Water distribution from a shallow well in a sugar cane field (Jilayus Sommutram)

Using shallow wells for crops and lowering the saline groundwater table (Thailand)

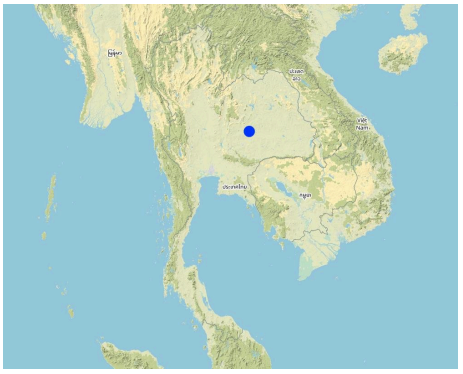
shallow well

DESCRIPTION

Pumping groundwater from shallow wells for agriculture can control the groundwater table in recharge areas. It helps to manage saline aquifers and reduce soil salinity. Such shallow wells range from 25 to 30 meters deep. This technology is very well-accepted by the land users.

The shallow well is a structure created in the ground by digging or drilling to access water resources. This example of shallow wells is their use in recharge areas to lower groundwater tables. The technology is a subproject of a larger LDD initiative. The technology has been promoted by the Land Development Department at Bua Yai district Nakhon Ratchasima province since 2014. The objectives of the main project are (1) to provide water resources in recharge areas for agriculture: (2) to reduce the amount of saline groundwater and (3) to set up positive economic impact measures.
The process of technology establishment comprises 1) a recharge area survey in salt-affected areas, 2) drilling shallow wells to 25-30 meters depth, 3) installing 5.5 hp gasoline pumps and testing water quality, 4) pumping groundwater and distributing it to the cultivated areas.
Shallow well technology has been implemented on the fields of Mr. Boonchu Supho, Ban Nong Mek, Moo 9, T.Dan Chang, A. Buayai, Nakhon Ratchasima Province. Mr. Boonchu Supho has 21 rai (approx. 3.4 hectares), undulating area with a 2-5% slope, situated at approx. 200 meters above sea level, with a tropical climate, and soil which is classified as being in the series of Kula Ronghai (Ki). This area is upland, and located in the recharge area. Mr. Boonchu Supho has 13 rai (approx. 2 hectares) of lowland rice fields and one shallow well.
In the past, water scarcity was the main issue with his land. Droughts resulted in water scarcity and low productivity. After excavating a shallow well in 2014, groundwater was used for 19 rai of cultivation. Due to soil salinity reduction, rice yields increased to 590 kg/rai (approx. 3700 kg/ha: an increase of approx. 47.4%). Sugar cane yield increased to 30 ton/rai. Moreover, land users can use land more efficiently with mixed plantations of banana, pineapples, sweet bamboo, chilies, galangal and lemongrass to generate income. Even with a drought in 2018, his land had enough water for cultivation, while rice fields in the surrounding area faced water scarcity problem.
In conclusion, the benefits of the shallow well are 1) lowering the groundwater table and reducing salinity, 2) enhancing rice and sugar cane yields, 3) ability to cultivate throughout the year and 4) better soil properties and a better environment. However, the disadvantage of the shallow well is that farmers have to pay for electricity (around 1,200 THB/ 9 months or 10,800 THB/year).

LOCATION



Location: Ban Koksa-ard Moo 10 T.Danchang, A.Buayai, Nakhon Ratchasima, Thailand

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 318342.40359, 15.6126

Spread of the Technology:

In a permanently protected area?:

Date of implementation: 2014; less than 10 years ago (recently)

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☑ through projects/ external interventions

Water distribution from a shallow well in sugar cane (Jilayus Sommutram)

Water distribution from a shallow well in rice field (Jilayus Sommutram)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [ ] create beneficial social impact
- [x] prevents soil salinity and to lower the groundwater table on recharge area

Land use

Land use mixed within the same land unit: No

Cropland

- Annual cropping: cereals - rice (wetland), vegetables - other
- Perennial (non-woody) cropping: banana/plantain/abaca, pineapple, sugar cane
- vegetable

Number of growing seasons per year: 2
Is intercropping practiced? No
Is crop rotation practiced? No

Waterways, waterbodies, wetlands - Main products/ services: shallow well

Water supply

- [ ] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation
- [x] shallow well

Purpose related to land degradation

- [ ] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [x] adapt to land degradation
- [ ] not applicable

Degradation addressed

chemical soil deterioration - Cs: salinization/ alkalinization

physical soil deterioration - Pc: compaction, Pk: slaking and crusting

biological degradation - Bc: reduction of vegetation cover, Bq: quantity/ biomass decline, Bl: loss of soil life

water degradation - Hq: decline of groundwater quality

SLM group

- rotational systems (crop rotation, fallows, shifting cultivation)
- ground water management
- desalination

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility

structural measures - S11: Others

TECHNICAL DRAWING

Technical specifications
None

Author: Mr.Jilayus Sommutram

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **21 rai own by one selected land user....(e.g. 24 acres, 4.5 hectares)**; conversion factor to one hectare: **1 ha = 1 hectare =...6.25 rai**)
- Currency used for cost calculation: **THB**
- Exchange rate (to USD): 1 USD = n.a THB
- Average wage cost of hired labour per day: 300 THB

Most important factors affecting the costs

Cost of shallow wells implementation at the 1st year consists of 100,000 THB of labor hiring, equipment, and installation. Besides, land users have to pay 2,500 THB for farm pond construction The expenditure at the 1st year in 2014, pumping groundwater needs to use electricity 8 hours/ 270 day. The amount of water pumping has distributed to 13 rai of rice fields, 1.5 rai of sugar cane fields, 1 rai of chilies, galangal and lemongrass fields. The expenditure at the 1st year with 19 rai is 42,050 THB combine with electricity charge 10,800 THB. Thus, the grand total of expenditure is 52,850 THB. The income from crop production at 1st year, land users sold rice yield and got 109,200 THB (the average amount of yield is 560 kg/rai, totally gain yield is 7,280 kg, price of rice yield is 15 THB/kg). Land users got 40,500 THB from sugar cane production (the average amount of yield is 30 ton/rai, totally gain yield is 45 ton, price of sugar cane yield is 900 THB/ton). Moreover, land users also got 2,000 THB/month or 24,000 THB/year from chilies, galangal, and lemongrass production. Thus, the grand total of income is 173,700 THB and net income is 120,850 THB Cost and income at 2nd year in 2015 are described as following; The expenditure at 2nd year in 2015, pumping groundwater needs to use electricity 8 hours/ 270 day. The amount of water pumping has distributed to 13 rai of rice fields, 1.5 rai of sugar cane fields, 1 rai of sweet bamboo, 1 rai of chilies, galangal and lemongrass fields and 0.5 rai of reed fields. The expenditure at the 2nd year is 40,475 THB combine with electricity charge 10,800 THB and 2,000 THB of water pump modifying fee Thus, the grand total of expenditure is 51,275 THB. The income from crop production at the 2nd year, land users sold rice yield and got 109,200 THB (the average amount of yield is 560 kg/rai, totally gain yield is 7,280 kg, price of rice yield is 15 THB/kg). Land users got 40,500 THB from sugar cane production (the average amount of yield is 30 ton/rai, totally gain yield is 45 ton, price of sugar cane yield is 900 THB/ton). Moreover, land users also got 3,500 THB/month or 42,000 THB/year from reed, sweet bamboo, chilies, galanga, and lemongrass production. Thus, the grand total of income is 191,700 THB and net income is 140,425 THB The expenditure at the 3rd year in 2016, pumping groundwater needs to use electricity 8 hours/ 270 day. The amount of water pumping has distributed to 13 rai of rice fields, 1.5 rai of sugar cane fields, 1 rai of sweet bamboo, 1 rai of chilies, galangal and lemongrass fields and 1 rai of reed fields and 0.5 rai of reed. The expenditure at the 3rd year is 40,800 THB combine with electricity charge 10,800 THB and 2,000 THB of water pump modifying fee Thus, the grand total of expenditure is 51,600 THB. The income from crop production at 3rd year, land users sold rice yield and got 109,200 THB (the average amount of yield is 560 kg/rai, totally gain yield is 7,280 kg, price of rice yield is 15 THB/kg). Land users got 40,500 THB from sugar cane production (the average amount of yield is 30 ton/rai, totally gain yield is 45 ton, price of sugar cane yield is 900 THB/ton). Moreover, land users also got 3,500 THB/month or 42,000 THB/year from reed, sweet bamboo, chilies, galangal, and lemongrass production. Thus, the grand total of income is 191,700 THB and net income is 140,100 THB The

expenditure at the 4th year in 2017, pumping groundwater needs to use electricity 8 hours/ 270 day. The amount of water pumping has distributed to 13 rai of rice fields, 1.5 rai of sugar cane fields, 1 rai of sweet bamboo, 1 rai of chilies, galangal and lemongrass fields and 1 rai of reed fields and 0.5 rai of reed. The expenditure at the 4th year is 37,125 THB combine with electricity charge 10,800 THB and 2,000 THB of water pump modifying fee Thus, the grand total of expenditure is 47,925 THB. The income from crop production at 4th year, land users sold rice yield and got 109,200 THB (the average amount of yield is 560 kg/rai, totally gain yield is 7,280 kg, price of rice yield is 15 THB/kg). Land users got 40,500 THB from sugar cane production (the average amount of yield is 30 ton/rai, totally gain yield is 45 ton, price of sugar cane yield is 900 THB/ton). Moreover, land users also got 3,500 THB/month or 42,000 THB/year from reed, sweet bamboo, chilies, galangal, and lemongrass production. Thus, the grand total of income is 191,700 THB and net income is 143,775 THB The expenditure at the 5th year in 2018, pumping groundwater needs to use electricity 8 hours/ 270 day. The amount of water pumping has distributed to 13 rai of rice fields, 1.5 rai of sugar cane fields, 1 rai of sweet bamboo, 1 rai of banana, 1 rai of chilies, galangal and lemongrass fields,1 rai of reed

Establishment activities

1. To drilling shallow well with 25-30 meters depth (Timing/ frequency: January 2014)
2. Sugar fields (Timing/ frequency: May 2014, 2016, 2018)
3. Pineapple fields (Timing/ frequency: May 2018)
4. Banana fields (Timing/ frequency: May 2014)
5. Reed fields (Timing/ frequency: May 2015)
6. Sweet bamboo fields (Timing/ frequency: May 2015)
7. Chillies, galangal and lemon grass fields (Timing/ frequency: May 2014-2018)
8. Rice fields (Timing/ frequency: June 2014-2018)

Establishment inputs and costs (per 21 rai own by one selected land user....(e.g. 24 acres, 4.5 hectares))

Specify input	Unit	Quantity	Costs per Unit (THB)	Total costs per input (THB)	% of costs borne by land users
Labour					
Costs of labor for sugarcane cultivation	puddle	1.0	2500.0	2500.0	
Costs of labor for rice cultivation.	rai	13.0	1150.0	14950.0	
Costs of labor for sugar cane cultivation.	rai	1.5	1200.0	1800.0	
Costs of labor for pineapple cultivation.	rai	1.0	1200.0	1200.0	
Equipment					
Costs of labor for Banana cultivation	rai	1.0	600.0	600.0	
Costs of labor for Papyrus cultivation.	rai	0.5	900.0	450.0	
Costs of labor for Sweet bamboo cultivation.	rai	1.0	600.0	600.0	
Costs of labor for Chilli, galangal, lemon grass cultivation	rai	1.0	900.0	900.0	
Cost of shallow water well drilling equipment	puddle	1.0	100000.0	100000.0	
Plant material					
Bud seedling sugarcane	seedling	2250.0	0.9	2025.0	
Bud seedling Pineapple	seedling	2500.0	2.0	5000.0	
Bud seedling Banana	seedling	100.0	10.0	1000.0	
Bud seedling Papyrus	seedling	3000.0	0.2	600.0	
Fertilizers and biocides					
Bud seedling sweet bamboo	seedling	25.0	80.0	2000.0	
Bud seedling Chilli, galangal, lemon grass	seedling	2000.0	1.0	2000.0	
Seedling rice KDML105	seedling	65.0	25.0	1625.0	
Chemical fertilizer 15-15-15	kg	300.0	13.0	3900.0	
Chicken manure	kg	2000.0	2.0	4000.0	
Other					
Electricity charge	hr	240.0	5.0	1200.0	
Machinery	rai	19.0	500.0	9500.0	
Total costs for establishment of the Technology				**155'850.0**	
Total costs for establishment of the Technology in USD				*155'850.0*	

Maintenance activities

1. Maintenance (Timing/ frequency: 1 Times/year)
2. Electricity charge (Timing/ frequency: 1 Times/month)

Maintenance inputs and costs (per 21 rai own by one selected land user....(e.g. 24 acres, 4.5 hectares))

Specify input	Unit	Quantity	Costs per Unit (THB)	Total costs per input (THB)	% of costs borne by land users
Equipment					
electricity charge,5 baht per unit 8 hours per day, 360 days / year	time	2880.0	5.0	14400.0	
Machinery	time	1.0	2000.0	2000.0	
Total costs for maintenance of the Technology				**16'400.0**	
Total costs for maintenance of the Technology in USD				*16'400.0*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [ ] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 1084.0
Average annual rainfall from 2008-2013
Name of the meteorological station: Meteorological Department
Temperatures average 13-39 degrees Celsius, average relative humidity 55-89.%

Slope
- [ ] flat (0-2%)
- [x] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [x] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [ ] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to: ground water

Is salinity a problem?
- [x] Yes
- [ ] No

Occurrence of flooding
- [ ] Yes
- [x] No

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [ ] average
- [x] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [x] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha

Scale
- [ ] small-scale
- [x] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

- [x] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [ ] individual, not titled
- [x] individual, titled

Water use rights

- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual
- [x] Rainfed.

Access to services and infrastructure

health	poor	good
education	poor	good
technical assistance	poor	good
employment (e.g. off-farm)	poor	good
markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts

Crop production	decreased	increased
crop quality	decreased	increased
risk of production failure	increased	decreased
product diversity	decreased	increased
production area (new land under cultivation/ use)	decreased	increased
drinking water availability	decreased	increased
drinking water quality	decreased	increased
water availability for livestock	decreased	increased
expenses on agricultural inputs	increased	decreased
farm income	decreased	increased
workload	increased	decreased

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved
health situation	worsened	improved
land use/ water rights	worsened	improved
cultural opportunities (eg spiritual, aesthetic, others)	reduced	improved
recreational opportunities	reduced	improved
community institutions	weakened	strengthened
national institutions	weakened	strengthened
SLM/ land degradation knowledge	reduced	improved
conflict mitigation	worsened	improved
situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)	worsened	improved

Ecological impacts

water quantity	decreased	increased
water quality	decreased	increased
harvesting/ collection of water (runoff, dew, snow, etc)	reduced	improved
surface runoff	increased	decreased
excess water drainage	reduced	improved
groundwater table/ aquifer	lowered	recharge
evaporation	increased	decreased
soil moisture	decreased	increased
soil cover	reduced	improved
soil loss	increased	decreased
soil accumulation	decreased	increased
soil crusting/ sealing	increased	reduced
soil compaction	increased	reduced
nutrient cycling/ recharge	decreased	increased
salinity	increased	decreased
soil organic matter/ below ground C	decreased	increased
acidity	increased	reduced
vegetation cover	decreased	increased
biomass/ above ground C	decreased	increased
plant diversity	decreased	increased
invasive alien species	increased	reduced
animal diversity	decreased	increased

beneficial species (predators, earthworms, pollinators)	decreased	increased
habitat diversity	decreased	increased
pest/ disease control	decreased	increased
flood impacts	increased	decreased
landslides/ debris flows	increased	decreased
drought impacts	increased	decreased
impacts of cyclones, rain storms	increased	decreased
emission of carbon and greenhouse gases	increased	decreased
fire risk	increased	decreased
wind velocity	increased	decreased
micro-climate	worsened	improved

Off-site impacts

water availability (groundwater, springs)	decreased	increased
reliable and stable stream flows in dry season (incl. low flows)	reduced	increased
downstream flooding (undesired)	increased	reduced
downstream siltation	increased	decreased
groundwater/ river pollution	increased	reduced
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	improved
wind transported sediments	increased	reduced
damage on neighbours' fields	increased	reduced
damage on public/ private infrastructure	increased	reduced
impact of greenhouse gases	increased	reduced

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Land users to pay a 2,000 baht machinery as a long-term investment to operate for several years and pay the electric fee for water pumping but land users can have 10,800 THB and the revenue daily, monthly and annually and reduce costs in the household

CLIMATE CHANGE

-

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [ ] single cases/ experimental
- [x] 1-10%
- [ ] 11-50%
- [ ] > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [x] Yes
- [ ] No

Land users have modified water pump machine by use electric pump instead of a gasoline pump

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)
- [x] changing practice

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Reduce soil salinity
- Save money by bringing rice and vegetables grown into household food.
- Increase sales revenue, rice, sugarcane, pineapple, Papyrus, banana, lemongrass, galangal, chili, and sweet bamboo.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- After one year of shallow wells implemented, land users must take care and maintain shallow wells as usual. Make an agreement on taking care of shallow wells after implemented.
- None To inform LDD when something is wrong

- Save money by bringing rice and vegetables grown into household food.

Strengths: compiler's or other key resource person's view
- Pumping water from shallow wells for agricultural use, can reduce groundwater table and prevent salinity that is a great measure on land degradation mitigation
- The land user can have food from plant production from their farms. The land user can reduce household expenses. Left to sell, resulting in a daily, monthly and annual income and make a better life.
- Biodiversity enhancement, there are many plants and living things such as earthworms, birds, fish, frogs, and insects. This is resulting in a balanced ecosystem.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome
- Other land users who are not participating. will not get knowledge about the use of shallow well to reduce the level of underground water. LDD staff / Land users participating in the project to advise or educate other farmers on how to join the project.

REFERENCES

Compiler
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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4391/

Linked SLM data
n.a.

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Institution
- Land Development Department (Land Development Department) - Thailand

Project
- Book project: where the land is greener - Case Studies and Analysis of Soil and Water Conservation Initiatives Worldwide (where the land is greener)
- Decision Support for Mainstreaming and Scaling out Sustainable Land Management (GEF-FAO / DS-SLM)

Key references

- Evaluate the project using water from shallow wells to prevent. Distribution of saline soil as farmers participate in Bua Yai District,Nakhon Ratchasima Province (Kamolthip Sasithorn: 2017: http://www.ldd.go.th
- Study of groundwater level changes to rice production in an integrated saline soil development project area, Bua Yai District, Nakhon Ratchasima Province (Bowon Buakhao: 2017): http://www.ldd.go.th

Links to relevant information which is available online
- where the land is greener - Case Studies and Analysis of Soil and Water Conservation Initiatives Worldwide: https://www.wocat.net/library/media/27/