that flows through the community. They sought for methods to reserve water in the area, while they also conserved upstream forest by building 19 detention and



check dams to reserve water in Bang Krok Canal and other small creeks, slow down water speed, lift up water level and distribute to cultivated fields. Today, the community can store 169,750 cubic meters in the weir and 103,680 cubic meters in Nong Kok Reservoir (0.014 square kilometers). The reservoir acts as “**Monkey Cheek**” storing water during rainy season and feeding water to Bang Krok canal for agricultural purpose during dry season.

### Water for consumption

Long time ago, Pak Suad Community faced water scarcity as a result of forest encroachment and lack of water resource management. In addition, the drinking water factory was dilapidated so villagers had to buy drinking water from outsource for more than 20 years. When the community restored and conserved watershed forest to its prosperity, the water supply in Bang Krok Canal and Nong Kok Pond become

The restored water can be distributed to 0.77 square kilometers of agricultural land and also strengthen water security for 585 people in 141 households. Furthermore, the abundance of water supply brings back the prosperity and biodiversity richness of the upstream forests. Interestingly, during the drought in 2016, neighbor communities requested to buy water from Pak Suad Community to relieve water scarcity in their areas.

sufficient for domestic consumption and agriculture. In 2011, the Water Resource Management Committee has rehabilitated the abandoned water supply for consumption system and drinking water factory to its normal state. Currently, more than 112 households have access to clean water which consequently reduces the expense on drinking water by 25,000 baht monthly.



### 3. Community Funds – Long lasting happiness

The community establishes the community-level funds to build resilient livelihood and reduce the reliance on local government agencies. Managed by local community members, today the fund can generate a circular flow of income in the community to support public benefits for social welfare, such as healthcare, education, and occupation. The fund is reserved as an emergency fund during disaster events and a support to the community's water resource management. Currently, there are 585 members participated with more than two million baht of revolving fund. There are four community funds detailed as follow:

#### Fertilizer Fund

The fund started to run since 2009 to alleviate the high cost of chemical fertilizer from outside. The community uses local materials, such as husk, swine and bat excretes and remains from oil palm. This strategy reduces the burden of seeking fertilizer from outside by 3,480 baht per household annually.



#### Organic Pig and Chicken Fund

The fund was established in 2009, together with the fertilizer fund, to reduce burden for farmers as they have low capital of production. Farmers who want to have a small organic pig and chicken farm can register to receive a fund without any charges. Furthermore, they can take swine excrete as a mix of fertilizer creating 20,000 bath of income each year.





## Drinking Water Fund

Established in 2011, the drinking water fund aims to reduce the cost of buying drinking water from outside and provide quality drinking water within the community instead. Nowadays, the fund gains 438,000 baht annually.



## Oil Palm Fund

The community committee established Oil Palm Fund in 2012. Oil palm cultivating areas are divided into two parts, road-side with 1,116 trees, and public farmlands with total 0.86 square kilometers. This fund generates roughly 125,000 baht for the community each year.







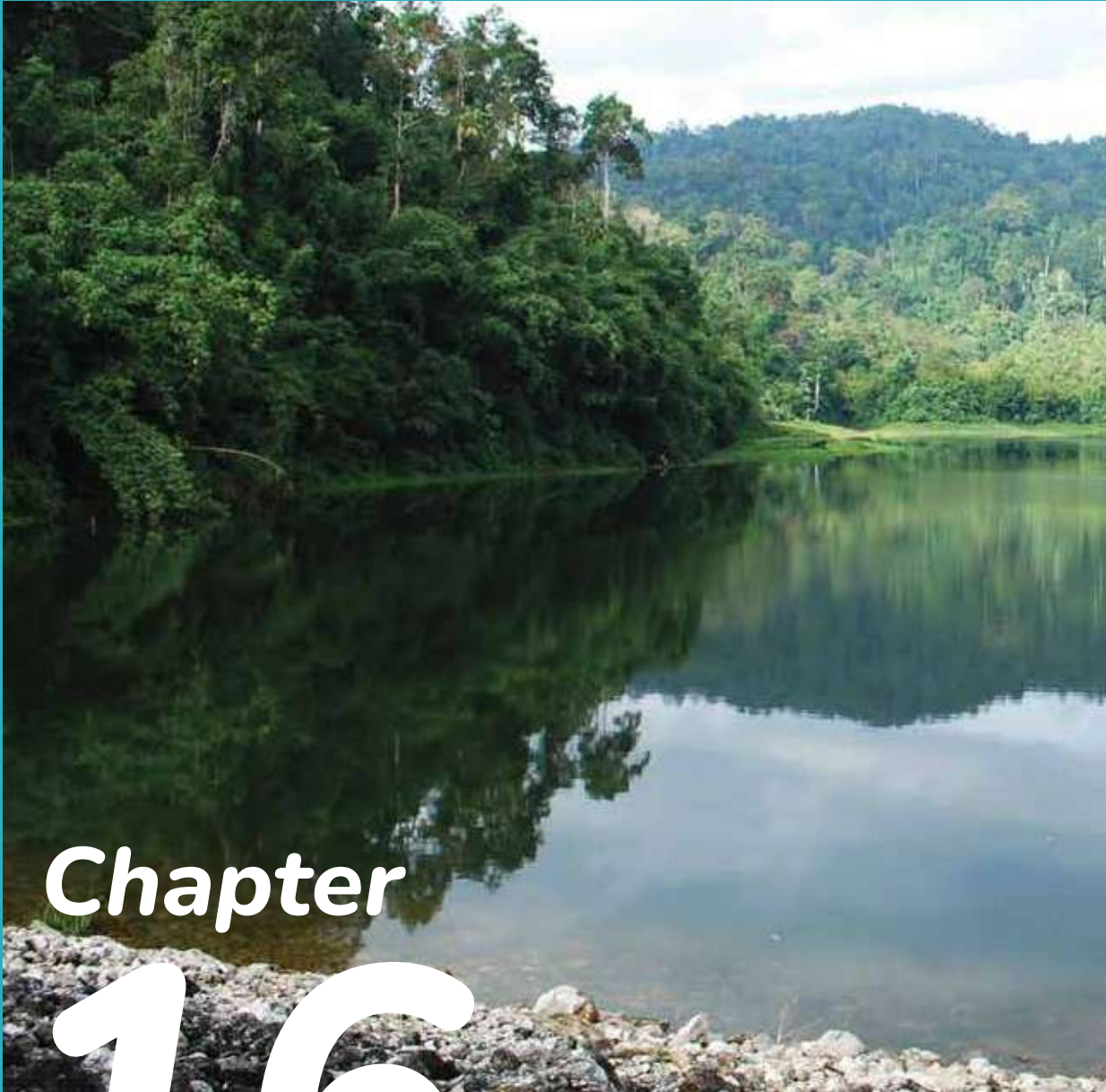
# Replication

---

At the end of 2020, Ban Pak Suad community has successfully expanded their practices from 18,000 people to cover 25,000 people in 8 villages. The agricultural area benefited from this concept has also expanded to 0.15 square kilometer.







*Chapter*

# 16



Holistic Management of Reservoir and Ponds to  
Reduce Drought Risk and Increase Productivity

# Thapcris Community,

Phanom District, Surat Thani Province



# Good Practices

---

- Integrate water-related risk reduction and natural resource management for improved agriculture
- Build community enterprises to boost collaborative agriculture and increase values of products





# The Challenge

---

Thapcrist Community migrated from central region of Thailand and settled down at Tapi River Basin, Khlong Cha Un Sub-district, Phanom District, Surat Thani Province, 1,050 people lived in an area of 15.11 square kilometers which 9.36 square kilometers was used for agricultural products.

In the past, the community conducted monoculture crops giving the risk on floods and droughts as well as crop productions. In 1984, H.M. King Bhumibol

Adulyadej requested the Royal Irrigation Department to construct Khlong Bang Sai Nuan Reservoir in Phanom District. However, lacking of water management system, Thapcrist villagers who lived at downstream of the reservoir still suffered from water shortage during dry season. They had to buy drinking water due to poor water quality while flooding during monsoon season impacted on agricultural productions.



# The Approach

---

The HII and Utokapat Foundation assisted the Thapcrist Community to establish “**Bang Sai Nuan Water Management Group**” to improve water management and distribution. The check dams were built by the community helped trapping sediment and retaining moisture to restore the ecosystem at the upstream forest. Water storage and distribution systems with a pond network were established to reduce flood level and store water for dry season use. The community set their own regulations to distribute water to households through outlets

and spillways.

As a consequence of better water management, the farmers shifted from monoculture to integrated agriculture, following the New Theory. New partnerships, such as the Plant Genetic Conservation Project, provided local seedling. Community members also established their own enterprises to support agricultural production and trading of products. People’s quality of life has been improved with increased income, clearance of debt and reduced expenses of buying the drinking water.



# The Impacts

---

*Past*



*Present*



The community conserved the upstream forest of 3.2 square kilometers around Klong Bang Sai Nuan Reservoir. Weedy vines were removed to reduce damaged of the big trees located in the upstream forest. The water reserve system was established for total storage of 2.43 million cubic metres, including water storage of 230,000 cubic metres from 160 network ponds. Downstream flood risk has been reduced while an agricultural area of 1.6 square kilometers was mitigated during rain recession. It can decrease the potential loss amount 13.83 million baht from dry spell.

Bang Sai Nuan Reservoir Water Management Group set the regulations and rules to fairly distribute water for consumption and agriculture to 160 households in 5.76 square kilometers. The group also established “**Water Pipelines Maintenance Funds**” by

collecting the maintenance fee of 50 baht per 0.0016 square kilometer from the member.

The community allocated water from the reservoir to produce drinking water through water purification system installed at the community hall saving expenditure from buying the drinking water approximately 972,000 baht per year. The farmers have shifted from monoculture of fruit orchards to integrated agriculture such as ornamental plants, rubber trees and oil palm trees. Minimum household income has increased to approximately 591,000 baht per year. The Ornamental Plants Community Enterprises are established to provide mutual support to farmers with the Flowers Revolving Fund returning an average annual income of 1.2 million baht to the community.



# Success Factors

---

## Building capacity to apply new knowledge and skills

Acquiring knowledge on water management and learning new technologies such as satellite mapping, GPS, and telemetering was not easy for Thapcris villagers. The HII and Utokapat Foundation paid a special attention for capacity building of community members and the efforts have been paid off. Thapcris villagers have been able to apply the technologies to collect data, analyze water balance and jointly develop their water storage and distribution systems. The crop planning and household accounting skills was introduced to the members. In the meantime, the Ornamental Plants Community Enterprises and the Flowers Revolving Fund were established to demonstrate the value of capacity building to maximize potentials of farmers in eliminating poverty and building sustainable livelihoods.

## Collaboration between community, academia and government

The Thapcris Community participated in partnership with government, local government and the Royal Irrigation Department in water management and water allocation to be in line with water from reservoir. Likewise, the Ornamental Plants Community Enterprises and the Flowers Revolving Fund were established to provide guidance as well as technical support to the Community members in managing fund and increasing market connection.

# Good Practices

---

## 1. Integrate water-related risk reduction and natural resource management for improved agriculture

Thapcris Community shows the successful integration of upstream and downstream water management reducing flood and drought risk and supports agricultural production.

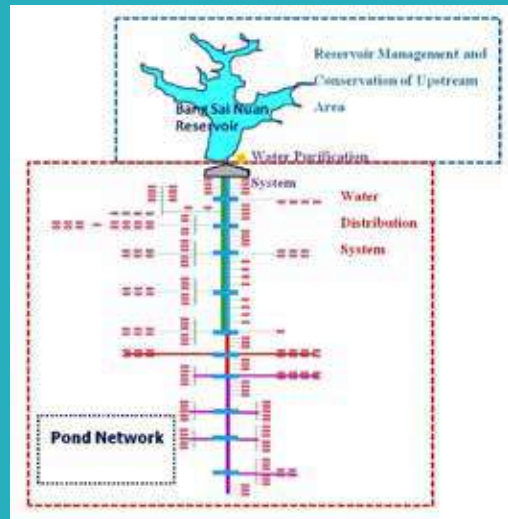
### Upstream water and forest rehabilitation

The check dams were built by the Thapcris Community to trap the sediment and retain dampness for the upstream forest of Bang Sai Nuan Reservoir, the main water resources. In addition, weedy vines were removed to protect the trees.



## Downstream water distribution system and pond network increase water storage and reduce flood and drought risk

A water distribution system was established to distribute water from the Bang Sai Nuan Reservoir Canal to 160 households over a total area of 5.76 square kilometers through water outlets and spillways.



Pond networks in Thapcris Community area

A pond network system connects with water sources and distributes water through sub-canals to be stored in 160 farm ponds. This helps reduce excessive flood water and stores water for dry season. The network can store

a total of 230,000 cubic metres for agriculture up to 3-7 days during dry spell periods as well as alleviates the potential loss during rain recession period to agricultural area of 1.6 square kilometers.



## Improved water quality

After water problem and quality was resolved which providing sufficient water supply, community water purification system then was installed to produce drinking water for sell at reasonable price.

The community set regulations and rules to ensure equitable distribution and sustainable use of water.

Water allocation through water outlets controlled with a time schedule of distribution has been recognized as the model of water outlet system and water storage in terms of pond network system in Thailand.



## 2. Build community enterprises to boost collaborative agriculture and increase values of products

Since better control of flood and sufficient water supply during dry season has allowed the Thapcris Community to shift from monoculture to integrated agriculture. Higher value crops such as flowers, ornamental plants, rubber trees, oil palm trees and others bring higher incomes while promoting a minimum income around 591,000 baht per household per year. Their debts were reduced and had better livelihood since then.

Learning from their positive experience with the water management group,

the Thapcris Community established the Community Enterprises to associate with production and increase the market value. Meanwhile, the “**Flowers Revolving Fund**” demonstrates a good example as the Fund helps farmers in terms of loan for money saving and pursuit ornamental plants growing career including enhance price bargaining power of selling flowers in the market. The Fund creates an annual income of 1.2 million baht and savings of 110,800 baht.



# Replication

---

At the end of 2020, Thapcrist Community has successfully expanded their practices from 30 people to cover 300 people. The agricultural area benefited from this concept has also expanded from 0.03 square kilometer to 0.72 square kilometer.







**Flash Flood**



**Drought**