Phragmites australis in a wetland system (Nicola Dal Ferro)

Wetland system (Italy)

Aree umide in territori agrari

DESCRIPTION

Vegetated water basins for the control of diffuse pollution

In the last 50 years high intensive monoculture practices implied an oversimplification of agro-ecosystems, a decline of biodiversity and a deterioration in the quality of water resources. The need to prevent nonpoint surface water pollution form agricultural practices has recently led to consider wetlands as effective depurative systems. Construction and maintenance of wetlands have been supported by the Veneto region as an agri-environmental measure through the Rural Development Programme (RDP).

Purpose of the Technology: Wetland systems (WSs) depurate water resources from diffuse pollution, creating a semi-natural environment that promote wildlife and generally biodiversity. WS are characterised by the complete submersion (or for most part of the year) of the soil and a slow water flow that favour environmental and natural functions such as denitrification, flood control, suspended solids sedimentation. Moreover wetlands have been proposed as an alternative land use in reclaimed areas below the sea level which are facing problems of subsidence.

Establishment / maintenance activities and inputs: Thanks to their effectiveness on the improvement of agri-ecosystems, the maintenance and creation of wetland systems have been supported by the regional government in order to reduce the environmental impacts of conventional agriculture practices. The area invested to create a wetland depends on the input pollutants, the size of the area that is considered and the availability of space. The creation of a wetland system provides the establishment of emergent and submerged aquatic macrophytes on a water basin ca. 50 cm depth. The efficacy of water depuration is strictly related to the water residence time.

Natural / human environment: Adopting wetland systems allows to achieve several environmental benefits. Generally, the ecosystem is positively affected by the introduction of a water basin as it provides food, nesting cover and shaded areas to wildlife species. Sediment deposition, anaerobic denitrification conditions and the purifying effect of aquatic plants reduce eutrophication and improve the water quality. Due to their semi-natural structure and high differentiation of plant species, WSs enhance the quality of life through the improvement of agricultural landscape and the creation of recreational areas.

LOCATION

Location: Veneto region, Italy, Italy

No. of Technology sites analysed:

Geo-reference of selected sites

- n.a.

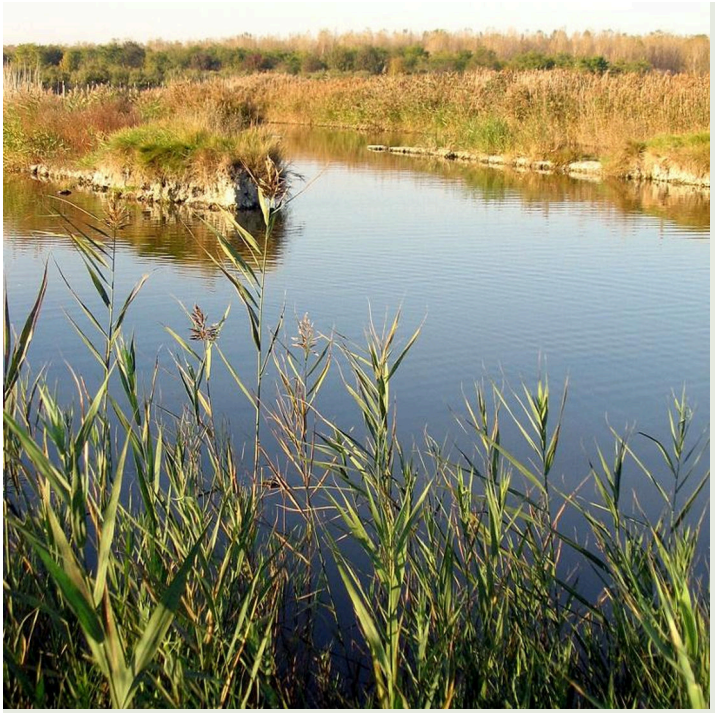
Spread of the Technology:

In a permanently protected area?:

Date of implementation: 10-50 years ago

Type of introduction

- [ ] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [x] during experiments/ research
- [ ] through projects/ external interventions



Wetland system (Nicola Dal Ferro)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [ ] improve production
- [ ] reduce, prevent, restore land degradation
- [x] conserve ecosystem
- [x] 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

Cropland

- Annual cropping: cereals - maize, legumes and pulses - soya, wheat

Number of growing seasons per year: 1

Waterways, waterbodies, wetlands - Swamps, wetlands

Water supply

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

Purpose related to land degradation

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

Degradation addressed

biological degradation - Bh: loss of habitats, Bs: quality and species composition/ diversity decline

water degradation - Hp: decline of surface water quality

SLM group

- wetland protection/ management

SLM measures

structural measures - S11: Others

TECHNICAL DRAWING

Technical specifications

Plan and longitudinal view of a constructed wetland sited at the Experimental Farm of University of Padova. A-B: longitudinal section; C: pump; D: wetland inlet; E: wetland outlet; F: side bank; G: stream.

Location: Legnaro. Padova, Italy

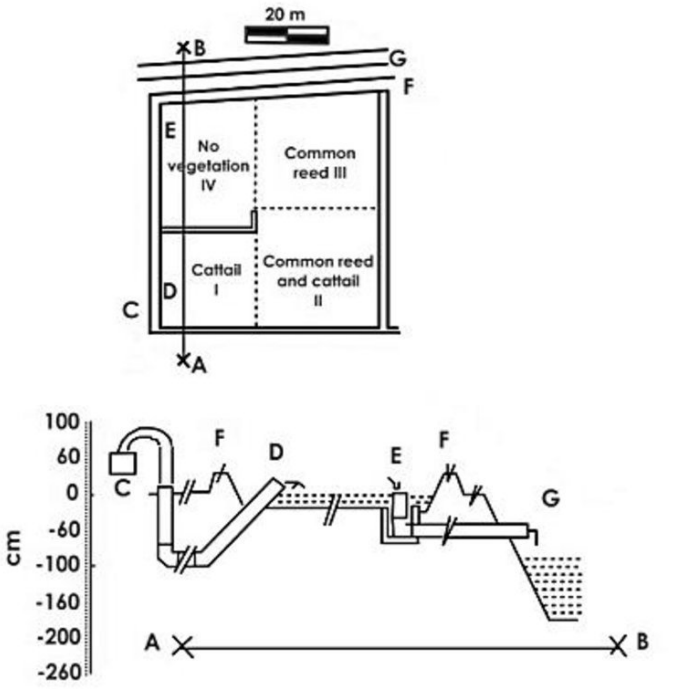
Technical knowledge required for field staff / advisors: high

Technical knowledge required for land users: moderate

Main technical functions: control of dispersed runoff: retain / trap, control of dispersed runoff: impede / retard, improvement of water quality, buffering / filtering water

Dam/ pan/ pond
Height of bunds/banks/others (m): 0.3
Width of bunds/banks/others (m): 10
Length of bunds/banks/others (m): 40

Construction material (earth): Wetland banks are made locally by soil.
Dimensions refer to 1 m3 water to treat/day



Author: Passoni et al., 2009

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 = 0.8 Euro €
- Average wage cost of hired labour per day: 21.00

Most important factors affecting the costs

n.a.

Establishment activities

1. Capital costs for land, site investigation, plants, water control, media (Timing/ frequency: None)
2. Not available (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
Other					
Capital costs. System implementation	ha	1.0	2500.0	2500.0	30.0
Total costs for establishment of the Technology				**2'500.0**	
Total costs for establishment of the Technology in USD				*3'125.0*	

Maintenance activities

n.a.

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
- ☐ 2,001-3,000 mm
- ☐ 3,001-4,000 mm
- ☐ > 4,000 mm

Agro-climatic zone

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

Specifications on climate

Thermal climate class: temperate

Slope

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

Landforms

- ☑ plateau/plains
- ☐ ridges
- ☐ 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.
- ☐ 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)
- [x] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] 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
- [x] 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?
- [ ] Yes
- [ ] No

Occurrence of flooding
- [ ] Yes
- [ ] No

Species diversity
- [ ] high
- [x] 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
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

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

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

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

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

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

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

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] 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
- [ ] 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
irrigation water availability	decreased ✓ increased
irrigation water quality	decreased ✓ increased

Socio-cultural impacts

cultural opportunities (eg spiritual, aesthetic, others)	reduced ✓ improved
recreational opportunities	reduced ✓ improved
Improved livelihoods and human well-being	decreased ✓ increased

Increased awareness on biodiversity

Agro-tourism in improved natural areas

Improved agricultural landscape, biodiversity, agro-ecology

and generally natural spaces, even for recreational activities. Moreover reduced water pollution.

Ecological impacts

water quality	decreased	increased
plant diversity	decreased	increased
beneficial species (predators, earthworms, pollinators)	decreased	increased
habitat diversity	decreased	increased

Off-site impacts

water availability (groundwater, springs)	decreased	increased
reliable and stable stream flows in dry season (incl. low flows)	reduced	increased
downstream siltation	increased	decreased
groundwater/ river pollution	increased	reduced
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	improved

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

There is a need of initial investment, however wetlands can improve the multifunctionality of agricultural systems and create additional economic opportunities to the agro-ecological benefits.

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
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

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?

- Yes
- No

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

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

- Improves surface water quality

  How can they be sustained / enhanced? strenghten and support maintenance activity
- Increases recreational areas

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

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

- Reduces crop production Differentiate the farmers' income

How can they be sustained / enhanced? Better territorial marketing

- Favours biodiversity and faces the loss of habitats

How can they be sustained / enhanced? Enlarge wetland areas

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1647/

Linked SLM data
Approaches: Rural development programme in the Veneto region https://qcat.wocat.net/en/wocat/approaches/view/approaches_2598/

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Key references

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- Programma di sviluppo rurale per il veneto 2007-2013, Regione Veneto, 2007. Dipartimento Agricoltura e Sviluppo Rurale.: