Irrigation canal that brings freshwater to arable land (Vasileios Diamantis)

Transport of freshwater from local streams (Greece)

Μεταφορά γλυκού από γειτονικά αρδευτικά κανάλια

DESCRIPTION

Freshwater transport from local streams for irrigation purposes, in order to replace the traditional form of irrigation (by pumping saline groundwater from wells).

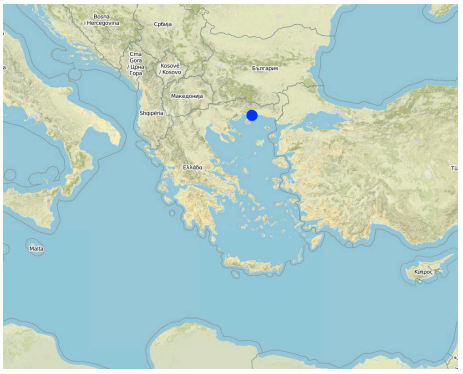
In low-lying regions suffering from overuse of the ground water for irrigation and seawater intrusion, pumping groundwater is detrimental and results in soil degradation (salinization) and reduced plant growth.

Purpose of the Technology: For this reason, freshwater is transported over distances of up to 500 m (or more) from surface streams, for irrigation using water of better quality. In this way, overexploitation of the aquifer is being reduced.

Establishment / maintenance activities and inputs: The pumps transfer water from canals or streams for irrigation purposes. A pumping station (10HP), pipes (PP-R, Ø 1100mm) for water transport and diesel or electricity for pump operation are the major items needed to replace groundwater with freshwater irrigation. However, annual maintenance of the pump and network is necessary.

Natural / human environment: The majority of families living in the research area make their living mostly from agricultural activities but also from livestock. Croplands are dominantly irrigated by wells (groundwater) and only those which are close to streams are irrigated with freshwater. Owing to over-pumping of the aquifer in order to irrigate the crop fields, there has been seawater intrusion over the past years. As a result, irrigation with groundwater led to saline soils. The group affected by this process comprises farmers who are now beginning to understand the extent of the desertification problem in the area. The degradation process significantly affects the quality of life of the local people. Saline soils lead to low productivity and thus to lower incomes (causing poverty) and thus an increase in social unrest. Although the farmers are totally aware of the on-going degradation problem that affects their fields and their livelihoods, they seem to be unwilling to change the way they irrigate their fields (with groundwater) as long as they do not have an alternative source of irrigation such as freshwater from local streams. The lack of information about how the salt-affected fields can be restored also makes the farmers believe that this situation is permanent and will extend over a wider area.

LOCATION



Location: Eastern Macedonia and Thrace, Prefecture of Xanthi, Greece

No. of Technology sites analysed:

Geo-reference of selected sites
- 24.8533, 40.9161

Spread of the Technology:

In a permanently protected area?:

Date of implementation: 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

Electric water pump that provides irrigation water directly from canal (Alexandros Pechtelidis)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- 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
- create beneficial economic impact
- create beneficial social impact

Land use

Land use mixed within the same land unit: Ja - Agroforestry

Cropland

- Annual cropping: cereals - maize, fibre crops - cotton, fodder crops - clover, wheat
- Tree and shrub cropping: olive

Number of growing seasons per year: 1

Water supply

- rainfed
- mixed rainfed-irrigated
- full irrigation

Purpose related to land degradation

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

Degradation addressed

chemical soil deterioration - Cs: salinization/ alkalinization

SLM group

- irrigation management (incl. water supply, drainage)

SLM measures

management measures - M7: Others

TECHNICAL DRAWING

Technical specifications

Scheme showing the SLM technology application

Location: Eastern Nestos Delta River Basin. Prefecture of Xanthi

Date: 14/03/2010

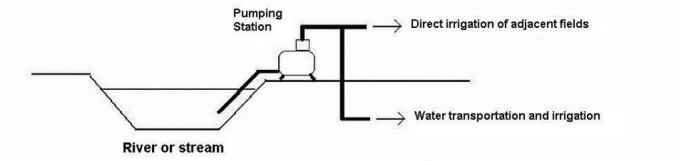
Technical knowledge required for field staff / advisors: high

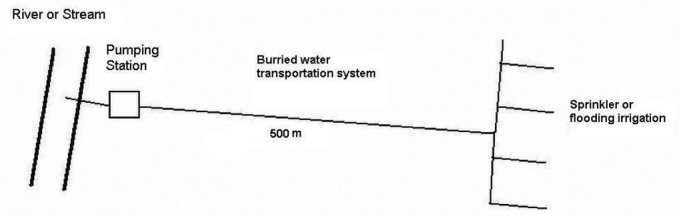
Technical knowledge required for land users: moderate

Main technical functions: water spreading, replacing saline groundwater with surface freshwater, reduce pressure/overexploitation on aquifer

Secondary technical functions: improvement of surface structure (crusting, sealing), improvement of topsoil structure (compaction), improvement of subsoil structure (hardpan), increase of infiltration, increase of groundwater level / recharge of groundwater

Agronomic measure: soil desalinization
Material/ species: freshwater
Remarks: salinity leaching





Author: Alexandros Pechtelidis, Vas. Sofias 12, Xanthi, Greece

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **euro**
- Exchange rate (to USD): 1 USD = 0.7 euro
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

Diesel or electricity price affects the final cost.

Establishment activities

1. construction of irrigation network (Timing/ frequency: None)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (euro)	Total costs per input (euro)	% of costs borne by land users
Labour					
Labour	Irrigation network	1.0	969.0	969.0	100.0
Equipment					
hire of an ecavator	Irrigation network	1.0	1107.0	1107.0	100.0
Pumping station	Irrigation network	1.0	3460.0	3460.0	100.0
Construction material					
Water transport pipes	Irrigation network	1.0			100.0
Other					
Diesel fuel (1 Lt)	Liter	1.0	1.4	1.4	100.0
Electricity (1 Kw)	Liter	1.0	0.4	0.4	100.0
Total costs for establishment of the Technology				**5'537.8**	
Total costs for establishment of the Technology in USD				*7'911.14*	

Maintenance activities

1. Network maintenance (Timing/ frequency: annualy)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (euro)	Total costs per input (euro)	% of costs borne by land users
Labour					
Labour	Irrigation network	1.0	138.0	138.0	100.0
Equipment					
Hire of an ecavator	Irrigation network	1.0	275.0	275.0	100.0
Pumpiong station	Irrigation network	1.0	200.0	200.0	100.0
Other					

diesl fuel or erlectricity	Irrigation network	1.0	1512.0	1512.0	100.0
Total costs for maintenance of the Technology				**2'125.0**	
Total costs for maintenance of the Technology in USD				*3'035.71*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 501-750 mm
- [ ] 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
Thermal climate class: temperate. Mediterranean type climatic conditions

Slope
- [x] flat (0-2%)
- [ ] 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
- [x] 0-100 m a.s.l.
- [ ] 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
- [ ] 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)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] 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
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] 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:

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

Occurrence of flooding
- [ ] Ja
- [ ] Nee

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

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

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [x] 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
- [x] poor
- [x] average
- [ ] rich
- [ ] very rich

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

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

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

Gender
- [x] women
- [x] men

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

Area used per household
- [ ] < 0.5 ha
- [ ] 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
- [x] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [x] individual, titled

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

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

IMPACTS

Socio-economic impacts

Crop production	decreased	increased	Quantity before SLM: 3.4t/ha Quantity after SLM: 4.2t/ha Increased, but: Sodic soils may first require gypsoum application
risk of production failure	increased	decreased	Less salinity risk
irrigation water availability	decreased	increased	Due to increased demand for freshwater
irrigation water quality	decreased	increased	Due to increased demand for freshwater
demand for irrigation water	increased	decreased	Freshwater for irrigation from streams/river
expenses on agricultural inputs	increased	decreased	Requires funding for implementation
farm income	decreased	increased	Better crop quality
Demand for groundwater	increased	decreased	

Socio-cultural impacts

SLM/ land degradation knowledge	reduced	improved	
Improved livelihoods and human well-being	decreased	increased	Income increase and thus well-being.

Ecological impacts

water quality	decreased	increased	
excess water drainage	reduced	improved	
groundwater table/ aquifer	lowered	recharge	
evaporation	increased	decreased	For sodic soils
soil crusting/ sealing	increased	reduced	
salinity	increased	decreased	

Off-site impacts

reliable and stable stream flows in dry season (incl. low flows)	reduced	increased	
downstream flooding (undesired)	increased	reduced	Due to water abstraction from streams/river for irrigation
groundwater/ river pollution	increased	reduced	Due to reduced groundwater exploitation

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

The benefits are obvious from the first year of application of the SLM technology and the maintenance cost is logical.

CLIMATE CHANGE

Gradual climate change

annual temperature increase: not well at all ✓ very well

Climate-related extremes (disasters)

local rainstorm: not well at all ✓ very well
local windstorm: not well at all very well — Answer: not known
drought: not well at all ✓ very well
general (river) flood: not well at all ✓ very well

Other climate-related consequences

reduced growing period: not well at all very well — Answer: not known

ADOPTION AND ADAPTATION

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

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

Number of households and/ or area covered

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?

- Ja
- Nee

To which changing conditions?

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

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Better yield

  How can they be sustained / enhanced? Application of fertilizers
- More income due to improved crop quality

  How can they be sustained / enhanced? Selection of crop type
- Better future perspective for the area

  How can they be sustained / enhanced? Financial motives

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

- Increased irrigation water quality which result in better soil quality

  How can they be sustained / enhanced? Construction of more irrigation canals
- Remediation of soils

  How can they be sustained / enhanced? Better drainage systems
- Groundwater recharge

  How can they be sustained / enhanced? Construction of more irrigation canals
- Improved quality/quantity of yield

  How can they be sustained / enhanced? Selection of the most suitable crop type
- Improved livelihood of the locals

  How can they be sustained / enhanced? Better local products promotion

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

- Bureaucratic problems Promotion of fast track financial programs

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

- Installation cost Financial aid from government/EU
- Applicable only for fields adjacent or very close to a fresh water source Construction of canals

REFERENCES

Compiler
John Gkiougkis

Editors

Reviewer
Deborah Niggli
Alexandra Gavilano

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Resource persons
John Gkiougkis - SLM specialist
Alexandros Pechtelidis - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1042/

Linked SLM data
Approaches: Combating Soil Salinization https://qcat.wocat.net/af/wocat/approaches/view/approaches_2576/

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Key references
- Gkiougkis I. et. al. (2010) Proceedings of the 12th International Congress, Geological Society of Greece, Patras, May, 2010: