



Sustainable agricultural productivity through farm pond option in the integrated watershed management of Northeast Thailand

*Thawilkal Wangkahart¹, Prabhakar Pathak², Suhas P Wani ²,
Bonyong Toomsan³, Somsak Idhipong¹, Somchai Chauchin¹,
Pranee Seehaban⁴ and Preecha Chueychoom¹,*

*¹ Office of Agricultural Research and Development Region (OARD³),
Department of Agriculture (DOA), Khon Kaen, Thailand*

² International Crop Research Institute for the Semi Arid Tropics (ICRISAT), Patancheru, A.P. India

³ Faculty of Agriculture, Khon Kaen University (KKU), Khon Kaen, Thailand.

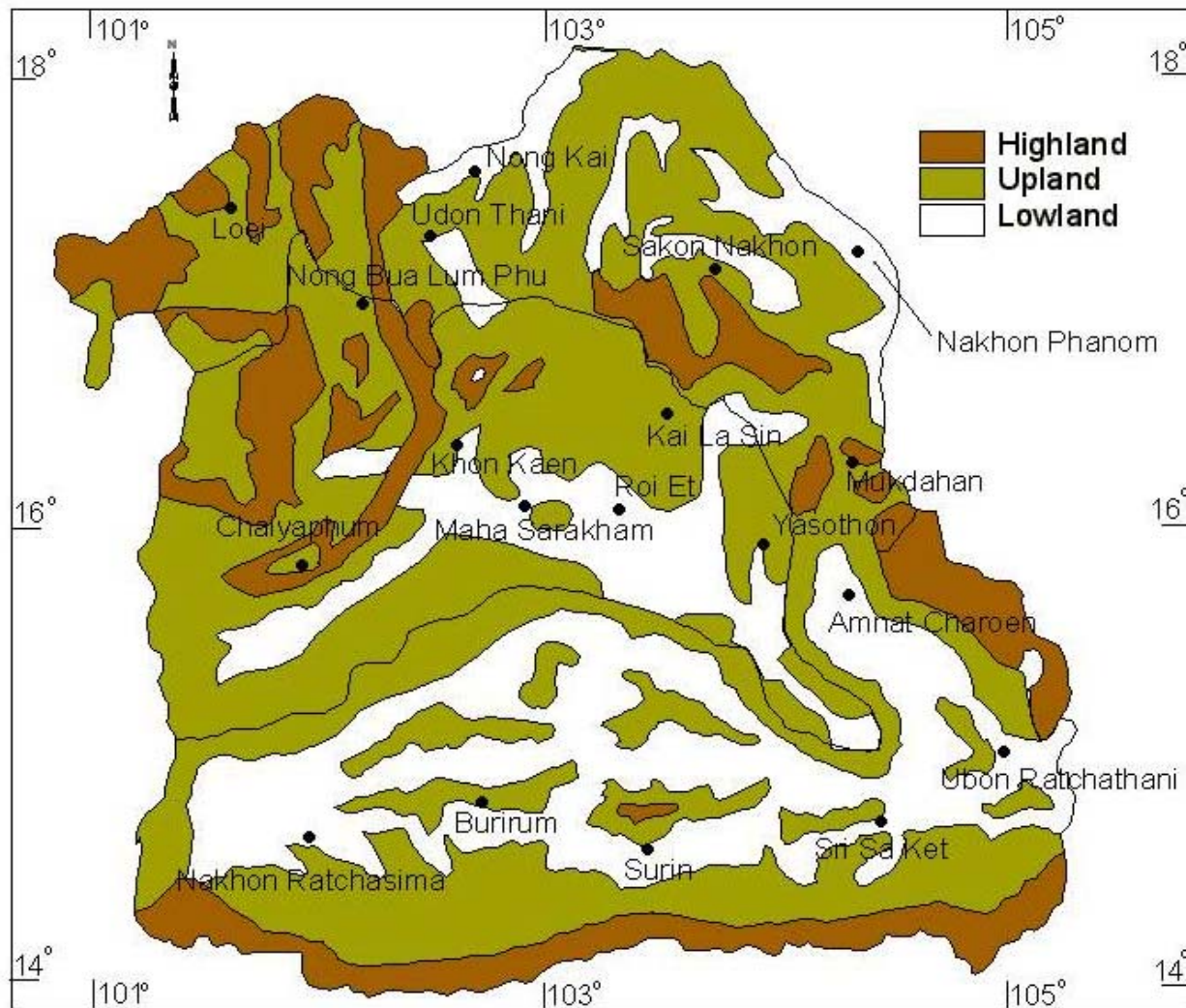
⁴ Office of Land Development Region 5, Land Development Department (LDD), Khon Kaen, Thailand.

Northeast Thailand

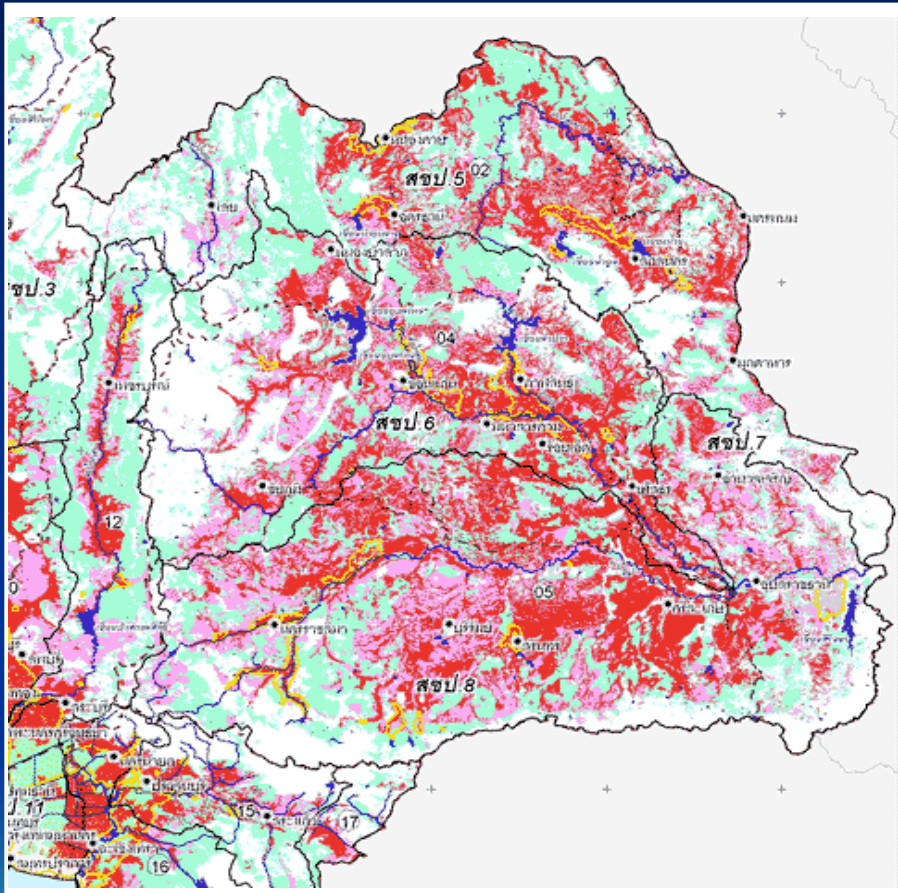
- One-third in terms of area and population of Thailand
- Generates only 15% gross domestic production.
- Sandy soil: infertile and poor soil moisture retention.
- Extremely erratic rainfall distribution: drought & flooding are common limits.
- 90% arable are rainfed in which limited water accessibility.
- Vicious cycle, land degradation low agri. productivity, low farm income, low investment and poverty.



Topography of north-eastern Thailand



NE-Water Resources Development Zones



Accessible Zones

I-Dams and Reservoirs

8-9% Farm Families

II-Natural Rivers

10% Farm Families

Inaccessible Zone

III-Small Scale Water

Resources (SSWR)

80% Farm Families

Potential Use of Small Scale Water Resources Alternatives

Villagers Require ment	Zone III SSWR Alternatives						
	W eir	Re ha b	Ta nk	Pond	Sha llow	De ep	Ro of
Drinking					x,?	x,?	x
HH Use	x	x	x	X	x	x	?
Animals	x	x	x	X	x	x	
Wet Seas. Crop	x	x	x	X	x,?	?	
Dry Seas. Crop	x	x	x	X	x,?	?	
Fish Raising	x	x	x	X			

**RID: Weirs, Rehab. Nat.,
Village Tanks : NE 5,184
(55%)**

Farm Ponds

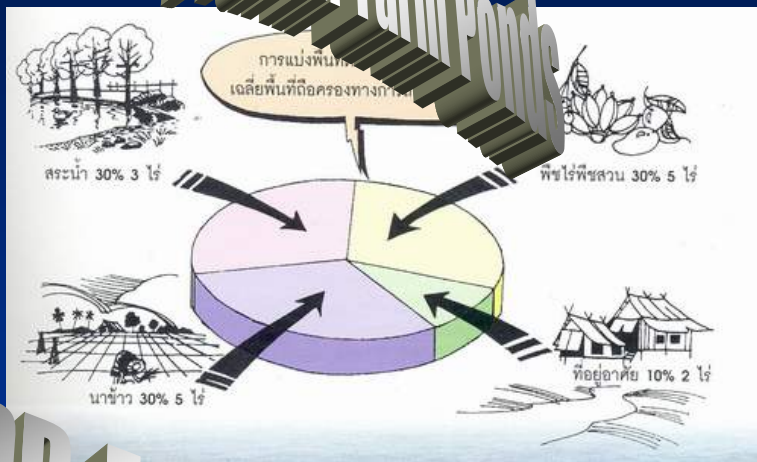
MOAC

**New Theory Farm (NTF) :
NE 7,600 (49.8%) NTF-FPs**

**LDD-Farm Pond (LDD-FP):
NE 1,807 (45%) LDD-FPs**

Note: Extra farm income generation are closely related to dry season crops.
x=Potential use. x,? = Some use and some restricted.

New Theory Farm-Farm Ponds



LDD-Farm Pond



NTF-FP

- : 5,000-10,000 m3 Capacity
- : 30-30-30-10 ratio of Water-Paddy-Crop-House
- : Lowland Paddy, at least 15 rai
- : 4,423 out off 6,783 (65%) NTF-Fs were supported by ADB Loan

LDD-Farm Pond (LDD-FP)

- 1,260 m3 Capacity
- Upper lowland Paddy
- Dry out in hot season

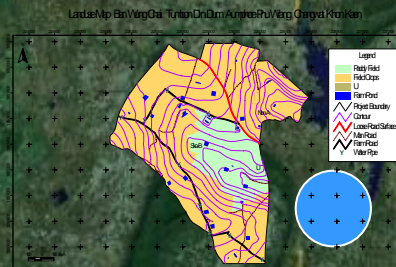
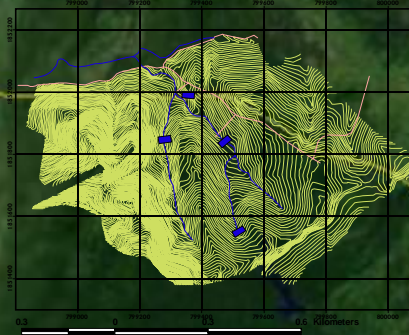
ADB-ICRISAT PROJECT Thailand

Participatory Watershed Management for Reducing Poverty and Land Degradation in SAT Asia

Tad Fa Watershed 1999



LOM SAK AIRPORT



Wang Chai Watershed 2003



KHON KAEN AIRPORT
Khon Kaen



Image © 2006 MDA EarthSat

© 2006 Google™

Pointer 16° 56'52.21"N 101° 29'21.15"E elev 2014 ft

Streaming ||||| 100%

Eye alt 112.28 mi

Land Use and Constraints

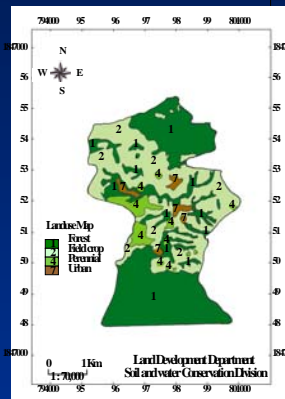
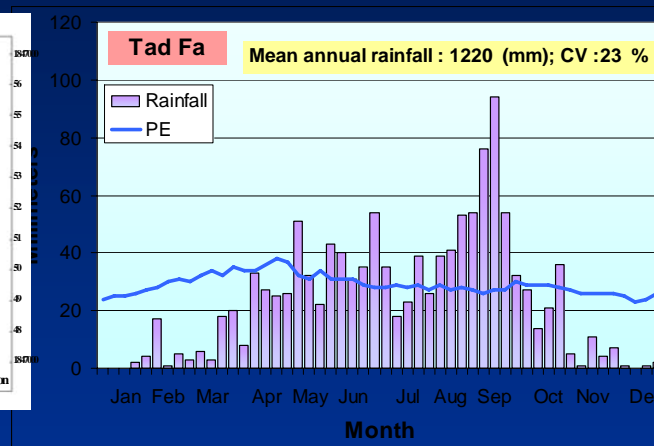
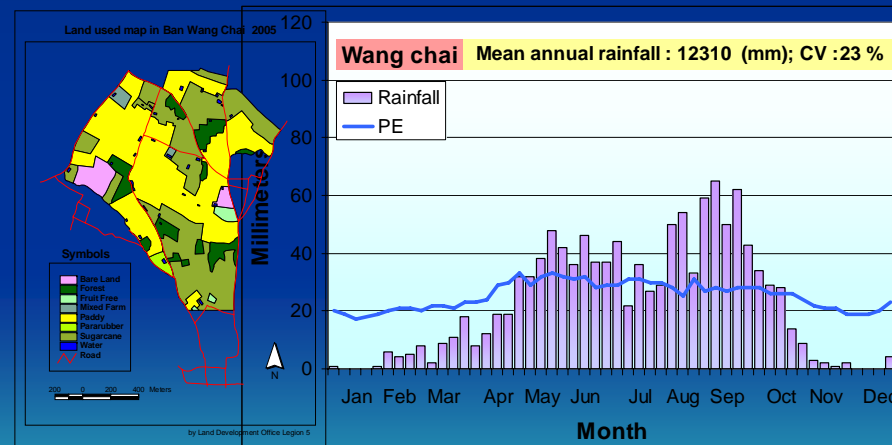


Figure 60: Map showing land use of Tad Fa watershed



Paddy is majority
Sandy low soil fertility
Low water retention
Drought and flooding
Sandy deposits

Maize is majority,
Severe soil erosion
Poor infrastructure
Less incentive on soil conservation
Lack technical back stopping on SWNM
Low productivity
Low income



Tad Fa Watershed
Phu-phaman Dist., KKN

Wang Chai Watershed
Phu-wiang Dist., KKN

Approaches of ADB-ICRISAT Project on Participatory Watershed Management



- A holistic systems approach.
- Multi disciplinary and multi institutional consortium approach for technical backstopping for mini-watershed management.
- Focus on increasing agricultural productivity and farm income in which reducing land degradation manners.
- Focus on increasing water availability and water use efficiency.
- Farmers participatory approach.
- Use of new science tools and
- Continuous monitoring in key areas.

Consortium Partners:

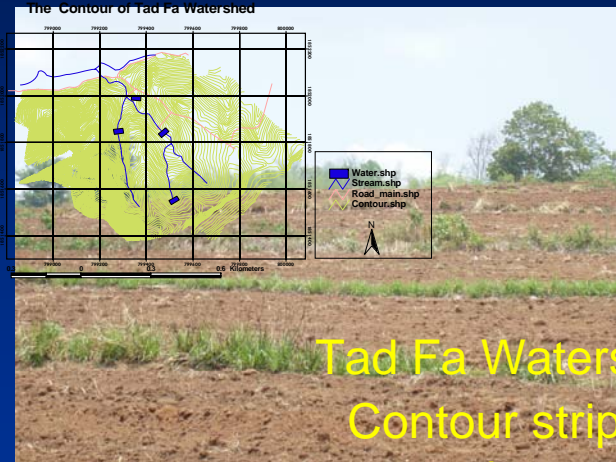
DOA = Department of Agriculture

LDD = Land Development Department

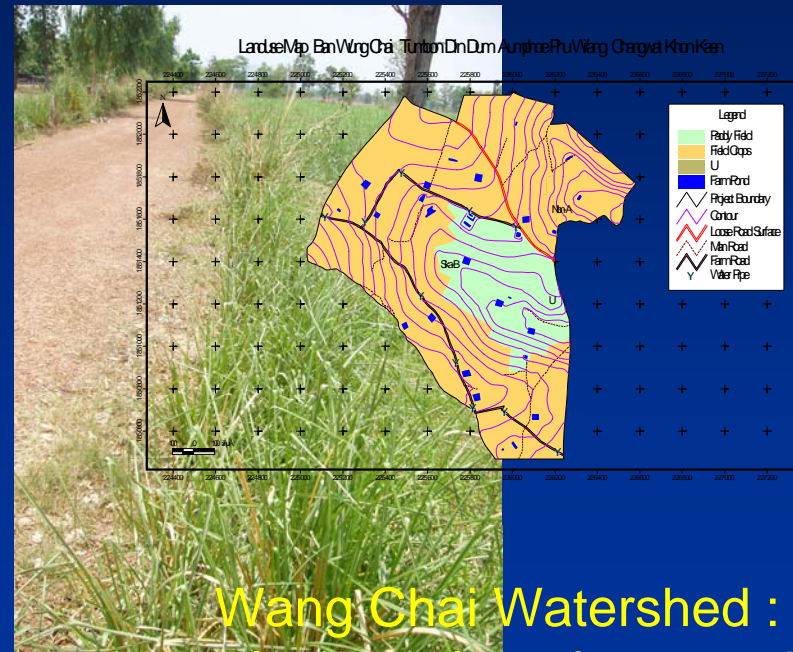
KKU = Khon Kaen University

ICRISAT = International Crops Institutes of the Semi-Arid Tropics

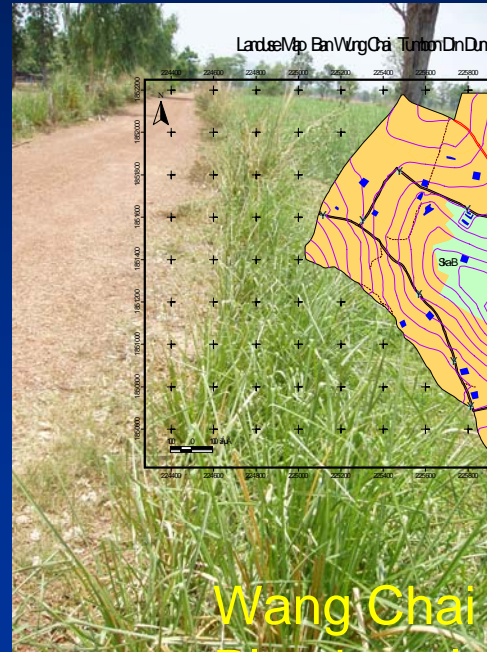
Using Vetiver Grass for Soil Erosion & Runoff Control



Tad Fa Watershed:
Contour strip, half
moon strip surround
trees to conserve soil
moisture



Wang Chai Watershed :
Planting along farm road
sides to protect the road
and runoff



Improved Cropping Systems

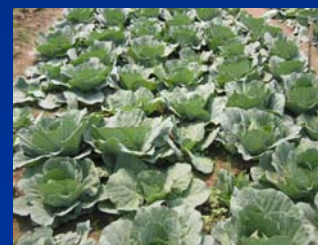


Multiple cropping systems:
17 farmers sown ricebean and 35 farmers cowpea as **sequential crop** after rice or maize. And 7 farmers adopted the **relay cropping** of ricebean with maize.

Recommended Varieties	Cropping Systems	Yield (kg/h)
Black Cowpea (K305)	Sequential after maize	372
Ricebean (L28-0395)	Relay with maize	524

On-Farm Yield Evaluation in TAD FA Watershed, 2004

Sources of Income	Baht	%
Horticulture	12,000	12
Vegetables	45,333	45
Field Crops	43,125	43
Total	100,458	100



Agro-fruit tree base system:

2004-5, five agro-fruit tree farmers were given 500 rattans, 11,000 teaks, 150 plums, and 10 aromatic oil trees to extend planting to **1500** fruits trees (longan, litchi, jack fruits) as agro forestry farm and also introduced inter-fruit tree row vegetables planting. Mixed farming are developing.

Dry Season Crop after Rice



Farm pond water save use for dry season crops yield (kg/ha), 2004

Dry-season crops	Residual moisture along river	FP Water Save Use		
		Residual moisture	Once irrigate	Twice irrigate
Black cowpea	509	475	601	-
Soybean	-	-	602	870
Groundnut	5,176* (KK6)	-	678* (KK5)	2,233* (KK5)

**= Fresh weight and KK5 >3,694 kg/h when irrigated 3 times*

IPM Scaling Up

2004 crop season, using this “Simple IPM Technique” 3 farmers could save their cabbage production cost, on the word they obtained more profit, about 20,675 Baht/ha/crop season (95%)



**Cost Reduction by Using Simple IPM for Pest Control
in Tad Fa Watershed , 2004 Unit : Baht/ha/crop season**

Net Return per crop season	Conven tional Cost	Simple IPM Cost	Cost Reduction
Cabbage, Chi. Cabbage (11,000-18,000)	21,875	1,200	20,675





ICRISAT Hydrological and Sediment Monitoring Systems

Rainfall, Runoff and Soil Loss at Tad Fa Watershed, 2003 and 2004

Land-use Systems	Rainfall (mm)		Runoff (mm)		Soil loss (t ha ⁻¹)	
	2003	2004	2003	2004	2003	2004
Annual Crops	1,650	1,312	256	214	32.5	24.6
Fruit Trees with FP			142	135	6.3	4.8

Community strengthening



Boiled groundnut
packaging



Training on "Fish Sauce"
processing by local expert

Food base activities



Out Reaches Benefits

Benefits and Up-scaling of Improved Technologies



Innovations	Tad Fa Watershed	Wang Chai Watershed
Farm ponds	Rainy vegetables and home garden security	Rainy paddy security and dry season crop
Vetiver Grass Planting	Contour strip: for soil and water conserve and run off	Vetiver Farm Road: for soil and water conserve
Improved Cropping systems	Agro-fruit trees , annual crop sequencing & relay with legumes systems	Dry season crop before and after paddy rice
IPM	Rainy vegetable: pesticide cost reduction	Winter vegetables: pesticide cost reduction
Community Strengthening	Poor: due to no land title and only men involving	Fair: but nominated by women



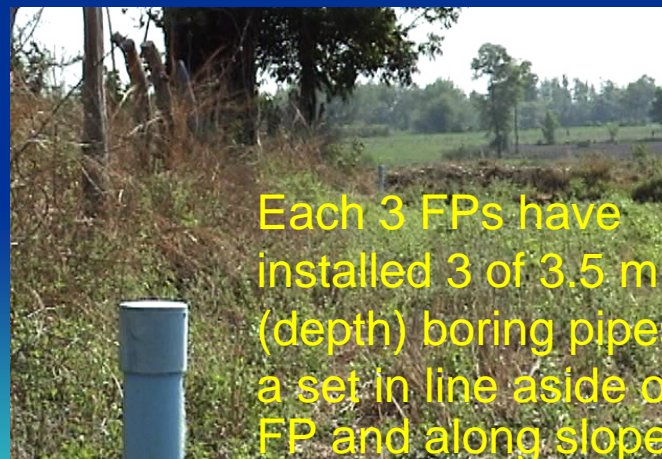
Water Ponding Capability and Impact of LDD-FP



Depth Scales were installed in 13 FPs each at Wang-chai watershed

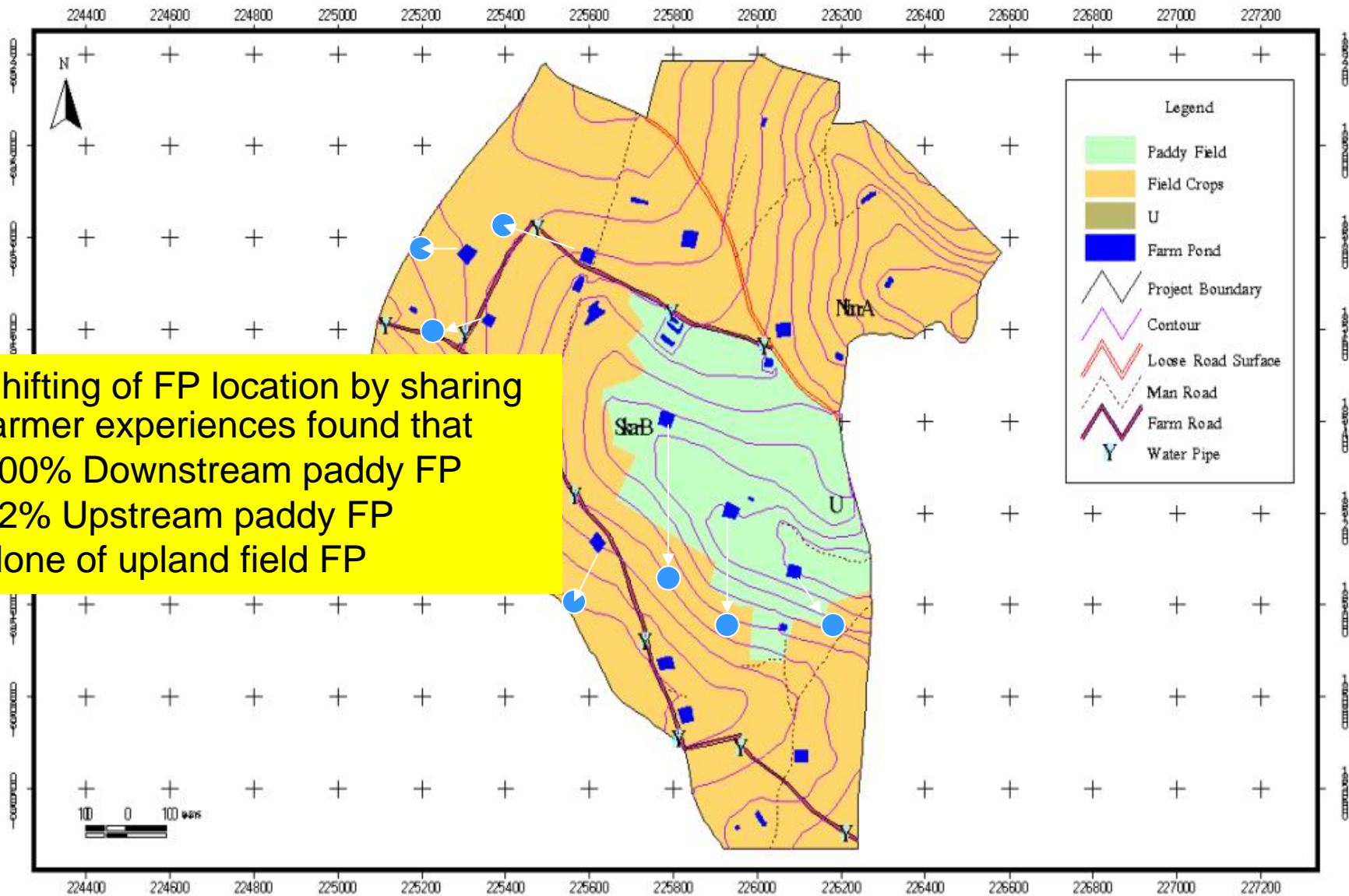
Impact study :

13 FP farmers and other 21 FP farmers at Wang Chai watershed were semi-structure interview after crop year 2004 and 2005, additional to 2 FP farmers at Tad Fa watershed in 2006

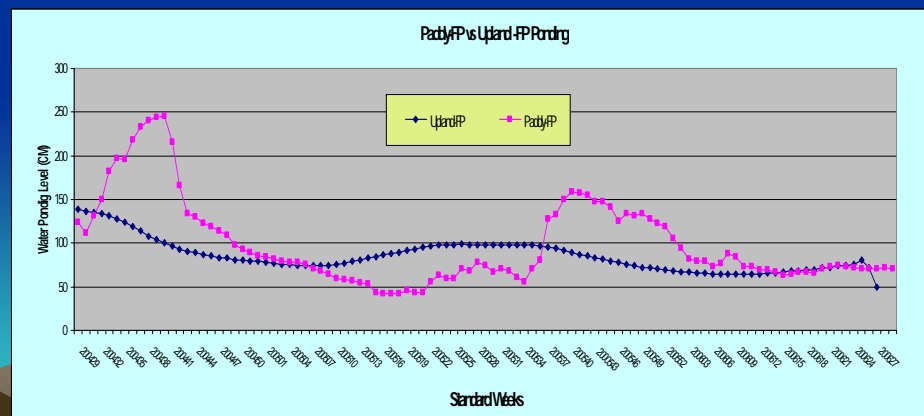
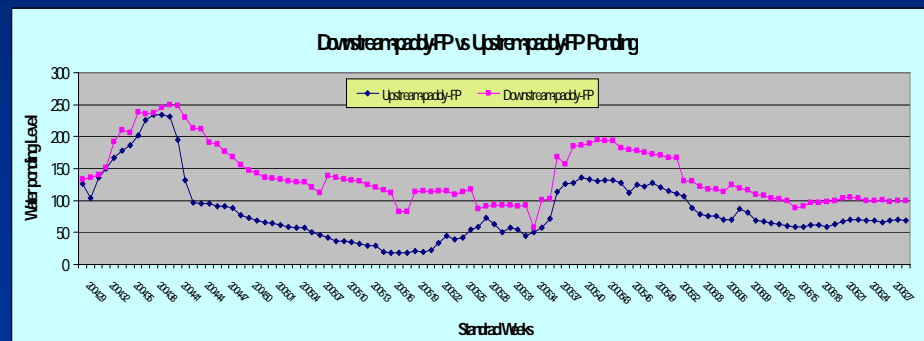
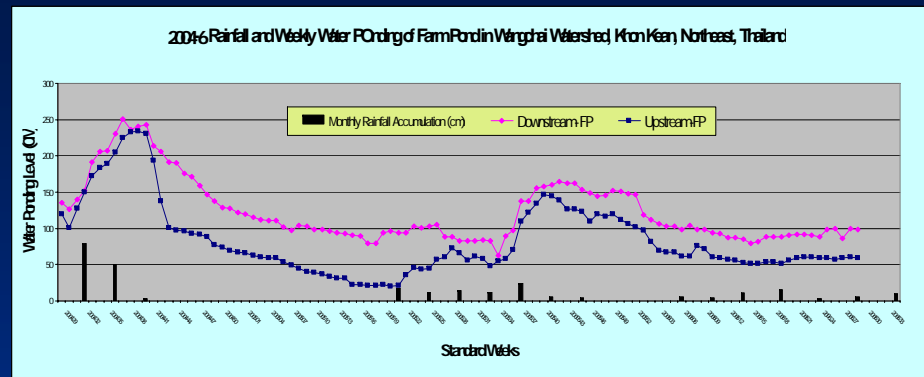
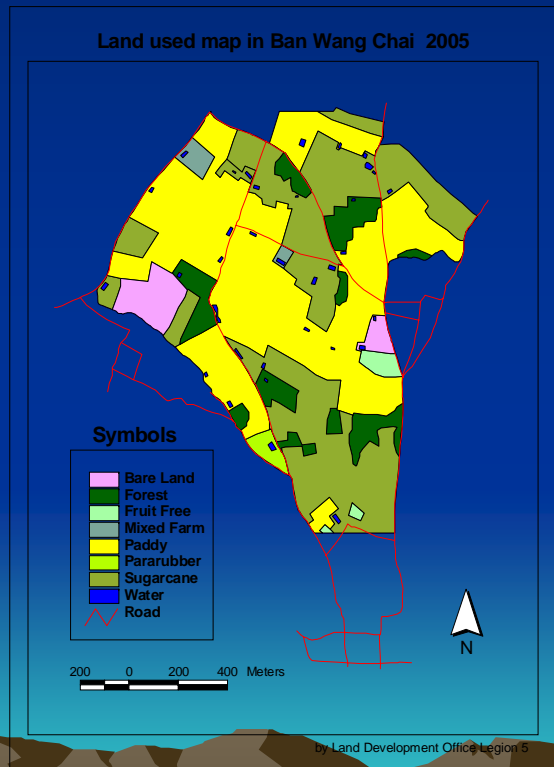


Each 3 FPs have installed 3 of 3.5 m (depth) boring pipes a set in line aside of FP and along slope

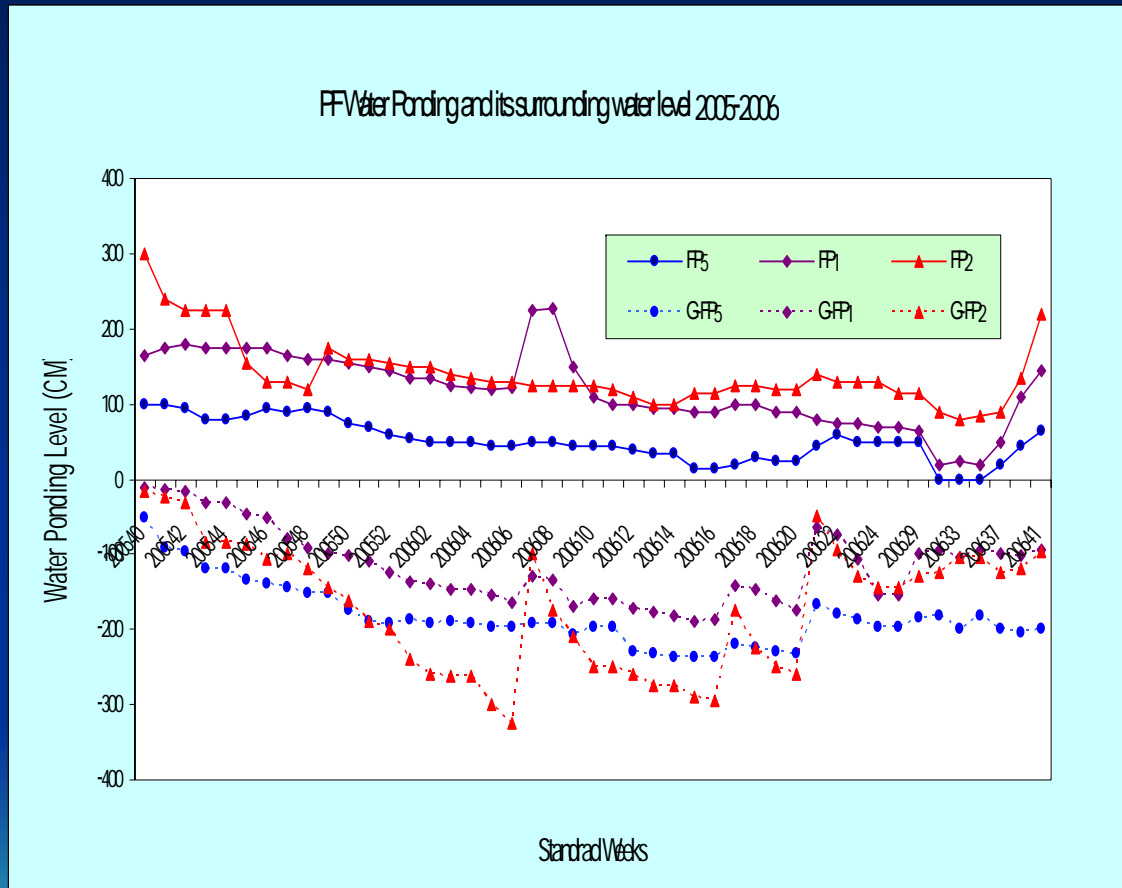
Landuse Map Ban Wung Chai Tumbon Din Dum Aumphoe Phu Wiang Changwat Khon Kaen



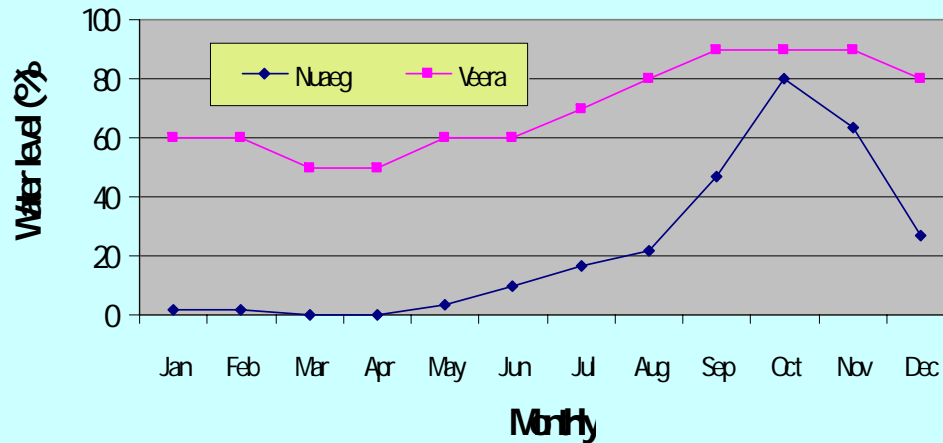
LDD-FP Water Ponding Depth Characters within Various Locations



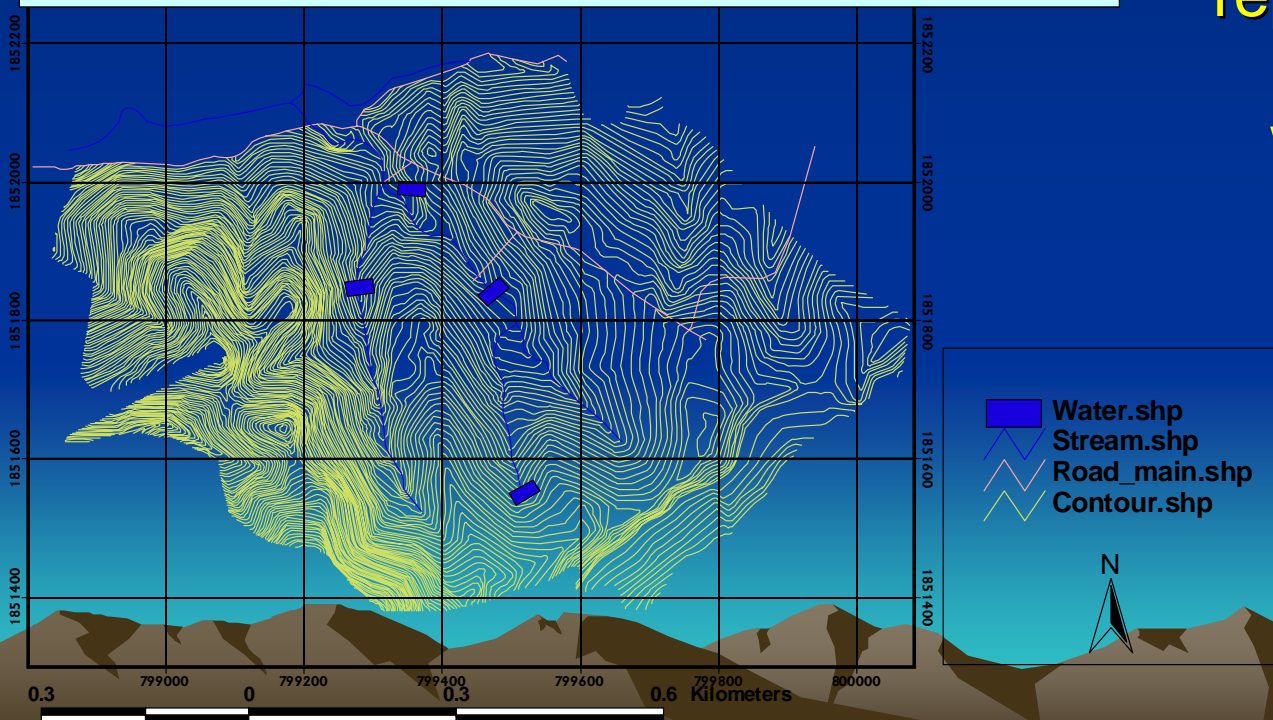
Water Ponding & Groundwater Depth



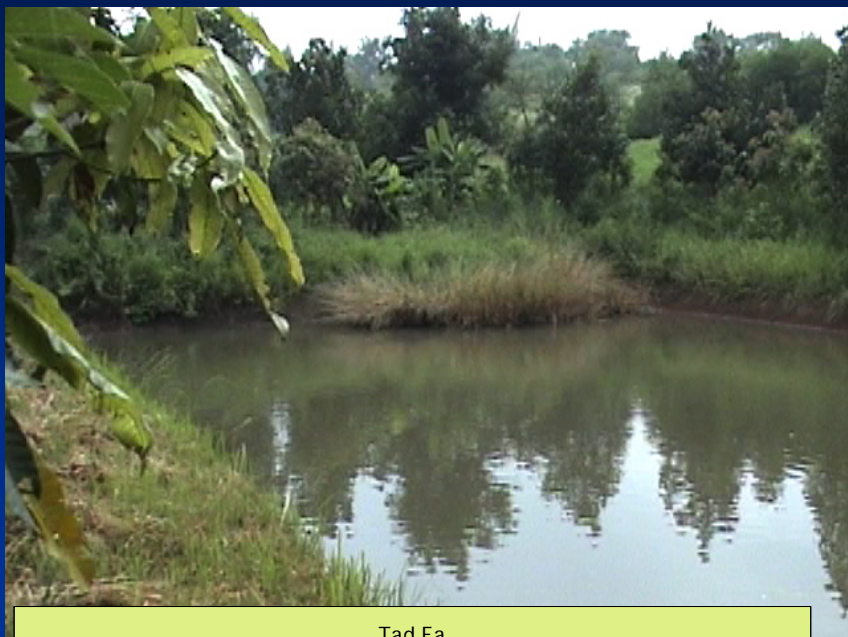
FP Water ponding level of Tad Fa Watershed, 2004-2006



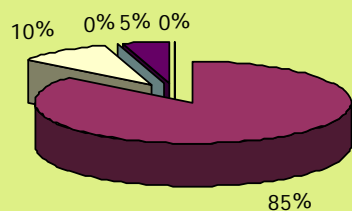
2 FP water
ponding
characters were
represented in
Tad Fa
watershed



Benefit Withdrawal from LDD-FP



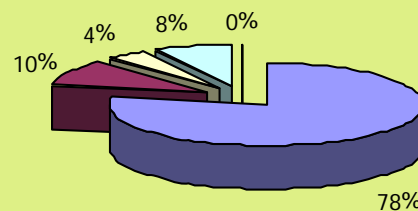
Tad Fa



■ Paddy ■ Vegetable □ Horticulture □ Fish culture ■ Others



Wang Chai



■ Paddy ■ Vegetable □ Horticulture □ Fish culture ■ Others

Findings

- Farm pond is a good sound for farmer on replacing “bed-load pond” or “retard pond” in soil conservation view and similarity to vetiver farm road for contour bunding which both could reduce sediment in downstream
- With farmer participatory in FP design, location of FP in particularly, incentive farmer to make use and do self maintenance more
- The ponding capability, groundwater play a significant role in rolling watershed whereas soil texture do in hilly FP. Moreover, run off water inlet also do significantly
- Even small water, but farmers learnt the best mode of use FP water supplementary such for paddy security in rolling watershed and rainy vegetables in hilly watershed that make additional farm income
- Upper paddy FP indicated greater benefit, however, Upland field FP (field crop) indicated less in utilize and benefit and poor maintenance
- FP, proper integration with crop-soil, right space and time, is valuable in the village (mini) watershed

