Pond Al Yakloum, Mresti municipality, Mount Lebanon, Lebanon

Runoff Pond Al Yakloum (Lebanon)

Birki Al Yakloum

DESCRIPTION

The Al Yakloum pond collects runoff from a local catchment and water is led through a channel system alongside a farm road. Sandy particles are captured in a sediment trap before runoff enters the pond. The pond provides water to approximately 5 ha of orchard - which is irrigated through a precision system.

The Al Yakloum Pond is located in a public area within the municipality of Mrusti (Mount Lebanon). Runoff water is collected from a natural catchment and is led to the pond through a channel that runs alongside a farm road. The catchment area is mostly unproductive private land, and extends to approximately 2 ha in total. Sediment is an issue in the catchment due to the fine sandy outcrops. Sandy particles are thus carried in the runoff – and require settling out in a sediment trap to limit the turbidity of water in the pond. Thus runoff first enters a stilling basin (a sediment trap) where the suspended solids are deposited: runoff is then transferred through a pipe leading to the pond.
The pond's volume is around 7500 m3, and it is used to irrigate an orchard of about 5 ha in size, which is planted to apples, cherries and olives. A precision smart irrigation system is used for water application. The system includes IoT sensors that provide real time information about soil humidity and weather conditions that allow to automatize the valve opening depending on the plant needs thus optimizing the water consumptions. The volume of water collected is not enough to fulfil all the theoretical water requirements of the orchard crops, therefore the irrigation is merely supplementary to rainfall, and its impact on production is limited. However, the alternative water resource in the area is groundwater. This is high cost and has negative environmental impacts. Therefore the runoff pond technology is preferable for the sustainability of agriculture in the area. If the efficiency of runoff water collection and its application can be improved, then pump withdrawal requirements from groundwater sources decrease and this will optimize the efficiency of irrigation.

LOCATION

Location: Municipality of Mrusti, Mount Lebanon, Lebanon

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 35.65868, 33.63128

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: Ja

Date of implementation: 2002; 10-50 years ago

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

Sedimentation trap, located above the pond to settle the sediment transported by the runoff water

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

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

Land use

Land use mixed within the same land unit: Nee

Cropland

- Annual cropping

Number of growing seasons per year: 1
Is intercropping practiced? Ja
Is crop rotation practiced? Nee

Waterways, waterbodies, wetlands - Ponds, dams

Unproductive land - Specify: Unproductive area used as catchment area of approximately 2ha

Water supply

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

Purpose related to land degradation

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

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion

water degradation - Hs: change in quantity of surface water, Hg: change in groundwater/aquifer level

SLM group

- water harvesting
- irrigation management (incl. water supply, drainage)
- water diversion and drainage

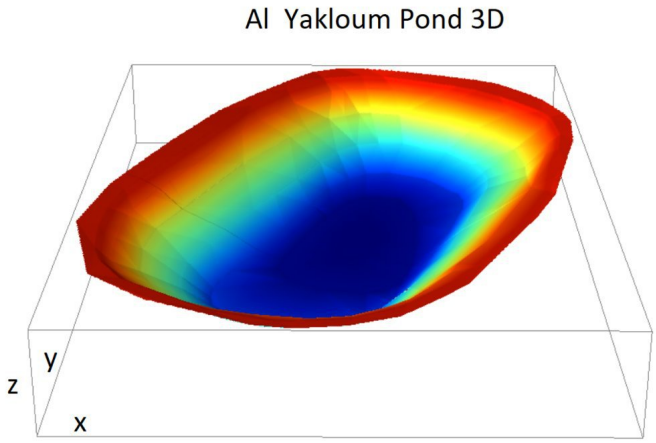
SLM measures

structural measures - S5: Dams, pans, ponds

TECHNICAL DRAWING

Technical specifications

Maximum depth 8 m, Area approximately 35 m x 60 m, bank slope approx 35°



ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **n.a.**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

n.a.

Establishment activities

1. Pond Cleaning from sediment (Timing/ frequency: After the irrigation season for the duration of 2 weeks)
2. Geomembrane (HDPE) replacement in damaged spots and compaction of the underneath soil with clay application (Timing/ frequency: Approximately one month)
3. Construction of Retaining Wall to prevent soil erosion on the escarpment close to the pond (Timing/ frequency: Approximately one month)
4. Sedimentation Trap (Timing/ frequency: Approximately two weeks)
5. Rip-rap Channel to convey the water into the Sedimentation Trap (Timing/ frequency: Approximately two weeks)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (n.a.)	Total costs per input (n.a.)	% of costs borne by land users
Labour					
Cleaning of the ponds from sediment and removal of existing backfill	n	1.0	3000.0	3000.0	
Excavations and Backfilling	n	1.0	3600.0	3600.0	
Maintenance of existing HDPE geomembrane	n	1.0	3000.0	3000.0	
Equipment					
Geomembrane	m^2	1727.0	8.0	13816.0	
Sedimentation Trap	n	1.0	7087.0	7087.0	
Retaining Wall	n	1.0	21.186	21.19	
Rip-rap channel	m	60.0	6.0	360.0	
Fence and Gates along the pond including cast-in-place concrete	m	160.0	38.8	6208.0	
Total costs for establishment of the Technology				**37'092.19**	
Total costs for establishment of the Technology in USD				*37'092.19*	

Maintenance activities

n.a.

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (n.a.)	Total costs per input (n.a.)	% of costs borne by land users
Labour					
Cleaning of the sediment trap	times per year	5.0	50.0	250.0	100.0
Cleaning of the rip-rap channel	times per year	5.0	20.0	100.0	100.0
Total costs for maintenance of the Technology				**350.0**	
Total costs for maintenance of the Technology in USD				*350.0*	

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☐ 751-1,000 mm
- ☑ 1,001-1,500 mm
- ☐ 1,501-2,000 mm

Agro-climatic zone

- ☐ humid
- ☑ sub-humid
- ☐ semi-arid
- ☐ arid

Specifications on climate

Average annual rainfall in mm: 1100.0

Winter rains, mostly in Dec-Jan, normally no rain from May to beg of Sep, apparently the rainy season is shifting to the spring due to climate change

Name of the meteorological station: Maasser Al Shouf

- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

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

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

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [x] 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
- [x] concave situations
- [ ] not relevant

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

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

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

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

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

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

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

Water quality refers to: ground water

Is salinity a problem?
- [ ] Ja
- [x] Nee

Occurrence of flooding
- [ ] Ja
- [x] Nee

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

Habitat diversity
- [x] high
- [ ] 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
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] 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
- [ ] individual/ household
- [x] groups/ community
- [x] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

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

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

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

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [x] group
- [ ] individual, not titled
- [ ] individual, titled

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

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

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

Comments

Related to the specific Municipality of Mrusti

IMPACTS

Socio-economic impacts

Crop production

decreased — increased

Increase of runoff catchment will have an impact on the amount of water supplied to cultivated area thus increasing the production

crop quality

decreased — increased

Increase of runoff catchment will have an impact on the amount of water supplied to cultivated area thus increasing the quality production

production area (new land under cultivation/ use)

decreased — increased

The increased amount of runoff water combined with the reduction of losses given by the precision smart irrigation system permitted to extend the area connected to the pipe system

land management: hindered — simplified

irrigation water availability: decreased — increased

irrigation water quality

decreased — increased

Sedimentation trap will limit the turbidity of the ponds. The catchment area do not include high anthropized area therefore the pollution is very limited.

Socio-cultural impacts

Ecological impacts

harvesting/ collection of water (runoff, dew, snow, etc): reduced — improved

evaporation

increased — decreased

Collecting the water in an uncovered pond leads to an increase of the evaporation.

Off-site impacts

downstream flooding (undesired)

increased — reduced

Increasing the amount of water harvested reduces the amount of runoff water in the downstream area, therefore reducing the hydraulic risk and soil erosion during extreme rain events.

downstream siltation

increased — decreased

Reduction of runoff and surface water along the earthen channels and the roads decreases the amount of sediment transport showing a positive impact in terms of land degradation.

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

CLIMATE CHANGE

Gradual climate change

annual temperature increase: not well at all — very well

ADOPTION AND ADAPTATION

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

- single cases/ experimental
- 1-10%
- 11-50%
- ☑ > 50%

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

- ☑ 0-10%
- 11-50%
- 51-90%
- 91-100%

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

- [x] Ja
- [ ] Nee

Rehabilitating the pond to collect more runoff water, which may increase due to rain intensifications due to climate change

To which changing conditions?

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

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Availability of water for a longer period in a free or cost limited system
- No need of pump and fuel for irrigating
- Increase the production

Strengths: compiler's or other key resource person's view

- Environmental low impact solution, efficient use of water resource
- Making use of surface water that may reduce flood risk in downer slopes
- Scaling up the practice to similar context

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

- Presence of sediment Anti-erosion intervention, sediment trap
- Volume insufficient for the whole period Increasing the efficiency of catchment
- High bank slope Good soil compaction

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Road as diverting structure that doesn't allow the water to naturally flow towards the ponds Diverting channels
- Pond and sedimentation trap need to be cleaned Often maintenance interventions

REFERENCES

Compiler
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Editors

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William Critchley
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Resource persons
Nicola D'Alberton - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_6319/

Linked SLM data
n.a.

Documentation was faciliated by

Institution
- n.a.

Project
- n.a.

Links to relevant information which is available online
- Master thesis - Nicola D'Alberton: https://abouthydrology.blogspot.com/2021/04/saving-water-growing-crops-ms-thesis-by.html