Fishbone shaped trenches waiting to be filled with fascine bundles before being covered with soil. (Helen Gambon, Swiss Red Cross)

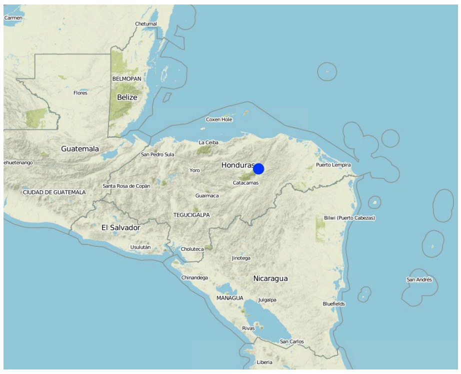
Fascine drainage (Honduras)

DESCRIPTION

Fascine drains are used to drain excess water from elevated lands that might affect plots of land or houses below. They help prevent landslides and gully formation.

The Department of Olancho is a rainforest area located in the mountain range area of Cordillera Central and Sierra de Agalta, at an average altitude of 1,500 masl. Though most of the area of Olancho is protected as a natural reserve or natural park, there are high levels of deforestation resulting from livestock practices and intense industrial forest management practices. However, small farmers also cause deforestation. These practices result in rampant forest fires, soil degradation and erosion. The Department of Olancho is regularly affected by tropical storms and hurricanes coming in from the Atlantic. This combination of strong natural phenomena, topographic exposure and harmful use of natural resources causes significant material damage and even human deaths.
Fascine drains are used to drain excess water from the elevated land that affects lands or houses in lower areas. This Technology is used in sites where counterslopes are present. The technology helps prevent landslides and gullies.
Fascine drains are implemented by digging fishbone shaped trenches with arms connecting to a main trench. The Technology is generally built from the bottom up and the side angles vary between 20° and 45°. The trenches are filled with live grasses, such Pennisetum sp, King Grass (Pennisetum sp) or sugar cane (Saccharum officinarum). These plants are moored with stakes that regenerate easily (such as (Madriado – Gliricidia sepium). Then, the land around the trenches is tightly packed. Since the livestock can damage the fascine bundles, the area must be fenced off. To avoid production losses, grass is sown (maralfalfa or King Grass) on top of the fascines. These grasses can be trimmed three times a year and used as fodder.
This technology may be combined with others, such as live hedges using Vetiver grass (Vetiveria zizanioides).
In this case study, the fascine drains were implemented by the Project "Resiliencia" undertaken by the Swiss/ Honduran Red Cross. This project aims at helping sustainable development to enhance the resilience of rural areas in Olancho by reducing disaster hazards together and promoting health at every level (home, community, municipality). Bioengineering works are implemented in areas which were identified as being vulnerable by updated risk assessments. The beneficiaries are highly vulnerable and exposed to disasters.

LOCATION



Location: Dulce Nombre de Culmí municipality, Río Blanco community, Departament of Olancho, Honduras

No. of Technology sites analysed: single site

Geo-reference of selected sites
- -85.58228, 15.16825

Spread of the Technology: evenly spread over an area (approx. < 0.1 km2 (10 ha))

In a permanently protected area?:

Date of implementation: 2007

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

After implementation, fascine drains are no longer visible. Here they are covered with Maralfalfa grasses that can be used as fodder for livestock. (Helen Gambon, Swiss Red Cross)

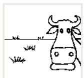
After implementation, fascine drains are no longer visible. Here they are covered with Maralfalfa grasses that can be used as fodder for livestock. (Helen Gambon, Swiss Red Cross)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [ ] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [x] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [x] 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



Grazing land

- Cut-and-carry/ zero grazing

Water supply

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

Purpose related to land degradation

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

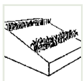
Degradation addressed

soil erosion by water - Wm: mass movements/ landslides, Wo: offsite degradation effects

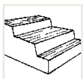
SLM group

- water diversion and drainage

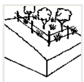
SLM measures



vegetative measures - V2: Grasses and perennial herbaceous plants



structural measures - S3: Graded ditches, channels, waterways



management measures - M2: Change of management/ intensity level

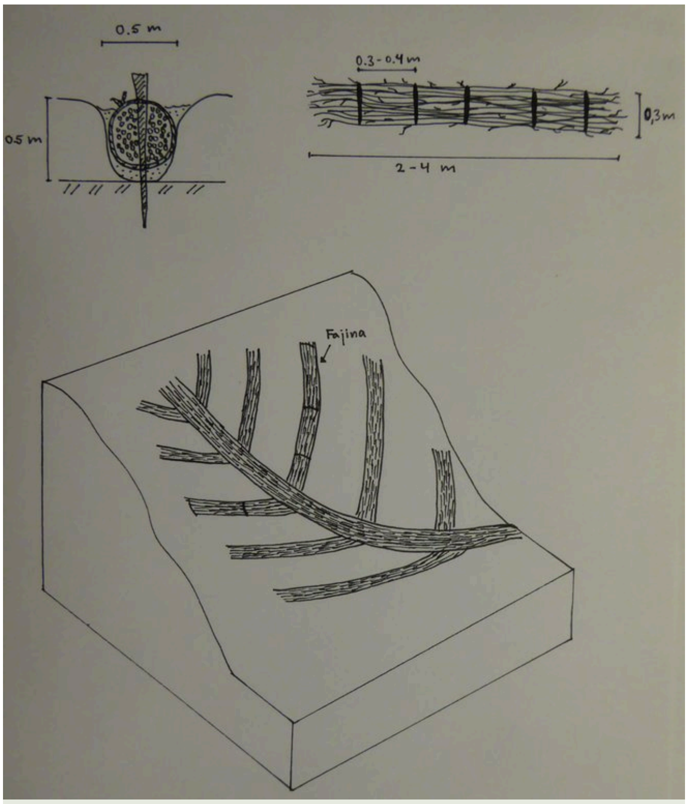
TECHNICAL DRAWING

Technical specifications

The system involves digging fishbone shaped trenches connected to a main trench. Central drains generally are 50 cm deep and lateral drains are 30 cm deep. These are generally built from the bottom up and the side angles vary between 20º and 45º. Side trenches are generally 1.0 to 2.5 meters apart, built in parallel lines, with lengths varying between 3 and 8 meters. Trenches are filled with plant stems with a high regeneration rate, such as Maralfalfa grass (Pennisetum sp), King Grass (Pennisetum sp) or sugar cane (Saccharum officinarum). These are then moored with 70 cm stakes made of trees that regenerate easily (eg. Madriado – Gliricidia Sepium) which are used toi anchorthe surrounding soil. The area must be fenced off to avoid livestock from damaging the stakes, since the latter sprout leaves.

In this case study, fascine drains were implemented by the "Resiliencia" project undertaken by the Honduran/Swiss Red Cross in order to provide sustainable support to enhance resiliency in rural areas of Olancho, by working on reducing disaster hazards and promoting health at all levels (home, community, municipality). Bioengineering works are implemented in critical sites based on risk analyses. beneficiaries are highly vulnerable and exposed to disasters.

Once fionished, the fascine drains and the live vetiver hedges will protect a school house from landslides.



Author: Helen Gambon, Swiss Red Cross

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **one fascine drainage system** volume, length: **40m x 40m**)
- Currency used for cost calculation: **Lempiras**
- Exchange rate (to USD): 1 USD = 21.0 Lempiras
- Average wage cost of hired labour per day: 150 Lempiras

Most important factors affecting the costs

Purchase and transportation of plants not available on site

Establishment activities

1. Clear land (Timing/ frequency: winter)
2. Prepare stakes and transport them to site (Timing/ frequency: winter)
3. Place stakes and wire (Timing/ frequency: winter)
4. Prepare plant material (king grass or maralfalfa) and tie them in bunches (Timing/ frequency: winter)
5. Dig 50 cm deep trenches (center) and 30 cm (branches) (Timing/ frequency: winter)
6. Place bundles in trenches and moor with stakes (Timing/ frequency: winter)
7. Cover with soil (Timing/ frequency: winter)
8. Plant vegetation to cover (Timing/ frequency: winter)

Establishment inputs and costs (per one fascine drainage system)

Specify input	Unit	Quantity	Costs per Unit (Lempiras)	Total costs per input (Lempiras)	% of costs borne by land users
Labour					
Trained labor	person per day	1.0	500.0	500.0	
Untrained labor	person per day	18.0	150.0	2700.0	30.0
Equipment					
shovel, pike, gloves, machete	pieces	3.0	2.0	6.0	100.0
Cord	pound	5.0	25.0	125.0	100.0
Plant material					
maralfalfa, king grass, sugar cane or bamboo	pounds	200.0	2.0	400.0	
wood for stakes	piece	60.0	3.0	180.0	100.0
Construction material					
posts	post	100.0	25.0	2500.0	100.0
barbed wire	roll	1.0	450.0	450.0	
Other					
Transportation for plants	trip	1.0	500.0	500.0	100.0
Total costs for establishment of the Technology				**7'361.0**	
Total costs for establishment of the Technology in USD				*350.52*	

Maintenance activities

1. Cut grass with machete (Timing/ frequency: every 4 months)

2. Keep watch on the fence (Timing/ frequency: Continuously)

Maintenance inputs and costs (per one fascine drainage system)

Specify input	Unit	Quantity	Costs per Unit (Lempiras)	Total costs per input (Lempiras)	% of costs borne by land users
Labour					
Untrained labor	person-days	6.0	150.0	900.0	100.0
Total costs for maintenance of the Technology				**900.0**	
Total costs for maintenance of the Technology in USD				*42.86*	

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
Average annual rainfall in mm: 1400.0
Dry season from January to June, Rainy Season between June and October, with a heatwave in August.

Slope
- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [x] 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.
- [x] 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
- [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
- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 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?
- [ ] Yes
- [x] No

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

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

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

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] 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
- [ ] women
- [x] men

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

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha

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

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village

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

- [ ] 2-5 ha
- [x] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [ ] group
- [x] individual, not titled
- [ ] individual, titled

- [x] individual

Water use rights

- [ ] 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

fodder production	decreased							✓	increased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM 100% increase
animal production	decreased				✓				increased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM Land user did not need to reduce livestock to implement the technology nor increase its numbers
workload	increased			✓					decreased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM Maintenance

Socio-cultural impacts

SLM/ land degradation knowledge	reduced						✓		improved	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM

Ecological impacts

surface runoff	increased							✓	decreased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM
excess water drainage	reduced							✓	improved	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM
soil loss	increased					✓			decreased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM
nutrient cycling/ recharge	decreased					✓			increased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM
biomass/ above ground C	decreased					✓			increased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM
landslides/ debris flows	increased						✓		decreased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM
impacts of cyclones, rain storms	increased							✓	decreased	Quantity before SLM: Amount before SLM Quantity after SLM: Amount after SLM

Off-site impacts

damage on neighbours' fields	increased						✓		reduced	Quantity before SLM: 0 Quantity after SLM: 2 Before implementation, the speed of water flow damaged the land plots in the lower areas of the site of intervention. Once the fascine drains were set in place, water now filters into the ground at a higher rate, thus its flow speed has decreased and the water flowing towards the stream.

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	
seasonal temperature increase	not well at all					✓	very well	Season: summer
seasonal rainfall decrease	not well at all			✓			very well	Season: summer

Climate-related extremes (disasters)

tropical storm	not well at all				✓		very well
extra-tropical cyclone	not well at all				✓		very well
landslide	not well at all				✓		very well

ADOPTION AND ADAPTATION

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

- [x] 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?

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

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

- [ ] Yes
- [x] 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

- The Technology protects houses against running surface water and landslides
- Food is produced for livestock

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

- The Technology prevents soil loss and gully formation.

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

- The livestock can destroy the fascine drains Area must be fenced off and monitored

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

- Land users abandon the land due to migration. Though migration is common, a part of the family usually stays behind and they can sustain the SLM Technology.

REFERENCES

Compiler
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Editors
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Resource persons

Jorge Alberto Argueta - land user
Nelin Lorena Acosta Granados - SLM specialist
Carlos Rolando Montes Lobo - None

Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_744/

Linked SLM data

Approaches: Participative Slope Stabilization https://qcat.wocat.net/en/wocat/approaches/view/approaches_745/

Documentation was faciliated by

Institution

- Swiss Red Cross (Swiss Red Cross) - 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

- Local responses to global challenges - community based disaster risk reduction. Experiences from Honduras. Case Study. Swiss Red Cross, May 2016: info@redcross.ch (gratis)