Excavation of soil and water conservation channels separated by tie bands (Kenneth Twinamasiko)

Soil and Water Conservation Channels (Uganda)

Emirongooti

DESCRIPTION

A soil and water conservation channel is an excavated trench along the contour with tie bands after an interval to trap water and soil which are being washed down the slopes by a downpour

The technology is applied in already existing degraded farmlands, which are individually owned. An average farm size is less than half an acre.

A typical soil and water conservation channel is a trench 1m wide, 1m deep and with tie bands (1m wide to avoid flow of water along the trench) at intervals of 10m along the contour. The excavated soil is used piled up into an earth bund next to the trench at lower side and stabilized by planting hedge rows of "Starria grass" to avoid erosion.

This technology reduces the speed of water running down the slope during a downpour and traps the water and soil that is being washed thereby reducing soil erosion and increasing water retention.

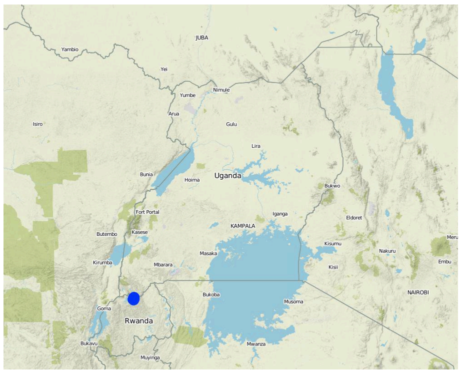
Areas which are prone to degradation by erosion are identified and later, the farmers are trained on benefits of this technology, how to set out the technology by use of the ‘A – frame’, how to construct the channels and how to maintain them by periodic de-silting and planting grasses and shrubs on the bands.

The 'A - Frame' is an A shaped structure made from wooden poles or thin metal poles that can be easily constructed and used to peg flat or graded contours or water drains.

This technology helps maintain the good top soil, which would have otherwise been washed down the slope into the valley and increases water retention.

The land users like this technology because their soil is not lost but what they dislike about this technology is that it is labour intensive, setting it out is technical and not easily conceptualized and it takes part of the land. Individual land users excavate these channels in their individual plots of land using simple hand tools like hoes, spades and pick axes.

LOCATION



Location: Rubaya Sub County, Kabale District, South Western Region, Uganda

No. of Technology sites analysed: 100-1000 sites

Geo-reference of selected sites
- 29.9397, -1.4164
- 29.9484, -1.4032
- 29.9522, -1.4031
- 29.9486, -1.4034
- 29.9396, -1.4157
- 29.9394, -1.4152
- 29.9408, -1.4661
- 29.9313, -1.431
- 29.9431, -1.4423
- 29.9306, -1.4516
- 29.9415, -1.4636
- 29.9367, -1.4547

Spread of the Technology: evenly spread over an area

In a permanently protected area?:

Date of implementation: 2015

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


Excavation of soil and water conservation channels separated by tie bands (Kenneth Twinamasiko)


Use of the ‘A-frame’ to set out the soil and water conservation channels (Kenneth Twinamasiko)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

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

Land use

Cropland

- Annual cropping
- Perennial (non-woody) cropping

Number of growing seasons per year: 2

Water supply

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

Purpose related to land degradation

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

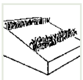
Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying, Wm: mass movements/ landslides

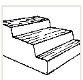
SLM group

- rotational systems (crop rotation, fallows, shifting cultivation)
- improved ground/ vegetation cover
- integrated soil fertility management

SLM measures



vegetative measures - V1: Tree and shrub cover, V2: Grasses and perennial herbaceous plants

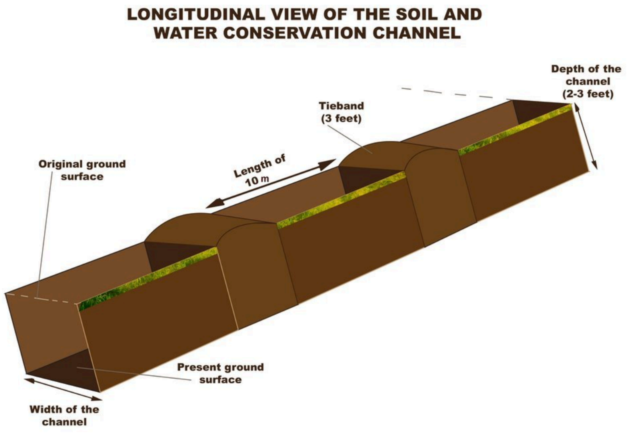


structural measures - S3: Graded ditches, channels, waterways

TECHNICAL DRAWING

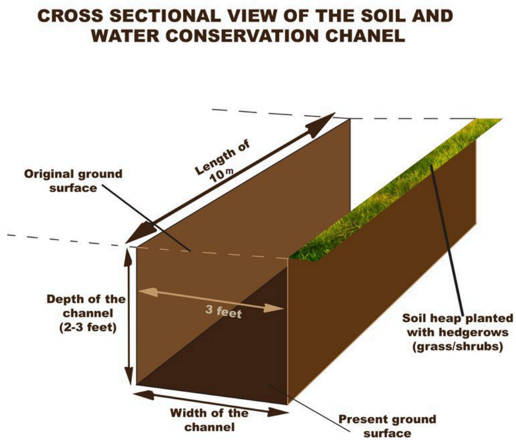
Technical specifications

None



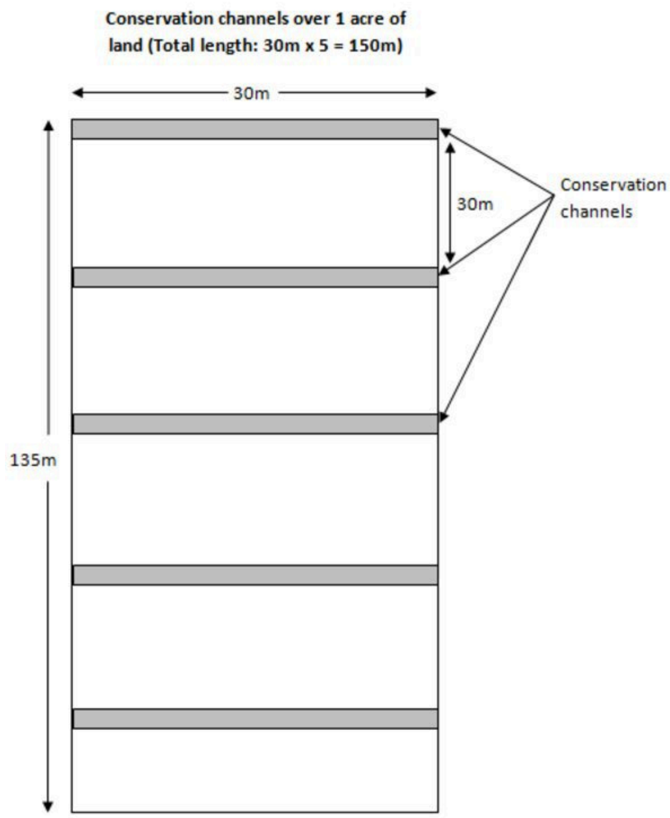
Author: Kigezi Diocese Water and Sanitation Programme

None



Author: Kigezi Diocese Water and Sanitation Programme

None



Author: Kigezi Diocese Water and Sanitation Programme

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **Per acre (each acre usually has 150meters of channels)**)
- Currency used for cost calculation: **USD**
- Exchange rate (to USD): 1 USD = 3300.0
- Average wage cost of hired labour per day: USD 2.12

Most important factors affecting the costs

The costs have been calculated basing on depth of top soil of 51 – 80cm. When the depth of the top soil is shallow, then the costs of breaking the underlying sub-surface layers, which are usually rock, are much higher. Also during the rainy season, the soil is more workable The costs of maintenance will be less where the rest of the landscape also has conservation channels, has good vegetative cover and where the hill slope is gentle.

Establishment activities

1. Setting out the soil and water conservation channel using the A-frame to set out the contour lines (Timing/ frequency: After harvest of crops)
2. Excavation of the soil and water conservation channel and build up soil bund on the lower side of the trench; leave a tie band every 10 meters (Timing/ frequency: In the dry season)
3. Planting of hedge rows on the bands (Timing/ frequency: On the onset of rains)

Establishment inputs and costs (per Per acre (each acre usually has 150meters of channels))

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Setting out	meter	150.0	0.02	3.0	100.0
Excavation of the channels	meter	150.0	1.06	159.0	100.0
Planting starria grass	meter	150.0	0.02	3.0	100.0
Equipment					
Forked hoes (1 piece can excavate 1km)	meter	6.67	5.0	33.35	
Pick axes (1 piece can excavate 1km)	meter	6.67	5.0	33.35	
Spades (1 piece can be used on 1km)	meter	6.67	5.0	33.35	
Plant material					
Starria grass (1 sack for 20m)	sacks	7.5	7.0	52.5	
Total costs for establishment of the Technology				**317.55**	
Total costs for establishment of the Technology in USD				*0.1*	

Maintenance activities

1. De-silting the channels and spreading the silt on the fields and restoring the bunds (Timing/ frequency: When half full)
2. Maintenance of the hedge rows by triming and replanting empty spaces (Timing/ frequency: Continuous)

Maintenance inputs and costs (per Per acre (each acre usually has 150meters of channels))

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Desilting of channels (when half full)	meter	1.0	0.265	0.27	100.0
Trimming of hedge rows (100m per day)	days	1.0	0.0212	0.02	100.0
Total costs for maintenance of the Technology				**0.29**	

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [x] 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
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate

Bi-modal rainfall pattern with long rainy season from September to December then March to May
Name of the meteorological station: Kabale District Meterological Department

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
- [ ] mountain slopes
- [x] 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.
- [x] 1,501-2,000 m a.s.l.
- [x] 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)
- [x] moderately deep (51-80 cm)
- [x] deep (81-120 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%)
- [x] medium (1-3%)
- [ ] low (<1%)

- [ ] very deep (> 120 cm)

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

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

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

Water quality refers to:

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

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

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

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

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

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

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

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

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

Gender
- [x] women
- [x] men

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

Area used per household
- [x] < 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
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

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

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

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

Access to services and infrastructure

		1	2	3	
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

		1	2	3	4	5	6	7		
Crop production	decreased						✓		increased	The impacts are seen immediately after the first crop
crop quality	decreased						✓		increased	
fodder production	decreased						✓		increased	
fodder quality	decreased						✓		increased	
risk of production failure	increased						✓		decreased	
production area (new land under cultivation/ use)	decreased						✓		increased	
land management	hindered							✓	simplified	
expenses on agricultural inputs	increased				✓				decreased	
farm income	decreased					✓			increased	
diversity of income sources	decreased				✓				increased	
workload	increased			✓					decreased	

Socio-cultural impacts

		1	2	3	4	5	6	7	
food security/ self-sufficiency	reduced					✓			improved
health situation	worsened				✓				improved

community institutions	weakened					✓			strengthened
SLM/ land degradation knowledge	reduced						✓		improved
conflict mitigation	worsened					✓			improved

Ecological impacts

surface runoff	increased						✓		decreased
groundwater table/ aquifer	lowered				✓				recharge
soil moisture	decreased					✓			increased
soil cover	reduced					✓			improved
soil loss	increased						✓		decreased
soil accumulation	decreased					✓			increased
soil organic matter/ below ground C	decreased					✓			increased
flood impacts	increased					✓			decreased

Off-site impacts

water availability (groundwater, springs)	decreased				✓				increased
downstream flooding (undesired)	increased					✓			reduced
damage on neighbours' fields	increased						✓		reduced
damage on public/ private infrastructure	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

The adoption rate of this technology is gradual as people keep appreciating the benefits

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all						very well	Answer: not known
seasonal temperature increase	not well at all						very well	Season: wet/ rainy season Answer: not known
seasonal temperature increase	not well at all						very well	Season: dry season Answer: not known
annual rainfall decrease	not well at all				✓		very well	
seasonal rainfall decrease	not well at all				✓		very well	Season: wet/ rainy season

Climate-related extremes (disasters)

local rainstorm	not well at all				✓		very well	
local thunderstorm	not well at all				✓		very well	
local hailstorm	not well at all				✓		very well	
land fire	not well at all				✓		very well	
general (river) flood	not well at all					✓	very well	
flash flood	not well at all					✓	very well	
landslide	not well at all				✓		very well	
epidemic diseases	not well at all			✓			very well	
insect/ worm infestation	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
- [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?

- [ ] Ja
- [x] 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

- 1) It controls soil loss from the land users garden
- 2) It provides silt which is spread in their garden
- 3) Hedge rows are used as fodder and as mulching material
- 4) The conserved water is used to benefit the plants in the same garden

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

- 1) It improves water percolation in the soil which increases soil moisture content and increases ground water recharge
- 2) It is a simple technology which uses simple hand tools
- 3) It reduces conflicts related to land being washed into the neighbours plot since land is fragmented

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

- 1) This technology requires a lot of hard labour The land users were encouraged to form small groups which work together to ease the work and share knowledge and skill
- 2) Land users feel that the channels take up alot of their land, which would otherwise be used for growing crops The land users have been helped to appreciate the benefits of the technology in making the seemingly smaller land more productive

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

- 1) This technology is dependent on land users continued efforts in de-silting and maintenance of the hedge rows. When this is not done the technology fails Land users are encouraged to periodically desilt the channels
- 2) The effectiveness of this technology is dependent on the compliance of other land users in the landscape. For example if it is done downhill and not uphill, then the channels will be overwhelmed by the volume of the soil and water runoff All community members were sensitised on the importance and effectiveness of this technology and existing by-laws will foster members uphill to practice the technology. The benefits of the technology will encourage other land users to adopt it
- 3) The process of maintaining and rolling out this technology requires engagement of many stakeholders Management structures, which are well linked with government structures, have been set up and trained at various levels to manage the process of maintaining and rolling out the technology

REFERENCES

Compiler
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Date of documentation: Nov. 9, 2016

Last update: Aug. 7, 2019

Resource persons
- SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_711/

Linked SLM data
Approaches: Catchment Based Integrated Water Resources Management https://qcat.wocat.net/af/wocat/approaches/view/approaches_724/

Documentation was faciliated by

Institution

- Tear Fund Switzerland (Tear Fund Switzerland) - Switzerland

Project

- Book project: where people and their land are safer - A Compendium of Good Practices in Disaster Risk Reduction (DRR) (where people and their land are safer)

Key references

- Kigezi Diocese Water and Sanitation Programme, IWRM Annual Report (April 2015 - March 2016): www.kigezi-watsan.ug
- IWRM Pilot report 2013: www.kigezi-watsan.ug

Links to relevant information which is available online

- Handbook of chennel design for soil and water conservation: www.worldwidehelpers.org
- Soil conservation handbook: www.wcc.nrcs.usda.gov/ftpref/wntsc/H&H/TRsTPs/TP61.pdf
- Soil conservation: http://www.fao.org/docrep/t0321e/t0321e-10.htm