# Dawa-Cheffa Traditional Checkdam (Ethiopia)

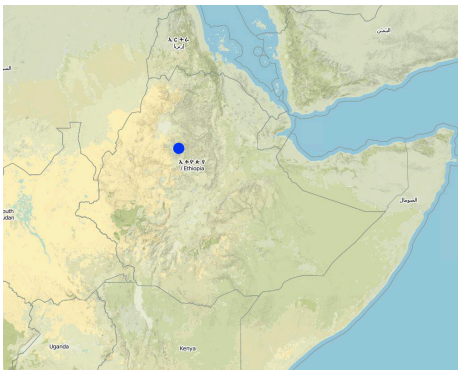
Kiter

## DESCRIPTION

**A structural measure constructed by stone/soil/wood acrross the gully to control erosion and create favourble condition for crop cultivation.**

The technology is known by the farmers for more than a century. Since the area is highly affected by gully erosion, this practice is widely used by farmers in the area and also widely practiced. Its construction starts from the bottom of the gully and proceeds upslope with different dimensions. The height depends on the depth of the gully and it is increased from year to year. On the average the width is 1m and hieght is 1.80m. The technology is used to develop big gullies and treatment of small gully like depressions, attain slope change to enhance land suitability to crop production and to conserve soil and water. The construction of the stone checkdam starts with small heights and some height is added every year until the intended height is reached. The increase in height could be done during maintenance also. The major objective being to stop gully growth, trap sediment and retain water running down the gully. In the course of increasing the height, the area for sediment deposition gets wider. The technology is suitable to areas with low rainfalls of rugged topography having a network of gullies.

## LOCATION



**Location:** Koshem Watershed, Amhara Regional State, Ethiopia

**No. of Technology sites analysed:**

**Geo-reference of selected sites**
- 38.0, 11.0

**Spread of the Technology:** evenly spread over an area (approx. 10-100 km2)

**In a permanently protected area?:**

**Date of implementation:** more than 50 years ago (traditional)

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

## 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

### Land use

**Cropland**
- Annual cropping: cereals - maize, cereals - sorghum, legumes and pulses - beans, legumes and pulses - other, oilseed crops - sunflower, rapeseed, other, haricot bean, teff
- Perennial (non-woody) cropping

- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [ ] create beneficial economic impact
- [ ] create beneficial social impact

- Tree and shrub cropping: citrus, coffee, open grown, fruits, other, mango, mangosteen, guava, papaya, acacia, eucalyptus, khata edulis, ageava sisal, banana, lemon

Number of growing seasons per year: 2
Is intercropping practiced? Yes

**Grazing land**

**Forest/ woodlands**

- (Semi-)natural forests/ woodlands. Management: Clear felling

Products and services: Timber, Fuelwood, Grazing/ browsing

### Water supply

- [x] rainfed
- [ ] 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, Wg: gully erosion/ gullying

**chemical soil deterioration** - Cn: fertility decline and reduced organic matter content (not caused by erosion)

### SLM group

- surface water management (spring, river, lakes, sea)

### SLM measures

**agronomic measures** - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility, A3: Soil surface treatment, A6: Residue management, A7: Others

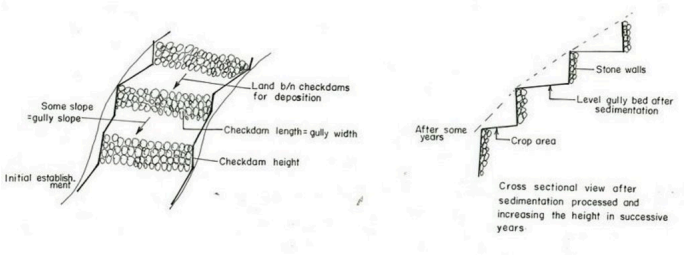
**vegetative measures** -

**structural measures** - S6: Walls, barriers, palisades, fences

## TECHNICAL DRAWING

### Technical specifications

Amhara




Technical knowledge required for field staff / advisors: high

Technical knowledge required for land users: moderate

Main technical functions: increase / maintain water stored in soil, sediment retention / trapping, sediment harvesting

Secondary technical functions: reduction of slope angle, reduction of slope length, increase of infiltration

Mixed cropping / intercropping
Material/ species: sorghum/maize +haricot beans
Quantity/ density: 70,000 sor
Remarks: broadcast

Agronomic measure: mixed cropping / intercropping
Material/ species: teff + sunflower
Quantity/ density: -
Remarks: broadcast

Manure / compost / residues
Material/ species: Animal dung, fuelwood ash, leaves, soil
Quantity/ density: 0.6 ton/ha

Contour tillage
Remarks: along contour

Agronomic measure: Sediment trapped by checkdam
Remarks: along the contour

Agronomic measure: Seedbed preparation by hoe

Aligned: -contour
Vegetative material: T : trees / shrubs
Number of plants per (ha): 1500
Vertical interval between rows / strips / blocks (m): 1-1.8m
Spacing between rows / strips / blocks (m): 8-10m
Vertical interval within rows / strips / blocks (m): 1-2m
Width within rows / strips / blocks (m): 1x1

Vegetative measure: aligned: contour
Vegetative material: G : grass
Number of plants per (ha): -
Vertical interval between rows / strips / blocks (m): 1-1.8m
Spacing between rows / strips / blocks (m): 8-10m
Vertical interval within rows / strips / blocks (m): -
Width within rows / strips / blocks (m): -

Vegetative measure: aligned: contour
Vegetative material: G : grass
Number of plants per (ha): 2000
Vertical interval between rows / strips / blocks (m): 1-1.8m
Spacing between rows / strips / blocks (m): 8-10m
Vertical interval within rows / strips / blocks (m): -
Width within rows / strips / blocks (m): -

Vegetative measure: Vegetative material: G : grass

Vegetative measure: Vegetative material: G : grass

Trees/ shrubs species: acacia, eucalyptus, khata edulis, ageava sisal

Fruit trees / shrubs species: coffee, papaya, guava, banana, lemon, manago, orange

Grass species: elephant grass, local grass

Slope (which determines the spacing indicated above): 12.00%

If the original slope has changed as a result of the Technology, the slope today is (see figure below): 3.00%

Gradient along the rows / strips: 0.00%

Structural measure: Checkdam
Vertical interval between structures (m): 1
Spacing between structures (m): 8m
Depth of ditches/pits/dams (m): 0.3m
Width of ditches/pits/dams (m): 1m
Length of ditches/pits/dams (m): 5m
Height of bunds/banks/others (m): 0.5-1m
Width of bunds/banks/others (m): 1m
Length of bunds/banks/others (m): 5.m

Construction material (earth): Soil is embnked upslope of the stone wall as reinforcement

Construction material (stone): Stone is used to construct the embankment/wall/and is supported by soil in the upslope side to reinf

Construction material (wood): Wood used as support at the downslope side

Slope (which determines the spacing indicated above): 12%

If the original slope has changed as a result of the Technology, the slope today is: 3%

Lateral gradient along the structure: 0%

For water harvesting: the ratio between the area where the harvested water is applied and the total area from which water is collected is: 1:3

Vegetation is used for stabilisation of structures.

Change of land use type: gully converted to cropland

Other type of management: fencing and guarding - protect animals from interering to plantations

## ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

### Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **Birr**
- Exchange rate (to USD): 1 USD = 8.6 Birr
- Average wage cost of hired labour per day: 0.70

### Most important factors affecting the costs

labour, slope and depth of the gully, width of the gully, availability of construction material, soil depth. The establishment cost considerts the cost incurred over 15 years.

### Establishment activities

1. Seedling production (Timing/ frequency: March to June)
2. Planting (Timing/ frequency: June to July)
3. Excavation (Timing/ frequency: dry season)
4. Stone collection (Timing/ frequency: dry season)
5. Construction (Timing/ frequency: dry season)
6. Fencing (Timing/ frequency: after plantation)

### Establishment inputs and costs

| Specify input | Unit | Quantity | Costs per Unit (Birr) | Total costs per input (Birr) | % of costs borne by land users |
|---|---|---|---|---|---|
| **Labour** | | | | | |
| Labour | ha | 1.0 | 4625.0 | 4625.0 | 90.0 |
| **Equipment** | | | | | |
| Tools | ha | 1.0 | 120.0 | 120.0 | 95.0 |
| **Construction material** | | | | | |
| Stone | ha | 1.0 | | | 100.0 |
| **Total costs for establishment of the Technology** | | | | **4'745.0** | |
| *Total costs for establishment of the Technology in USD* | | | | *551.74* | |

### Maintenance activities

1. clean crop residue (Timing/ frequency: Early January /)
2. primary digging (Timing/ frequency: Feb-March /)
3. harrowing (Timing/ frequency: March /)
4. manure application (Timing/ frequency: March /)
5. planting (Timing/ frequency: April /)
6. weeding and cultivation (Timing/ frequency: Late June-August /)
7. harvest (Timing/ frequency: November-December /)
8. replanting (Timing/ frequency: during rains /once a year)

9. pruning and thining (Timing/ frequency: dry season /once a year)
10. Stone collection (Timing/ frequency: dry season/once a year)
11. Placing the stones where maintenance is required (Timing/ frequency: dry season/once a year)
12. repairing breaks in fences (Timing/ frequency: before replanting / annual)

Maintenance inputs and costs

| Specify input | Unit | Quantity | Costs per Unit (Birr) | Total costs per input (Birr) | % of costs borne by land users |
|---|---|---|---|---|---|
| **Labour** | | | | | |
| Labour | ha | 1.0 | 624.0 | 624.0 | 100.0 |
| **Equipment** | | | | | |
| Tools | ha | 1.0 | 30.0 | 30.0 | 100.0 |
| **Construction material** | | | | | |
| Stone | ha | 1.0 | | | 100.0 |
| **Total costs for maintenance of the Technology** | | | | **654.0** | |
| *Total costs for maintenance of the Technology in USD* | | | | *76.05* | |

## NATURAL ENVIRONMENT

### Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 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
- [x] sub-humid
- [x] semi-arid
- [ ] arid

### Specifications on climate
Specification 500-750 mm (600mm)
Specification 750-1000 mm (900mm)

Semi-arid: In the SWC area the semiarid part is about 70%
Sub-humid: Comprises about 30%

### 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
- [x] 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
- [ ] 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)
- [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%)
- [ ] medium (1-3%)
- [x] low (<1%)

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

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

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

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

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

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

### Habitat diversity
- [ ] high
- [ ] 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
- [x] average
- [ ] rich
- [ ] very rich

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

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

### Individuals or groups
- [ ] individual/ household
- [ ] groups/ community
- [ ] cooperative

### Gender
- [ ] women
- [ ] men

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

- [ ] employee (company, government)
- [ ] 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**
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

**Land ownership**
- [x] 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**

## IMPACTS

### Socio-economic impacts

Crop production — decreased / increased: ✓ (increased)
The cost benefit anlysis for sorghum shows negative profit but for other crops such as combination of coffe, papaya, chat the profit is high

fodder production — decreased / increased: ✓ (increased)

fodder quality — decreased / increased: ✓ (increased)

farm income — decreased / increased: ✓ (increased)
for cropping patterns which consider field crops + cash crops is high

### Socio-cultural impacts

SLM/ land degradation knowledge — reduced / improved: ✓ (improved)

### Ecological impacts

surface runoff — increased / decreased: ✓ (decreased)
Quantity before SLM: 70
Quantity after SLM: 5

soil moisture — decreased / increased: ✓ (increased)
soil depth increased by depostion infiltration enhanced

soil cover — reduced / improved: ✓ (improved)
plantations

soil loss — increased / decreased: ✓ (decreased)
Quantity before SLM: 10
Quantity after SLM: 0
checdams decrease gully slope

Soil fertility — decreased / increased: ✓ (increased)
Fertile top soil erdoed upslope is trapped in the gully

Biodiversity — decreased / increased: ✓ (increased)
combined application of useful plants and crop

### Off-site impacts

reliable and stable stream flows in dry season (incl. low flows) — reduced / increased: ✓ (increased)
high percolation rate of rain water

downstream flooding (undesired) — increased / reduced: ✓ (reduced)
runoff is trapped by supportive technologies undertaken in the upper catchment and runoof velocity retarded by checkdams

downstream siltation — increased / decreased: ✓ (decreased)
sediment trapped in the gullies

## COST-BENEFIT ANALYSIS

### Benefits compared with establishment costs

Short-term returns — very negative / very positive: ✓ (very negative)

Long-term returns — very negative / very positive: ✓ (very positive)

### Benefits compared with maintenance costs

Short-term returns — very negative / very positive: ✓ (very negative)

Long-term returns — very negative / very positive: ✓ (very positive)

## CLIMATE CHANGE

-

## 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**

25000

**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**

- Land reclaimed

  How can they be sustained / enhanced? fertility of soils increased by accumulated top soil from other area.
- retain moisture

  How can they be sustained / enhanced? water stored in the soil.

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

- Reduce runoff speed

  How can they be sustained / enhanced? exercise frequent maintenance and stablize the structure with vegetative measures
- Reduce soil loss

  How can they be sustained / enhanced? soil is trapped by the checkdam
- Moisture retention

  How can they be sustained / enhanced? the soil trapped provides more space for water to be stored.
- reduce slope length

  How can they be sustained / enhanced? by raising the gully bed.

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

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

## REFERENCES

**Compiler**
Unknown User

**Editors**

**Reviewer**
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**Resource persons**
Kemal Umer - SLM specialist

**Full description in the WOCAT database**
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1058/

**Linked SLM data**
n.a.

**Documentation was faciliated by**

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Project
- n.a.

**Key references**
- Monthly, quarterly and annual achievement reports of the DWARDO:
- Work norm of MERET:
- Ethiopian Highlands Reclamation stdy:
- Soil and water conservation , Morgan 1986: